

Qatar Computing and Information Technology Curriculum 2018

Kindergarten to Grade 12

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Foreword

Building an education system that emulates the best education systems will contribute to preparing Qatari students to face global challenges and to become innovators and entrepreneurs in the future. This will help to promote a knowledge-based economy and to raise the rates of development as top priorities for the State of Qatar.

The "Qatar National Curriculum Framework (QNCF)" was published as a key foundation of the education system, setting out a clear destination for the development of education in the State of Qatar and acting as a point of departure for the realization of Qatar Vision 2030 in the field of public education.

The above is to be achieved based on the values, goals and principles, as well as the competencies, included in the QNCF. This serves as the basis for developing and designing the education curriculum and writing its policies, as well as for the development of supporting education materials. All these components are an integral part of its internal structure and architecture.

The QNCF is based on a curriculum model that places the subjects in a wider learning context and provides a basic reference for reviewing, modifying, implementing, monitoring and evaluating the curriculum, to ensure that it is consistent with the latest developments.

Thus, in order to produce a comprehensive, expanded and inclusive educational curriculum that meets the needs of all students, it was necessary to work on and develop the existing curriculum by reviewing and revising it based on the QNCF.

The revised curriculum reflects a competency-based approach that identifies the competencies that learners need to acquire in order to be able to respond successfully to the opportunities and challenges of the 21st century.

The implementation of the developed curriculum in public education will support the transition to a new education model, and will lay the foundation for students in the State of Qatar to become successful lifelong learners, and effective and responsible citizens.

Introduction

During recent years with the mainstream rollout of computers in schools, we have learned significant lessons about Information and Communications Technologies (ICT) or Information Technology (IT) in Education and its potential transforming impact on national education systems. The Ministry of Education and Higher Education of the State of Qatar is reforming its curricula to face the urgent challenges by acknowledging the aspects that must be tackled such as teacher competencies, learning resources, student motivation, as well as the linkages to other areas of national policy and socio-economic development.

In this context, the creation of the new Computing and Information Technology standards is the foundation of the national Computing and Information Technology curriculum. Qatar Vision 2030 acknowledges technology as a key factor for a modern knowledge-based economy, and the Qatar National Curriculum Framework (QNCF) defines Information Technology as a major school subject in grades 1-12. The Computing and Information Technology subject supports children's learning by offering beneficial opportunities in the areas of logic and mathematical thinking, language and communication, emergent literacy and creativity.

The curriculum standards are the result of the collaboration between several stakeholders in the Computing and Information Technology education community: the Ministry's ICT experts team, ICT supervisors of primary, preparatory and secondary schools and industry experts. The curriculum standards were reviewed by the Computer Science departments, and curriculum development experts of three Qatari Higher Education institutions (Qatar University, Carnegie Mellon University in Qatar and College of the North Atlantic – Qatar).

The following principles were guiding the development of the new Computing and Information Technology Curriculum Standards:

- Align with the Qatar National Curriculum Framework and Qatar Vision 2030.
- Focus on essential knowledge and skills in digital literacy while facilitating life-long learning.
- Reflect the need for diversity in participation in ICT. Equity and accessibility are key concerns.
- Benchmark with international standards and frameworks.
- Not reinventing the wheel. Incorporate best practices from around the world and professional research in Computing and Information Technology education.

The new curriculum standards are meant to provide guidance for developing curriculum resources, assessments and teacher professional development programs.

Since Computing and Information Technology is undoubtedly the subject that changes as fast as technology itself changes, these curriculum standards will be reviewed periodically to ensure their compliance with current technologies and trends in Computing and Information Technology education. We have taken precaution to make the standards as sustainable as possible by making them platform and application independent. Incorporating the teachers' feedback from the implementation of the standards in each grade and the current international practices, further adjustments can be made to enrich their effectiveness.

Features of the New Standards and Improvements Introduced

New technologies and developments in Computing as a school subject are constantly emerging, and the Computing and Information Technology curriculum standards have to be at the edge of these transformations. Knowledge and skills students need to master for their studies, life and work should be as future-proof as possible while being appropriate for the specific age groups.

The new Qatari Computing and Information Technology curriculum standards for grades 1-12 introduce several features:

- The standards were developed in the light of the Qatar National Curriculum Framework implications including the competencies, values, aims, principles and cross-cutting issues. Competencies are indicated with correspondence to each curriculum standard to guide the teachers through their implementation.
- They promote key 21st-century skills as defined by the American Association of School Librarians: collaboration, communication, teamwork, critical thinking, problem-solving and decision-making.
- The curriculum standards are fully graded.
- Following a spiral curriculum, the students deal with each concept or practice at different grade levels, each time at a higher level of difficulty and in greater depth.
- The curriculum standards are vertically-aligned and coherent across grades. There are no academic gaps or needless repetitions.
- They incorporate the latest developments in pedagogy: student-centred learning through a hands-on project-based approach.
- The curriculum standards focus on knowledge and skills (concepts and practices) as well as attitudes.
- They encompass both Computer Science (foundational principles and practices of computation) and Digital Literacy (creative and productive use and application of computer systems including considerations of e-safety, privacy, ethics and intellectual property) in an international context.
- Computational thinking is a core element of the new standards. Students will develop new approaches to problem-solving through abstraction, automation and analysis. Programming and robotics are introduced at various stages and in varying complexity in primary, preparatory and secondary grades with different programming tools and educational robot kits in order to engage all students with a smooth approach. As early as Grade 1 students become familiar with the basic principles of computational thinking.
- The curriculum standards are benchmarked against the latest international curricula, guidelines and national requirements in other countries. There is extensive coverage of tools and technologies that the student encounters in real-life.
- The standards are computing language, hardware and platform independent.
- They reflect an awareness of industry trends and the dynamic nature of the computer industry.

ie Computing and Information Technology curriculum standards for grades 1-12 ensure at all students:

- Have the knowledge and skills required to creatively produce digital artefacts.
- Can critically evaluate and apply information technology (including new and unfamiliar technologies) responsibly, collaboratively and effectively to solve problems.
- Can analyse problems in computational terms, and can write computer programs to solve them.
- Can understand and apply the fundamental principles of computer science, including logic, algorithms, data representation, and networks.
- Can critically express the individual, cultural and societal impacts of technology, and know how to stay safe, capitalise on opportunities and manage risks.
- Are able to communicate effectively.
- Understand, appreciate and actively engage in local communities.
- Are lifelong learners with a positive attitude to personal and professional development .
- Are committed to sustainable development and environmental protection.

Rationale for Computing and Information Technology Education

To meet the current demands and for the sake of their life skills and personal and professional development, students are expected to be able to use Information and Communication Technologies (ICT) confidently and critically for work, leisure, learning and communication. A modern curriculum framework and standards provide opportunities that:

- Develop 21st-century skills through educational resources that are aligned with and support digital age learning
- Enhance cross-disciplinary knowledge, connections and understanding
- Expose students to more active and meaningful learning experiences

Modern societies are increasingly based on information and knowledge. One of the Qatar Vision 2030 pillars is the human development strategy. It is a priority to build a capable national workforce which has the vital Information Technology skills to handle information and is reflective, creative and adept at problem-solving to generate knowledge.

The Qatar National Curriculum Framework sets out aims, values, principles and expected learning outcomes in terms of subject and cross-curricular learning and generic competencies to ensure that the curriculum is focused on preparing young people for the opportunities and challenges of a rapidly developing knowledge-based economy. Seen through this prism, the Computing and Information Technology subject is taught as a separate subject and is also expected to be integrated into the other subjects.

The new Computing and Information Technology curriculum fulfills all Qatar National Curriculum Framework priorities including the defined key competencies:



Creative and critical thinking



Literacy



Numeracy



Communication



Co-operation and participation



Inquiry and research



Problem-solving

Computing and Information Technology as a school subject requires a curriculum that promotes key 21st-century skills: collaboration, communication, teamwork, critical thinking, problem-solving and decision-making and is designed to incorporate the latest developments in pedagogy: student-centred learning through a hands-on project-based approach.

The objective is that students can go beyond learning the basic computer skills such as being able to do word-processing or go online and reach true digital citizenship, having the skills to participate in a digital society, for example to access government information online, to

responsibly use social networking sites, and to effectively use Information Technology tools and equipment in their personal life, their studies and later in their work. Another objective, especially for primary students, is the e-safety agenda to help children develop the skills, knowledge and understanding that will enable them to make informed decisions and protect their digital identity in the new environment.

A modern Computing and Information Technology curriculum framework and the supporting curriculum standards address all these aspects:

- Enabling students to use technology to learn more efficiently (technology literacy).
- Enabling students to acquire in-depth knowledge of their school subjects and apply it to complex, real-world problems (knowledge deepening).
- Enabling students, citizens and the workforce they become, to create the new knowledge required for more harmonious, fulfilling and prosperous societies (knowledge creation).

Aims of Computing and Information Technology Curriculum

The new Computing and Information Technology curriculum standards are aligned with the expected learning outcomes at the end of each education stage in the context of the Qatari education system. At each education stage, the emphasis is given to the learning progressions that are critical for ensuring coherence throughout the Computing and Information Technology curriculum. Best practices from mathematics and science education are implemented in a spiral curriculum that starts in the previous stage and continues to the following stage. The emphasis is on knowledge, skills and attitudes as well as the key values, aims and principles defined in the Qatar National Curriculum Framework.

Special attention is given in the sustainability and long-term impact of the curriculum standards although technology is a field with constant developments. Cross-cutting issues such as Health Education, Safety and Security, and the Environment and Sustainability are explicitly connected with technology issues based on the age group in each education stage.

Students leverage technology to live and work in an interconnected world and enrich their life-long learning by collaborating with others and working effectively in teams. Programming, as a key component of critical thinking and problem solving, is present through a carefully spiral approach in each grade increasing in complexity and reinforcing the students' previous knowledge and skills. A core element of the curriculum is to inspire the students to actively create instead of passively consume in order to meet the needs and contribute to the Qatari society.

Grades 1-3	Grades 4-6	Grades 7-9	Grades 10-12
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Knowledge

Learners will:

- Become familiar with computers and other computing devices learning to handle basic peripherals and operate simple programs.
- Become familiar with the key concepts of computational thinking: algorithms, pattern recognition, abstraction and decomposition.
- Develop an awareness of the importance of the Internet for information exchange and communication between people.

Skills

Learners will:

- Develop the ability to use appropriate software tools to work with drawings, photos, text and sound.
- Develop their typing skills in Arabic and English.
- Begin to search for various types of information such as text, image and sound with the teacher's assistance.

- Develop the ability to construct simple code scripts.
- Engage in collaboration and practise their cooperation and participation competencies.

Attitudes

Learners will:

- Develop their values in terms of digital citizenship such as respect, personal responsibility and endeavour while working with the computer to learn new things about how technology surrounds us in everyday life.
- Develop an interest in using ICTs.

Grades 1-3	Grades 4-6	Grades 7-9	Grades 10-12
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Knowledge

Learners will:

- Develop knowledge of block-based programming tools for computers and robots.
- Enhance their knowledge of the key concepts of computational thinking: algorithms, pattern recognition, abstraction and decomposition.
- Develop knowledge of how the Internet enables information exchange and communication.
- Develop an awareness of the key elements of cybersecurity and digital citizenship.

Skills

Learners will:

- Develop text processing skills.
- Create and deliver effective presentations.
- Compose story-based videos.
- Build a website or blog on a topic.
- Manipulate data, make calculations and create simple charts with a spreadsheet.
- Develop the ability to work with simple databases.
- Construct code using simple block-based programming.
- Programmatically control a robot.
- Develop their capacity to safely gather accurate and relevant information on specific topics from a range of online sources.

Attitudes

Learners will:

- Become responsible “digital natives” respecting Intellectual Property rights, safeguarding their privacy and recognising the rights and privacy of others.
- Understand the proper way of conducting themselves when communicating or exchanging information with others.

Grades 1-3	Grades 4-6	Grades 7-9	Grades 10-12
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Knowledge

Learners will:

- Develop knowledge of the hardware and software components of computer systems and how they communicate with one another and with other systems.
- Develop knowledge of the key principles of Computer Science.
- Expand their knowledge of programming through text-based programming tools.
- Develop knowledge of the design and implementation of computational abstractions that model real-world problems and physical systems.
- Expand their knowledge of best practices in design and 3D modelling.
- Develop knowledge of using infographics to enhance communication.

Skills

Learners will:

- Develop skills to critically select and use multiple digital tools, across a range of devices, to produce creative artefacts.
- Create or modify 3D models to meet specific requirements.
- Develop the ability to re-use and re-purpose digital artefacts with attention to design and usability.
- Collect, analyse and effectively present data.
- Work with relational databases and generate reports.
- Research through various sources and organise the collected information.
- Develop advanced skills to create programs such as a game or a mobile application.
- Create a website using HTML.
- Program an autonomous robot.
- Collaborate online as members of a team.

Attitudes

Learners will:

- Develop the ability to apply their technology skills responsibly and securely through real-life projects.
- Develop an enhanced attitude to protect their privacy and personal data while respecting the privacy and personal data of others.
- Develop their commitment in preserving the environment.

Grades 1-3	Grades 4-6	Grades 7-9	Grades 10-12
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Knowledge

Learners will:

- Develop an awareness of how the transformation and presentation of large data sets through visualisation and modelling methods makes information easy to interpret and valuable in decision making.
- Expand their knowledge of the hardware and software components of computer systems and computer networks.
- Develop enhanced knowledge of the key principles of Computer Science and computer programming.
- Develop an awareness of the importance of the iterative process in developing digital artefacts while fulfilling the changing needs of end users.
- Develop an awareness of the processes of implementing innovative ideas through the key principles of entrepreneurship.
- Expand their knowledge of emerging technologies such as the Internet of Things (IoT) or cloud computing.
- Develop an understanding of usability, security and accessibility of computer systems as crucial factors of their design.
- Develop deep knowledge of the concept of digital identity.

Skills

Learners will:

- Develop advanced computational thinking skills to design, develop and employ strategies for solving real-life problems through decomposition and pattern identification.
- Create innovative solutions through ICT tools and the capabilities of the Internet and the modern cloud technologies.
- Develop modular programs with a variety of programming languages, visual and textual.
- Develop secure and user-friendly programs taking into consideration accessibility requirements.
- Implement complex data structures and fundamental algorithms, e.g. for sorting and searching.
- Apply project management skills in their future studies and later in their profession.
- Implement automated data collection processes and manage data storage on a wide range of physical media and cloud platforms selected with respect to reliability, integrity and privacy.

Attitudes

Learners will:

- Develop positive values in terms of implementing Intellectual property rights, privacy laws and data security guidelines in the implementation of computational ideas and digital creations.

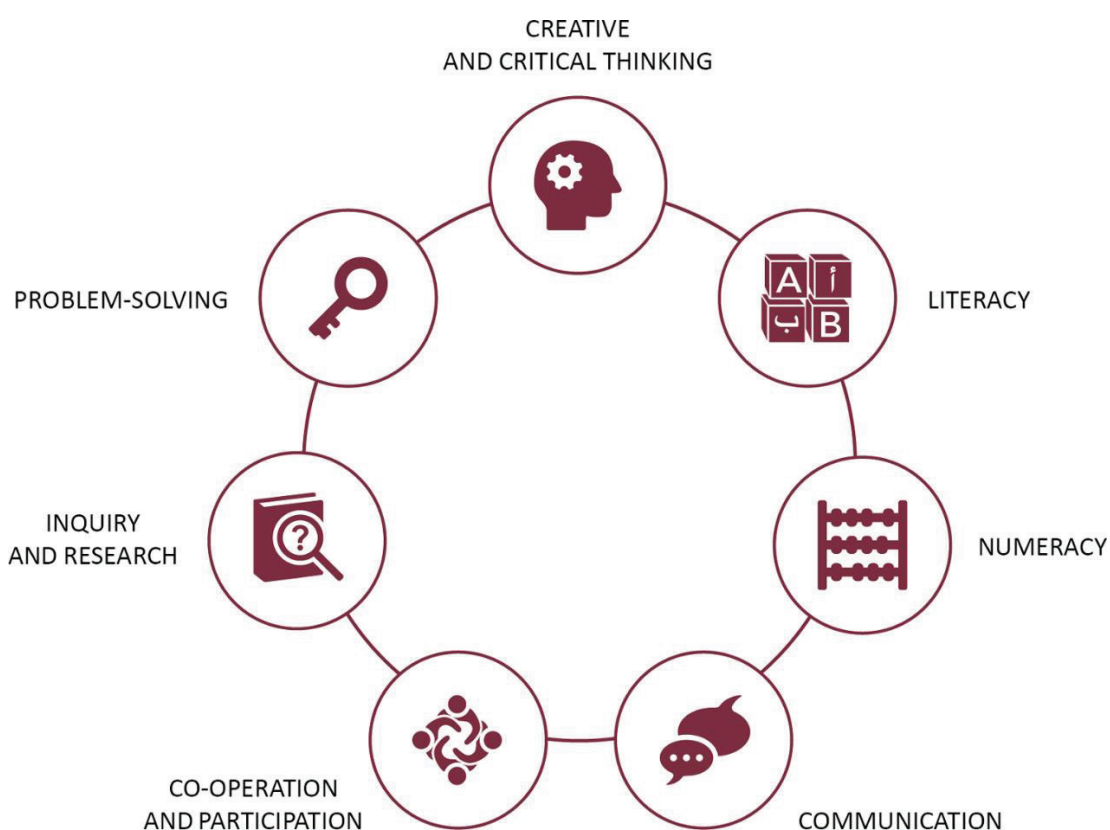
- Develop their capacity to evaluate the quality, suitability and credit information and online sources.
- Explore and reflect on the aspects of society affected by technology.

Teaching and Learning Computing and Information Technology in the 21st Century

General Competencies of the Qatari Curriculum

ICT (Information and Communications Technologies), Computing or Information Technology, as a school subject under different names, is part of the educational experience of children in most parts of the world. Taught as a separate subject, Computing and Information Technology is increasingly regarded as a new literacy, 'digital literacy', alongside language, mathematics and science. However, digital literacy is more than the ability to use a computer. Learning to collaborate with others and connect through technology are essential skills, in both the present and the future.

The Qatar National Curriculum Framework competencies are a combination of knowledge, skills and attitudes and constitute an integral part of the development of the Computing and Information Technology standards.



The connection between the Qatar National Curriculum Framework and each learning standard is outlined in detail in section 11 of this document.

The new Computing and Information Technology curriculum standards utilise all key 21st-century skills and real-life technology skills and are specially designed for the primary, preparatory and secondary schools in the State of Qatar. While maintaining high

international standards, the curriculum follows the guidelines and specifications set by the Qatar National Curriculum Framework, and the culture and customs of the State of Qatar have also been taken into consideration in their development. A well-defined set of curriculum standards provides a detailed context in which competencies and practical skills can be developed within an environment that is appropriate for the age of the students in each grade.

The new Qatari Computing and Information Technology curriculum standards are aligned with other international curricula, guidelines and national requirements such as the International Society for Technology in Education (ISTE) Standards for Students, the UK National Curriculum for Computing and the United States K-12 Computer Science Framework.

Moving toward a 21st-century form of education, the essential skills that students need to be fully prepared for life and work in a global economy are incorporated in the curriculum standards:

- Thinking – Creativity, critical thinking, problem-solving, decision-making and learning
- Working – Communication and collaboration
- Living – Citizenship, personal and social responsibility

Sometimes referred to as deep learning or core skills, these essential skills introduce students to new ways of working, new ways of thinking and new ways of living in a global world. Developing these skills will help them grow into creative and critical citizens, ready to shape the future for themselves and future generations.

