DRAFT

Computer Science - Curriculum Guidelines
Grade VI

DOMAIN A: ICT Fundamentals

STEP 1

Standard: Students develop an understanding of ICT, ICT devices, computer systems (hardware), and networks.

Student Learning Outcomes 1: Students will be able to recognize various ICT devices and their applications.

Knowledge:
Students will be able to:
- Define ICT (Information and Communication Technology)
- Define 'Computer'.
- Summarize the different developments in the history of Computers.

Students will be able to identify the advantages and daily applications of ICT devices e.g.:
- Communication applications
- Measurement applications
- Applications in manufacturing industries
- Advantages & disadvantages of ICT devices
- Applications of the ICT devices in business and daily life

Skills:
Students will be able to:
- Identify various ICT devices
- Recognize a computer and its external components
- Apply their knowledge to operate computer devices (like mouse/keyboard/printer & touch devices)
- Identify the use of ICT devices in:
  - Communication applications (print media, digital media, mobile phone, etc.)
  - Measurement applications (digital experiments, weather stations, navigation, etc.).
  - Applications in manufacturing industries (robotics used in manufacture and production line control).

STEP 2

Formative Assessments (**Descriptions of Formative Assessment Strategies can be found at the end of the document in 'Bank of Formative Assessment Strategies'.*)

- Problem Solving
- List 10 Things

- Examples/Non-Examples

Summative Assessments*:* (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Activity 1: Ask students some questions regarding the topic before starting the lesson. After getting their response, display some real objects or flashcards/printouts of different ICT devices. Ask the students to state the use of each device they identify.

Activity 2: Students can draw/find examples of various ICT devices.

STEP 1

Standard*:* Students develop an understanding of ICT, ICT devices, computer systems (hardware), and networks.

Student Learning Outcomes 2: Students will be able to distinguish between computer hardware and software.

Knowledge:
Students will be able to:

- Define hardware and software
- Identify Hardware components of a computer:
  - Input devices (e.g. keyboard, mouse, scanner, microphone, digital camera, sensors, etc.).
  - Output Devices (LCD/LED/SMD, printer, speakers, multimedia projector, etc.)

Skills:
Students will be able to*:*

- Differentiate between hardware and software
- Use various input and output devices of a computer efficiently

STEP 2

Formative Assessments (**Descriptions of Formative Assessment Strategies can be found at the end of the document in 'Bank of Formative Assessment Strategies'.*)

- Matching Activities

- Open-Ended Questions
- Paper Pass

Summative Assessments*:* (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Activity 1:

- Divide the students into pairs.
- Ask the students to brainstorm three or four activities they can accomplish with a computer. Encourage them to think about people they know who use the computer for their studies/work/play. What is the input used for that activity? What is the output?
- Have students brainstorm within their groups, record their ideas on the activity guide/page/board/poster and ask them to make a list of input and output devices.
- Point students towards the list of inputs and outputs you have listed on the board or students have jotted down.
- Ask the students to share their ideas regarding the input and output devices.

Activity 2: (Class Activity)

Introduction: Begin by questioning students about the applications they might have heard of already, like students may already know about some computer applications such as web browsers, Word processing applications, entertainment applications, and utilities. Explain that these are applications and then define the technical terms like hardware, software, operating system, and computer applications.

STEP 1

Standard*:* Students develop an understanding of ICT, ICT devices, computer systems (hardware), and networks.

Student Learning Outcomes 3: Students will be able to identify and analyze (basic) hardware components of a computing system (e.g. input, output, storage, and processing).

Knowledge:	**Skills:**
Students will be able to: ● Summarize how a computer processor works (input, processing, and output) ● Differentiate between data and information, along with examples. ● Identify types of computer memory (RAM and ROM)	Students will be able to: ● Recognize processor, memory, and storage as essential components of a computer ● Identify various steps involved in processing information

• Recognize the types of storage (SSD, HDD, and External storage)	• Categorize raw data into useful data or information • Differentiate between RAM and ROM • Compare the advantages, and disadvantages of various types of storage

STEP 2

Formative Assessments (**Descriptions of Formative Assessment. Assessment Strategies can be found at the end of the document in 'Bank of Formative Assessment Strategies'.*)

- Peer-Assessments
- Self-Assessments
- Three-Minute Pause

Summative Assessments*:* (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Activity 1:

- Ask the students to work in groups and write down their thoughts about it
- Tell the students that there are many inputs and outputs on the smartphones they must have used or seen. If the students struggle here, consider asking them the following prompts:
    - "How does the phone know it has to shut down when it is too hot?"
    - "How does the phone know its location?"
    - "How does the phone know when to switch from playing music through the speakers to playing music through the headphones?"
    - "How does the phone know when to turn off the screen when you put the phone up to your ear?"
- After completing that, ask the students to present their collective thoughts as a group to the class.
- Learning activity objectives: To stimulate the higher-order thinking skills in the students ask the above-mentioned questions.

DOMAIN *B*: Digital Skills

STEP 1

Standard: Develop various digital skills about the usage of operating systems, image processing, word processing, presentation, and data handling.

Student Learning Outcome 1: Students will be able to navigate around an Operating System (e.g. Microsoft Windows, MAC OS, Linux, Ubuntu, Android, iOS, etc.).

Knowledge:
Students will be able to:

- Define the term operating system
- Analyze the functions of an Operating System
- Differentiate between types of operating systems (Windows, MAC, Linux, and Android)
- List the functions of files, folders, shortcuts, and a drive (with examples)

Skills:
Students will be able to:

- Identify and analyze operating systems (Windows, MAC, Linux, Android, etc.).
- Navigate around an operating system by
    - Demonstrating the startup procedure of any available operating system
    - Identifying the desktop icons/tools (desktop, start button, start menu, taskbar, notification area, desktop icons) and explaining their functions
    - Demonstrating how to create, name, rename and delete a new file, folder and create a shortcut.
    - Demonstrating how to cut, copy, and paste a file/folder to another folder/location, drag and drop a file/folder to another folder/ location.

STEP 2

Formative Assessments (**Descriptions of Formative Assessment Strategies can be found at the end of the document in 'Bank of Formative Assessment Strategies'.*)

- **Know Want Learn Chart**
- **Quick Write**
- **Practice on Computer** (use an operating system, create, name, rename, and delete a file or folder, create a shortcut on desktop, cut, copy, paste a file/folder)

Summative Assessments: (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Activity 1: (Class Activity)

- Pre-organize some flashcards/ or physically arrange devices with different Operating Systems (the more variety of devices the better).

- Choose the most popular operating systems and display their icons on the board. Challenge students to try and name them all. Explain that these are all examples of Operating Systems, also known as system software. Explain that they are responsible for managing user interface, memory, peripherals, multi-tasking, security, etc. ("Operating Systems", 2022)
- Activity detailed materials can be found here: https://www.teachwithict.com/operating-system.html

Activity 2: (Lab Activity)

- Divide the students into pairs.
- Ask them to create a folder on the desktop and rename it.
- Instruct them to delete the folder and empty the recycle bin.
- Observe the students and guide them where help is needed.

Activity 3: (Lab Activity)

- Divide the students into pairs.
- Ask them to drag and drop the folder/file from one location to another location.
- Use the cut/copy/paste commands and also tell the shortcut keys used for these commands.
- Observe the students and guide them where help is needed.

Activity 4: (Lab Activity)

- Instructions: Students need to create a desktop shortcut of any file/folder.
- Teacher demonstration: 'Desktop icons are designed to enable quick access to frequently used programs, files, folders, and so on. Many of these icons will be shortcuts, which are used to launch a program (or whatever) from another location. You can create desktop shortcuts for pretty much anything on your computer: programs, files, folders, windows, and the like' ("Microsoft Windows 7 - 12 Desktop Icons", 2022)
- Detailed guideline on activity can be found here: http://www2.westsussex.gov.uk/LearningandDevelopment/IT%20Learning%20Guides/Microsoft%20Windows%207/12%20Desktop%20icons.pdf

STEP 1

Standard*:* Develop various digital skills related to the usage of operating systems, image processing, word processing, presentation, and data handling

Student Learning Outcomes 2: Students will be able to apply and demonstrate image-processing skills (using various software tools e.g. Paint, 3D Paint, Tux, etc.), while efficiently using computer hardware (e.g. mouse, keyboard, etc.)

Knowledge:	**Skills:**
Students will be able to: ● Use image processing software (e.g. Paint, 3D Paint, Tux, etc.) for creating and editing images.	Students will be able to: ● Explore image processing applications and draw freehand different brush types. ● Draw an image using 2D shapes like lines, circles, polygons, etc, and change color, outline, and position as needed. ● Add text to a drawing.