Qatar National Curriculum Framework Competencies in the curriculum standards

	Creative and Critical Thinking The central aim of education is to develop critical thinkers. Through the use of technology, students can develop higher-order thinking skills like categorisation and classification. They apply their critical thinking skills to conduct research and work on activities and projects. Students develop their ability to efficiently access and critically evaluate information and creatively use it to solve problems. The ICT tools that are used throughout the different key stages allow the students to express their creativity and thinking according to their age group. Students learn how to create authentic digital artefacts independently and how to realise their ideas with digital creativity tools. In higher grades, data analysis and modelling skills enable students to identify and analyse data from a range of sources and interpret results to draw inferences.
	Literacy Reading and writing are integral elements of the learning process and naturally in Computing and Information Technology students apply their reading and writing skills extensively. Besides practising their typing skills in Arabic and English in word processing tasks and working with various tools,

	students need to express themselves in writing to create digital artefacts or communicate with others. Furthermore, in higher grades, they have to create longer and more structured documents suitable for their academic studies while taking into account specific audiences and purposes. Researching for information on a wide range of topics required for their projects in all grades builds the students' literacy competence considerably.
	Numeracy Numeracy is essential for everyone as it helps individuals develop reasoning and logical thinking skills in their everyday activities. Apart from understanding the role of numeracy in the development of ICT and how computers work, students will apply their numeracy knowledge and skills in a broad variety of topics, activities and digital tools. Using spreadsheets and database management tools, they will manipulate numbers and transform data to information. Reading and analysing data, performing calculations, compiling statistics and designing coherent graphs are integrated in all key stages. In the context of programming and robotics, students will develop their numeracy competence while solving problems with code that includes a variety of calculations and measurements.
	Communication Proper communication, either written or oral, is considered a main objective throughout the new curriculum standards. The students will be able to communicate content for a variety of purposes clearly and appropriately. They will be able to select suitable platforms and tools and express themselves through digital media and formats. Students will plan and design several types of infographics and complex data visualisations to meet the desired goals. Starting in primary grades and expanding their knowledge progressively in higher grades, students will work on effective presentations, combining multimedia elements to enhance the message they want to convey.
	Co-operation and Participation Students need to become active learners and responsible team members. Through collaborative projects, they understand how essential it is to engage with others and work effectively in teams. Starting in primary grades, students learn how to adapt to different situations in order to complete a common goal. They work in groups on programming, robotics and design projects that require a range of different traits. The students will use modern ICT tools and collaborative technologies to contribute constructively to projects assuming various team roles and developing their leadership skills.

	Inquiry and Research Seeking and analysing information is fundamental for a modern constructivist learning environment where students pursue their learning goals. They learn to plan and employ research strategies to locate and retrieve information from various online sources. Students will be able to evaluate the accuracy, credibility and relevance of the retrieved information in order to build knowledge around topics and have meaningful learning experiences. Student-driven inquiries will help them test ideas, options and alternatives in order to develop solutions to real-world problems. Most importantly, students will understand the value of respecting the work of others and use proper references to the sources.
	Problem-solving Computational thinking is essentially a problem-solving process that involves creating solutions that capitalise on the power of computers. Programming and robotics enable the students to apply their problem-solving skills and their knowledge of fundamental principles of computer science to real-life problems. Starting in Grade 1, the students develop and employ strategies for understanding and solving problems. Gradually they apply this competence to create automated solutions that utilise computers and robots through a variety of software development tools. They will break problems into smaller parts (decomposition), extract important information (pattern recognition) and develop models (abstraction) to understand complex systems. They will also learn how to test and correct issues in their solutions using the iterative design process and working in teams.

Teaching and Learning Strategies

Evolution of educational theories

In the late 1960s, the term "society of knowledge" appears in international literature to describe a post-industrial society, a society in which Information and Knowledge tend to be particularly developed.

The development of teaching science in the context of ever-changing ICT lead to the term "society of learning" to describe learning as an acquisition and change in :

- knowledge
- skills
- tactics
- beliefs
- attitudes and conducts of the individual

This learning takes place in collaborative environments and is built through discussions among individuals or groups that create and understand communication and through joint implementation of activities. On the other hand, 21st-century students are digital natives;

they were born during a time when the Internet and mobile devices are the norm. Most students are “plugged in” to a technologically sophisticated world outside of schools. Teachers of digital natives must find ways to deliver instruction that benefits from technology.

Instructional strategies

A teaching strategy involves combining and sequencing a number of different instructional activities to help the students accomplish the learning objectives of each lesson. A diversity of instructional strategies ensures that the learning is more effective and in-depth knowledge is achieved. For the Computing and Information Technology subject and according to the students’ age group and grade these may include the following:

- Collaborative learning
- Problem-based learning
- Direct instruction
- Project-based activities
- Enquiry experiments (exploration)
- Discussion
- Games and simulations
- Formative assessment

Collaborative learning is a successful teaching strategy in which small teams, each with students of different levels of ability, use a variety of learning activities to improve their understanding of a concept and practise their skills. It requires that the members of the team view their role as part of the whole team. All members have to interactively engage and be able to reflect on personal learning. The students’ interpersonal and leadership skills are increased. Long-term groups may be more successful leading to learning benefits for all. To ensure equal participation the size of the group need to be kept between 3 to 5 members. This strategy may not be effective, if the student learning is not enhanced by discussion and sharing ideas.

Problem-based learning is a student-centred approach which uses a carefully defined problem as a context for the students to conduct self-directed enquiry, integrate theory and practice, and apply their knowledge and skills to develop a solution to the problem. The students go through the process of acquiring new knowledge based on the recognition of a need to learn. This approach promotes deeper rather than superficial learning and fosters logical reasoning and problem-solving skills, while the teacher only facilitates the process. Learning is more enjoyable for students as the aspiration of solving a problem provides a stimulating experience. Sometimes though, depending on the concept to be learned and the size of the classroom, the implementation of this approach may be difficult.

In Computing and Information Technology there are occasions when actual direct instruction is both the most effective and the most efficient way of teaching a concept or a skill. These are the threshold concepts and skills, the ones that once they are explained really transform the way the students think about computing. These thresholds, such as how a database is defined, how networking protocols work or programming concepts like data structures, functions and recursion, may not be discovered by the students through play or creative projects. Direct instruction should always be followed by multiple opportunities for the students to express their knowledge and understanding.

Project-based activities can be implemented independently or collaboratively, and the teacher's role is to provide guidance to students towards the successful completion of their projects and attainment of deep understanding of key concepts.

Direct or explicit instruction is expected to be balanced with open inquiry activities. Computing is inherently open-ended, complex and student-driven providing motivation and engagement. Direct instruction is a systematic and teacher-directed way of teaching and needs to be focused on critical concepts by providing step-by-step demonstration to break down complex tasks and be followed up by numerous opportunities for practice.

In all of the above teaching approaches, the teachers need to plan for a wide range of diversity of students in the classroom. Acknowledging that students are diverse in their backgrounds and abilities simultaneously acknowledges that a one-size-fits-all approach cannot guarantee success for all students, but that it is possible for all students to meet high standards. Teachers have to provide options for students to demonstrate understanding in multiple formats and allow them to engage with the material in different ways.

The teachers will choose an appropriate teaching strategy based on the size of the classroom, the abilities of the students, the available teaching time and the ICT resources. The required time for each activity will have to be estimated including the time required to debrief after the activity.

ICT integration

Since the subject is Computing and Information Technology, all topics in all grades are by default being taught through the use of ICT. The subject is not taught in a regular classroom but the computer lab. Each student is using a personal computer to understand Computing and Information Technology concepts and practice ICT and programming skills.

Subject Assessment Strategies

The core of Computing and Information Technology as a subject is very practical. Hands-on learning of knowledge and skills is a challenge for the assessment of what students have learnt. Sometimes it is also difficult to separate out the learning of individual students who have worked collaboratively on a project. Formative assessment should be in those contexts where knowledge and skills are taught explicitly and intentionally.

Within the scope of this curriculum standards document, the suggested assessment strategies of the subject of Computing and Information Technology are outlined (depending on the students' age group and grade):

- Self-evaluation questionnaire (student-driven accountability)
- Evaluation of the learning process (in-lab hands-on activities, interest and contribution, team cooperation)
- Peer assessment, marking of drafts, questioning (formative assessment to influence improvement, feedback should be provided to students)
- Project review (individual or teamwork, only reports on outcomes – not on the process used)
- Project portfolio analysis (with a focus on the evolution and development of the portfolio rather than the evaluation of a single project)

- Exam based on the learning outcomes that should be achieved (summative assessment that takes place after learning to quantify achievement)
- Artefact-based interview

A set of guiding principles common to all assessment areas should be established:

- Focus on key parts of the content (knowledge and skills) instead of details
- Demanding age-related challenges
- Clarity in definition of activities and projects
- Diversity of the assessment methods and cognitive processes to be stimulated
- Differentiation possibilities
- Consideration of the available time
- Use of consistent criteria of performance quality (sharing of objectives and assessment criteria with the students)
- Performance criteria should include:
 - participation in the learning process (interest in activities/projects, collaboration inside a team, attitude)
 - use of tools (knowledge and skills)
 - results of task (accuracy, understanding and application of the concepts involved)

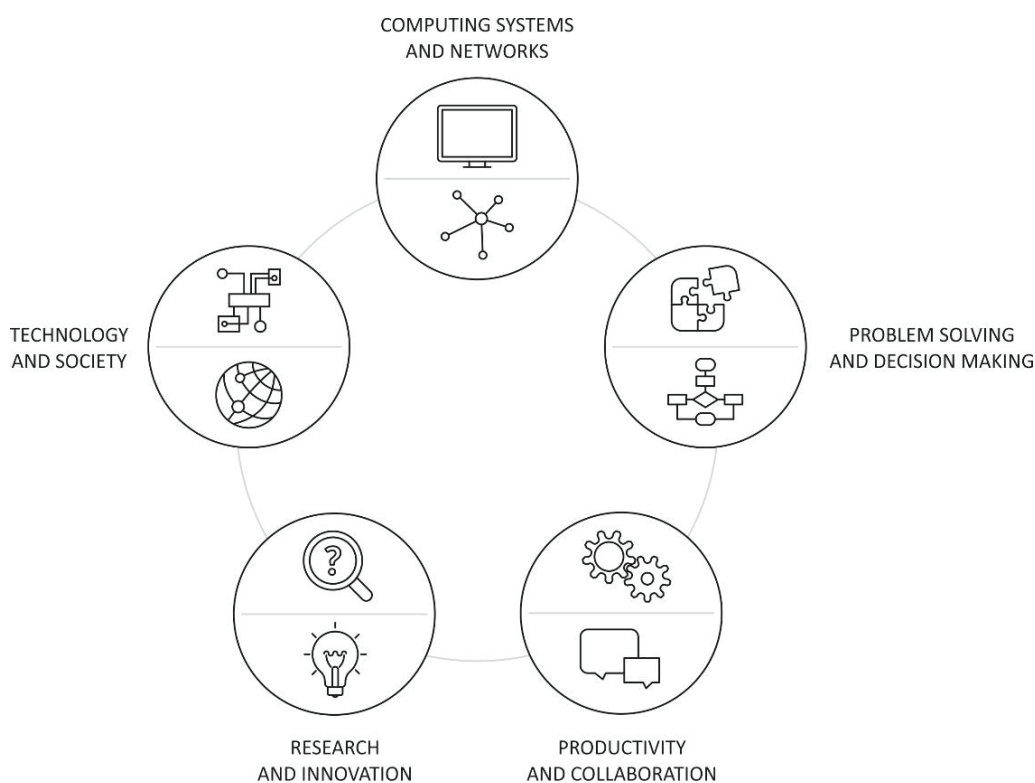
The new curriculum standards and learning outcomes for Computing and Information Technology are clear and descriptive. The standards and outcomes along with the suggested learning objectives make the task of the preparation of assessment activities and exams easier.

Main Domains & Strands of the Computing and Information Technology Curriculum

Domains and Strands

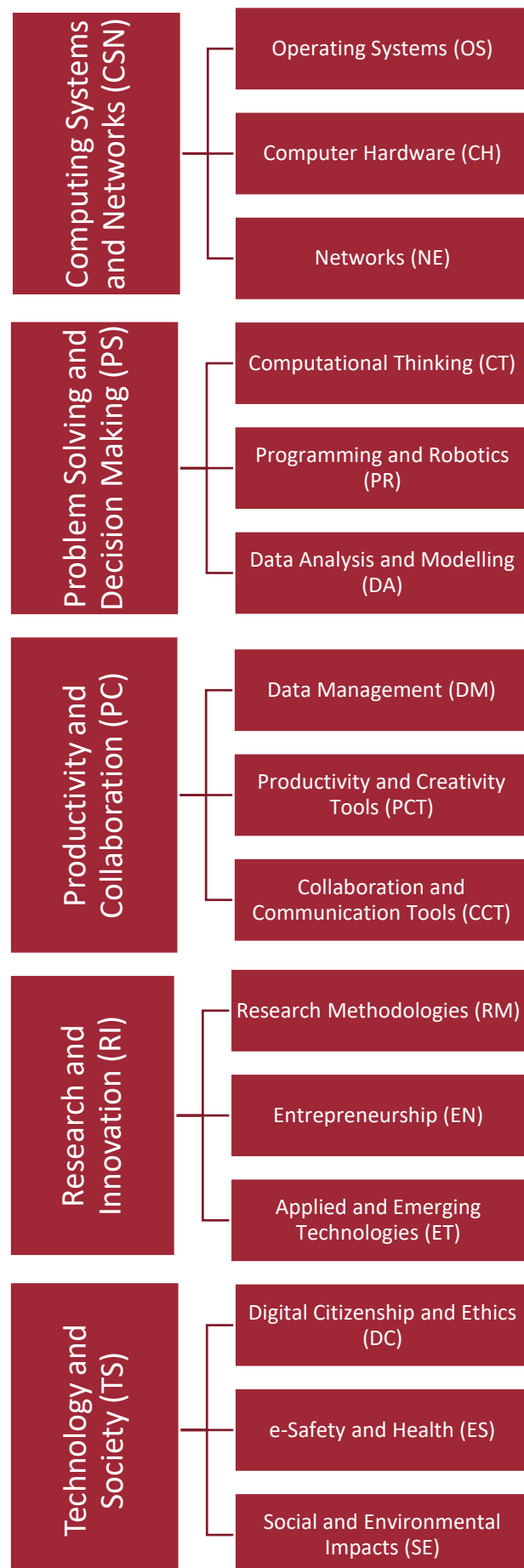
The new Computing and Information Technology curriculum is organised into five domains:

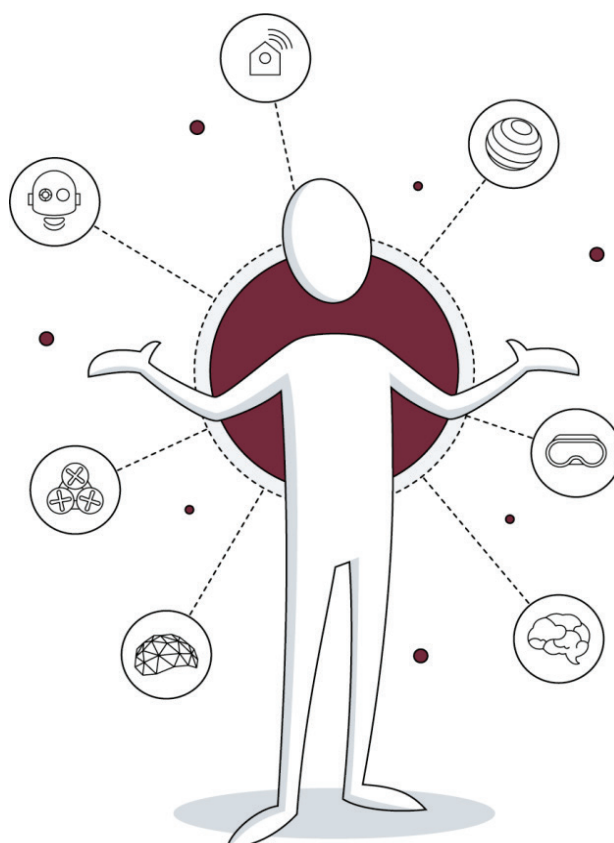
1. Computing Systems and Networks (CSN)
2. Problem Solving and Decision Making (PS)
3. Productivity and Collaboration (PC)
4. Research and Innovation (RI)
5. Technology and Society (TS)



Computing and Information Technology Domains Framework

Each domain consists of different strands that cover a wide range of current and future information and communications technologies, computer science and digital citizenship topics:





Description of Strands

Computing Systems and Networks

Operating Systems

Students start to learn how to operate the computer and its basic peripherals in primary grades. As early as Grade 1, they learn how to use the mouse and the keyboard correctly. In the first primary grades students also practise their typing skills extensively in Arabic and English. Progressively they will be able to operate a range of computers and their operating system, including the file system and security, and solve common software problems (simple IT troubleshooting). The standards of the key Computer Science concepts regarding the operating systems are presented in Grade 10.

Computer Hardware

Starting in Grade 1, students will be able to identify the basic components of a computer and its peripherals and later they will discover how computers and their related peripherals work. Working on different projects, they will understand how to select appropriate input and output devices, from a camera to a 3D printer, to accomplish specific tasks. In Grade 6, the Computer Hardware strand includes data collection devices (data loggers) appropriate for experiments in science labs. Later on, students learn how to evaluate a computer system for a specific purpose critically. In Grade 10, key Computer Science concepts on the architecture of a computer system and its main components are explored in a simple approach suitable for the specific age group.

Networks

In primary grades, students are also introduced to the basic concepts of networking, and later, in preparatory and secondary grades, they will extend their knowledge to current wired and wireless network topologies and implementations. Students will learn how networks create the core infrastructure of telecommunications and how information flows across the various types of networks and networking devices. They will understand the different methods of data exchange through wired and wireless networks and the benefits and drawbacks of “the cloud”. In Grade 10, the main networking protocols are introduced, and wireless security methods are discussed. In the Technical Track of Grades 11 and 12, students explore the benefits of storage area networks and VPN technologies.

Problem Solving and Decision Making

Computational Thinking

Computational thinking is a core element of the broader discipline of computer science and focuses on pattern recognition, abstraction and decomposition. Starting as early as Grade 1, students explore the main concepts of computational thinking appropriately for this age group. They learn how to decompose a simple problem into smaller steps and how to follow a simple sequence of commands to accomplish a task. Progressively they will learn to work visually with flowcharts and construct algorithms that can solve problems that require sequencing, repetition and selection. In higher grades, students will understand how complex problems can be solved algorithmically and be able to apply best practices from the iterative design process. They will be able to select appropriate data structures and handle external events or stimuli. Students will be able to analyse, find problems in and correct an algorithm as well as choose the most efficient solution to a problem. Reusability and advanced testing techniques with test scenarios will be explored in secondary grades. In the Technical Track of Grades 11 and 12, the standards involve understanding the concepts of concurrency, object-oriented and user-centred design and complex data structures, such as queues, stacks and graphs. Algorithms will be evaluated regarding efficiency, correctness, reliability and flexibility.

Programming and Robotics

In the Programming and Robotics strand students will apply their computational thinking skills and fully utilise their creativity and problem-solving competences to create programs using various software development tools, block-based and text-based. In Grades 2 and 3, very young students will implement simple algorithms in a Logo environment to draw geometrical and other shapes. The standards related to Programming cover a variety of coding techniques in block-based programming environments progressively from Grades 4 to 8. In Grade 8, students become familiar with a game development environment that motivates team collaboration. Text-based programming is introduced in Grade 9 and is further explored in secondary grades. Students will understand the principles of programming and how coding transforms an algorithm to a set of computer instructions to solve problems programmatically. Testing and debugging are covered progressively and extensively in all grades. Working with physical and virtual robots in various grades, students will explore robotics and how robots can respond to external stimuli when programmed correctly. In the Technical Track of Grades 11 and 12, students will explore modern programming paradigms, such as object-oriented programming.

Data Analysis and Modelling

The concepts of data and information and their role in decision-making are introduced in Grade 5. Students will learn methodologies of collecting accurate data automatically in Grade 6. In the preparatory grades, they will explore modelling techniques to analyse data and interpret results to draw inferences. The Data Analysis and Modelling standards in secondary grades involve the transformation of data into information, the study of databases that support big data and the implementation of modelling and simulation techniques in spreadsheets for advanced statistical analysis.

Productivity and Collaboration

Data Management

Students will learn how to store and manage data. In the primary grades, they will understand the concept of a file and its relevant data. They will explore ways to collect, transform and store data on different storage media. The primary tool for the transformation and management of data at this key stage is the spreadsheet that provides ease of use. In preparatory grades, students will explore tools that can manage and maintain data for particular audiences and purposes, such as relational databases. In Grade 10, the Data Management standards involve the concepts of security and network storage. Later in Grades 11 and 12 encoding techniques to represent data efficiently will be introduced. In the Technical Track of Grades 11 and 12, students will develop their knowledge in data processing techniques.

Productivity and Creativity Tools

The Productivity and Creativity Tools standards cover a diverse range of knowledge and skills with an emphasis on technologies and tools needed to create digital artefacts for a range of purposes. Word processing, image drawing and photo manipulation, and creating presentations are concepts that are covered extensively in a progressive way in primary and preparatory grades. Starting from basic text editing in Grade 1 and progressing to comprehensive word processing tools in the rest of the primary grades, the standards are extended to advanced document design techniques in secondary grades. Students discover best practices as they work on a variety of activities and real-life projects. They will be able to design digital artefacts that enhance visual communication for particular audiences. To accomplish this goal, the standards involve the design and creation of infographics, diagrams and multimedia presentations. In primary grades, students learn how to edit photos and combine them with short sound and movie clips, and later in higher grades, they learn how to capture and edit video.

Collaboration and Communication Tools

In the primary grades, students will be able to share information and ideas effectively using a variety of media and ICT tools. They will understand the difference between email messaging and instant messaging and how to use them effectively. Blogging and social media are introduced through best practices and guidelines for sharing and exchanging information. In Grade 7, students will be able to compare a range of communication and social media tools critically. Later, in higher grades, the standards cover the collaboration platforms that are implemented securely through cloud computing. Students will learn how to work with others in collaborative environments with video conferencing tools and online

office suites. In secondary grades, they will become familiar with project management concepts and learn how to manage shared projects effectively.

Research and Innovation

Research Methodologies

The standards in Research Methodologies progress from Grade 1 to 6 with the introduction of web surfing and searching on the Internet. Students will be able to locate and retrieve information and different types of digital data from a wide range of online sources. They learn how to critically compare the information they gather in order to ensure its accuracy. In the preparatory grades, students will be able to identify patterns in sets of information to create appropriate inquiries and assess the suitability and credibility of retrieved data using a range of criteria. They will explore ways of organising the retrieved information. In higher grades, students will extend their knowledge of research methodologies for specific tasks.

Entrepreneurship

Starting in Grade 4, students will be able to use ICT tools that enhance their entrepreneurship skills. In the primary grades, the Entrepreneurship standards are linked to expressing ideas through presentations and understanding how different graphs can affect a decision. Later, in the preparatory grades, students will explore how technology can positively impact business processes through real-life projects that are focused on a modern knowledge-based economy. In Grade 10, students learn how to use models to support accurate decision-making. In Grades 11 and 12, they are introduced to the concept of system life cycle and its impact on the introduction of a new system and discuss global e-commerce trends.

Applied and Emerging Technologies

Students in primary grades will discuss the advantages and disadvantages of new technologies and what impact they have in their life and education. Later, in preparatory grades, they will explore emerging technologies that have the potential to disrupt the way people live, learn and work. Teleworking and mobility are key concepts that will be extensively discussed as they change the traditional way of working. In higher grades, other technologies that are explored are artificial intelligence, machine learning and quantum computing. Students are introduced not only to the benefits of the new technologies but their negative aspects and the obstacles encountered in the implementation of ground-breaking developments.

Technology and Society

Digital Citizenship and Ethics

The Digital Citizenship and Ethics standards are introduced gradually from Grade 1 based on the age of the students in each grade. Students start by learning the basic rules for using a computer, and progressively they become familiar with basic social protocols and best practices to protect their privacy and the privacy and rights of others. In the primary grades, they learn how to communicate respectfully and responsibly with others online. Students will understand the concepts of Intellectual Property rights and how to use, modify or share the work of others in an ethical and responsible way. They will understand netiquette and learn how to report and prevent cyberbullying. Students will learn to be respectful and kind

while communicating over the Internet. Later on, in preparatory grades, they will become familiar with the proper uses of social media and understand the appropriate way of collecting others' personal information. The main emphasis of the standards is to enable students to become active and responsible digital citizens. In Grades 11 and 12, they will discuss the impact of the digital divide on societies and learn how to manage digital identities and reputations.

e-Safety and Health

The focus of the e-Safety and Health strand is on safe computing: keeping the technology users healthy and securing the data stored in computer systems or exchanged over networks. The concept of ergonomics is introduced as early as in Grade 1 and is then presented progressively in higher grades. Students will be aware of potential health issues while working with ICT and learn the correct posture to have when using different computing devices. They also become familiar with health issues related to the excessive use of a computer. Regarding e-Safety, students will be able to stay safe, exploit opportunities and manage risks while interacting with ICT tools. They will understand the dangers of sharing their personal information and learn how to protect their digital identity adequately. They will understand the concepts of data security and data backup. Students will discuss strategies to secure and protect networks. They will learn how to store and exchange data online through encryption securely. Students will explore strategies to evaluate secure websites for commercial transactions.

Social and Environmental Impacts

In primary grades, students will discuss how the computer has changed the world and the positive and negative impacts of technology in everyday life. In Grade 2, they will learn how to dispose of electronic devices and consumables properly. In preparatory grades, students will compare and contrast the positive and negative effects of technology on the environment. They will also discuss the impact of ICT on self-learning and life-long learning. In higher grades, students will discuss the impact of technology on the local community or society. They will explore ways in which technology can be more accessible to people with disabilities. Students will understand the concept of sustainable development and how it can be achieved.

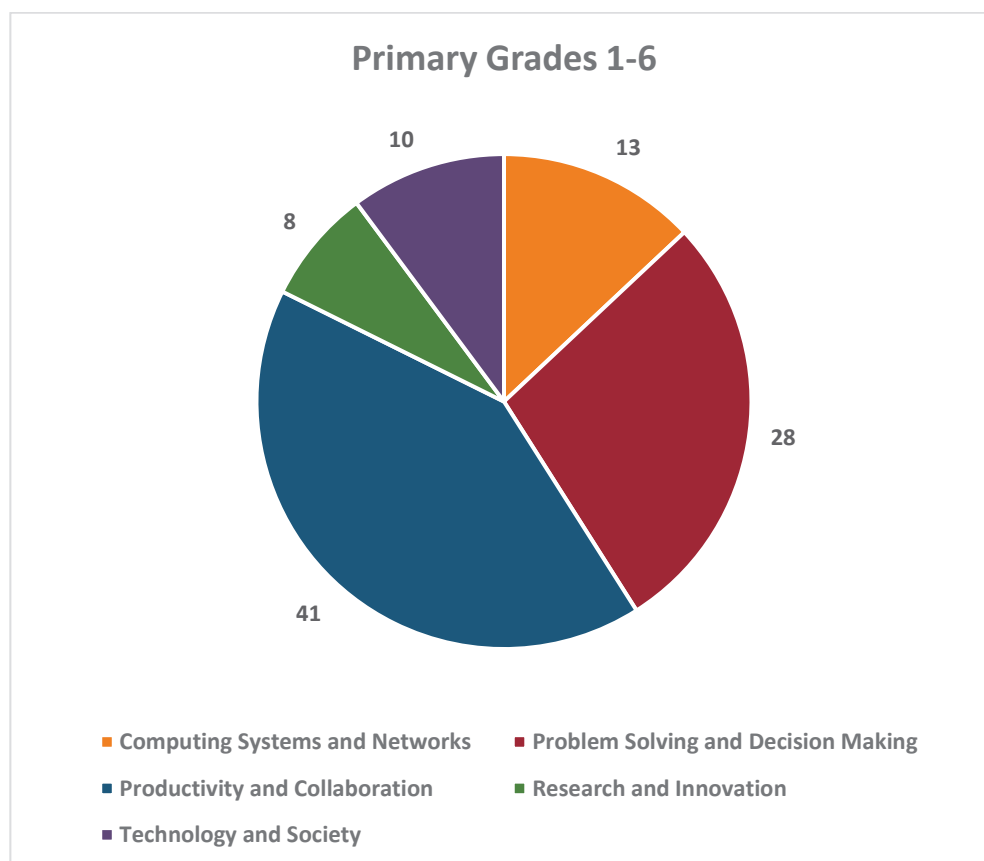
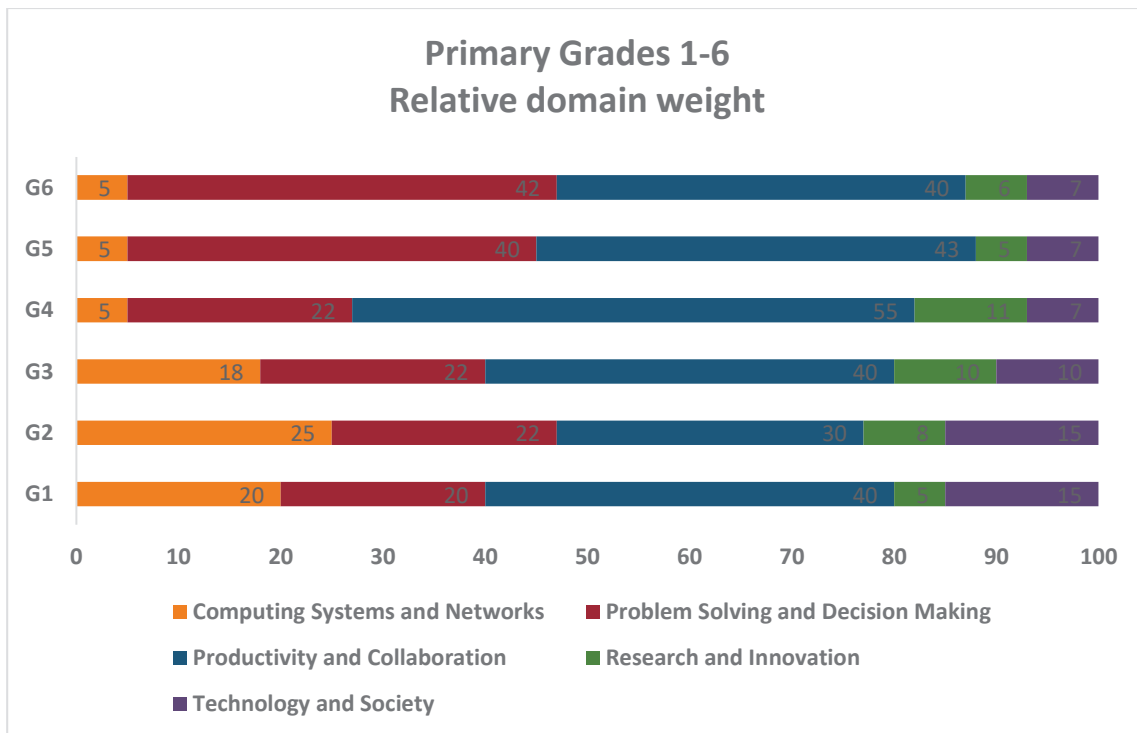
**Relative Weight & Teaching
Time of the Subject
According to the Strand
and Grade**

The relative weight of each domain and strand per grade is given below as an approximate proportion of the total available teaching time. All numbers are percentages (%).

The weighting of domains and strands takes into consideration the amount and complexity of concepts and practices in the relevant curriculum standards.

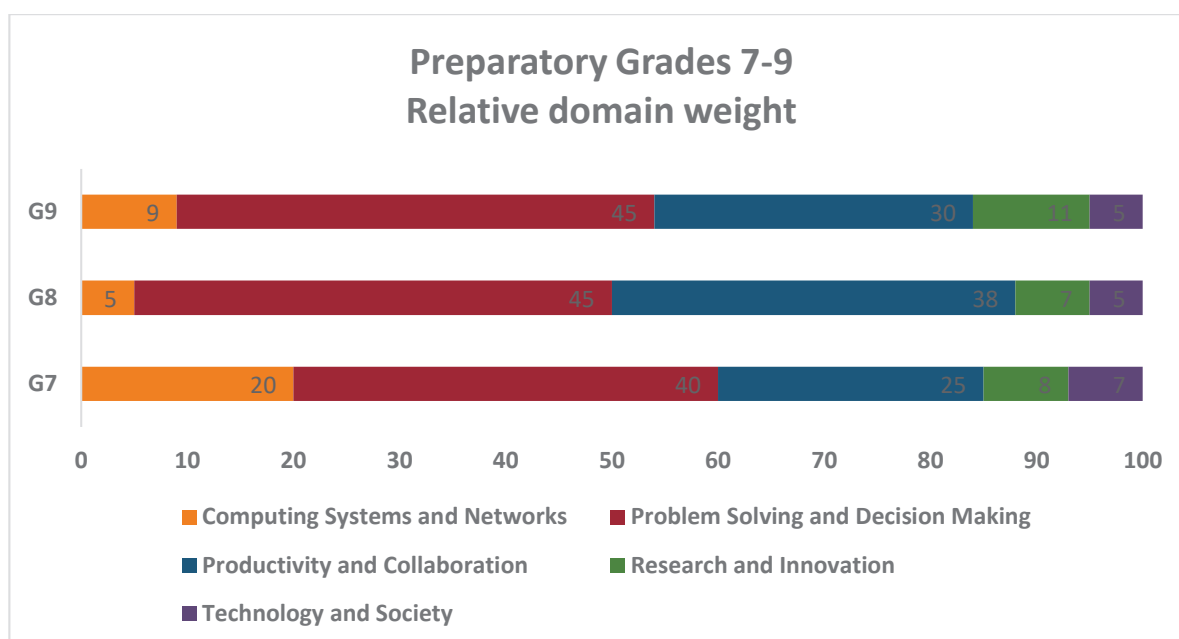
Primary Grades 1-6

	G1	G2	G3	G4	G5	G6
Computing Systems and Networks	20	25	18	5	5	5
OS Operating Systems	10	15	8	2	2	2
CH Computer Hardware	5	5	5	2	2	2
NE Networks	5	5	5	1	1	1
Problem Solving and Decision Making	20	22	22	22	40	42
CT Computational Thinking	20	10	10	10	10	10
PR Programming and Robotics		12	12	12	25	25
DA Data Analysis and Modelling					5	7
Productivity and Collaboration	40	30	40	55	43	40
DM Data Management	5	5	2	3	26	18
PCT Productivity and Creativity Tools	30	20	28	40	15	20
CCT Collaboration and Communication	5	5	10	12	2	2
Research and Innovation	5	8	10	11	5	6
RM Research Methodologies	5	8	10	7	2	3
EN Entrepreneurship				2	2	2
ET Applied and Emerging Technologies				2	1	1
Technology and Society	15	15	10	7	7	7
DC Digital Citizenship and Ethics	5	5	5	1	4	4
ES e-Safety and Health	5	5	4	5	2	2
SE Social and Environmental Impacts	5	5	1	1	1	1
	100	100	100	100	100	100

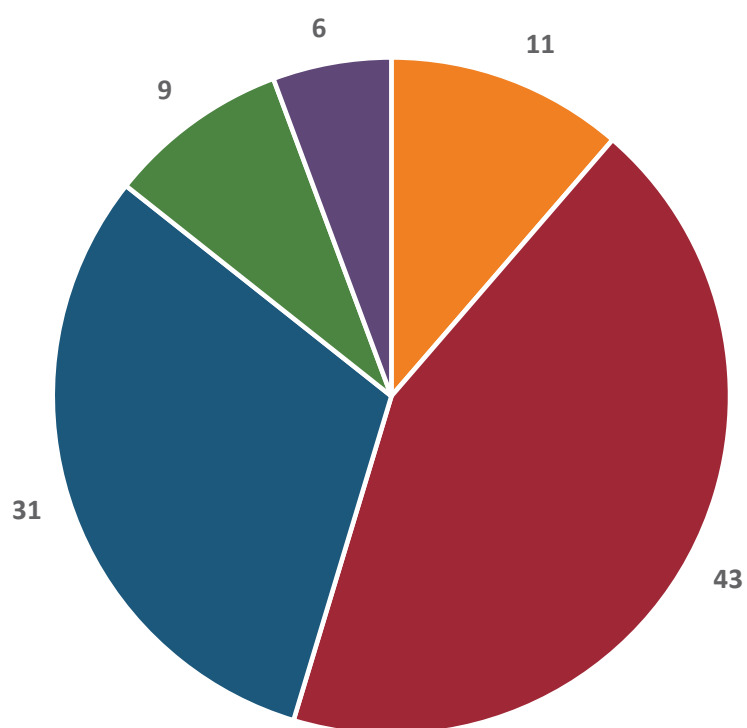


Preparatory Grades 7-9

	G7	G8	G9
Computing Systems and Networks	20	5	9
OS Operating Systems	10	2	2
CH Computer Hardware	5	2	5
NE Networks	5	1	2
Problem Solving and Decision Making	40	45	45
CT Computational Thinking	5	5	5
PR Programming and Robotics	30	30	30
DA Data Analysis and Modelling	5	10	10
Productivity and Collaboration	25	38	30
DM Data Management	4	10	10
PCT Productivity and Creativity Tools	16	20	10
CCT Collaboration and Communication	5	8	10
Research and Innovation	8	7	11
RM Research Methodologies	5	3	5
EN Entrepreneurship	2	2	5
ET Applied and Emerging Technologies	1	2	1
Technology and Society	7	5	5
DC Digital Citizenship and Ethics	2	2	1
ES e-Safety and Health	4	2	3
SE Social and Environmental Impacts	1	1	1
	100	100	100



Preparatory Grades 7-9



- Computing Systems and Networks
- Problem Solving and Decision Making
- Productivity and Collaboration
- Research and Innovation

Secondary Grades 10-12

G11H: Grade 11 Humanities and Literature Track

G11S: Grade 11 Sciences Track

G11T: Grade 11 Technical Track

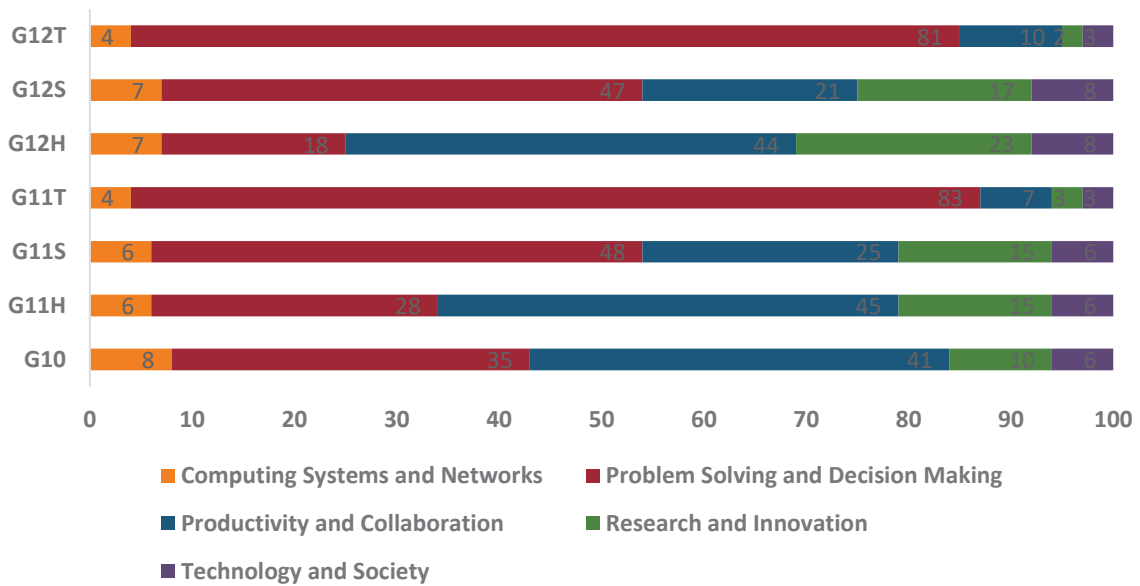
G12H: Grade 12 Humanities and Literature Track

G12S: Grade 12 Sciences Track

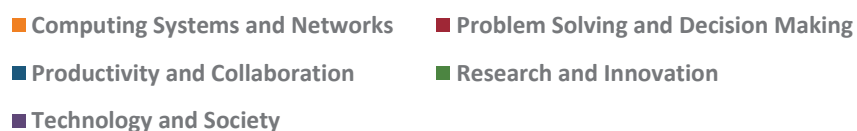
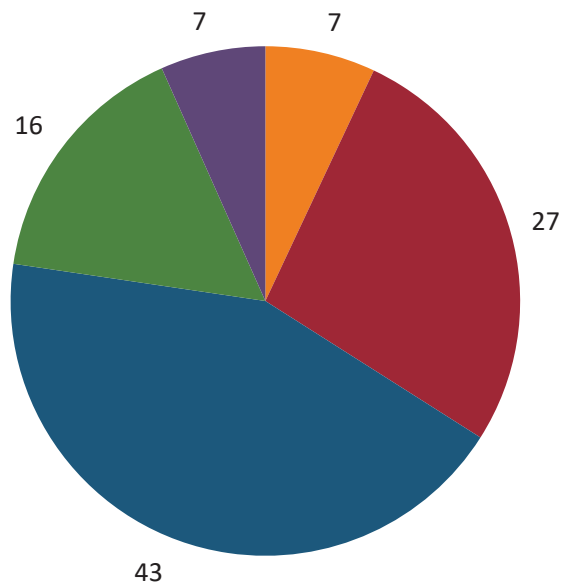
G12T: Grade 12 Humanities and Literature Track