	• Save a file and open saved files in paint. • Demonstrate proficiency in using computer hardware (e.g. mouse, keyboard, etc.) • Draw an image using 3D shapes**

STEP 2

Formative Assessments (**Descriptions of Formative Assessment Strategies can be found at the end of the document in 'Bank of Formative Assessment Strategies'.*)

- **Fist of Five**
- **Matching Activities**
- **Inside-Outside Circle**
- **Oral Questioning** – based on how, why, what if
- **Muddiest (or Clearest) Point**
- **Practice on Computer** (draw a freehand drawing, draw 2D shape & 3D shape image, add text to the drawing and make a greeting card, character or house, etc.)

Summative Assessments: (Theory & Practical**)**

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Activity 1: (Class Activity)

Discuss the types of software with the students. Explain the functions of application software and system software. Draw a pictograph on the board by adding the use of software for education, productivity, and entertainment by adding real-life examples.

Activity 2: (Lab Activity)

Divide the students into pairs. Explain to students that each pair is going to use an image processing software to draw a given prompt (for example, draw a house). Instruct students to open the software. Demonstrate how to use each of the "paint tools" and how to edit/erase. Demonstrate to the students how to use the spray paint, creating different shapes and colors. Students may use 3 different colors, 3 different shapes, and text. Ask if there are questions. Students will practice using the basic tools for 5 minutes. Give students 30 minutes or whatever time they need to draw and paint their house. Take a round to observe and guide the students as required. This activity is to mainly enhance a student's fine motor skills while allowing him/her to express inner creativity.

DOMAIN *C*: Algorithmic Thinking and Problem Solving

STEP 1

Standard*:* Identity, define, and analyze a problem, and apply algorithmic thinking and problem-solving strategies to develop step-by-step solutions to solve problems.

Student Learning Outcome 1: Students will be able to identify, define and analyze a problem; and develop a step-by-step solution to solve simple problems.

Knowledge:
Students will be able to:

- Define and identify a problem.
- Analyze different techniques to deconstruct a problem.
- Differentiate between simple and complex problems.

Skills:
Students will be able to:

- Identify:
  - What is given – facts.
  - Data needed to solve the problem – input.
  - The output of the problem when given a certain input.
  - Specific instructions vs. nonspecific instructions.

Example: If a recipe is given, determine ingredients; given a maze, a robot, and a set of instructions the robot can follow; determine how to perform tasks using the given instructions; determine the task completed using given a set of instructions, etc.

- Deconstruct a problem into sub-problems (e.g. process of making fries, getting ready for school, etc.).
- Design a set of step-by-step instructions to solve a problem (e.g., giving directions using a specific set of words) through logic and reasoning.
- Integrate solutions to sub-problems to solve the main problem.
- Using given data and facts, reason about conclusion (guess the identity of a classmate given a set of qualities/features).

STEP 2

Formative Assessments

Assessment 1: Problem identification, analysis, and definition. Design a written quiz to identify and define the underlying problems in statements/situations etc.
Assessment 2: Problem-solving- Design quiz to apply all the problem-solving steps and choose the best solution out of all the available solutions; ask students to give reasons for the selection of a particular solution.
Assessment 3: Problem decomposition; Design a quiz with some simple and complex problems and ask students to differentiate between them. Ask students to deconstruct a complex problem into smaller parts.

Assessment 4: Step by step solution to a problem (Algorithm Designing by using Logic)- design a quiz to write complete step-by-step instructions to solve any problem.

In-class or Homework Prompt: Ask students to write 3 problems they see around them and apply all the steps from problem identification to writing step-by-step solutions to the problem.
Students can design solutions to one problem and then can compare them with their classmates to find the best solution.
Student Self-Assessment/Reflection: Ask students to identify problems they are facing in school/ home or while coming to school/real-life/math/science and write them in a statement, find the problem solution and write down step by step solution for it.

Summative Assessments: (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations).

Students can solve the following problems by breaking down the problem into smaller parts, and then suggesting a sequence of steps to reach a solution. Activities should be in groups of 4-6 students, and the output document should include a problem statement and a step-by-step solution.

- **Activity 1:** (Maze/map) to reach the target where none of the paths should be repeated.
- **Activity 2**: Use different blocks to make shapes.
- **Activity 3**: Create different objects by using Origami (Boat, house, doll, robot, airplane, etc.)
- **Activity 4:** Identify numbers of shapes in an image.
- **Activity 5:** Solve a Rubik's cube.
- **Activity 6:** Find the odd one out in the given objects.
- **Activity 7:** Arrange a birthday party/ family dinner/find the best path to school, etc.
- **Activity 8:** Solve a mathematical equation by deconstructing it into various smaller parts. (BODMAS, Finding LCM/HCF, solving algebraic equation)
- **Activity 9:** Design an activity to solve a big scientific problem by deconstructing it into various smaller parts. (Life cycles of living things, change in the state of matter, etc.)
- **Activity 10:** Design an activity like (draw the smiley/ draw the shape, etc.) to understand the concept of Logic; every student can have different logic and can follow different steps to solve the same problem.

STEP 1

Standard*:* Identity, define, and analyze a problem, and apply algorithmic thinking and problem-solving strategies to develop step-by-step solutions to solve problems.

Student Learning Outcome:2 Students will be able to analyze and apply basic algorithmic thinking to solve different types of problems

Knowledge: Students will be able to: ● List benefits of algorithmic thinking. ● recognize that algorithms are a sequence of precisely described instructions. ● Examine that Algorithmic thinking is breaking down a problem, identifying important information, logical thinking, and confidence in decision making. ● Define conditional statements/ selection statements that decide whether certain instructions should run (e.g. if there is rain take an umbrella)? ● Identify loops, and analyze how they allow instructions to be repeated. ● Analyze ways to solve a problem by using a combination of sequence, selection, and repetition.	**Skills:** Students will be able to: ● Identify and differentiate between simple and complex problems. ● Create a sequence of steps to solve a problem. ● Relate sequence, selection, and repetition to daily life tasks. ● Create solutions to problems using sequencing, loops, and conditions.

STEP 2

Formative Assessments

Assessment 1: Understand the algorithm as a step-by-step procedure. Design a written quiz to identify steps of a simple mathematical algorithm for adding two 3-digits integers.
Assessment 2: Design a worksheet in which they give multiple scenarios to determine which problem-solving technique (sequence, loops, and conditions) can be applied.
In-class or Homework Prompt: Ask students to write 3 problems around them and apply all the steps from problem identification to writing step-by-step solutions to the problem.
Students can design solutions to one problem and then can compare them with their classmates to find the best solution.
Student Self-Assessment/Reflection: Ask students to identify problems in their daily routines where they can apply sequencing, conditions, and loops to determine their solution (Eg. problem of traffic can be solved through traffic lights that run in loops).

Summative Assessments: (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations. The learning activities below have been adopted from https://www.kodable.com/learn/learn-to-code-sequence/***)***

In-class activity 1: ALGORITHMS

The key learning is that activities should use algorithms or step-by-step processes to perform a task. Students can work in groups:

- **Prompt 1**: Write an algorithm that would allow a person to create a pizza with 4 toppings.
- **Prompt 2**: Write an algorithm that gives the steps involved with brushing your teeth.
- **Prompt 3:** Write an algorithm to find a path in an 8x8 box with one starting point and ending point.

In class activity 2: SEQUENCE[1]

The key learning is that activities should use a specific sequence to perform a task. Students can work in groups:

- **Prompt 1:** Apply sequencing using BODMAS to solve a mathematical problem.
- **Prompt 2:** 'Divide students into pairs such that one partner is the "coder" and one partner is the "robot". The coder decides on a simple task for their partner "robot" to do; the simpler the task, the better, like "walk across the room." Next, the coder gives their partner "robot" step-by-step instructions, also known as an algorithm, to complete the task. "Robots" need to remember that they can only do exactly what their coder tells them to do. If one of the steps is incorrect or not specific enough, this will result in a bug in their algorithm, and it will need to be redone. Switch places when finished' (Learning Activity, 2022).

In-class activity 3: REPETITION or LOOPS[2]

The key takeaway is that activities should apply repetition or loops to solve a problem.

- **Prompt 1:** Ask the students to pick between creating a fun dance or exercise routine. Ask students to come up with three actions to perform physically e.g. for a workout routine, this could be a jumping jack, pushup, and sit-up, and for a dance routine, this could be a clap, spin, and jump. 'Have the students decide how many times each action should be repeated, or "looped". For example, "clap 2 times, spin 1 time, and jump 3 times". Perform the routine altogether, looping each action the designated number of times. Then, try looping the entire routine at least twice! As an extension, invite a partner to execute the same commands and perform the routine together!' (Flex Your Loop Skills, 2022).

In-class activity 4: CONDITIONS[3]

The key takeaway is that activities should use conditions to solve a problem.

- **Prompt 1:** 'Come up with a rule – something that always happens in the same way. For example, "I go to school on Mondays". Then, come up with an exception, also known as a condition, to this rule. For example, "If it is a holiday, then I don't go to school on Monday." Write the conditional statement at the top of a piece of paper. Use the rest of the paper space to illustrate the conditional statement. In this example, you could draw a picture of your favourite holiday. Repeat this process 3 times so you have three conditional art pieces! If working in pairs, one partner can come up with the rules, and the other can come up with the condition and draw the image. Then, switch roles' ("Learn with Conditions", 2022).