	G10	G11H	G11S	G11T	G12H	G12S	G12T
Computing Systems and Networks	8	6	6	4	7	7	4
OS Operating Systems	4	3	3	2	4	4	2
CH Computer Hardware	3	1	1	1	2	2	1
NE Networks	1	2	2	1	1	1	1
Problem Solving and Decision Making	35	28	48	83	18	47	81
CT Computational Thinking	5	3	3	30	6	6	25
PR Programming and Robotics	25	20	40	52	6	35	55
DA Data Analysis and Modelling	5	5	5	1	6	6	1
Productivity and Collaboration	41	45	25	7	44	21	10
DM Data Management	3	5	5	2	3	3	6
PCT Productivity and Creativity Tools	35	30	10	2	35	12	3
CCT Collaboration and Communication	3	10	10	3	6	6	1
Research and Innovation	10	15	15	3	23	17	2
RM Research Methodologies	4	3	3		4	4	
EN Entrepreneurship	5	11	11	2	16	10	1
ET Applied and Emerging Technologies	1	1	1	1	3	3	1
Technology and Society	6	6	6	3	8	8	3
DC Digital Citizenship and Ethics	3	2	2	1	3	3	1
ES e-Safety and Health	2	3	3	1	3	3	1
SE Social and Environmental Impacts	1	1	1	1	2	2	1
	100	100	100	100	100	100	100

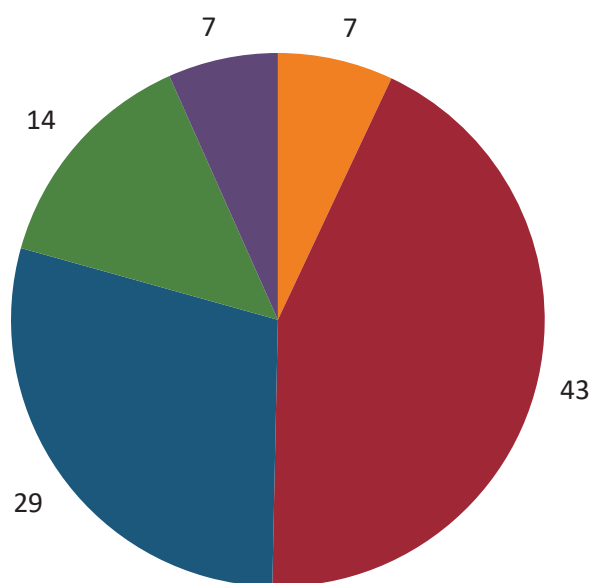
Secondary Grades 10-12 Relative domain weight



Secondary Grades 10-12 Humanities Track

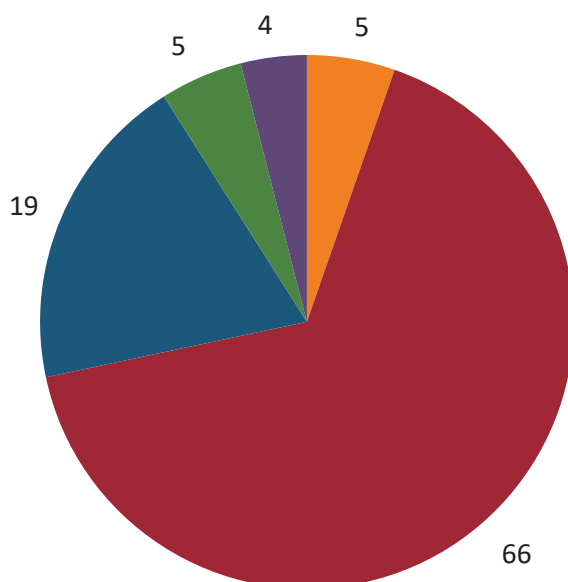


Secondary Grades 10-12 Sciences Track



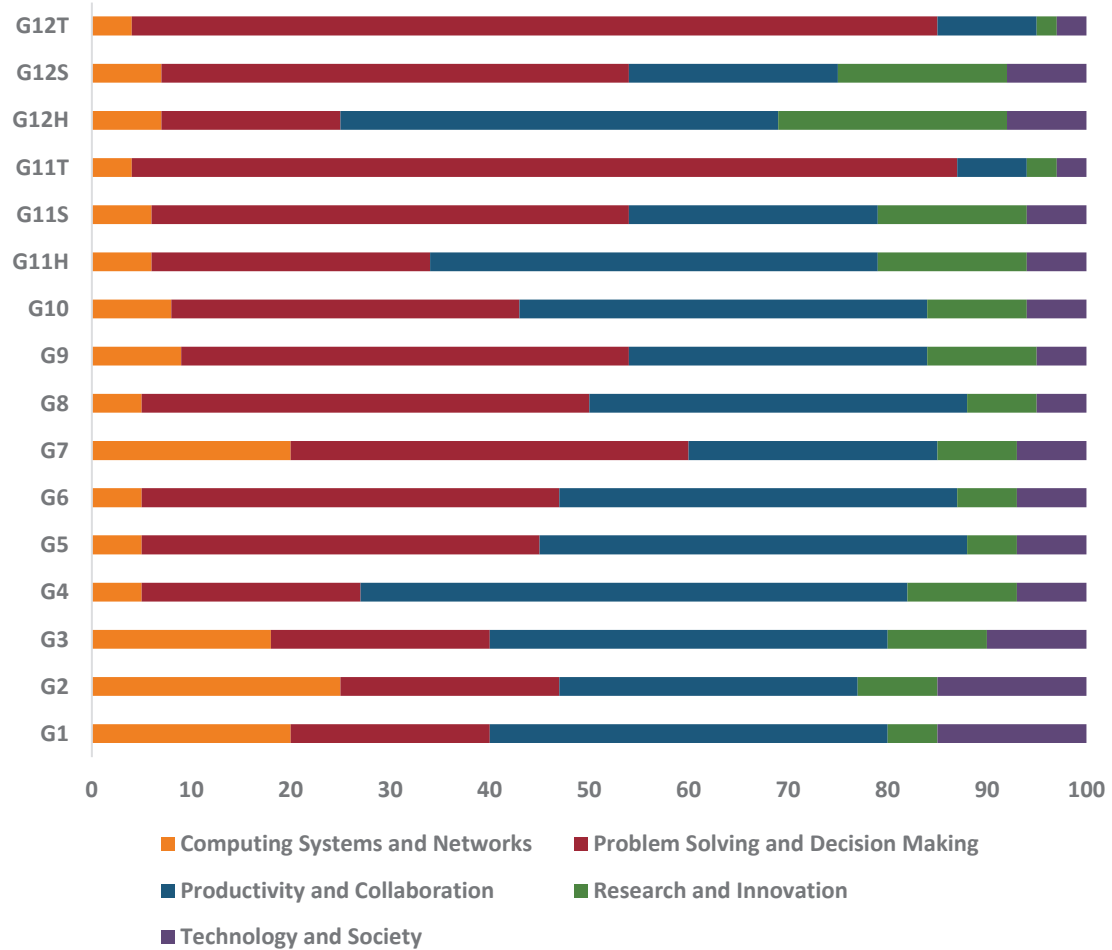
- Computing Systems and Networks
- Problem Solving and Decision Making
- Productivity and Collaboration
- Research and Innovation
- Technology and Society

Secondary Grades 10-12 Technical Track



- Computing Systems and Networks
- Problem Solving and Decision Making
- Productivity and Collaboration
- Research and Innovation
- Technology and Society

Grades 1-12 Relative domain weight



Computing and Information Technology Teaching Time

The table below shows the number of periods per week for each grade and the total approximate teaching time per year based on an academic year of 30 teaching weeks (excluding exams and holidays) and 45 minutes per period.

Grade	Number of periods per week	Approximate teaching time in hours per year
Primary 1-6	2	45 hours per year
Preparatory 7-9	2	45 hours per year
Secondary 10	2	45 hours per year
Secondary 11-12 Sciences Track Elective	2	45 hours per year
Secondary 11-12 Humanities Track Elective	2	45 hours per year
Secondary 11-12 Technical Track Elective	8	180 hours per year

The two periods of 45 minutes each week for all grades (except Grade 12 Technical Track) are strongly recommended to be adjacent in the timetable to maximise the cognitive benefit to students.

Cross-curricular and Integration

Computing and Information Technology is one of the most fundamentally cross-curricular subject areas in K-12 education. Although the subject is easily linked to the rest of the STEM subjects, Science, Engineering and Mathematics, it is about using technology, logic, creativity and computational thinking to solve problems that spans all school disciplines.

Specifically, as part of STEM-based education, the Computing and Information Technology curriculum enables students to employ an applied approach that integrates the four disciplines into a unified learning paradigm.

Similarly, the activities and the projects developed for the Computing and Information Technology subject in each grade are linked to the other subjects and the Qatar National Curriculum Framework cross-cutting issues:

- **Mathematics**

Computational thinking is one of the core elements of the new curriculum standards and is inextricably linked to mathematics and logic. Data processing and analysis through the use of spreadsheets and data visualisation with charts and graphs require extensive use of mathematical functions, statistics and modelling.
- **Sciences**

Programming provides the opportunity to work on modelling and simulations of real-world problems linked to sciences. Students use ICT tools to collect data (data logging) during science experiments for further analysis and reporting. They also have opportunities to search on the Internet and find virtual interactive experiments and videos or animations that enhance scientific learning and enquiry. Emerging technologies like Robotics, Virtual Reality (VR) and Augmented Reality (AR) enable students to explore different environments.
- **Arabic and English language**

Working with tools such as word processing and presentation software, the students are practising their communication and literacy skills as well as computer typing. The technology can inspire young people to read and write. The students have the chance to express themselves appropriately in writing, taking into consideration different audiences and purposes. Communicating ideas and information also involves the use of language in a variety of situations. Researching on the internet for resources needed for projects and activities on other subjects requires a good understanding of the language.
- **Islamic Studies**

Activities and projects across a variety of strands are linked to the Islamic Studies subject, including Quran applications (recitation and interpretation), in which students could use research and inquiry skills, and the digital production of different artefacts related to Islamic studies.
- **The Arts**

Graphic design, drawing, 3D modelling, audio and video editing, and photo manipulation are among the topics covered in the Productivity and Creativity Tools strand. Beyond the usual tools, the Programming and Robotics strand guides the students in Primary and Preparatory grades to create art with the use of code or through visual development tools.

- **Social Studies**

Activities and projects across a variety of strands are linked to the Social Studies subject including Geographic Information Systems (GIS), Global Positioning Systems (GPS), and many others. Entrepreneurship is a new strand of the curriculum standards linked to the Information Age and its opportunities.

- **Physical Education**

The e-Safety and Health strand covers all topics related to the students' health including how to position themselves and the different devices they are using properly to avoid injury. In addition, various activities and projects related to Physical Education are implemented to foster developing a healthy and active lifestyle for students.

- **Cross-cutting issues (Life skills, safety and security, environment and sustainability)**

A dedicated domain "Technology and Society" is established as part of the curriculum design to accommodate cross-cutting issues with relevant strands: Digital Citizenship and Ethics, e-Safety and Health, Social and Environmental Impacts. Students develop their values such as respect and personal responsibility and become responsible "digital natives". They explore topics like Intellectual Property rights, privacy and data security and build their commitment to preserving the environment.

Scope & Sequence Chart

Primary Grades 1 – 6

Domain	Strand	G1	G2	G3	G4	G5	G6
Computing Systems and Networks	Operating Systems	G1.CSN.OS.1 Use a computer to complete relevant simple specified tasks with assistance	G2.CSN.OS.1 Operate a selected range of software functions and commands of an operating system with guidance	G3.CSN.OS.1 Identify a selected range of software functions and commands when operating a computer and computing devices	G4.CSN.OS.1 Use a selected range of software functions and commands when operating a computer and/or computing devices	G5.CSN.OS.1 Use a selected range of software functions and commands to personalise a computer and computing devices	G6.CSN.OS.1 Use a selected range of software functions and commands when operating a computer and computing devices
	Computer Hardware	G1.CSN.CH.1 Label common computers and computing devices with input and output functions and describe them using basic terminology	G2.CSN.CH.1 Safely operate a computer and a selected range of appropriate computing devices	G3.CSN.CH.1 Describe a selected range of appropriate input, output and storage computing devices and their fundamental functions using basic terminology	G4.CSN.CH.1 Use a selected range of appropriate input and output computing devices	G5.CSN.CH.1 Experiment with a selected range of appropriate input output computing devices	G6.CSN.CH.1 Describe the use of appropriate computing devices for data collection

Domain	Strand	G1	G2	G3	G4	G5	G6
		G1.PS.CT.2 Correct algorithms with mistakes that include sequencing to accomplish a task without a computing device	G2.PS.CT.2 Analyse and fix an algorithm that includes sequencing and simple loops with a computing device	G3.PS.CT.2 Correct an algorithm that includes sequencing and repetition with guidance	G4.PS.CT.2 Analyze and fix an algorithm that includes sequencing and repetition with a computing device	G5.PS.CT.2 Correct an algorithm that includes sequencing, repetition and selection with a computing device	G6.PS.CT.2 Demonstrate an understanding of the use of variables to store data
		G1.PS.CT.3 Decompose a simple task into small steps with assistance	G2.PS.CT.3 Decompose a problem into small sub-problems with assistance	G3.PS.CT.3 Decompose a problem into small sub-problems with guidance	G4.PS.CT.3 Decompose a problem using pattern identification		
	Programming and Robotics		G2.PS.PR.1 Code programs that include sequencing and simple loops to accomplish a task with a computing device	G3.PS.PR.1 Code programs that include sequencing and repetition to accomplish a task with a computing device	G4.PS.PR.1 Code programs that include sequencing and repetition to accomplish a task with a computing device or a robot	G5.PS.PR.1 Code programs that include sequencing, repetition and selection to accomplish a task with a computing device or to control a robot	G6.PS.PR.1 Code programs that include sequencing, repetition and complex decisions to accomplish a task with a computing device

Domain	Strand	G1	G2	G3	G4	G5	G6
Productivity and Collaboration	Data Analysis and Modelling		G2.PS.PR.2 Analyse and fix a program that includes sequencing and simple loops with a computing device	G3.PS.PR.2 Analyse and fix a program that includes sequencing and repetition with a computing device	G4.PS.PR.2 Debug program that includes sequencing, repetition with a computing device or a robot	G5.PS.PR.2 Debug a program that includes sequencing, repetition and selection with a computing device	G6.PS.PR.2 Develop programs that include sequencing, repetition and selection to control a robot
						G5.PS.DA.1 Explain the concepts of data, information and data relevance.	G6.PS.DA.1 Describe the methodology of data collection
						G5.PS.DA.2 Identify different types of graphical representation of information	
Productivity and Collaboration	Data Management	G1.PC.DM.1 Use a computer or computing device to store and retrieve digital data with assistance	G2.PC.DM.1 Use a computer or computing device to store and retrieve digital data with guidance	G3.PC.DM.1 Use a computer or computing device to store and retrieve digital data independently	G4.PC.DM.1 Use appropriate ICT tools to store and retrieve different types of digital data	G5.PC.DM.1 Use appropriate ICT tools to store, transform and present data for specific purposes	G6.PC.DM.1 Use appropriate ICT tools to collect, transform and maintain data for a range of purposes and audiences

Domain	Strand	G1	G2	G3	G4	G5	G6
	Productivity and Creativity Tools	G1.PC.PCT.1 Use software tools to generate simple solutions, modifications or data representations for personal purposes on a computing device with assistance	G2.PC.PCT.1 Use software tools to generate simple solutions, modifications or data representations for personal or school purposes on a computing device with guidance	G3.PC.PCT.1 Experiment with software tools to generate simple solutions, modifications or data representations for particular purposes	G4.PC.PCT.1 Use appropriate ICT tools to independently create and modify digital artefacts for specific purposes	G5.PC.PCT.1 Use appropriate ICT tools to independently or collaboratively create and modify digital artefacts for specific purposes	G6.PC.PCT.1 Use appropriate ICT tools to independently or collaboratively create and modify digital artefacts for a range of purposes and audiences
	Collaboration and Communication Tools	G1.PC.CCT.1 Describe how messages can be sent in computer mediated communications for others to receive	G2.PC.CCT.1 Use selected ICT tools safely to view information shared by trusted audience with guidance	G3.PC.CCT.1 Use selected ICT tools safely to share and exchange information with appropriate and known audiences	G4.PC.CCT.1 Use ICT tools to share and exchange information with known and unknown audiences	G5.PC.CCT.1 Use appropriate ICT tools to collaborate with known and unknown audiences	G6.PC.CCT.1 Use ICT tools to share and exchange information with known and unknown audiences to explore different points of view on various topics
Research and Innovation	Research Methodologies	G1.RI.RM.1 Use ICT to identify where information is located with assistance	G2.RI.RM.1 Use ICT to locate and use information from a given set of online sources with guidance	G3.RI.RM.1 Use ICT for a planned search and retrieval of information from a range of digital sources	G4.RI.RM.1 Retrieve different types of digital data from a range of digital sources	G5.RI.RM.1 Use ICT tools to locate, retrieve and appropriately reuse digital data from a range of digital sources	G6.RI.RM.1 Use ICT tools to locate, retrieve and critically compare digital data from a range of digital sources

Domain	Strand	G1	G2	G3	G4	G5	G6
Technology and Society	Entrepreneurship				G4.RI.EN.1 Use presentation or multimedia tools to express ideas	G5.RI.EN.1 Describe the importance of creating programs to provide solutions to existing problems	G6.RI.EN.1 Explain how different types of graphical data representation affect decisions
	Applied and Emerging Technologies				G4.RI.ET.1 Explore the fundamental functions of the components of a robot	G5.RI.ET.1 Discuss how the use of software impacts everyday life	G6.RI.ET.1 Discuss technologies that can enhance education
	Digital Citizenship and Ethics	G1.TS.DC.1 Describe the rules for using a computer	G2.TS.DC.1 Describe the rules of using a computer and computing devices	G3.TS.DC.1 Apply basic social protocols when using ICT to communicate respectfully and responsibly with others online	G4.TS.DC.1 Compare and contrast the types of usage rights of digital resources	G5.TS.DC.1 Use information and sources in an ethical and responsible way	G6.TS.DC.1 Apply best practices to protect personal privacy, identity, rights and emotional safety of others when communicating or sharing information with known or unknown audiences

Domain	Strand	G1	G2	G3	G4	G5	G6
	e-Safety and Health	G1.TS.ES.1 Describe the rules to safely operate a computer taking into consideration ergonomics	G2.TS.ES.1 Discuss the rules to safely operate a computer and computing devices taking ergonomics into consideration	G3.TS.ES.1 Explain the rules when sharing personal information with known and unknown audiences	G4.TS.ES.1 Apply best practices to protect the computer and personal data from physical and online threats	G5.TS.ES.1 Discuss the importance of time management when using technology	G6.TS.ES.1 Explain potential security threats when sharing data online
		G1.TS.ES.2 Describe the rules when sharing personal information with known and unknown audiences	G2.TS.ES.2 Describe simple protection rules when using the Internet	G3.TS.ES.2 Discuss the potential threats of email messages	G4.TS.ES.2 Identify potential health issues related to excessive computer use		
	Social and Environmental Impacts	G1.TS.SE.1 Discuss how they use computers and computing devices in multiple ways in their everyday life	G2.TS.SE.1 Describe proper ways of disposal of electronic devices and their consumables	G3.TS.SE.1 Discuss computing technologies that have changed the world	G4.TS.SE.1 Discuss examples of how visionary information-technology-minded people can affect society	G5.TS.SE.1 Discuss applications of robotics and the impacts in society	G6.TS.SE.1 Compare and contrast the positive and negative impacts of technology in everyday life

Domain	Strand	G7	G8	G9
Computing Systems and Networks	Operating Systems	G7.CSN.OS.1 Use a selected range of operating system functions and commands	G8.CSN.OS.1 Operate a multitasking operating system with efficiency	G9.CSN.OS.1 State the main operations of the operating system of a computer system
	Computer Hardware	G7.CSN.CH.1 Apply criteria for evaluating a computer system for a given purpose	G8.CSN.CH.1 Experiment with innovative output devices	G9.CSN.CH.1 Explain the role of the basic computer hardware components in the operation of a computer system
	Networks	G7.CSN.NE.1 Model the role of protocols in transmitting data across networks and the Internet	G8.CSN.NE.1 Explain how high-speed networks connect any two locations in the world	G9.CSN.NE.1 Describe the main networking concepts and the key network protocols
	Computational Thinking	G7.PS.CT.1 Design a computing artefact that responds to an event	G8.PS.CT.1 Design collaboratively a software artefact	G9.PS.CT.1 Use an iterative design process to solve problems, both independently and collaboratively
Problem Solving and Decision Making	Programming and Robotics	G7.PS.PR.1 Create software to accomplish a task with a computing device or a robot	G8.PS.PR.1 Create software to solve a problem in collaboration with others	G9.PS.PR.1 Create software to solve a problem with a text-based programming language
			G8.PS.PR.2 Create an interactive digital game that implements a set of rules	
	Data Analysis and Modelling	G7.PS.DA.1 Interpret results to draw inferences from processed data	G8.PS.DA.1 Present information from processed data	G9.PS.DA.1 Analyse data organised in a relational database
Productivity	Data Management	G7.PC.DM.1 Use ICT tools to	G8.PC.DM.1 Use ICT tools to	G9.PC.DM.1 Use ICT tools to

Domain	Strand	G7	G8	G9
and Collaboration		store and maintain data for given purposes	transform data for particular audiences and purposes	manage and maintain a relational database
	Productivity and Creativity Tools	G7.PC.PCT.1 Use ICT tools to design and modify digital artefacts that enhance visual communication	G8.PC.PCT.1 Use ICT tools to design, produce and modify digital artefacts that enhance oral and written communication	G9.PC.PCT.1 Use ICT tools to design and modify digital artefacts for particular audiences and purposes
	Collaboration and Communication Tools	G7.PC.CCT.1 Compare and contrast the advantages and disadvantages of a range of communication and social media tools	G8.PC.CCT.1 Use ICT tools to share information and collect data from a specific known audience	G9.PC.CCT.1 Use ICT tools to communicate and work effectively with others in collaborative environments
Research and Innovation	Research Methodologies	G7.RI.RM.1 Identify patterns in sets of information to create appropriate inquiries	G8.RI.RM.1 Assess the suitability of data or information using a range of appropriately given criteria	G9.RI.RM.1 Organise research information in collaboration with others
	Entrepreneurship	G7.RI.EN.1 Discuss the uses and limitations of autonomous systems	G8.RI.EN.1 Analyse the impact of technology in the operations of a business or organisation	G9.RI.EN.1 Use ICT tools to visually organise thoughts and concepts
Technology and Society	Applied and Emerging Technologies	G7.RI.ET.1 Explore technologies that enhance the way we use travel, hospitality and entertainment services	G8.RI.ET.1 Outline the advantages and disadvantages of artificial intelligence	G9.RI.ET.1 Compare and contrast traditional work practices with the modern online collaborative way of working
	Digital Citizenship and Ethics	G7.TS.DC.1 Identify proper uses of social media to develop strategies that avoid adverse situations	G8.TS.DC.1 Apply best practices with regards to digital citizenship and the collection of others' personal information	G9.TS.DC.1 Apply generally accepted social protocols when using ICT to collaborate with local or global communities
	e-Safety and Health	G7.TS.ES.1 Implement a computer protection and data backup strategy	G8.TS.ES.1 Assess the negative impacts of the use of technology on personal health	G9.TS.ES.1 Identify strategies to secure and protect networks
	Social and Environmental Impacts	G7.TS.SE.1 Analyse the role of computing-related jobs in our society	G8.TS.SE.1 Compare and contrast the positive and negative effects of technology on the environment	G9.TS.SE.1 Discuss the impact of ICT on self-learning and life-long learning

Secondary Grades 10 – 12

G11H: Grade 11 Humanities and Literature Track

G11S: Grade 11 Sciences Track

G11T: Grade 11 Technical Track

G12H: Grade 12 Humanities and Literature Track

G12S: Grade 12 Sciences Track

G12T: Grade 12 Humanities and Literature Track

Domain	Strand	G10	G11H	G11S	G11T	G12H	G12S	G12T
Computing Systems and Networks	Operating Systems	G10.CSN.OS.1 Use troubleshooting procedures to solve routine operating system malfunctions	G11.CSN.OS.1 Illustrate the main operations of different operating systems	G11.CSN.OS.1 Illustrate the main operations of different operating systems	G11T.CSN.OS.1 Illustrate the main operations of different operating systems	G12.CSN.OS.1 Apply best practices to reduce the digital footprint	G12.CSN.OS.1 Apply best practices to reduce the digital footprint	G12T.CSN.OS.1 Apply best practices to reduce the digital footprint
					G11T.CSN.OS.2. 1 Illustrate how the processor is using its resources efficiently			G12T.CSN.OS.2 Discuss how the operating system has evolved to support Internet of Things devices and real-time applications
Computer Hardware								
	Computer Hardware	G10.CSN.CH.1 Use troubleshooting procedures to solve routine computer hardware malfunction	G11.CSN.CH.1 Illustrate the main differences between mobile devices and desktop computers	G11.CSN.CH.1 Illustrate the main differences between mobile devices and desktop computers	G11T.CSN.CH.1 Illustrate the main differences between mobile devices and desktop computers	G12.CSN.CH.1 Discuss the advantages and disadvantages of big data cloud storage	G12.CSN.CH.1 Discuss the advantages and disadvantages of big data cloud storage	G12T.CSN.CH.1 Discuss the advantages and disadvantages of big data cloud storage

Domain	Strand	G10	G11H	G11S	G11T	G12H	G12S	G12T
Problem Solving and Decision Making	Networks	G10.CSN.NE.1 Classify the network types based on their characteristics	G11.CSN.NE.1 Discuss the scalability and availability of cloud infrastructure	G11.CSN.NE.1 Discuss the scalability and availability of cloud infrastructure	G11T.CSN.NE.1 Discuss the scalability and availability of cloud infrastructure	G12.CSN.NE.1 Compare and contrast the positive and negative effects of network convergence	G12.CSN.NE.1 Compare and contrast the positive and negative effects of network convergence	G12T.CSN.NE.1 Compare and contrast the positive and negative effects of network convergence
					G11T.CSN.NE.2 Discuss the benefits gained from using storage area networks			G12T.CSN.NE.2 Explore how the use of VPN technologies has changed traditional working patterns
	Computational Thinking	G10.PS.CT.1 Define reusable procedures that solve similar task	G11.PS.CT.1 Implement a cyclical design process in developing a software application	G11.PS.CT.1 Implement a cyclical design process in developing a software application	G11T.PS.CT.1 Implement a cyclical design process in developing a software application	G12.PS.CT.1 Apply advanced testing techniques to ensure quality in software development	G12.PS.CT.1 Apply advanced testing techniques to ensure quality in software development	G12T.PS.CT.1 Apply advanced testing techniques to ensure quality in software development
					G11T.PS.CT.2 Assess the appropriateness of an algorithm for a specific task			G12T.PS.CT.2 Explore the concept of concurrency
					G11T.PS.CT.3 Explore a user-centred design for solutions to real-life problems			G12T.PS.CT.3 Solve real-life problems with the use of object-oriented concepts

Domain	Strand	G10	G11H	G11S	G11T	G12H	G12S	G12T
Computing and Information Technology	Programming				G11T.PS.CT.4 Evaluate the need for a variety of programming paradigms			G12T.PS.CT.4 Determine the suitability of complex data structures for specific tasks
					G11T.PS.CT.5 Compare how advanced data structures are used by algorithms			
	Robotics	G10.PS.PR.1 Create software to control a robot or another computing device	G11.PS.PR.1 Develop an application user interface to be inclusive and accessible	G11.PS.PR.1 Develop an application user interface to be inclusive and accessible	G11T.PS.PR.1 Develop an application user interface to be inclusive and accessible		G12S.PS.PR.1 Explore modern programming paradigms in software development	G12T.PS.PR.1 Evaluate the feasibility of extending the features of an existing program
				G11S.PS.PR.1 Use appropriate software development tools and web technologies to develop a website	G11T.PS.PR.2 Use appropriate software development tools and web technologies to develop a website		G12S.PS.PR.2 Evaluate the feasibility of extending the features of an existing program	G12T.PS.PR.2 Explore modern programming paradigms in software development
					G11T.PS.PR.3 Use advanced programming techniques to solve computational problems			G12T.PS.PR.3 Use appropriate software development tools for specific programming tasks

Domain	Strand	G10	G11H	G11S	G11T	G12H	G12S	G12T
Productivity and Collaboration					G11T.PS.PR.4 Use advanced data structures to create generalised solutions			G12T.PS.PR.4 Use advanced programming techniques to represent complex data structures
	Data Analysis and Modelling	G10.PS.DA.1 Use ICT tools that efficiently transform data into information to support accurate decision making	G11.PS.DA.1 Understand the effects of information quality in decision-making	G11.PS.DA.1 Understand the effects of information quality in decision-making	G11T.PS.DA.1 Understand the effects of information quality in decision-making	G12.PS.DA.1 Explore technologies that enhance business decisions through advanced statistical analysis of data	G12.PS.DA.1 Explore technologies that enhance business decisions through advanced statistical analysis of data	G12T.PS.DA.1 Explore technologies that enhance business decisions through advanced statistical analysis of data
Productivity and Collaboration	Data Management	G10.PC.DM.1 Use ICT tools that securely maintain data on a variety of storage media locally or on networks	G11.PC.DM.1 Explore encoding techniques to represent data efficiently	G11.PC.DM.1 Explore encoding techniques to represent data efficiently	G11T.PC.DM.1 Explore encoding techniques to represent data efficiently	G12.PC.DM.1 Assess the capabilities of big data management	G12.PC.DM.1 Assess the capabilities of big data management	G12T.PC.DM.1 Assess the capabilities of big data management
					G11T.PC.DM.2 Process locally stored digital data programmatically			G12T.PC.DM.2 Use data management tools to perform data processing techniques

Domain	Strand	G10	G11H	G11S	G11T	G12H	G12S	G12T
Research and Innovation	Productivity and Creativity Tools	G10.PC.PCT.1 Use ICT tools to design, produce and modify digital artefacts for a range of audiences and purposes	G11.PC.PCT.1 Use appropriate ICT tools to design business-related diagrams	G11.PC.PCT.1 Use appropriate ICT tools to design business-related diagrams	G11T.PC.PCT.1 Use appropriate ICT tools to design business-related diagrams	G12.PC.PCT.1 Use appropriate ICT tools to produce information for business purposes	G12.PC.PCT.1 Use appropriate ICT tools to produce information for business purposes	G12T.PC.PCT.1 Use appropriate ICT tools to produce information for business purposes
	Collaboration and Communication Tools	G10.PC.CCT.1 Evaluate ICT tools to communicate and collaborate with a team	G11.PC.CCT.1 Use appropriate ICT tools to manage collaborative projects	G11.PC.CCT.1 Use appropriate ICT tools to manage collaborative projects	G11T.PC.CCT.1 Use appropriate ICT tools to manage collaborative projects	G12.PC.CCT.1 Use appropriate ICT tools to communicate with others securely	G12.PC.CCT.1 Use appropriate ICT tools to communicate with others securely	G12T.PC.CCT.1 Use appropriate ICT tools to communicate with others securely
	Research Methodologies	G10.RI.RM.1 Assess the suitability of data or information using a range of own appropriate criteria	G11.RI.RM.1 Research the feasibility of new ideas for products or services	G11.RI.RM.1 Research the feasibility of new ideas for products or services	G11T.RI.RM.1 Research the feasibility of new ideas for products or services	G12.RI.RM.1 Research exposed private data on the Internet	G12.RI.RM.1 Research exposed private data on the Internet	G12.RI.RM.1 Research exposed private data on the Internet
Research and Innovation	Entrepreneurship	G10.RI.EN.1 Use models and specific data to	G11.RI.EN.1 Explore the impact of the	G11.RI.EN.1 Explore the impact of the	G11T.RI.EN.1 Explore the impact of the	G12.RI.EN.1 Discuss major trends that	G12.RI.EN.1 Discuss major trends that	G12.RI.EN.2 Discuss major trends that

Domain	Strand	G10	G11H	G11S	G11T	G12H	G12S	G12T
		support accurate decision making	system life cycle in the introduction of a new or updated system	system life cycle in the introduction of a new or updated system	system life cycle in the introduction of a new or updated system	impact commerce globally	impact commerce globally	impact commerce globally
			G11H.RI.EN.1 Explore how an effective advertisement works	G11S.RI.EN.21 Evaluate the optimisation of a website based on how search engines work		G12H.RI.EN.1 Discuss how the form of a business document affects its function	G12S.RI.EN.1 Discuss how the choice of a software development tool affects the cost and quality of a software product	G12T.RI.EN.1 Discuss how the choice of a software development tool affects the cost and quality of a software product
		G10.RI.ET.1 Assess the impacts of the advancements in computer hardware on the way we use and interact with computers	G11.RI.ET.1 Assess the impact of mobility in technology on the working patterns	G11.RI.ET.1 Assess the impact of mobility in technology on the working patterns	G11T.RI.ET.1 Assess the impact of mobility in technology on the working patterns	G12.RI.ET.1 Discuss the use of technology in e-commerce	G12.RI.ET.1 Discuss the use of technology in e-commerce	G12T.RI.ET.1 Discuss the use of technology in e-commerce
Technology and Society	Applied and Emerging Technologies	G10.TS.DC.1 Apply practices that comply with legal obligations regarding the use of personal information	G11.TS.DC.1 Assess the impact of the digital divide on access to critical information	G11.TS.DC.1 Assess the impact of the digital divide on access to critical information	G11T.TS.DC.1 Assess the impact of the digital divide on access to critical information	G12.TS.DC.1 Manage digital identities and reputations by demonstrating an understanding of digital footprint	G12.TS.DC.1 Manage digital identities and reputations by demonstrating an understanding of digital footprint	G12T.TS.DC.1 Manage digital identities and reputations by demonstrating an understanding of digital footprint
	Digital Citizenship and Ethics							

Domain	Strand	G10	G11H	G11S	G11T	G12H	G12S	G12T
	e-Safety and Health	G10.TS.ES.1 Assess privacy issues related to everyday, online computer monitoring	G11.TS.ES.1 Protect data with encryption mechanisms	G11.TS.ES.1 Protect data with encryption mechanisms	G11T.TS.ES.1 Protect data with encryption mechanisms	G12.TS.ES.1 Identify strategies to evaluate secure websites for commercial transactions	G12.TS.ES.1 Identify strategies to evaluate secure websites for commercial transactions	G12T.TS.ES.1 Identify strategies to evaluate secure websites for commercial transactions
	Social and Environmental Impacts	G10.TS.SE.1 Assess the impact of ICT in the workplace	G11.TS.SE.1 Brainstorm ways in which technology could be made more accessible to everybody	G11.TS.SE.1 Brainstorm ways in which technology could be made more accessible to everybody	G11T.TS.SE.1 Brainstorm ways in which technology could be made more accessible to everybody	G12.TS.SE.1 Assess the impact cryptocurrencies may have on the global economy	G12.TS.SE.1 Assess the impact cryptocurrencies may have on the global economy	G12T.TS.SE.1 Assess the impact cryptocurrencies may have on the global economy

Standards and Learning Outcomes According to Strand and Grade

Grade 1

Domain	Strand	Standard	Learning Outcomes	C
Computing Systems and Networks	Operating Systems	G1.CSN.OS.1 Use a computer to complete relevant simple specified tasks with assistance	G1.CSN.OS.1.1 Use the mouse, mouse buttons, click, double-click and move arrow cursor	 
			G1.CSN.OS.1.2 Use the keyboard	
			G1.CSN.OS.1.3 Identify ways of operating a computer besides the mouse and keyboard	
			G1.CSN.OS.1.4 Describe the computer desktop and its basic parts and icons	
			G1.CSN.OS.1.5 Start up and shut down a computer	
			G1.CSN.OS.1.6 Start a program using a shortcut icon and operate a program window for given tasks.	
			G1.CSN.OS.1.7 Use the computer program Paint to complete copy, paste, save, and open commands	
	Computer Hardware	G1.CSN.CH.1 Label common computers and computing devices with input and output functions and describe them using basic terminology	G1.CSN.CH.1.1 Recognize a computing machine	 
			G1.CSN.CH.1.2 Recognize the main parts of computing machine and explain what the key parts of a computing machine do	

Grade 1

Domain	Strand	Standard	Learning Outcomes	C
	Networks	G1.CSN.NE.1 Name the main uses of the Internet	G1.CSN.NE.1.1 Explain how the Internet works in simple words	  
			G1.CSN.NE.1.2 Identify important uses of the Internet	
Problem Solving and Decision Making	Computational Thinking	G1.PS.CT.1 Construct algorithms that include sequencing to accomplish a task without a computing device	G1.PS.CT.1.1 Create algorithms to model daily processes	  
		G1.PS.CT.2 Correct algorithms with mistakes that include sequencing to accomplish a task without a computing device	G1.PS.CT.2.1 Identify mistakes in a simple algorithm where the algorithm includes sequencing	  
		G1.PS.CT.3 Decompose a simple task into small steps with assistance	G1.PS.CT.3.1 Describe how to break a simple task into small steps	 
Productivity and Collaboration	Data Management	G1.PC.DM.1 Use a computer or computing device to store and retrieve digital data with assistance	G1.PC.DM.1.1 Save a document with the help of the teacher	 
			G1.PC.DM.1.2 Open a document with the help of the teacher	
	Productivity and Creativity Tools	G1.PC.PCT.1 Use software tools to generate simple solutions, modifications or data representations for personal purposes on a computing device with assistance	G1.PC.PCT.1.1 Use a simple drawing program	
			G1.PC.PCT.1.2 Draw and edit basic shapes	
			G1.PC.PCT.1.3 Use a simple typing program	
			G1.PC.PCT.1.4 Select, edit and apply basic formatting to text	

Grade 1

Domain	Strand	Standard	Learning Outcomes	C
	Collaboration and Communication Tool	G1.PC.CCT.1 Describe how messages can be sent in computer mediated communications for others to receive	G1.PC.CCT.1.1 Describe the uses and advantages of computer mediated communication G1.PC.CCT.1.2 Identify data files that can be exchanged	 
Research and Innovation	Research Methodologies	G1.RI.RM.1 Use ICT to identify where information is located with assistance	G1.RI.RM.1.1 Relate the information to the digital data files in which it is stored G1.RI.RM.1.2 Identify the most common data file types through their icons G1.RI.RM.1.3 Explain that the Internet contains information that can be accessed with a computer and a web browser	 
Technology and Society	Digital Citizenship and Ethics	G1.TS.DC.1 Describe the rules for using a computer	G1.TS.DC.1.1 Describe the rules for working with a computer	 
	e-Safety and Health	G1.TS.ES.1 Describe the rules to safely operate a computer taking into consideration ergonomics	G1.TS.ES.1.1 Protect his/her health when working with a computer and identify the hazards of incorrect posture	 
		G1.TS.ES.2 Describe the rules when sharing personal information with known and unknown audiences	G1.TS.ES.2.1 List safety rules when working with the Internet	 

Grade 1

Domain	Strand	Standard	Learning Outcomes	C
	Social and Environmental Impacts	G1.TS.SE.1 Discuss how they use computers and computing devices in multiple ways in their everyday life	G1.TS.SE.1.1 Identify different types of computers in the everyday life of the student at home and at school	 
			G1.TS.SE.1.2 Describe the evolution of calculating machines and computers	

Grade 2

Domain	Strand	Standard	Learning Outcomes	C
Computing Systems and Networks	Operating Systems	G2.CSN.OS.1 Operate a selected range of software functions and commands of an operating system with guidance	G2.CSN.OS.1.1 Use components and icons of the desktop of a computer	 
			G2.CSN.OS.1.2 Personalise the computer desktop	
			G2.CSN.OS.1.3 Describe how the cursor changes according to the current action	
			G2.CSN.OS.1.4 Perform simple` digital files management actions	
			G2.CSN.OS.1.5 Organize digital files into folders	
			G2.CSN.OS.1.6 Start programs	
			G2.CSN.OS.1.7 Use a web browser	
	Computer Hardware	G2.CSN.CH.1 Safely operate a computer and a selected range of appropriate computing devices	G2.CSN.CH.1.1 Use a printer to print from a computer program	 
			G2.CSN.CH.2.1 Identify the internal components of the system unit of a desktop computer	
		G2.CSN.CH.2 Identify the main internal and external components of common computing devices and their fundamental functions	G2.CSN.CH.2.2 Identify the peripheral devices of a desktop computer	 
	Networks	G2.CSN.NE.1 Describe how people connect to information through a network	G2.CSN.NE.1.1 Identify types of information the student can find on the Internet	 
			G2.CSN.NE.1.2 Discuss how information on the Internet can be accessed	