[1] Details of activity can be found on: https://www.kodable.com/learn/learn-to-code-sequence/

[2] Details of activity can be found here: https://www.kodable.com/learn/loops-coding-activity-free/

[3] Details of this activity can be found here: https://www.kodable.com/learn/learn-with-conditions/

- **Prompt 2:** 'Students will line up at one end of the classroom to reach the other side of the classroom. The teacher, and then the students themselves will call out conditionals and all the students will advance or not depending on the specific conditional statement. Have the students line up at one side of the room.
  Explain the rules:
  1. The object of the game is to get across the room first.
  2. For if...then conditionals: If the condition called out is true for you, then perform the action described in the then. If the condition called out is false for you, then do nothing.
  3. For if...then...else conditionals, listen carefully to the whole condition, as the else may apply to you' ("Learn with Conditions", 2022).

DOMAIN D: Programming

<table>
<tr><td colspan="2">Standard: Understand and apply fundamental programming constructs using visual and textual programming tools.</td></tr>
<tr><td colspan="2">Student Learning Outcome 1: Students will be able to analyze the fundamentals of computer programming.</td></tr>
<tr><td>Knowledge:
Students will be able to:
Determine the need for a programming language.
list ways in which programming is important in today's world.
Define 'Program'.
List different applications of computer programming.
Identify programming languages and their uses.</td><td>Skills:
Students will be able to:
Differentiate between an algorithm and a program.
Convert an algorithm into a program.</td></tr>
<tr><td colspan="2">Formative Assessments

Student Reflection – how many daily items use some sort of programming to work? What could be the benefits of learning programming?

Summative Assessments: (Theory & Practical)
Term Assessment
Mid-Year Exams
Final Exams</td></tr>
<tr><td colspan="2">Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)</td></tr>
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- **In-class or Homework Prompt** - Describe how various industries use programming (e.g. gaming industry, automobile industry, textile manufacturing industry, farming industry, etc.)
- **Research project or Homework Prompt** – Students can work in groups in class or as a homework research assignment. The prompt "What kind of programming languages exist and what are their uses?". The takeaway is to understand that programming language exists for specific purposes (e.g. HTML for web development, python for data science, Unity for game design, etc.)

Standard: Understand and apply fundamental programming constructs using visual and textual programming tools.

Student Learning Outcome 2: Students will be able to analyze and apply basic programming constructs (e.g. sequence, selection, repetition, variables, inputs/events); by creating simple single-sprite, single-script programs using visual programming tools.

Knowledge:
Students will be able to:

- List the fundamental programming constructs that enable a computer to interpret a computer program. The constructs are:
    - An event is an action from the user (or something outside the computer)
    - A sequence is a series of actions that are completed in a specific order. Computers follow all instructions in the sequence in which they are written.
    - A loop repeats instructions until a specific stopping condition is met.
    - A variable is used to store information called a value.
    - A conditional statement asks a question to figure out which path to take next.
- Analyze ways to debug a computer program.

Skills:
Students will be able to:

- Recognize that a program executes in a sequence – write computer programs accordingly.
- Write a program using the following constructs:
    - Event - take input from the user e.g. when the user presses an arrow key on the keyboard, or when the user clicks the mouse button – a certain action is executed.
    - Loop - repeats an instruction(s) a finite number of times or forever.
    - Motion - That involves the motion of a sprite/object.
    - Variable- creates and assigns values to a variable(s) (as per the event e.g. create an integer variable such as a score or a counter, and increase or decrease the value when certain events take place)
    - Conditional statement (if-else block) – running a block of code only if a specific condition is true

	● Debug a computer program.

Formative Assessments

Quiz 1 – Definitions of fundamental constructs
Quiz 2 – Explaining a computer program (i.e. code) in natural language (i.e. human language) (e.g. When the green flag is clicked, change x by 100 can be explained as when the program starts the sprite will move right by 100), and converting natural language (i.e. human language) to a computer program (i.e. code).

Student Self-Assessment/Reflection:

- What are some programming constructs that we use in our daily lives?
- The importance of following a certain **sequence of instructions**. The sequence of instructions to perform a certain task correctly. (e.g. breaking the eggshell and then frying the egg will work, but frying the egg and then breaking the eggshell will not work).
- The use of **loops**. Which instructions do we repeat in our daily lives (e.g. pour water till the glass is full)
- The use of **conditional statements**. Which instructions do we follow under certain occasions (e.g. take an umbrella if it is raining or sunny)

Summative Assessments:

- Term Assessment
- Mid-Year Exams
- Final Exams

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Students should code the following activities, and be encouraged to test their code, and debug accordingly if the program does not meet the required outcomes.

Lab Activity or In-class Coding Task #1 – EVENTS: When the program starts (e.g. in block-coding; using the event block "When green flag clicked"), make an action happen (e.g. make a sprite do something like change color when the sprite is clicked, or display some text like “hello world”)

Lab Activity or In-class Coding Task # 2 – SEQUENCE: When the program starts, two or three instructions should be executed in sequence (e.g. in block-coding; when the player clicks a sprite, make it go to a random position, play a sound, and switch costume in that order). Reflection question – what happens when the order is changed? Add a wait block (e.g. a wait one-second block or a print statement) between each instruction to make the changes more noticeable in a sequence.

Lab Activity or In-class Coding Task # 3 (continuation of task # 2) – LOOPS: When the program starts; give an instruction that will repeat forever (e.g. take the instructions given in task # 2 and set them to repeat)

Lab Activity or In-class Coding Task # 4: VARIABLES: Create an integer variable, assign a value to the variable at the start of the program, and then change the value in response to a certain input (e.g. create a score variable. When the program starts, the score should be set to zero, and when the player presses the up-arrow key the score should increase by 1, and the score should decrease by 1 when the down arrow key is pressed)

Lab Activity or In-class Coding Task # 5 (continuation of task # 4): Run an instruction only if a specific condition is true (for example when the variable score from task # 4 reaches a certain value, a sound should play)

DOMAIN *E*: *Digital Citizenship*

STEP 1	
Standard: Students will be able to engage positively, critically, and competently in the digital environment.	
Student Learning Outcomes 1: *Students will analyze the basics of information literacy and digital civility and appropriate uses of technology.*	
Knowledge: Students will be able to: ● Identify essentials of good digital citizenship such as safe and responsible technology use. ● Recognize key concepts of copyright, plagiarism, and piracy, and define ethical standards of sourcing online information. ● Examine ethical issues that arise in ICT while surfing online. ● Analyze the importance of being safe, responsible, and respectful online. ● Identify health-related issues of using ICT devices.	**Skills:** *Students will be able to …* ● list school ICT lab rules. ● Use devices responsibly ● Demonstrate proper posture when using devices, and healthy behaviour such as taking breaks to avoid eye and body strain. ● use devices in a moderated manner (for example using devices for less time, or using age appropriate programs, or closing/shutting down and appropriately storing devices after use etc.). ● Identify steps to secure information privacy and confidentiality. ● Identify possible dangers of the internet and related security.
STEP 2	

Formative Assessments (**Descriptions of Formative Assessment Strategies can be found at the end of the document in 'Bank of Formative Assessment Strategies'.*)

- **ReQuest/ Reciprocal Questioning**
- **KWL Chart**
- **The Minute Paper**
- **Quick Write**
- **Onion Ring**
- **ABCD Whisper**
- **Circle, Triangle, Square**

Summative Assessments (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

In-class exercise or homework prompt: Students should identify and demonstrate proper posture when using devices, and know techniques for reducing eye and body strain during use. The teacher divides students into groups and assigns a device e.g. computer, TV, phone, etc. Each group then has to discuss the appropriate usage, proper posture, duration of usage, post-use storing of the device, etc. Students will present their points to the class after discussion.

In-class exercise or homework prompt: The teacher can make a worksheet on common devices, and the appropriate length of usage for health and safety reasons. Students will need to match the device to the appropriate health & safety standard on the worksheet. The teacher can support the students as required during the activity. Reflection questions to ask – did you know about the health standards of using these devices? Have you noticed anyone following unhealthy screen habits? How can you help them?

In-class activity: This activity demonstrates the importance of feeling safe online. The teacher will set the context by explaining how certain situations make us feel happy, but we should also be aware that some situations might make us feel uncomfortable and may even put us at risk. The key takeaway is that the students should be able to identify risky or uncomfortable behavior in an online setting.

Prompt: Invite the students to reflect on the following: "What should we do when something makes us feel uncomfortable, unsafe, at-risk, or scared?" Reflect together on the importance of telling a trusted adult when we feel uncomfortable, unsafe, at-risk, or scared.

"The power of the internet allows students to experience and visit places they might not be able to see in person. But, just like traveling in the real world, it's important to be safe when traveling online. On this virtual field trip, students can practice staying safe on online adventures."