Grade 2

Domain	Strand	Standard	Learning Outcomes	C
Problem Solving and Decision Making	Computational Thinking	G2.PS.CT.1 Construct algorithms that include sequencing and simple loops to accomplish a task with a computing device	G2.PS.CT.1.1 Describe the basic workings of a computer	  
			G2.PS.CT.1.2 Explain a sequence of commands	
			G2.PS.CT.1.3 Explain a loop of commands	
			G2.PS.CT.1.4 Compare the use of a sequence and loop of commands	
			G2.PS.CT.1.5 Use patterns to accomplish a task	
	Computational Thinking	G2.PS.CT.2 Correct an algorithm that includes sequencing and simple loops with a computing device	G2.PS.CT.2.1 Identify mistakes in a basic algorithm where the algorithm includes sequencing and simple loops	  
		G2.PS.CT.3 Decompose a problem into small sub-problems with assistance	G2.PS.CT.3.1 Explain the steps	
	Programming and Robotics	G2.PS.PR.1 Code programs that include sequencing and simple loops to accomplish a task with a computing device	G2.PS.PR.1.1 Code programs with sequences	  
			G2.PS.PR.1.2 Code programs with simple loops	
		G2.PS.PR.2 Debug a program that includes sequencing and simple loops with a computing device	G2.PS.PR.2.1 Identify mistakes in a basic program that includes sequencing and simple loops	  
Productivity and	Data Management	G2.PC.DM.1 Use a computer or computing device to	G2.PC.DM.1.1 Save a document with the teacher's guidance	

Grade 2				
Domain	Strand	Standard	Learning Outcomes	C
Collaboration		store and retrieve digital data with guidance	G2.PC.DM.1.2 Recognize the text and image data file types according to their icons and extensions and open a document with the teacher's guidance	
	Productivity and Creativity Tools	G2.PC.PCT.1 Use software tools to generate simple solutions, modifications or data representations for personal or school purposes on a computing device with guidance	G2.PC.PCT.1.1 Perform basic editing into a text document.	
			G2.PC.PCT.1.2 Perform basic formatting of text	 
			G2.PC.PCT.1.3 Insert drawings and pictures in a text document	
	Collaboration and Communication Tools	G2.PC.CCT.1 Use selected ICT tools safely to view information shared by trusted audience with guidance	G2.PC.CCT.1.1 Discuss how the Internet can be used for communication	 
Research and Innovation	Research Methodologies	G2.RI.RM.1 Use ICT to locate and use information from a given set of online sources with guidance	G2.RI.RM.1.1 Describe how textual and graphic information can be accessed with a computer and a web browser	 
			G2.RI.RM.1.2 Take information from a web page	
Technology and Society	Digital Citizenship and Ethics	G2.TS.DC.1 Describe the rules of using a computer and computing devices	G2.TS.DC.1.1 Keep the workspace and computing devices clean	 
	e-Safety and Health	G2.TS.ES.1 Discuss the rules to safely operate a computer and computing devices taking ergonomics into consideration	G2.TS.ES.1.1 Protect his/her health when working with a computer or other computing devices	 

Grade 2

Domain	Strand	Standard	Learning Outcomes	C
		G2.TS.ES.2 Describe simple protection rules when using the Internet	G2.TS.ES.2.1 Discuss how to be safe while surfing on the Internet	 
			G2.TS.ES.2.2 Explain the importance of protecting a computer from viruses with special software	
	Social and Environmental Impacts	G2.TS.SE.1 Describe proper ways of disposal of electronic devices and their consumables	G2.TS.SE.1.1 Identify computer items that require recycling	 
			G2.TS.SE.1.1 Describe how computer items to be recycled must be collected	

Grade 3

Domain	Strand	Standard	Learning Outcomes	C
Computing Systems and Networks	Operating Systems	G3.CSN.OS.1 Identify a selected range of software functions and commands when operating a computer and computing devices	G3.CSN.OS.1.1 Use the save command in a computer program without assistance or guidance	 
			G3.CSN.OS.1.2 Use an external storage device to store a data file	
			G3.CSN.OS.1.3 Search for digital files and folders locally	
			G3.CSN.OS.1.4 Use a web browser to navigate the web	
	Computer Hardware	G3.CSN.CH.1 Describe a selected range of appropriate input, output and storage computing devices and their fundamental functions using basic terminology	G3.CSN.CH.1.1 Select appropriate devices to use for data storage	 
			G3.CSN.CH.1.2 Select appropriate devices to use for printing a data file	
			G3.CSN.CH.1.3 Select appropriate devices to capture voice and sound or an image and store it on the computer	
			G3.CSN.CH.1.4 Select appropriate devices to interact with the computer	
	Networks	G3.CSN.NE.1 Describe how people connect with other people through a network	G3.CSN.NE.1.1 Explain email as a means of communication between the student and other students via the Internet	  
			G3.CSN.NE.1.2 Explain the difference between asynchronous and synchronous communication	
Problem Solving and	Computational Thinking	G3.PS.CT.1 Construct algorithms that	G3.PS.CT.1.1 Describe what a computer program is	

Grade 3

Domain	Strand	Standard	Learning Outcomes	C
Decision Making		include sequencing and repetition to accomplish a task with a computing device	G3.PS.CT.1.2 Identify sequence and loop (repetition) as control structures and compare their usage	 
		G3.PS.CT.2 Correct an algorithm that includes sequencing and repetition with guidance	G3.PS.CT.2.1 Identify simple mistakes in an algorithm that includes sequencing and loops	  
		G3.PS.CT.3 Decompose a problem into small sub-problems with guidance	G3.PS.CT.3.1 Express a problem as smaller problems	 
	Programming and Robotics	G3.PS.PR.1 Code programs that include sequencing and repetition to accomplish a task with a computing device	G3.PS.PR.1.1 Identify the main characteristics of a block-based visual programming tool	 
			G3.PS.PR.1.2 Draw with a pen on the screen using a block-based visual programming tool	
		G3.PS.PR.2 Debug a program that includes sequencing and repetition with a computing device	G3.PS.PR.2.1 Identify mistakes in a program where the program includes sequencing and loops using a block-based visual programming tool	  
Productivity and Collaboration	Data Management	G3.PC.DM.1 Use a computer or computing device to store and retrieve digital data independently	G3.PC.DM.1.1 Save a document	
			G3.PC.DM.1.2 Save a data file on an external storage device	
	Productivity and Creativity Tools	G3.PC.PCT.1 Experiment with software tools to generate simple	G3.PC.PCT.1.1 Format text with a word processor	
			G3.PC.PCT.1.2 Format titles and lists with a word	

Grade 3

Domain	Strand	Standard	Learning Outcomes	C
		solutions, modifications or data representations for particular purposes	processor	
			G3.PC.PCT.1.3 Correct a text document	
			G3.PC.PCT.1.4 Store a text document locally	
			G3.PC.PCT.1.5 Create an audio data file with the computer	
			G3.PC.PCT.1.6 Create an image slideshow with the computer	
			G3.PC.PCT.1.7 Manipulate a photo image	
	Collaboration and Communication Tools	G3.PC.CCT.1 Use selected ICT tools safely to share and exchange information with appropriate and known audiences	G3.PC.CCT.1.1 Explain how a person can communicate with others via email	  
			G3.PC.CCT.1.2 Send an email message	
			G3.PC.CCT.1.3 Reply to an email message	
Research and Innovation	Research Methodologies	G3.RI.RM.1 Use ICT for a planned search and retrieval of information from a range of digital sources	G3.RI.RM.1.1 Use the web to search for, access and gather information	 
			G3.RI.RM.1.2 Use online encyclopedias and dictionaries	
			G3.RI.RM.1.3 Discuss web sites that contain trustworthy information	
Technology and Society	Digital Citizenship and Ethics	G3.TS.DC.1 Apply basic social protocols when using ICT to communicate respectfully and responsibly with others online	G3.TS.DC.1.1 Create a proper email message.	 
			G3.TS.DC.1.2 Identify ownership of digital products that others produce and demonstrate respect for the work of others	
			G3.TS.DC.1.3 Describe the rules that must be followed when communicating with others via email.	

Grade 3

Domain	Strand	Standard	Learning Outcomes	C
	e-Safety and Health	G3.TS.ES.1 Explain the rules when sharing personal information with known and unknown audiences	G3.TS.ES.1.1 Explain how personal data must be protected when communicating via email	 
		G3.TS.ES.2 Discuss the potential threats of email messages	G3.TS.ES.2.1 Explain how to recognize different types of harmful email messages.	 
	Social and Environmental Impacts	G3.TS.SE.1 Discuss computing technologies that have changed the world	G3.TS.SE.1.1 Discuss different computing technologies that have changed our everyday lives and the world in general	 

Grade 4				
Domain	Strand	Standard	Learning Outcomes	C
Computing Systems and Networks	Operating Systems	G4.CSN.OS.1 Use a selected range of software functions and commands when operating a computer and/or computing devices	G4.CSN.OS.1.1 Use shortcuts to work more efficiently	 
			G4.CSN.OS.1.2 Move applicable data between programs	
	Computer Hardware	G4.CSN.CH.1 Use a selected range of appropriate input and output computing devices	G4.CSN.CH.1.1 Use an appropriate capture device to record audio, images and video	 
	Networks	G4.CSN.NE.1 Discuss the difference between synchronous and asynchronous communications	G4.CSN.NE.1 Classify communication tools based on the way data is exchanged	  
Problem Solving and Decision Making	Computational Thinking	G4.PS.CT.1 Construct algorithms that include sequencing and repetition to efficiently accomplish a task	G4.PS.CT.1.1 Define an algorithm	  
			G4.PS.CT.1.2 Compare the usage of sequence and loop (repetition) as control structures	
			G4.PS.CT.1.3 Analyse a problem and outline a solution	
		G4.PS.CT.2 Revise an algorithm that includes sequencing and repetition	G4.PS.CT.2.1 Trace logical mistakes in an algorithm that includes sequencing and loops	  
		G4.PS.CT.3 Decompose a problem using pattern identification	G4.PS.CT.3.1 Express a problem as smaller problems, identifying patterns	  

Grade 4				
Domain	Strand	Standard	Learning Outcomes	C
	Programming and Robotics	G4.PS.PR.1 Code programs that include sequencing and repetition to accomplish a task with a computing device or a robot	G4.PS.PR.1.1 Convert an algorithm to code using a block-based visual programming tool	  
			G4.PS.PR.1.2 Control the appearance of an object and its location on the screen using a block-based visual programming tool	
			G4.PS.PR.1.3 Output information with code using a block-based visual programming tool	
			G4.PS.PR.1.4 Create a simple program that moves a robot	
		G4.PS.PR.2 Debug program that includes sequencing, repetition with a computing device or a robot	G4.PS.PR.2.1 Identify mistakes in a program that includes sequencing and loops using a block-based visual programming tool	  
Productivity and Collaboration	Data Management	G4.PC.DM.1 Use appropriate ICT tools to store and retrieve different types of digital data	G4.PC.DM.1.1 Classify different types of data files according to the content type and size	 
			G4.PC.DM.1.2 Obtain images from a scanner or camera	
	Productivity and Creativity Tools	G4.PC.PCT.1 Use appropriate ICT tools to independently create and modify digital artefacts for specific purposes	G4.PC.PCT.1.1 Format text for clarity and easier reading	  
			G4.PC.PCT.1.2 Enhance text with images	
			G4.PC.PCT.1.3 Use language tools to revise a document and print the document	

Grade 4				
Domain	Strand	Standard	Learning Outcomes	C
			G4.PC.PCT.1.4 Express ideas with the creation of a presentation	
			G4.PC.PCT.1.5 Enhance a presentation with multimedia elements	
			G4.PC.PCT.1.6 Edit a sound recording	
			G4.PC.PCT.1.7 Create a simple video story with music	
	Collaboration and Communication Tools	G4.PC.CCT.1 Use ICT tools to share and exchange information with known and unknown audiences	G4.PC.CCT.1.1 Communicate with friends by use of the Internet	
			G4.PC.CCT.1.2 Exchange email messages online	
			G4.PC.CCT.1.3 Demonstrate the ability to manage email messages	
			G4.PC.CCT.1.4 Demonstrate the ability to manage email messages with attachments	
			G4.PC.CCT.1.5 Share photos, music and videos via the Internet	
Research and Innovation	Research Methodologies	G4.RI.RM.1 Retrieve different types of digital data from a range of digital sources	G4.RI.RM.1.1 Use search engines for research purposes	
			G4.RI.RM.1.2 Use the web for dictionary definitions, language translation, online maps and calculations of mathematical equations	 
			G4.RI.RM.1.3 Find audio and video elements online to enhance presentations	

Grade 4

Domain	Strand	Standard	Learning Outcomes	C
			G4.RI.RM.1.4 Retrieve images and videos from the web	
	Entrepreneurship	G4.RI.EN.1 Use presentation or multimedia tools to express ideas	G4.RI.EN.1.1 Use best practices when delivering a presentation	 
	Applied and Emerging Technologies	G4.RI.ET.1 Explore the fundamental functions of the components of a robot	G4.RI.ET.1.1 Describe the main components of a robot	 
Technology and Society	Digital Citizenship and Ethics	G4.TS.DC.1 Compare and contrast the types of usage rights of digital resources	G4.TS.DC.1.1 Provide examples of digital products that are free to use and share	 
			G4.TS.DC.1.2 Identify paid digital products	
	e-Safety and Health	G4.TS.ES.1 Apply best practices to protect the computer and personal data from physical and online threats	G4.TS.ES.1.1 Discuss ways of protecting the computer from malware	 
			G4.TS.ES.1.2 Apply best practices in using passwords	
	Social and Environmental Impacts	G4.TS.ES.2 Identify potential health issues related to excessive computer use	G4.TS.ES.2.1 Discuss potential health issues associated with excessive use of computing devices	 
			G4.TS.SE.1 Discuss examples of how visionary information technology-minded people can affect society	 

Grade 5				
Domain	Strand	Standard	Learning Outcomes	C
Computing Systems and Networks	Operating Systems	G5.CSN.OS.1 Use a selected range of software functions and commands to personalise a computer and computing devices	G5.CSN.OS.1.1 Change basic computer settings	 
			G5.CSN.OS.1.2 Change the settings of the main unit of a robot	
	Computer Hardware	G5.CSN.CH.1 Experiment with a selected range of appropriate input output computing devices	G5.CSN.CH.1.1 Programmatically use the keyboard, mouse and monitor as input and output devices	 
	Networks	G5.CSN.NE.1 Explore the basic types of computer networks	G5.CSN.NE.1.1 Classify various types of computer networks based on their extent and use	 
	Computational Thinking	G5.PS.CT.1 Construct algorithms that include sequencing, repetition and selection to accomplish a task with a computing device	G5.PS.CT.1.1 Create a flowchart that describes an algorithm with sequence, loop and selection (IF)	  
		G5.PS.CT.2 Correct an algorithm that includes sequencing, repetition and selection with a computing device	G5.PS.CT.2.1 Identify mistakes in an algorithm where the algorithm includes sequencing, loops and selection (IF)	  
	Programming and Robotics	G5.PS.PR.1 Code programs that include sequencing, repetition and selection to accomplish a task with a computing device or to control a robot	G5.PS.PR.1.1 Convert an algorithm to a script using a block-based visual programming tool	 
			G5.PS.PR.1.2 Input information with code using a block-based visual programming tool	

Grade 5

Domain	Strand	Standard	Learning Outcomes	C
			G5.PS.PR.1.3 Create a program that handles events	
			G5.PS.PR.1.4 Create a program that controls a robot	
		G5.PS.PR.2 Debug a program that includes sequencing, repetition and selection with a computing device	G5.PS.PR.2.1 Identify mistakes in a program where the program includes sequencing, loops and selection (IF)	  
	Data Analysis	G5.PS.DA.1 Explain the concepts of data, information and data relevance.	G5.PS.DA.1.1 Differentiate between data and information	 
			G5.PS.DA.1.2 Explain what is meant by data relevance	
			G5.PS.DA.1.3 Classify data to fields	
		G5.PS.DA.2 Use appropriate ICT tools for data modelling	G5.PS.DA.2.1 Explain the processes used to collect, transform and analyse data to solve a problem with computational tools	  
	Productivity and Collaboration	Data Management G5.PC.DM.1 Use appropriate ICT tools to store, transform and present data for specific purposes	G5.PC.DM.1.1 Describe various uses of a database	
			G5.PC.DM.1.2 Organise information in a database	
			G5.PC.DM.1.3 Transform information in a database	
			G5.PC.DM.1.4 Create a spreadsheet to organise data	
			G5.PC.DM.1.5 Format data in a spreadsheet	

Grade 5

Domain	Strand	Standard	Learning Outcomes	C
			G5.PC.DM.1.6 Make calculations with a spreadsheet	
			G5.PC.DM.1.7 Present information with a spreadsheet	
	Productivity and Creativity Tools	G5.PC.PCT.1 Use appropriate ICT tools to independently or collaboratively create and modify digital artefacts for specific purposes	G5.PC.PCT.1.1 Express oneself artistically using a drawing tool	 
			G5.PC.PCT.1.2 Use a 3D drawing tool to modify and share a 3D shape	
	Collaboration and Communication Tools	G5.PC.CCT.1 Use appropriate ICT tools to collaborate with known and unknown audiences	G5.PC.CCT.1.1 Share a programming project using a block-based visual programming tool	 
Research and Innovation	Research Methodologies	G5.RI.RM.1 Use ICT tools to locate, retrieve and appropriately reuse digital data from a range of digital sources	G5.RI.RM.1.1 Find images online for remixing in new digital products	 
	Entrepreneurship	G5.RI.EN.1 Describe the importance of creating programs to provide solutions to existing problems	G5.RI.EN.1.1 Determine problems that can be solved with a program	
	Applied and Emerging Technologies	G5.RI.ET.1 Discuss how the use of software impacts everyday life	G5.RI.ET.1.1 Identify key software applications that transform daily tasks	
Technology and Society	Digital Citizenship and Ethics	G5.TS.DC.1 Use information and sources in an ethical	G5.TS.DC.1.1 Compare the various types of usage rights	

Grade 5

Domain	Strand	Standard	Learning Outcomes	C
		and responsible way	G5.TS.DC.1.2 Reference the work of others when used in new digital products	
	e-Safety and Health	G5.TS.ES.1 Discuss the importance of time management when using technology	G5.TS.ES.1.1 Discuss the excessive use of technology and proper time allocation to computer-related activities	 
	Social and Environmental Impacts	G5.TS.SE.1 Discuss applications of robotics and the impacts in society	G5.TS.SE.1.1 Compare and contrast the positive and negative impacts of robotics in society	 

Grade 6

Domain	Strand	Standard	Learning Outcomes	C
Computing Systems and Networks	Operating Systems	G6.CSN.OS.1 Use a selected range of software functions and commands when operating a computer and computing devices	G6.CSN.OS.1.1 Manage files and folders	 
	Computer Hardware	G6.CSN.CH.1 Describe the use of appropriate computing devices for data collection	G6.CSN.CH.1.1 Use a data logger as a data collection device	 
	Networks	G6.CSN.NE.1 Explain how synchronous and asynchronous communications tools work	G6.CSN.NE.1.1 Compare and contrast various communication tools based on the way data is exchanged	  
Problem Solving and Decision Making	Computational Thinking	G6.PS.CT.1 Construct algorithms that include sequencing, repetition and complex decisions to accomplish a task with a computing device or a robot	G6.PS.CT.1.1 Create a flowchart that describes an algorithm with sequence, loop and selection (IF)	 
			G6.PS.CT.1.2 Create a flowchart that describes an algorithm with sequence and loop to create a graphical representation	
	Programming and Robotics	G6.PS.PR.1 Code programs that include sequencing, repetition and complex decisions to accomplish a task with a computing device	G6.PS.CT.2.1 Classify various types of data used by a given program	  
			G6.PS.PR.1.2 Create a program that draws 2D shapes	