Explain to the students that you are going to talk about the internet and how to use the internet safely. Show the students the happy face and the sad face in the two corners of the room and explain that you will read a few statements. They should walk to the happy face if they think that a situation makes them feel happy or to the sad face if a situation makes them feel scared, sad, or not at ease.

They can stay in the middle of the room if they are unsure about how they feel. Readout loud the following statements: • I am eating an ice cream. • I am playing a game I like. • I can´t find my backpack. • I made a kite and I am going to try it out with my friends today. • A stranger asks me to accompany him/her to an unfamiliar location. After each statement, allow the students enough time to choose a corner of the room. Ask the students in each corner to answer and discuss the following question within their group: "How does this situation make you feel? And why?" Invite a child from each group to share a few of the answers with the class. Do not forget to involve those who chose the middle by asking: "Why have you decided to stay in the middle? How do you think you might feel in this scenario?"

In-class activity:
The Start activity is a good opportunity to discuss child safety more broadly. It is important to explain to the students that one of the key strategies when feeling unsafe or uncomfortable, whether online or offline, is to approach a trusted adult. It is recommended that you share with the students the NO-GO-TELL approach. If something or someone is making them feel uncomfortable or unsafe, they should do the following: • Say NO when someone is making you feel uncomfortable or unsafe. • Then GO: leave or run away from that person or situation. • And TELL: talk to a trusted adult about the situation.

In-class activity:
Rules on online safety vary according to the age of the child and the exposure and access that each child has to online materials. For example, younger students might accept media content at face value and therefore need extra support to make sense of what they are seeing. Below we suggest a few rules that students should follow when using the Internet. Please refer to the list if you think that the student's notes need to be added or that the students might have missed a crucial rule. Please note that these are just suggestions: you are the expert in your classroom. Feel free to adapt the rules to what you think is appropriate in your environment.
1. I will discuss with my parents the rules for going online.
2. I will always think carefully before clicking on online content. I should not click on any content that I feel uncomfortable with or unsure about. For example, do not click on a video, if the preview video picture looks in any way scary or makes you feel uncomfortable, or if you do not understand it.
3. I will stop watching any program that makes me feel uncomfortable right away. As soon as I realize it is making me feel uncomfortable or unsafe, or I do not understand what is happening, I will turn it off.
4. I will not share personal information, such as my name, address, or phone number, without my parents' permission.
5. I will not make friends online with people I do not know. The most important rule is that I will tell my parents or a trusted adult right away any time I come across something online that makes me feel unsafe, uncomfortable or that I do not understand

DOMAIN *F*: Entrepreneurship *in Digital Age***

STEP 1

Standard: *Students will understand and apply the tools and mindsets needed to develop and launch a business idea*

Advanced SLO**
Student Learning Outcomes 1*: Students will be able to define and analyze entrepreneurship, its subtypes, and the entrepreneurship process.*

Knowledge:
Students will be able to:

- *Define the term 'Entrepreneurship.*
- *Identify different types of entrepreneurs and present a few examples of entrepreneurs.*
- *Differentiate between traditional & digital entrepreneurship along with examples.*
- *Summarize the entrepreneurship process.*

Skills:
Students will be able to:

- *Identify different types of entrepreneurs and present a few examples of entrepreneurs.*
- *Differentiate between traditional & digital entrepreneurship along with examples.*
- *Analyze how traditional entrepreneurs could use technology to improve or scale their business*

STEP 2

Formative Assessments

Quiz – assessment on knowledge and understanding of entrepreneurship, uses of technology in business, and business plan components.

Project-based assessment – create a business plan, design a solution to a problem and identify market size, customer profile, estimated revenue, costs, and profit.

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Activity 1: Students can discuss a famous entrepreneur and their professional & personal journey, and present to the class as an individual or a group.

Activity 2: "lemonade stand" students can work in groups, come up with a small revenue-generating activity like a lemonade stand, garage sale, movie night, bake sale, art auction. They should complete the activity independently and record the funds raised, and then donate to a charity.

Self-reflection / homework: Students can watch any of these entrepreneurship-related videos and share in oral or written presentation their comments on entrepreneurship
Innoventure Jr.: What is an entrepreneur? https://www.youtube.com/watch?v=Sc-yHMF7mNo
Teaching Entrepreneurship for Students! https://www.youtube.com/watch?v=6fKVyeGdKxY

Grade *VII*

DOMAIN A: ICT Fundamentals

STEP 1

Standard*:* Students develop an understanding of ICT, ICT devices, computer systems (hardware), and networks.

Student Learning Outcomes 1: Students will be able to identify the use of emerging technologies in various walks of life (e.g. artificial intelligence, biometrics, robotics, computer-assisted translation, 3D and holographic imaging, virtual reality, Cloud Computing, and open-source software).

Knowledge:
Students will be able to:

- the define and apply the following emerging technologies:
  - Robotics
  - Artificial intelligence
  - self-driving cars
  - 3D printing
  - virtual reality & augmented reality
  - 3D and holographic imaging

Skills:
Students will be able to:

- Recognize the progression in various technologies (e.g. landline phones to smartphones, 1st generation computer processors to 12th generation computer processors, etc).
- Describe the application and impact of emerging technologies.

STEP 2

Formative Assessments (**Descriptions of Formative Assessment Strategies can be found at the end of the document in 'Bank of Formative Assessment Strategies'.*)

- **Turn and Talk**
- **Whip Around**

Summative Assessment*:* (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Activity 1: Students (Individual/Group) are to research any emerging technology of their choice and present their findings to the whole class.

STEP 1

Standard*:* Students develop an understanding of ICT, ICT devices, computer systems (hardware), and networks.

Student Learning Outcomes 2: Students will be able to identify (advanced) hardware components of a computing system (e.g. different types of I/O ports and different types of peripherals).

Knowledge:
Students will be able to:

- Identify different I/O ports of a computer system (USB port, Type-C port, HDMI port, SATA port, PCI-express port, etc.)
- Identify different peripherals of a computer system (e.g. graphic card, printers, scanners, mouse, keyboard, webcams, etc.)

Skills:
Students will be able to:

- Identify and describe the properties of different I/O ports.
- Identify and describe the applications of different peripherals.

STEP 2

Formative Assessments (**Descriptions of Formative Assessment Strategies can be found at the end of the document in 'Bank of Formative Assessment Strategies'.*)

- **Ask**
- **Teach a Friend**
- **Think-Pair-Share**

Summative Assessments*:* (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Activity 1: Students will be asked to inspect a computer in the lab and identify the type of port that is in use

DOMAIN *B*: Digital Skills

STEP 1

Standard*:* Develop various digital skills about the usage of operating systems, image processing, word processing, presentation, and data handling.

Student Learning Outcome 1: Students will be able to develop and demonstrate word-processing and presentation skills (using various software tools e.g. MS Word, MS PowerPoint, Prezi, Canva, Photo Story, Movie-maker, etc.)

Knowledge:

Students will be able to:

- Describe the purpose of a word processor.
- Create and edit a document using any word processing software (e.g. MS Word, Google Docs, notepad, Open Office, etc).
- Explain the importance of a presentation tool.
- Create a presentation using any one of the word processing software.

Skills:

Students will be able to:

- Create an artifact (report, essay, etc.) using the following tools in word processing software:
    - Open a new Word document and tinker with the user interface of the word processor (MS Word).
    - Add and modify the text (underline, bold, italicize, font style, font size, font color) to a document in the word processor (MS Word).
    - Save and open files in the word processor (MS Word).
    - Format a document in the word processor (MS Word) (text alignment, bullets, page margins, page layout, spacing, indent).
    - Insert, resize and add text in images in the document.
    - Cut, copy, and paste text/image into a document.
    - Use spell-check.
    - Create and modify numbered and bulleted lists.
    - Demonstrate understanding of the difference between Save and Save as.
    - Insert and format a table.
    - Add header, footer, and page numbers in a document.
    - *Advanced skill: Use thesaurus and synonym features ***
    - *Advanced skill: Apply a procedure to print a document***
- Create a multimedia presentation by:
    - Adding new slides.

	o Adding various objects on the slides (image, text, video, audio, etc). o Animating an object to appear on click. o Creating internal/external Hyperlinks. o Adding notes. o Creating a slideshow and an executable file.

STEP 2

Formative Assessments (**Descriptions of Formative Assessment Strategies can be found at the end of the document in 'Bank of Formative Assessment Strategies'.*)

- **Open-Ended Questions**
- **3-2-1**
- **Problem Solving**
- **Practice on Computer** (draw a freehand drawing, draw 2D shape & 3D shape image, add text to the drawing, make a greeting card, character or house, etc.)

Summative Assessments (Theory & Practical**)**

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Activity 1:

- Engage students with the topic by asking them to open Microsoft Word and allowing them to navigate freely for three minutes. At the end of this time, ask them to share experiences, questions, and comments.
- Tell students they will be learning to use this program, then ask them to consider why learning to use Microsoft Word will be beneficial to them.
- Have them open a New Document.
- Have students preview the menus briefly by running their mouse across each but not opening any options under. Preview and predict what each tab does.
- Discuss features and allow students to ask questions, but instruct them to refrain from going further than exploration for now.
- Ask - Which feature will you use to:
    - Determine margins?
    - Create page borders?

- Check spellings?
- Add a table of contents?
- Preview the document?

Activity 2:
Students can prepare a presentation on the book they read last time; while incorporating all the tools.

STEP 1

Standard 1: Students will demonstrate the ability to use email.

Advanced SLO**
Student Learning Outcome 2: Students will get introduced to electronic mailing systems (e-mail) and learn appropriate usage.

Knowledge:
Students will be able to…

- List the uses of electronic mail (e-mail).
- Identify and explain the common platforms for electronic mail.
- Create an e-mail address, and how to send electronic mail (tone, language, etc).
- Demonstrate the process of authentication. 'Any process by which you verify someone, or something (a device) is who, what, they, or it claim(s) to be. Example: Some websites use a combination of e-mail addresses and passwords as a means of authentication' ("What is Authentication?", 2022).
- Demostrate an appropriate use of email (signing out after usage etc).
- Explain standard email protocols like SMTP and POP3 and implications for those who use them.

Skills:
Students will be able to…

- Define the following terms
  - email address
  - password
  - contacts
- Use an email service to create an email account.
- Create an electronic mail, with the appropriate subject line, content, and signature, adding in appropriate addressee, cc, bcc, and attachments
- Send and receive emails with attachments.
- Organize emails using different folders/labels.
- Demonstrate ability to log in and log out from an email inbox.
- Demonstrate ability to use email as a means of authentication for another website login password.

STEP 2

Formative Assessments:

Quiz 1 *- email and standard protocols*
In-class or Homework Prompt *– List down appropriate uses of email.*
In-class or Homework Prompt *– Email the teacher something you have appreciated in school. or class*
Student Self-Assessment/Reflection *– How would you like to use email?*

Summative Assessment*:* (Theory & Practical)

- Term Assessment

- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

In-class Task #1 **–Password power up** [4]- 'students will define the term "password" and describe a password's purpose, understand why a strong password is important, and practice creating a memorable and strong password.' ("Password Power-Up", 2022).

In-class exercise or Homework prompt *– Students should create an email address using common freely available platforms like Microsoft or Google. Teachers can conduct a demonstration, and students can follow the process and create their own email inboxes.*

In-class Task – 3-2-1

Ask the students to jot down 3 things they have learned about the email, make 2 personal connections to email, or write anything 2 things they didn't understand about email, and 1 area that needs to be discussed with the peers or teacher.

Support materials could include:
What is email: https://www.youtube.com/watch?v=VEYC1VnnEaY
Purpose structure & content of emails:
https://study.com/academy/lesson/purpose-content-structure-of-emails.html

DOMAIN *C*: Algorithmic Thinking and Problem Solving

STEP 1

Standard*:* Identify, define and analyze a problem, and apply algorithmic thinking and problem-solving strategies to develop step-by-step solutions to solve problems.

Student Learning Outcome: Students will be able to apply the concept of computational thinking to handle complex problems

[4] Reference material: https://www.commonsense.org/education/digital-citizenship/lesson/password-power-up

Knowledge: Students will be able to: ● Explain that an algorithm is a sequence of precisely described instructions. ● Describe how to apply computational thinking to solve a complex problem (breaking down a problem, identifying important information, logical thinking, and confidence in decision making).	**Skills:** Students will be able to: ● Extract relevant information required to solve the problem (abstraction). ● Break down a problem by identifying patterns/similarities to solve a complex problem. ● Write and design algorithms for complex problems. ● Draw a flowchart (input, output, process, and decisions) to graphically represent an algorithm.

STEP 2

Formative Assessments:
Quiz 1 – Identify an example of a simple problem e.g. tie your shoes (where there is only one sequence of steps that will solve the problem), and an example of a complex problem e.g. coming to school on time (the complexity is in determining causes of late-ness, e.g. sleep time, waking up time, traffic on the route, and then coming up with multiple solutions for each issue).

Quiz 1: Writing an algorithm of a complex problem by following all the important steps.
Step 1: Problem identification in the underlying problems in statements/situations etc.
Step 2: Breaking down the problem into smaller steps.
Step 3: Write steps in sequence to solve the problems.
Step 4: Draw a flow chart of steps.

Quiz 2: Identifying the prerequisite of writing algorithms of a simple problem as well as complex problems. Design a quiz to present the problem to students where they can identify problem statements, write all the prerequisites of the problem and write a complete algorithm.

In-class assignment or homework prompt: Students should be able to write at least 2 different solutions to the same problem. Design an assessment where students should be asked to write at least 2 different step-by-step solutions to solve any problem and write algorithms.

In-class assignment or homework prompt: Students should draw the basic flowchart of any problem while identifying the inputs/outputs.

- Design an assessment and ask students to draw the flowchart of at least 3 different algorithms (Provide the algorithm; students will just draw the flowcharts).
- Design an assessment and ask students to identify the problem, follow the problem-solving process and write step-by-step solutions to the problem (algorithm) and convert the algorithm into its graphical representation (flowchart).
- Design an assessment and ask students to identify the errors in the flowchart and redraw the correct flowchart.

In-class or Homework Prompt:

- Design different problems where the student should be able to extract the relevant information to the problem (Abstraction) and recognize various patterns/similarities (Pattern recognition) and decompose a big problem into smaller parts.
- Design at least 3-5 problems where students should be able to decompose a complex problem into smaller parts and write the algorithm to solve the problem efficiently.
- Design the problems where students should not only be able to write the algorithm but also be able to draw the flowcharts.
- Design the problems where students should be able to identify the fundamental blocks in flowcharts
- Design the problems where students should be able to identify errors in the flowchart and redraw them.

Student Self-Assessment/Reflection: Ask the students to identify problems they are facing in school/ home or while coming to school/real-life/math/science and write a problem statement, find the relevant information; identify the similarities in the information; write step by step solution to the problem and then graphically represent it into the flowchart.

Summative Assessment*:* (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Activities should not be focused on individual working, students should also learn to work in groups while completing the activities. (A group of 4-6 students should be encouraged to work on various activities.) Each student/group should identify a problem, apply abstraction and pattern recognition, decomposition problem, write an algorithm, and should write step by step solution to the problem.

Design problem, solution, and flow chart around the following problems:

1. Activity 1: Design activities to identify the mathematical/scientific or any other problems e.g.; sorting numbers in numerical order
2. Activity 2: Science Problem (Digestive system, respiratory system, transport in Plant, physical & chemical changes, etc.);
3. Activity 3: Computer problem (designing a small application like calculator, animated story, interactive presentation, etc.)

STEP 1

Standard: *Identify a problem statement and apply algorithmic thinking strategies to solve problems.*

Student Learning Outcome 2: Students will be able to apply concepts of conditional statements, finite, and infinite loops to write different algorithms.	
Knowledge: Students will be able to: ● Determine where to use a finite loop and infinite loop. ● Infer clear instructions to be considered for an algorithm to produce correct results. ● Recognize that more than one algorithm can solve a given problem. ● Distinguish between problems where If and If then else condition can be applied.	**Skills:** Students will be able to: ● Apply finite and infinite loops in algorithm building. ● Identify problems where IF then Else condition can be applied. ● Break down a problem and create a sub-solution for each of its parts. ● Recognize whether an input is fit to determine the correct output. ● *Use logical reasoning to predict outputs given varying inputs ***

STEP 2

Formative Assessments:

Assessment 1*: Design assessment and present problem to students where they should be able to identify and differentiate between 3 different types of algorithmic thinking application (Sequencing/Loops/ Conditions).*

Assessment 2*: Design assessment where students should be able to identify errors in the algorithms. (understand clear instructions and be able to write them step-by-step).*

Assessment 3: *Design assessment where students should be able to predict outputs while given varying inputs.*

Assessment 4*: Design assessment where students should be able to identify the scenario where to apply the Sequencing.*

Assessment 5*: Design assessment where students should be able to identify the scenario where to apply the finite/infinite loops.*

Assessment 6: *Design assessment where students should be able to identify the scenario where to apply simple if and if then else conditions.*

In-class or Homework Prompt: *Students should be presented with different problems where they have to apply Sequencing, Loops, and Conditions concepts.*

Student Self-Assessment/Reflection: *Ask students to write 3 problems around them (Real Life, Mathematical, Scientific & computer problems) and identify the scenarios where to apply sequencing, Loops, and Conditions and then can compare it with the classmates to find the best solution.*

Summative Assessment*:* (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

(The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations).