Grade 6

Domain	Strand	Standard	Learning Outcomes	C
			G6.PS.PR.1.3 Create a script to solve a problem using variables	
		G6.PS.PR.2 Develop programs that include sequencing, repetition and selection to control a robot	G6.PS.PR.2.1 Create an accurate program that controls a robot based on sensory input	  
	Data Analysis	G6.PS.DA.1 Describe the methodology of data collection	G6.PS.DA.1.1 Explain the benefits of using a data logger as a data collection device	  
Productivity and Collaboration	Data Management	G6.PC.DM.1 Use appropriate ICT tools to collect, transform and maintain data for a range of purposes and audiences	G6.PC.DM.1.1 Transform information with a spreadsheet	  
			G6.PC.DM.1.2 Use a spreadsheet to present and interpret information	
			G6.PC.DM.1.3 Use a data logger as a data collection and recording device	
	Productivity and Creativity Tools	G6.PC.PCT.1 Use appropriate ICT tools to independently or collaboratively create and modify digital artefacts for a range of purposes and audiences	G6.PC.PCT.1.1 Present information with a word processor	  
			G6.PC.PCT.1.2 Manage tables of data in a document	
			G6.PC.PCT.1.3 Create a structured multi-page document	
			G6.PC.PCT.1.4 Create and publish a website online	

Grade 6

Domain	Strand	Standard	Learning Outcomes	C
	Collaboration and Communication Tools	G6.PC.CCT.1 Use ICT tools to share and exchange information with known and unknown audiences to explore different points of view on various topics	G6.PC.CCT.1.1 Discuss best practices to securely share and exchange information on social media platforms	 
Research and Innovation	Research Methodologies	G6.RI.RM.1 Use ICT tools to locate, retrieve and critically compare digital data from a range of digital sources	G6.RI.RM.1.1 Gather accurate and relevant information on a particular topic from a range of sources G6.RI.RM.1.2 Describe the basic structure of the Web	 
	Entrepreneurship	G6.RI.EN.1 Explain how different types of graphical data representation affect decisions	G6.RI.EN.1.1 Compare how information is presented through various types of charts	 
	Applied and Emerging Technologies	G6.RI.ET.1 Discuss technologies that can enhance education	G6.RI.ET.1.1 Identify types of computer games that can be used for educational purposes	
Technology and Society	Digital Citizenship and Ethics	G6.TS.DC.1 Apply best practices to protect personal privacy, identity, rights and emotional safety of others when communicating or sharing information with known or unknown audiences	G6.TS.DC.1.1 Identify guidelines for protecting privacy, rights and emotional safety of self or of others, when working online	 
	e-Safety and Health	G6.TS.ES.1 Explain potential security threats when sharing data online	G6.TS.ES.1.1 Use security guidelines to be protected from online threats	 

Grade 6

Domain	Strand	Standard	Learning Outcomes	C
	Social and Environmental Impacts	G6.TS.SE.1 Compare and contrast the positive and negative impacts of technology in everyday life	G6.TS.SE.1.1 Compare the positive and negative impacts of technology in everyday life	 

Grade 7

Domain	Strand	Standard	Learning Outcomes	C
Computing Systems and Networks	Operating Systems	G7.CSN.OS.1 Use a selected range of operating system functions and commands	G7.CSN.OS.1.1 Manipulate the file system of an operating system using productivity tips G7.CSN.OS.1.2 Customise the operating system	      
	Computer Hardware	G7.CSN.CH.1 Understand the function of the internal components and the peripheral devices of a computer system	G7.CSN.CH.1.1 Classify the different types of computers, their internal components and peripheral devices	
	Networks	G7.CSN.NE.1 Model the role of protocols in transmitting data across networks and the Internet	G7.CSN.NE.1.1 Examine how networking protocols enable the Internet	
Problem Solving and Decision Making	Computational Thinking	G7.PS.CT.1 Design a computing artefact that responds to an event	G7.PS.CCT.1.1 Construct algorithms with decision tables	  
			G7.PS.CT.1.2 Construct drawing algorithms for simple 2D graphs	
			G7.PS.CT.1.3 Construct algorithms to control a robot that responds to events	
	Programming and Robotics	G7.PS.PR.1 Create software to accomplish a task	G7.PS.PR.1.1 Control the behaviour of a robot using its sensors	

Grade 7

Domain	Strand	Standard	Learning Outcomes	C
		with a computing device or a robot	G7.PS.PR.1.2 Program an autonomous robot	
			G7.PS.PR.1.3 Convert an algorithm with decision tables to a script using a block-based visual programming tool	
			G7.PS.PR.1.4 Create a program that draws 2D graphs	
	Data Analysis and Modelling	G7.PS.DA.1 Interpret results to draw inferences from processed data	G7.PS.DA.1.1 Generate an infographic to present information in a clear and plausible manner	  
Productivity and Collaboration	Data Management	G7.PC.DM.1 Use ICT tools to store and maintain data for given purposes	G7.PC.DM.1.1 Use a contact management tool to store and maintain personal information of contacts	 
	Productivity and Creativity Tools	G7.PC.PCT.1 Use ICT tools to design and modify digital artefacts that enhance visual communication	G7. PC.PCT.1.1 Create digital 3D models	 
			G7. PC.PCT.1.2 Modify ready-made digital 3D models	
			G7.PC.PCT.1.3 Print 3D models	
			G7. PC.PCT.1.4 Create infographics to visualise complex ideas	
	Collaboration and Communication Tools	G7.PC.CCT.1 Use ICT tools to share information with a known or unknown audience	G7.PC.CCT.1.1 Discuss the similarities and differences of the communication and social media tools	 

Grade 7				
Domain	Strand	Standard	Learning Outcomes	C
			G7.PC.CCT.1.2 Explain the use of blogging as a medium of sharing ideas and exploring different points of view	
Research and Innovation	Research Methodologies	G7.RI.RM.1 Identify patterns in sets of information to create appropriate inquiries	G7.RI.RM.1.1 Use advanced search strategies	  
	Entrepreneurship	G7.RI.EN.1 Discuss the uses and limitations of autonomous systems	G7.RI.EN.1.1 Model the movement of an autonomous vehicle	 
	Applied and Emerging Technologies	G7.RI.ET.1 Explore technologies that enhance the way we use travel, hospitality and entertainment services	G7.RI.ET.1.1 Use mapping services for navigation and gathering of information	 
Technology and Society	Digital Citizenship and Ethics	G7.TS.DC.1 Identify proper uses of social media to develop strategies that avoid adverse situations	G7.TS.DC.1.1 Apply guidelines for exchanging ideas online and protecting privacy and personality	 
	e-Safety and Health	G7.TS.ES.1 Implement a computer protection and data backup strategy	G7.TS.ES.1.1 Assess the risks of malware based on their type	 
			G7.TS.ES.1.2 Use anti-malware tools effectively	
			G7.TS.ES.1.3 Defend the necessity of keeping multiple copies of data files	
			G7.TS.ES.1.4 Use data backup tools	

Grade 7

Domain	Strand	Standard	Learning Outcomes	C
	Social and Environmental Impacts	G7.TS.SE.1 Analyse the role of computing-related jobs in our society	G7.TS.SE.1.1 Discuss the importance of jobs related to computing	 

Grade 8

Domain	Strand	Standard	Learning Outcomes	C
Computing Systems and Networks	Operating Systems	G8.CSN.OS.1 Operate a multitasking operating system with efficiency	G8.CSN.OS.1.1 Manage multiple programs simultaneously	
	Computer Hardware	G8.CSN.CH.1 Apply criteria for evaluating a computer system for a given purpose	G8.CSN.CH.1.1 Compare different types of computers, internal components and peripheral devices based on technical characteristics and typical usage	 
	Networks	G8.CSN.NE.1 Describe how two computers around the world can be connected efficiently	G8.CSN.NE.1.1 Explain how high-speed networks connect any two locations in the world	 
Problem Solving and Decision Making	Computational Thinking	G8.PS.CT.1 Design collaboratively a software artefact	G8.PS.CT.1.1 Construct algorithms working in a team	  
	Programming and Robotics	G8.PS.PR.1 Create software to solve a problem in collaboration with others	G8.PS.PR.1.1 Create a program collaboratively	
			G8.PS.PR.1.2 Build 3D models programmatically	
			G8.PS.PR.1.3 Design a computer game with a game development tool	
			G8.PS.PR.1.4 Program the interactivity of a computer game	
	Data Analysis	G8.PS.DA.1 Present information from processed data	G8.PS.DA.1.1 Analyse data in a spreadsheet to present formatted information suitable for decision making	  

Grade 8

Domain	Strand	Standard	Learning Outcomes	C
Productivity and Collaboration	Data Management	G8.PC.DM.1 Use ICT tools to transform data for particular audiences and purposes	G8.PC.DM.1.1 Create spreadsheets with calculations and cell formatting	 
			G8.PC.DM.1.2 Exchange data with other programs	
	Productivity and Creativity Tools	G8.PC.PCT.1 Use ICT tools to design, produce and modify digital artefacts that enhance oral and written communication	G8.PC.PCT.1.1 Use different types of media files stored locally	 
			G8.PC.PCT.1.2 Plan a short movie	
			G8.PC.PCT.1.3 Create an audio clip	
			G8.PC.PCT.1.4 Edit a short movie	
			G8.PC.PCT.1.5 Create bitmap images	
			G8.PC.PCT.1.6 Enhance a photo	
	Collaboration and Communication Tools	G8.PC.CCT.1 Use ICT tools to share information and collect data from a specific known audience	G8.PC.CCT.1.1 Collect data through online forms	 
Research and Innovation	Research Methodologies	G8.RI.RM.1 Assess the suitability of data or information using a range of appropriately given criteria	G8.RI.RM.1.1 Search for multimedia content on appropriate websites to acquire multimedia content that can be reused	 
	Entrepreneurship	G8.RI.EN.1 Analyse the impact of technology in the operations of a	G8.RI.EN.1.1 Explain how a management information system leverages technology to enhance	 

Grade 8

Domain	Strand	Standard	Learning Outcomes	C
		business or organisation	efficiency in a business or organisation	
	Applied and Emerging Technologies	G8.RI.ET.1 Explore the concept of artificial intelligence and its various applications	G8.RI.ET.1.1 Define artificial intelligence	 
			G8.RI.ET.1.2 Analyse the positives and negatives of various artificial intelligence technologies	
Technology and Society	Digital Citizenship and Ethics	G8.TS.DC.1 Apply best practices with regards to digital citizenship and the collection of others' personal information	G8.TS.DC.1.1 Describe how personal information must be handled	 
	e-Safety and Health	G8.TS.ES.1 Assess the negative impacts of the use of technology on personal health	G8.TS.ES.1.1 Describe the physical and the psychological effects of prolonged usage of digital devices	
			G8.TS.ES.1.2 Describe the effects of incorrect posture to health resulting from the usage of digital devices	
	Social and Environmental Impacts	G8.TS.SE.1 Discuss how technology affects the environment	G8.TS.SE.1.1 Compare and contrast the positive and negative environmental effects of technology	 

Grade 9

Domain	Strand	Standard	Learning Outcomes	C
Computing Systems and Networks	Operating Systems	G9.CSN.OS.1 Identify the main operations of the operating system of a computer system	G9.CSN.OS.1.1 Explain the functions of the operating system manages memory, processes and files	 
			G9.CSN.OS.1.2 Compare and contrast system and application software	
	Computer Hardware	G9.CSN.CH.1 Explain the role of the basic computer hardware components in the operation of a computer system	G9.CSN.CH.1.1 Describe how data is represented, stored and processed in a computer system	  
			G9.CSN.CH.1.2 Describe the main architecture of a computer system	
	Networks	G9.CSN.NE.1 Outline the protocols main networking concepts and the key network protocols	G9.CSN.NE.1.1 Describe how the Web works	  
Problem Solving and Decision Making	Computational Thinking	G9.PS.CT.1 Use an iterative design process to solve problems, both independently and collaboratively	G9.PS.CT.1.1 Create an algorithm and the relevant flowchart iteratively	 
			G9.PS.CT.1.2 Create the documentation of an algorithm	
	Programming and Robotics	G9.PS.PR.1 Create software to solve a problem with a text-based programming language	G9.PS.PR.1.1 Convert algorithms to code using a text-based programming tool	  
			G9.PS.PR.1.2 Use code to handle data and perform mathematical calculations	
			G9.PS.PR.1.3 Create a mobile application with a block-based programming language	

Grade 9				
Domain	Strand	Standard	Learning Outcomes	C
			G9.PS.PR.1.4 Test a mobile application on a smartphone emulator	
			G9.PS.PR.1.5 Create a web page using a markup language	
	Data Analysis	G9.PS.DA.1 Analyse data organised in a relational database	G9.PC.DA.1.1 Use a database to search, filter and sort data	 
			G9.PC.DA.1.2 Use a database to generate formatted reports	
Productivity and Collaboration	Data Management	G9.PC.DM.1 Use ICT tools to manage and maintain a relational database	G9.PC.DM.1.1 Define the structure and relationships of data sets in a simple database	  
			G9.PC.DM.1.2 Create database tables	
			G9.PC.DM.1.3 Create personalised data entry forms	
			G9.PC.DM.1.4 Transfer data to and from a database	
			G9.PC.DM.1.5 Maintain a database securely	
	Productivity and Creativity Tools	G9.PC.PCT.1 Use ICT tools to design and modify digital artefacts for particular audiences and purposes	G9.PC.PCT.1.1 Use an online tool to create a document and work on it from anywhere	  
			G9.PC.PCT.1.2 Use a notes management tool to record personal information	

Grade 9

Domain	Strand	Standard	Learning Outcomes	C
	Collaboration and Communication Tools	G9.PC.CCT.1 Use ICT tools to communicate and work effectively with others in collaborative environments	G9.PC.CCT.1.1 Use a video conferencing service to collaborate on a project	 
			G9.PC.CCT.1.2 Deliver a presentation online	
			G9.PC.CCT.1.3 Use an online office suite in collaboration with others	
Research and Innovation	Research Methodologies	G9.RI.RM.1 Organise research information in collaboration with others	G9.RI.RM.1.1 Use a notes management tool to organise and share research information	 
	Entrepreneurship	G9.RI.EN.1 Use ICT tools to visually organise thoughts and concepts	G9.RI.EN.1.1 Compare and contrast mind maps and concept maps	 
			G9.RI.EN.1.2 Create a mind map	
	Applied and Emerging Technologies	G9.RI.ET.1 Compare and contrast traditional work practices with the modern online collaborative way of working	G9.RI.ET.1.1 Compare and contrast the advantages and disadvantages of online collaboration	 
Technology and Society	Digital Citizenship and Ethics	G9.TS.DC.1 Apply generally accepted social protocols when using ICT to collaborate with local or global communities	G9.TS.DC.1.1 Identify the best practices for the communication and sharing of information when collaborating online	 
	e-Safety and Health	G9.TS.ES.1 Identify strategies to secure and protect networks	G9.TS.ES.1.1 Discuss how wired and wireless networks can be protected from malicious attacks	 
	Social and Environmental Impacts	G9.TS.SE.1 Discuss the impact of ICT on self-learning and life-long learning	G9.TS.SE.1.1 Compare and contrast the advantages and disadvantages of online learning	 

Grade 10

Domain	Strand	Standard	Learning Outcomes	C
Computing Systems and Networks	Operating Systems	G10.CSN.OS.1 Use troubleshooting procedures to solve routine operating system malfunctions	G10.CSN.OS.1.1 Solve simple data storage problems	 
	Computer Hardware	G10.CSN.CH.1 Use troubleshooting procedures to solve routine computer hardware malfunctions	G10.CSN.CH.1.1 Solve simple problems with the computer and its peripherals	
	Networks	G10.CSN.NE.1 Classify the network types based on their characteristics	G10.CSN.NE.1.1 Illustrate the various network types	 
			G10.CSN.NE.1.2 Compare and contrast the advantages and disadvantages of the wired and the wireless types of networks	
			G10.CSN.NE.1.3 Outline key networking concepts and protocols	
Problem Solving and Decision Making	Computational Thinking	G10.PS.CT.1 Define reusable procedures that solve similar tasks	G10.PS.CT.1.1 Compare and contrast the advantages and disadvantages of using reusable code in programming	 
	Programming and Robotics	G10.PS.PR.1 Create software to control a robot or another computing device	G10.PS.PR.1.1 Create a program with reusable code for an IoT device	 
			G10.PS.PR.1.2 Implement a simple IoT hardware project	

Grade 10

Domain	Strand	Standard	Learning Outcomes	C
			G10.PS.PR.1.3 Implement a robotics project with reusable code	
	Data Analysis	G10.PS.DA.1 Use ICT tools that efficiently transform data into information to support accurate decision making	G10.PS.DA.1.1 Present formatted information accurately	 
Productivity and Collaboration	Data Management	G10.PC.DM.1 Use ICT tools that securely maintain data on a variety of storage media locally or on networks	G10.PC.DM.1.1 Manage data securely	 
	Productivity and Creativity Tools	G10.PC.PCT.1 Use ICT tools to design, produce and modify digital artefacts for a range of audiences and purposes	G10.PC.PCT.1.1 Shoot short video clips	
			G10.PC.PCT.1.2 Edit a short video to share on the web	
			G7.PC.PCT.1.3 Modify the structure of documents for academic and other purposes	
			G7.PC.PCT.1.4 Create personalised documents for a known audience.	
			G7.PC.PCT.1.5 Export a document to other data formats.	
	Collaboration and Communication Tools	G10.PC.CCT.1 Evaluate ICT tools to communicate and collaborate with a team	G10.PC.CCT.1.1 Select appropriate ICT tools for a sales team to share and exchange information	 
Research and Innovation	Research Methodologies	G10.RI.RM.1 Assess the suitability of data or information	G10.RI.RM.1.1 Use criteria to evaluate the quality, suitability and credibility of	

Grade 10

Domain	Strand	Standard	Learning Outcomes	C
		using a range of own appropriate criteria	data or information and online sources	
	Entrepreneurship	G10.RI.EN.1 Use models and specific data to support accurate decision making	G10.RI.EN.1.1 Create a model that predicts future sales	 
	Applied and Emerging Technologies	G10.RI.ET.1 Assess the impacts of the advancements in computer hardware on the way we use and interact with computers	G10.RI.ET.1.1 Discuss the development of human-computer interaction with the advancements in computing infrastructure	
Technology and Society	Digital Citizenship and Ethics	G10.TS.DC.1 Apply practices that comply with legal obligations regarding the use of personal information	G10.TS.DC.1.1 Describe how collected personal information must be legally handled	 
	e-Safety and Health	G10.TS.ES.1 Assess privacy issues related to everyday, online computer monitoring	G10.TS.ES.1.1 Illustrate various methods of monitoring	 
			G10.TS.ES.1.2 Compare and contrast the positives and negatives of monitoring	
	Social and Environmental Impacts	G10.TS.SE.1 Assess the impact of ICT in the workplace	G10.TS.SE.1.1 Compare and contrast the positives and negatives of the use of technology in the workplace	

Grade 11 – Common (Humanities and Sciences Tracks)

Domain	Strand	Standard	Learning Outcomes	C
Computing Systems and Networks	Operating Systems	G11.CSN.OS.1 Illustrate the main operations of different operating systems	G11.CSN.OS.1.1 Compare and contrast the main operations of major operating systems	
	Computer Hardware	G11.CSN.CH.1 Illustrate the main differences between mobile devices and desktop computers	G11.CSN.CH.1.1 Compare and contrast the form and function of tablets or smartphones and desktop computers	
	Networks	G11.CSN.NE.1 Discuss the scalability and availability of cloud infrastructure	G11.CSN.NE.1.1 Describe the main components of cloud infrastructure in comparison with an on-premises system	 
Problem Solving and Decision Making	Computational Thinking	G11.PS.CT.1 Implement a cyclical design process in developing a software application	G11.PS.CT.1.1 Develop prototypes as part of a cyclical design process	 
	Programming and Robotics	G11.PS.PR.1 Develop an application user interface to be inclusive and accessible	G11.PS.PR.1.1 Develop a mobile application designed for accessibility	  
	Data Analysis and Modelling	G11.PS.DA.1 Understand the effects of information quality in decision-making	G11.PS.DA.1.1 Describe what information quality is G11.PS.DA.1.2 Explain the aims of data validation	  
Productivity and Collaboration	Data Management	G11.PC.DM.1 Explore encoding techniques to represent data efficiently	G11.PC.DM.1.1 Illustrate how data encoding works	  

Grade 11 – Common (Humanities and Sciences Tracks)