1. Key vocabulary terms (Algorithm design, Sequencing, Loops, Conditions, Infinite, and finite loops, If & If-Then-Else conditions) are introduced as needed by the various learning activities and performance tasks.
2. Activities should not be focused on individual working, students should also learn to work in groups while completing the activities. (A group of 4-6 students should be encouraged to work on various activities.)
3. Each student/group should identify a problem and be able to understand which algorithmic thinking concept will be applied there (Sequencing, Loops, and Condition)
4. Design activities around daily life problems e.g.;
5. Design activities to identify the mathematical/scientific or any other problems e.g; Math word problems (converting decimal numbers into binary, arranging absolute numbers into ascending and descending order, applying basic operations on integers and rational numbers; working with polynomials, manipulate algebraic expressions using formulae, etc.); Science problem (nervous system, excretory systems, chemical reactions, heat & its transfer, etc.); Computer problems (Designing a grading/ aging/ voting system, game designing with lives, levels, and obstacles, maze designing to reach certain targets, etc.)
6. Design following activities to identify, analyze and deconstruct problems:
    - ***Activity 1:*** *Take a* ***mathematical problem*** *and identify whether it's a sequencing/loops/condition problem or a combination of all and apply the concept and write step by step solution by applying algorithmic thinking.*
    - ***Activity 2****: Take a* ***science problem*** *and identify whether it's a sequencing/loops/condition problem or a combination of all and apply the concept and write step by step solution by applying algorithmic thinking.*
    - ***Activity 3****: Take a* ***computer problem*** *and identify whether it's a sequencing/loops/condition problem or a combination of all and apply the concept and write step by step solution by applying algorithmic thinking.*
    - ***Activity 4:*** *Design an activity like celebrating a day/planning a festivity activity (Group activity), and identify whether it's a sequencing/loops/condition problem or a combination and apply the concept and write step by step solution by applying algorithmic thinking.*

DOMAIN *D: Programming*

Standard: Explain and apply fundamental programming constructs using visual and textual programming tools	
Student Learning Outcome 1: Students will be able to understand how computers encode and decode computer programs (i.e. conversion of decimal to binary and vice versa, conversion of texts, images and sounds in binary)	
Knowledge:	**Skills:**

<table>
<tr>
<td>Students will be able to:
● Describe that computers store information using binary codes.
● Differentiate between binary and decimal number systems.
● Explain that computer can only understand specific instructions.

Advanced SLO**:
● Text, image, and sound representation in binary numbers</td>
<td>Students will be able to:
● Convert binary numbers into decimal numbers
● Convert decimal numbers into binary numbers

Advanced SLO**:
● Encode and decode text in binary using protocols of ASCII
● Encode and decode images in binary using protocols such as RGB</td>
</tr>
<tr>
<td colspan="2">Formative Assessments:

Quiz: Converting numbers from binary and decimal number systems and vice versa.

Summative Assessments:

● Term Assessment
● Mid-Year Exams
● Final Exams</td>
</tr>
<tr>
<td colspan="2">Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

● In-class Activity #1 - Students can conduct an activity to give instructions to complete a simple task like drawing a cat or a dog. Prompt: “Make groups of two, each student should have one piece of paper and a pencil. Student 1 will draw an animal, and then using instructions only (no hand gestures or any other movement) give student 2 instructions on how to draw the same image.” The learning objective is to understand that computers need specific instructions through a programming language and that instructions need to be very specific, and there is a need for standard terminology to navigate across the paper. Students can describe what kind of instructions a computer may need to be able to run programs.
● In-class Activity #1 - Specific instructions: Students pretend to be programmers and create a list of instructions for a simple task like making roti or drawing an animal and read it to the teacher. The teacher – pretending to be the computer – needs to follow the instructions exactly, teaching students the art of being specific, or realizing the gaps if they are not specific enough (e.g. a student could say ‘roll the dough’ but not explain that the dough needs to be taken out of the mixing bowl first, or what to roll it with). Sample open-source worksheets and activity details can be found here: https://classic.csunplugged.org/documents/activities/programming-languages/unplugged-12-programming_languages.pdf
Video of exercise can be found here: https://www.youtube.com/watch?v=Ct-lOOUqmyY
● Flashcards game: Students can learn to count using only 1 and 0. Using a set of five flashcards with 1, 2, 4, 8, and 16 dots on one side (representing a 1 in binary) and blank on the other (representing a 0 in binary). The teacher can turn over relevant cards, and</td>
</tr>
</table>

students can decode numbers and vice versa.
Sample open-source worksheets and activity details can be found here: https://classic.csunplugged.org/documents/activities/binary-numbers/unplugged-01-binary_numbers.pdf

- Worksheets for students to decode ciphers e.g. assign some numbers or letters to symbols and have students “decode” the hidden message or hidden number. Sample open-source worksheets can be found here: https://www.escapelincoln.com/wp-content/uploads/2020/03/CipherWorksheets_EscapeLincoln.pdf

Standard: Explain and apply fundamental programming constructs using visual and textual programming tools.

Student Learning Outcome 2: Students will be able to apply fundamental programming constructs to create multi-sprite, multi-script programs using visual programming tools.

Knowledge:
Students will be able to:

- Articulate that a combination of programming constructs can be put together to create more complex projects.
    - *o* The concept of combining events & coordinates to allow a user to move a sprite or a sprite, to move a sprite automatically without user intervention.
    - o The concept of setting a condition using mathematical operators on a variable (e.g. if the score is greater than 10, or if the timer is less than 0), or setting a condition for when two sprites collide (e.g. if touching another sprite).
    - o The concept of creating, setting, and changing a variable under certain conditions to either increase value (e.g. increase the score when the player touches a sprite) or decrease in value (e.g. countdown timer).

Skills:
Students will be able to:

- Write a program that will:
    - *o* Allow the user to move a sprite using arrow keys.
    - *o* Make sprites move automatically without user intervention when the program starts.
    - o Award the player a score point under certain conditions, such as if they can touch another sprite that is automatically moving, or if the player clicks on a moving sprite.
    - o Create a countdown timer.

Formative Assessments:

In-class Coding Tasks: The learning activities suggested below can also be used as assessments.

Quiz 1 – definitions of fundamental constructs of sequence, selection, repetition, variables, events, and motion through x-coordinates and y-coordinates

Quiz 2 – matching extracts of code to explanation (e.g. code block change x coordinate by 10 to be matched to explanation move sprite right or vice versa)

In-class exercise or homework prompt– Break down a computer/phone / online game you have played into simple instructions in the local language. Prompts/follow-up questions could include (1) What is the objective of the game? (2) How many sprites are there in the game? (3) How does the player move? (4) How does the player win (if applicable)? (5) How does the player lose (if applicable)? (6) What instructions have been given to the computer to make this game?

In-class exercise or homework prompt–What kind of events can be used by the player to move a sprite around a screen? (e.g. arrow key movement)

In-class exercise or homework prompt–Draw a three-panel story sequence, and code it.

Student Self-Assessment/Reflection– If two games use the same controls (like arrow keys) to move and award the player when why do so many of them exist? (The objective is to explain that coding itself is not sufficient, there needs to be a context in which the program exists, for example in the case of the game there is a game story that is being told with animations, character designs, music, etc. even if the code is the same)

Summative Assessments:

- Term Assessment
- Mid-Year Exams
- Final Exams

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations) (Please view activities listed below as recommendations)

- **Lab Activity or In-class Coding Task**– Vending machine – Create a "vending machine" by drawing or uploading a vending machine sprite, and code it so that the player presses a button or clicks on the machine, the "score" increases by 1.
- **Lab Activity or In-class Coding Task -** ATM – Create a "vending machine" by drawing or uploading a vending machine sprite, and code it so that the player presses a button or clicks on the machine, the "score" increases by 1.
- **Lab Activity or In-class Coding Task** – Create a program which uses takes input from the user to move a sprite, has at least two sprites, uses programming fundamental constructs like coordinates, conditionals, loops, and variables. Suggested prompts could be:
  - Add a player sprite and a "food" sprite that the player needs to chase.
  - Combining events and instructions to change coordinates, make the player sprite move right, left, up, and down when the player presses the upright arrow key, left arrow key, up arrow key, and down arrow key respectively.
  - Combining events and instructions to automatically move the "food" sprite (e.g. glide or go to a random position).
  - Create a score variable, set it to zero when the game starts, and use a conditional to change the variable when the player touches the second sprite.
  - Open-source project/learning materials: https://resources.scratch.mit.edu/www/guides/en/ChaseGuide.pdf
- **Lab Activity or In-class Coding Task:** Build mini-games using the following concepts:
  - Creating, setting, and changing integer variables for score & time.
  - Sequencing through event blocks (i.e. triggering code when a character is clicked or when the game starts).
  - Conditionals - triggering code on certain conditions such as scoring when a win condition is met, or losing when a loose condition is met.
  - Using a forever loop to repeat code.
  - Moving characters around a 2-dimensional space using coordinates.

Sample open source projects:

- Hide & Seek Game https://www.youtube.com/watch?v=1PFlVg7cr_g
- Table Tennis Game: https://resources.scratch.mit.edu/www/cards/en/pong-cards.pdf

In-class discussion - Students can present and play each other's games and explain the code.

"Speed code" competition – Students create a game within a limited time frame. First to finish a working project wins.

Coding drills – The teacher demonstrates a simple application in class, and students need to code it on their own in a timed drill.

DOMAIN *E*: *Digital Citizenship*

STEP 1

Standard 1: Learn to identify and use the basics of the internet, identify risks involved in an online exchange of information and apply digital safety protocols.

Student Learning Outcomes 1: Students will identify ways to protect against malicious activities or behaviours in the digital environment.

Knowledge:
Students will be able to:

- Explain ethics and what constitutes an ethical issue in digital environments.
- Outline the importance of being safe, responsible, and respectful online.
- Explain key concepts of copyright, plagiarism, and piracy.
- Evaluate digital media bias and messaging.

Students will identify:

- Improper use of computer resources.
- Steps to secure information privacy and confidentiality.
- Possible dangers of the internet and related security measures.

Skills:
Students will be able to:

- Identify the common uses of the internet such as business, social networking, entertainment, information/news.
- Identify appropriate and inappropriate behaviour when navigating the digital environment.
- Identify threats and know how to protect against malicious entities/activities like viruses, hacking, vandalism etc.
- Describe and use safe, appropriate, and responsible practices (netiquette) when participating online.
- Identify positive and negative impacts of using social media, both online and offline.

STEP 2

Formative Assessments (**Descriptions of Formative Assessment Strategies can be found at the end of the document in 'Bank of Formative Assessment Strategies'.*)

- **P-E-O (Predict-Explain-Observe)**

- **Question Shells**
- **Heads and tails**
- **Mind-maps**

Summative Assessments (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

In-class activity
Teachers can show videos on protecting your computer in class, and lead a discussion on ways to protect computers. Reflection questions can include (but not be limited to) What are some common ways in which computers can be protected? What happens when computers are not protected? Suggested video: https://www.youtube.com/watch?v=6mMZFoXbKqI

In-class activity
Students will then work in groups and present how to protect their online identity and computer

In-class activity
The teacher will place students in groups, and request each group to prepare a chart of ethical rules regarding the use of ICT. Students will present their posters, and the teacher can display posters in class.

In-class activity
The teacher can hold a debate, where two students can argue for and against the impact of using social media. The debate can include positives of social media, and students listening to the debate can vote for the winning debater. The teacher can ask reflection questions about the advantages of social media, such as connection to distant friends and relatives, selling goods & services, advertising revenue, learning more about culture and the world, entertainment, etc. The teacher can also ask reflection questions related to the negative impact of social media, such as health consequences, addictive behavior, sale of personal data, identify fraud, cyberstalking, etc.

DOMAIN *F*: *Entrepreneurship in the Digital Age***

STEP 1

Standard: Students will explain and apply the tools and mindsets needed to develop and launch a business idea.

Advanced SLO**
Student Learning Outcomes 1*: Students will be able to analyze the uses and benefits of design thinking for entrepreneurs.*

Knowledge:	**Skills:**
Students will know: ● Describe how innovation has changed the entrepreneurial mindset. ● List the steps of the design thinking process include identifying an issue, empathizing, defining, ideate, prototyping, testing, reflecting, iterate/repeating as needed, and implementing. ● Discuss the benefits to the innovation process of each design thinking step. ● Understand sustainable development goals in the context of the problems the world is facing that need to be solved.	Students will be able to: ● Identify the use and benefits of design thinking for entrepreneurs. ● Explain a project through the design thinking process; identify an issue, prototype & test. ● Identify key problems faced by the world today, through the lens of sustainable development goals. ● Share examples of problems faced that could be solved by a product or a service.

STEP 2

Formative Assessment

Quiz – assessment on knowledge and understanding of the design thinking process.
Project-based assessment – prototype a product, test, and re-design based on test feedback.

Summative Assessments (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Self-reflection/homework: Students can watch any of these entrepreneurship-related videos and share their comments on
What is Design Thinking?
https://www.youtube.com/watch?v=a7sEoEvT8l8&list=PL6cG1WctJGLB3Msassl6UPQ4yx_t2GLTG&index=1
Innoventure Jr: Think Like an Entrepreneur https://www.youtube.com/watch?v=Jg3G0pEV97s

Project prompt 1: Students pick one sustainable development goal and create a prototype within their context. Students can use whatever materials or resources are available (paper/ pen, video on a

phone, drawing of a cartoon, making a poster, etc). students can learn more about SDGs through these reference videos and more:
Emma Watson Introduces the World's Largest Lesson 2016
https://www.youtube.com/watch?v=-cEUhHTlcDU
Overview https://www.youtube.com/watch?v=M-iJM02m_Hg
The Road to the SDGs: A discussion with students -
https://www.youtube.com/watch?v=ZZzBbO6Y0uc&t=12s
Mr. Bean https://www.youtube.com/watch?v=s8cWM-TFZwM

In-class discussion – students can identify and list down problems that can be solved by a new product or service.

In-class discussion – students can identify common products and services and identify the problems they solve (e.g. washing machines solve the problem of hand washing taking too much time, or a fridge solves the problem of food spoiling).

In-class Activity
Students can research and list examples of innovation in business.

In-class activity
Students will apply scrum to solve a customer pain point, and then create a process to procure and sell the product:
Resources to explain the concept of scrum:

- Scrum in under 5 minutes - https://www.youtube.com/watch?v=2Vt7Ik8Ublw
- Scrum in School - https://www.youtube.com/watch?v=0KAbAWYPqus

Grade VIII

DOMAIN *A*: *ICT Fundamentals*

STEP 1

Standard*:* Students develop an understanding of ICT, ICT devices, computer systems (hardware), and networks

Student Learning Outcome 1: Students will be able to analyze the use of emerging technologies in various walks of life (e.g. artificial intelligence, 5G, robotics, computer-assisted translation, 3D and holographic imaging, virtual reality, distributed applications, block-chain, and Machine Learning)

Knowledge:	**Skills:**
Students will be able to o Name and explain the applications of emerging technologies in various walks of life (e.g. artificial intelligence, 5G, robotics, computer-assisted translation, 3D and holographic imaging, virtual reality, distributed applications, block-chain, and Machine Learning).	Students will be able to: ● Analyze emerging technologies relevant to different fields. (e.g. artificial intelligence, 5G, robotics, computer-assisted translation, 3D and holographic imaging, virtual reality, distributed applications / block-chain, and machine learning).

STEP 2

Formative Assessments (**Descriptions of Formative Assessment Strategies can be found at the end of the document in 'Bank of Formative Assessment Strategies'.*)

- **Teach a Friend**
- **Sentence Prompts**
- **Quick Writes**

Summative Assessment*:* (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Activity 1: (Research & Present)

- Divide the students into 2 groups.
- Name both groups as Group A and Group B respectively.
- Ask each group to research various emerging technologies of their choice and present features, applications, advantages, and disadvantages.

Activity 2: (Mapping)

- Divide the students into suitable pairs.
- Ask each pair to Open Google Maps on your computer/smartphone.
- Type your home address in the search bar and click Search.
- Click Get Directions and type the school's address in the starting directions bar and click search.
- Look at the map (or Satellite view) and see if that's how you get to school.

STEP 1

Standard*:* Students develop an understanding of ICT, ICT devices, computer systems (hardware), and networks.

Student Learning Outcome 2: Students will be able to analyze a network and identify core networking components and their roles.

Knowledge:
Students will be able to:

- Describe and differentiate between the types of computer networks:
  - LAN
  - MAN
  - WAN
  - VPN
- Explain the types of physical transmission media, and their uses:
  - Guided (Twisted Pair, Coaxial, Fiber Optics);
  - Unguided (wifi and lifi).
- Explain the types of wireless/wire transmission media, and their uses:
  - Cellular Communication
  - Satellite Communication
  - Global Positioning System
  - Bluetooth
- *Explain the concept of***
  - *IoT (Internet of Things)*
  - *Embedded Systems*
  - *Edge Computing*
  - *Data Analytics*

Skills:
Students will be able to:

- *o* Apply knowledge of networks to identify types of transmission relevant to a specific environment.

STEP 2

Formative Assessments (**Descriptions of Formative Assessment Strategies can be found at the end of the document in 'Bank of Formative Assessment Strategies'.*)

- **One Minute Fluency**
- **Graffiti Wall**
- **Take and Pass**

Summative Assessment*:* (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Activity 1: Digital Systems – Networks

- Inclass project: Students can individually or as groups demonstrate network or router function through posters, explanations, or acting.
- Reflection questions can include:
  - Definition and functions of domain name server (DNS)
  - Packet transmission through the internet using transmission control protocol/ internet protocol (TCP/IP).