Domain	Strand	Standard	Learning Outcomes	C
	Productivity and Creativity Tools	G11.PC.PCT.1 Use appropriate ICT tools to design business-related diagrams	G11.PC.PCT.1.1 Create a diagram that shows the flow of processes	 
	Collaboration and Communication Tools	G11.PC.CCT.1 Use appropriate ICT tools to manage collaborative projects	G11.PC.CCT.1.1 Explain the basic concepts of managing a collaborative project G11.PC.CCT.1.2 Use a project management tool to manage a team, tasks and resources	  
Research and Innovation	Research Methodologies	G11.RI.RM.1 Research the feasibility of new ideas for products or services	G11.RI.RM.1.1 Search for market and product information on appropriate websites	  
	Entrepreneurship	G11.RI.EN.1 Explore the impact of the system life cycle in the introduction of a new or updated system	G11.RI.EN.1.1 Describe the stages of an ICT system life cycle.	  
	Applied and Emerging Technologies	G11.RI.ET.1 Assess the impact of mobility in technology on the working patterns	G11.RI.ET.1.1 Compare and contrast the positives and negatives of teleworking	 
Technology and Society	Digital Citizenship and Ethics	G11.TS.DC.1 Assess the impact of the digital divide on access to critical information	G11.TS.DC.1.1 Describe how the adverse effects of the digital divide can be reduced	 

Grade 11 – Common (Humanities and Sciences Tracks)

Domain	Strand	Standard	Learning Outcomes	C
	e-Safety and Health	G11.TS.ES.1 Protect data with encryption mechanisms	G11.TS.ES.1.1 Describe encryption methods to protect data for storage and transmission	 
	Social and Environmental Impacts	G11.TS.SE.1 Brainstorm ways in which technology could be made more accessible to everybody	G11.TS.SE.1.1 Explore ideas to improve technological solutions for use by people with special needs	 

Grade 11 – Supplementary for track (Humanities Track)

Domain	Strand	Standard	Learning Outcomes	C
Productivity and Collaboration	Productivity and Creativity Tools	G11H.PC.PCT.1 Use appropriate ICT tools to design advertisements for specific purposes	G11H.PC.PCT.1.1 Create an illustrated advertisement	 
Research and Innovation	Entrepreneurship	G11H.RI.EN.1 Explore how an effective advertisement works	G11H.RI.EN.1.1 Identify design guidelines for advertisements	  

Grade 11 – Supplementary for track (Sciences Track)

Domain	Strand	Standard	Learning Outcomes	C
Problem Solving and Decision Making	Programming and Robotics	G11S.PS.PR.1 Use appropriate software development tools and web technologies to develop a website	G11S.PS.PR.1.1 Create a responsive website	  
Research and Innovation	Entrepreneurship	G11S.RI.EN.21 Evaluate the optimisation of a website based on how search engines work	G11S.RI.EN.1.1 Apply SEO techniques to attract visitors to a website	  

Grade 12 – Common (Humanities and Sciences Tracks)

Domain	Strand	Standard	Learning Outcomes	C
Computing Systems and Networks	Operating Systems	G12.CSN.OS.1 Apply best practices to reduce the digital footprint	G12.CSN.OS.1.1 Use operating system functions for secure web browsing	 
	Computer Hardware	G12.CSN.CH.1 Discuss the advantages and disadvantages of big data cloud storage	G12.CSN.CH.1.1 Compare and contrast on-premises and cloud storage of big data	
	Networks	G12.CSN.NE.1 Compare and contrast the positive and negative effects of network convergence	G12.CSN.NE.1.1 Describe how the network convergence affects consumers and businesses	  
Problem Solving and Decision Making	Computational Thinking	G12.PS.CT.1 Apply advanced testing techniques to ensure quality in software development	G12.PS.CT.1.1 Differentiate between a test scenario and a test case	 
			G12.PS.CT.1.2 Use a series of test cases to verify a program	
Productivity and Collaboration	Data Analysis and Modelling	G12.PS.DA.1 Explore technologies that enhance business decisions through advanced statistical analysis of data	G12.PS.DA.1.1 Explain the concepts and enabling technologies of business analytics	  
	Data Management	G12.PC.DM.1 Assess the capabilities of big data management	G12.PC.DM.1.1 Describe the data warehousing processes	 
	Productivity and Creativity Tools	G12.PC.PCT.1 Use appropriate ICT tools to produce information for business purposes	G12.PC.PCT.1.1 Use analysis tools to solve what-if problems	  
	Collaboration and Communication Tools	G12.PC.CCT.1 Use appropriate ICT tools to communicate with others securely	G12.PC.CCT.1.1 Identify e-mail encryption and digital signature techniques	 
			G12.PC.CCT.1.1 Exchange digitally signed and encrypted e-mail messages	

Grade 12 – Common (Humanities and Sciences Tracks)

Domain	Strand	Standard	Learning Outcomes	C
Research and Innovation	Research Methodologies	G12.RI.RM.1 Research exposed private data on the Internet	G12.RI.RM.1.1 Use search engines to locate personal information online	 
	Entrepreneurship	G12.RI.EN.1 Discuss major trends that impact commerce globally	G12.TS.SE.1.1 Identify current and future e-advertising methods	 
			G12.RI.EN.1.2 Describe basic e-commerce models	
	Applied and Emerging Technologies	G12.RI.ET.1 Discuss the use of technology in e-commerce	G12.RI.ET.1.1 Illustrate the technologies behind e-commerce	 
Technology and Society	Digital Citizenship and Ethics	G12.TS.DC.1 Manage digital identities and reputations by demonstrating an understanding of digital footprint	G12.TS.DC.1.1 Assess the impact of a person's digital footprint online	 
	e-Safety and Health	G12.TS.ES.1 Identify strategies to evaluate secure websites for commercial transactions	G12.TS.ES.1.1 Assess the security of a website for online transactions	
	Social and Environmental Impacts	G12.TS.SE.1 Assess the impact cryptocurrencies may have on the global economy	G12.TS.SE.1.1 Discuss the positives and negatives of using cryptocurrencies in financial transactions	 

Grade 12 – Supplementary for track (Humanities Track)

Domain	Strand	Standard	Learning Outcomes	C
Productivity and Collaboration	Productivity and Creativity Tools	G12H.PC.PCT.1 Use appropriate ICT tools to design business-related documents	G12H.PC.PCT.1.1 Create business forms and reports	 
Research and Innovation	Entrepreneurship	G12H.RI.EN.1 Discuss how the form of a business document affects its function	G12H.RI.EN.1.1 Compare and contrast document design guidelines.	  

Grade 12 - Supplementary for track (Sciences Track)

Domain	Strand	Standard	Learning Outcomes	C
Problem Solving and Decision Making	Programming and Robotics	G12S.PS.PR.1 Explore modern programming paradigms in software development	G12S.PS.PR.1.1 Develop an application based on the object-oriented programming concepts	  
		G12S.PS.PR.2 Evaluate the feasibility of extending the features of an existing program	G12S.PS.PR.2.1 Analyse intended and unintended implications by adding functionality to an existing program	
Research and Innovation	Entrepreneurship	G12S.RI.EN.1 Discuss how the choice of a software development tool affects the cost and quality of a software product	G12S.RI.EN.1.1 Evaluate the positives and negatives of different types of software development tools	  

Grade 11 – Technical Track

Domain	Strand	Standard	Learning Outcomes	C
Computing Systems and Networks	Operating Systems	G11T.CSN.OS.1 Illustrate the main operations of different operating systems	G11T.CSN.OS.1.1 Compare and contrast the main operations of mobile and desktop operating systems	
			G11T.CSN.OS.1.2 Compare and contrast the main operations of desktop and server operating systems	
		G11T.CSN.OS.2.1 Illustrate how the processor is using its resources efficiently	G11T.CSN.OS.2.1 Compare and contrast processor scheduling algorithms	
	Computer Hardware	G11T.CSN.CH.1 Illustrate the main differences between mobile devices and desktop computers	G11T.CSN.CH.1.1 Compare and contrast the form and function of tablets or smartphones and desktop computers	
			G11T.CSN.CH.1.1 Compare and contrast the hardware architecture between mobile and desktop computers	
	Networks	G11T.CSN.NE.1 Discuss the scalability and availability of cloud infrastructure	G11T.CSN.NE.1.1 Describe the main components of cloud infrastructure in comparison with an on-premises system	 
		G11T.CSN.NE.2 Discuss the benefits gained from using storage area networks	G11T.CSN.NE.2.1 Compare and contrast the various storage area networks	
Problem Solving and Decision Making	Computational Thinking	G11T.PS.CT.1 Implement a cyclical design process in developing a software application	G11T.PS.CT.1.1 Develop prototypes as part of a cyclical design process	 
		G11T.PS.CT.2 Assess the appropriateness of an algorithm for a specific task	G11T.PS.CT.2.1 Evaluate the efficiency of an algorithm in terms of time and space	

Grade 11 – Technical Track

Domain	Strand	Standard	Learning Outcomes	C
			G11T.PS.CT.2.2 Analyse the flow of execution of a recursive algorithm	
			G11T.PS.CT.2.3 Compare and contrast searching and sorting algorithms	
		G11T.PS.CT.3 Explore a user-centred design for solutions to real-life problems	G11T.PS.CT.3.1 Design a user interface with a focus on usability	
		G11T.PS.CT.4 Evaluate the need for a variety of programming paradigms	G11T.PS.CT.4.1 Compare and contrast the major programming paradigms	
		G11T.PS.CT.5 Compare how advanced data structures are used by algorithms	G11T.PS.CT.5.1 Evaluate appropriate data collections to represent data	
	Programming and Robotics	G11T.PS.PR.1 Develop an application user interface to be inclusive and accessible	G11T.PS.PR.1.1 Develop a mobile application designed for accessibility	  
		G11T.PS.PR.2 Use appropriate software development tools and web technologies to develop a website	G11T.PS.PR.2.1 Create a responsive website	
			G11T.PS.PR.2.2 Use a script language for a scenario with interactivity	
		G11T.PS.PR.3 Use advanced programming	G11T.PS.PR.3.1 Implement a variety of searching and sorting algorithms	

Grade 11 – Technical Track

Domain	Strand	Standard	Learning Outcomes	C
		techniques to solve computational problems	G11T.PS.PR.3.2 Implement modular programming methods to organise and reuse code	
		G11T.PS.PR.4 Use advanced data structures to create generalised solutions	G11T.PS.PR.4.1 Implement various data collections to handle program data	
	Data Analysis and Modelling	G11T.PS.DA.1 Understand the effects of information quality in decision-making	G11T.PS.DA.1.1 Describe what information quality is	
			G11T.PS.DA.1.2 Explain the aims of data validation	 
Productivity and Collaboration	Data Management	G11T.PC.DM.1 Explore encoding techniques to represent data efficiently	G11T.PC.DM.1.1 Illustrate how data encoding works	  
		G11T.PC.DM.2 Process locally stored digital data programmatically	G11T.PC.DM.2.1 Create code to manipulate local data files	
	Productivity and Creativity Tools	G11T.PC.PCT.1 Use appropriate ICT tools to design business-related diagrams	G11T.PC.PCT.1.1 Create a diagram that shows the flow of processes	 
	Collaboration and Communication Tools	G11T.PC.CCT.1 Use appropriate ICT tools to manage collaborative projects	G11T.PC.CCT.1.1 Explain the basic concepts of managing a collaborative project	 
			G11T.PC.CCT.1.2 Use a project management tool to manage a team, tasks and resources	

Grade 11 – Technical Track

Domain	Strand	Standard	Learning Outcomes	C
Research and Innovation	Research Methodologies	G11T.RI.RM.1 Research the feasibility of new ideas for products or services	G11T.RI.RM.1.1 Search for market and product information on appropriate websites	  
	Entrepreneurship	G11T.RI.EN.1 Explore the impact of the system life cycle in the introduction of a new or updated system	G11T.RI.EN.1.1 Describe the stages of an ICT system life cycle.	  
	Applied and Emerging Technologies	G11T.RI.ET.1 Assess the impact of mobility in technology on the working patterns	G11T.RI.ET.1.1 Compare and contrast the positives and negatives of teleworking	 
Technology and Society	Digital Citizenship and Ethics	G11T.TS.DC.1 Assess the impact of the digital divide on access to critical information	G11T.TS.DC.1.1 Describe how the adverse effects of the digital divide can be reduced	 
	e-Safety and Health	G11T.TS.ES.1 Protect data with encryption mechanisms	G11T.TS.ES.1.1 Describe encryption methods to protect data for storage and transmission	 
	Social and Environmental Impacts	G11T.TS.SE.1 Brainstorm ways in which technology could be made more accessible to everybody	G11T.TS.SE.1.1 Explore ideas to improve technological solutions for use by people with special needs	 

Grade 12 - Technical Track

Domain	Strand	Standard	Learning Outcomes	C
Computing Systems and Networks	Operating Systems	G12T.CSN.OS.1 Apply best practices to reduce the digital footprint	G12T.CSN.OS.1.1 Use operating system functions for secure web browsing	 
		G12T.CSN.OS.2 Discuss how the operating system has evolved to support Internet of Things devices and real-time applications	G12T.CSN.OS.2.1 Compare and contrast an IoT device operating system with a typical desktop operating system	
	Computer Hardware	G12T.CSN.CH.1 Discuss the advantages and disadvantages of big data cloud storage	G12T.CSN.CH.1.1 Compare and contrast on-premises and cloud storage of big data	
			G12T.CSN.CH.1.2 Explain the concepts and building blocks of private cloud storage	
	Networks	G12T.CSN.NE.1 Compare and contrast the positive and negative effects of network convergence	G12T.CSN.NE.1.1 Describe how the network convergence affects consumers and businesses	  
		G12T.CSN.NE.2 Explore how the use of VPN technologies has changed traditional working patterns	G12T.CSN.NE.2.1 Explain the network technologies required to implement a VPN	
Problem Solving and Decision Making	Computational Thinking	G12T.PS.CT.1 Apply advanced testing techniques to ensure quality in software development	G12.PS.CT.1.1 Differentiate between a test scenario and a test case	 
			G12.PS.CT.1.2 Use a series of test cases to verify a program	

Grade 12 - Technical Track

Domain	Strand	Standard	Learning Outcomes	C
		G12T.PS.CT.2 Explore the concept of concurrency	G12T.PS.CT.2 Create an algorithm that implements concurrency	
		G12T.PS.CT.3 Solve real-life problems with the use of object-oriented concepts	G12T.PS.CT.3.1 Use abstraction to create objects and classes	
			G12T.PS.CT.3.2 Use the basic principles of object-oriented programming to design a computational solution	
			G12T.PS.CT.3.3 Assess the suitability of object-oriented programming for a variety of computational problems	
	Programming and Robotics	G12T.PS.CT.4 Determine the suitability of complex data structures for specific tasks	G12T.PS.CT.4.1 Compare and contrast complex data structures and their uses	  
		G12T.PS.PR.1 Discuss intended and unintended implications by adding functionality to an existing program	G12T.PS.PR.1.1 Evaluate the feasibility of extending the features of an existing program	
			G12T.PS.PR.2.1 Develop an application based on the object-oriented programming concepts	
		G12T.PS.PR.2 Explore modern programming paradigms in software development	G12T.PS.PR.2.2 Create an application that uses libraries	

Grade 12 - Technical Track

Domain	Strand	Standard	Learning Outcomes	C
			G12T.PS.PR.2.3 Create an application with tasks running concurrently	
			G12T.PS.PR.2.4 Create an application that handles system and user generated events	
		G12T.PS.PR.3 Use appropriate software development tools for specific programming tasks	G12T.PS.PR.3.1 Explain the use of the various software development tools	
		G12T.PS.PR.4 Use advanced programming techniques to represent complex data structures	G12T.PS.PR.4.1 Implement complex data collections to manipulate data	
	Data Analysis and Modelling	G12T.PS.DA.1 Explore technologies that enhance business decisions through advanced statistical analysis of data	G12T.PS.DA.1.1 Explain the concepts and enabling technologies of business analytics	  
Productivity and Collaboration	Data Management	G12T.PC.DM.1 Assess the capabilities of big data management	G12T.PC.DM.1.1 Describe the data warehousing processes	  
		G12T.PC.DM.2 Use data management tools to perform	G12T.PC.DM.2.1 Apply database normalisation techniques to databases	

Grade 12 - Technical Track

Domain	Strand	Standard	Learning Outcomes	C
		data processing techniques	G12T.PC.DM.2.2 Create SQL scripts to manage normalised databases	 
	Productivity and Creativity Tools	G12T.PC.PCT.1 Use appropriate ICT tools to produce information for business purposes	G12T.PC.PCT.1.1 Use analysis tools to solve what-if problems	  
	Collaboration and Communication Tools	G12T.PC.CCT.1 Use appropriate ICT tools to communicate with others securely	G12T.PC.CCT.1.1 Identify e-mail encryption and digital signature techniques	 
			G12T.PC.CCT.1.1 Exchange digitally signed and encrypted e-mail messages	
Research and Innovation	Research Methodologies	G12.RI.RM.1 Research exposed private data on the Internet	G12.RI.RM.1.1 Use search engines to locate personal information online	 
	Entrepreneurship	G12T.RI.EN.1 Discuss how the choice of a software development tool affects the cost and quality of a software product	G12S.RI.EN.1.1 Evaluate the positives and negatives of different types of software development tools.	 
		G12.RI.EN.2 Discuss major trends that impact commerce globally	G12.TS.SE.2.1 Identify current and future e-advertising methods	 
			G12T.RI.EN.2.2 Describe basic e-commerce models	
	Applied and Emerging Technologies	G12T.RI.ET.1 Discuss the use of technology in e-commerce	G12T.RI.ET.1.1 Describe the technologies behind e-commerce	 

Grade 12 - Technical Track

Domain	Strand	Standard	Learning Outcomes	C
Technology and Society	Digital Citizenship and Ethics	G12T.TS.DC.1 Manage digital identities and reputations by demonstrating an understanding of digital footprint	G12T.TS.DC.1.1 Assess the impact of a person's digital footprint online	 
	e-Safety and Health	G12T.TS.ES.1 Identify strategies to evaluate secure websites for commercial transactions	G12T.TS.ES.1.1 Assess the security of a website for online transactions	
	Social and Environmental Impacts	G12T.TS.SE.1 Assess the impact cryptocurrencies may have on the global economy	G12T.TS.SE.1.1 Discuss the positives and negatives of using cryptocurrencies in financial transactions	 

Terminology

Term	Definition
Algorithm	A step-by-step process to complete a task.
Code	Any set of instructions expressed in a programming language.
Computational thinking	The human ability to formulate problems so that their solutions can be represented as computational steps or algorithms to be executed by a computer.
Computer hardware	The collection of physical parts of a computer system, internal or external.
Computer Science	The study of computers and algorithmic processes, including their principles, their hardware and software designs, their implementation, and their impact on society.
Computing	As a school subject: the study of how computers and computer systems work, and how they are constructed and programmed, and the foundations of information and computation.
Computing device	A physical device that uses hardware and software to receive, process, and output information. Computers, mobile phones, and computer chips inside appliances are all examples of computing devices.
Computing system	A collection of one or more computers or computing devices, together with their hardware and software. Although a computing system can be limited to a single computer or computing device, it more commonly refers to a collection of multiple connected computers, computing devices, and hardware.
Cybersecurity	The protection against access to, or alteration of, computing resources through the use of technology.
Data	Information that is collected and used for reference or analysis. Data can be digital or nondigital and can be in many forms, including numbers, text, show of hands, images, sounds, or video.
Decompose	Breaking a complex problem or system into parts that are easier to conceive, understand, program, and maintain.
Digital artefact	An artefact that is of a digital nature or creation.
Digital citizenship	The norms of appropriate, responsible behaviour with regard to the use of technology.
Digital literacy	A person's ability to find, evaluate, produce and communicate

	clear information through writing and other forms of communication on various digital platforms.
Emerging technologies	A new technology that is currently being developed or will be developed within the next five to ten years.
ICT - Information and communications technology	All the technology used to handle telecommunications, broadcast media, data processing and transmission systems, and network-based control and monitoring functions.
Implementation	The process of expressing the design of a solution in a programming language (code) that can be made to run on a computing device.
Information Technology	The use of computers and other electronic equipment to store, retrieve, transmit, and manipulate data.
Modelling	Constructing and manipulating abstract (mathematical and/or graphical) representations of economic, engineering, manufacturing, and other types of situations and natural phenomena, simulated with the help of a computer system.
Network	A group of computing devices (personal computers, phones, servers, switches, routers, etc.) connected by cables or wireless media for the exchange of information and resources.
Operating system	A system software that manages computer hardware and software resources and provides common services for computer programs.
Operation	An action, resulting from a single instruction, that changes the state of data.
Programming	The implementation of logic to facilitate specified computing operations and functionality.
Robotics	The field of computer science and engineering concerned with creating robots, devices that can move and react to sensory input.
Simulation	Imitation of the operation of a real-world process or system.
Software	Programs that run on a computing system, computer, or other computing device.
System	A collection of elements or components that work together for a common purpose.

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