Activity 2: Tablets of Stone

- Inclass project: Students can individually or as groups explore working of digital systems and protocols through presentation, role-play, diagram, flowchart

DOMAIN *B*: Digital Skills

STEP 1

Standard*:* *Distinguish between application and system software, and create a project by applying basic IT skills using productivity software.*

Student Learning Outcomes 1: Students will be able to develop and demonstrate data handling skills (using various software tools e.g. MS Excel, Google sheets, etc.)

Knowledge:	**Skills:**
Students will be able to: ● Describe the purpose and uses of spreadsheet software. ● List different spreadsheet software e.g. Excel, Google Sheets, OpenOffice	Students will be able to: ● Create a spreadsheet (i.e. result card, home budget, timetable, etc.) using the following tools: ● Organize data in worksheets within a workbook. ● Select a range of cells.

● Recognise and infer spreadsheet interface to create a result card, home budget, timetable, etc.	● Add borders. ● Increase/Decrease column width and height. ● Use simple built-in functions (e.g. sum, average, minimum, maximum). ● Create simple formulae (arithmetic operations). ● Create an appropriate chart for data presentation.

STEP 2

Formative Assessments (**Descriptions of Formative Assessment Strategies can be found at the end of the document in 'Bank of Formative Assessment Strategies'.*)

- **Graffiti Wall**

Summative Assessment*:* (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Lab / Computer Activity 1: Speed drill – The teacher can call out simple addition, subtraction, multiplication, and division questions, and the students need to solve the questions using the data handling software. The student to solve it the fastest time wins.

Lab / Computer Activity 2: Create graphs by adding data to a computer. The instructor can conduct a demonstration by collecting data from the class and list down in data handling software. The data question for students could be "What month is your birthday in" or "Out these five food items name your favorite". There should be a spreadsheet with the answer choices on the left and the number of results next to them, e.g.:

Month	# of students
Jan	
Feb	
etc.	

Favorite Food	# of students
Food item 1	
Food item 2	
etc.	

The data table should then be used to create a graph, and the results interpreted by the students.

Lab / Computer Activity 3 (follow on from activity 2): The instructor can ask the students to create their own survey questions, collect results from the class, and create a chart to display results.

Lab / Computer Activity 4: The instructor can locate some open-source data tables through internet research or find published financial accounts from company annual report publications, and ask students to re-create simple additions/subtraction/multiplication/division formulas in their data handling software to see if they get the same results when they input the numbers.

DOMAIN *C*: *Algorithmic Thinking*

STEP 1

Standard: Identify, define and analyze a problem, and apply algorithmic thinking and problem-solving strategies to develop step-by-step solutions to solve problems.

Student Learning Outcomes 1: Students will be able to apply the concepts of computational thinking and problem-solving strategies to solve complex problems by identifying the most efficient algorithm

Knowledge:
Students will be able to:

- Define and infer simple and complex problems, and how to identify each.
- Create algorithms/solutions to simple and complex problems.
- Discuss the scope and limitations, and that some problems cannot be solved computationally (e.g. factoring very large numbers in a small amount of time, or Turing's Halting problem, how a computer can never reliably inspect someone's code and tell you whether it will halt or run forever).
- *Discuss basics of writing pseudocode ***

Skills:
Students will be able to…

- Create algorithms/solutions to simple and complex problems.
- Apply the best possible solution to a problem from a pool of solutions.
- Describe that there are ways to characterize how well algorithms perform and that two algorithms can perform differently for the same task.
- Explain, with examples, some problems, which cannot be solved computationally.
- *Represent algorithms using structured language, such as pseudocode***

STEP 2

Formative Assessment:

Quiz 1 –problem identification, types of problems, and examples.

Quiz 2 – Solving simple problems, e.g. Write an algorithm to get the greatest common divisor (GCD) of two numbers.

***Assessment 2:** You have nine cards of the following colors. We need to arrange these cards into three rows and three columns, for example, Blue Orange Teal Blue Green Blue Gold Teal Green We also want the following rules to be satisfied:*
· The two green cards are on the left.
· The two teal cards are at the bottom.
· The three blue cards are at the top.
· The orange card is on the right.
Based on these rules, arrange the nine cards in the grid.

***Assessment 3**: 'A farmer is on his way back from the market, with him he has a fox, a chicken, and some grain. When he reaches a river crossing he must use a small boat only big enough for him and one other item. Unfortunately, if the fox is left alone with the chicken it will eat it, as will the chicken eat the grain? Explain how the farmer can cross the river.'* ("Crossing a river in a boat with some grain, a chicken and a fox.", 2022)

Assessment 4: *In the eighteenth century the city we now know as Kaliningrad was called Königsberg and it was part of Prussia. Like many other great cities, Königsberg was divided by a river, called the Pregel. It contained two islands and seven bridges were linking the various landmasses. A famous puzzle at the time was to find a walk through the city that crossed every bridge exactly once — the path wasn't allowed to cross any bridge more than once, and it wasn't allowed to leave any bridge out. Apply graph theory to determine the solution to this problem.* ("The Bridges of Königsberg", 2022)

Assessment 5: *Design an assessment where students should be able to write pseudocode of any 3 different algorithms.*

Assessment 6*: Design an assessment where students should be able to design an algorithm of 3 different problems (easy, difficult, and complex problems) and translate them into pseudocodes.*
Assessment 7: *Design an assessment where students should identify whether the problem can be solved or not? If not write the reasons, if yes write the reasons.*

Assessment 8: *Design an assessment where students should be able to write at least 2 different solutions to the same problem and identify which one is the best algorithm to solve the problem and why? (This activity can be a group/ class activity where students can identify their own solutions and write the algorithm and pseudocode and then decide which solution is best and why?)*

In-class or Homework Prompt:

- *Design different problems where students can apply degree property to determine whether the solution to a problem is possible or not.*
- *Writing algorithm of the simple problem and translating it into pseudocode.*
- *Writing algorithm of a complex problem and translating it into pseudocode.*
- *Write complex/wrong solution/algorithm to a problem and ask students to identify the errors and write the correct one.*
- *Presenting pseudocode with errors and asking students to identify the errors and write the correct one.*
- *Presenting a problem and identifying whether it can be solved or not and making them understand that some problems cannot be computationally solved.*
- *Present various solutions to a problem and identify the best possible solution to it.*

Summative Assessments
Mid-term, End term examinations.

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)
(The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations).

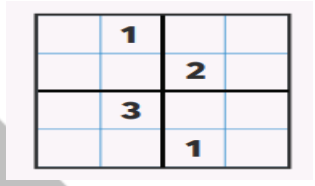
1. Represent algorithms using pseudocodes.

- ***Activity 1:*** *Provide a set of instructions or pseudocode. Using graph paper, follow the instructions and draw the output on a grid. Start from a point on the top left corner, initially facing East and the distance between two points on the graph paper is 50 steps*

- *The list of instructions/pseudocode is:*
  - *Move forward by 100 steps*
  - *Turn right by 90 degrees*
  - *Move forward by 100 steps*
  - *Turn right by 90 degrees*
  - *Move forward by 100 steps*
  - *Turn right by 90 degrees*
  - *Move forward by 100 steps*
  - *Turn right by 90 degrees*
- *If the activity has been done correctly the students are facing in the same direction as originally and should have drawn a square*

2. Activities that describe that there are ways to characterize how well algorithms perform and that two algorithms can perform differently for the same task.

- ***Activity 3:*** *Solve the Sudoku puzzle. The rules of the game are very easy. For the 4 x 4 game, the numbers 1 to 4 must be filled in each row, column, and smaller 2 x 2 boxes. Each number in a row, column, or box must be used exactly once! A 4 x 4 Sudoku puzzle looks as follows.*



The main idea is to consider all the valid possible solutions and then eliminate the options that do not satisfy the rules of the game

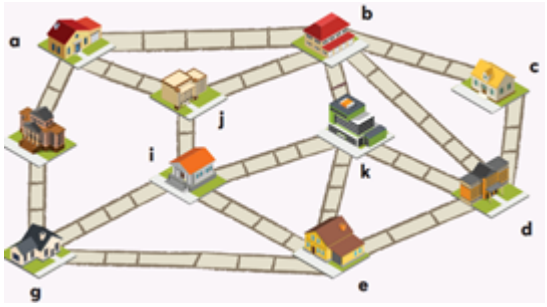
- ***Activity 4:*** *Ali, Mariam, Neha, and Usman were the only four participants in a cake-baking competition; they placed 1st, 2nd, 3rd, and 4th in some order. Also,*
  1. Mariam was not first, and Usman was not last;
  2. Neha placed next to neither Mariam nor Usman;
  3. Ali scored better than Mariam.
  Based on these clues, who placed 1st, 2nd, 3rd, and 4th?

3. Apply the best possible solution to a problem from a pool of solutions.

- ***Activity 5:*** *'A man finds himself on a riverbank with a wolf, a goat, and cabbage. He needs to transport all three to the other side of the river in his boat. However, the boat has room for only the man himself and one other item (either the wolf, the goat, or the cabbage). In his absence, the wolf would eat the goat, and the goat would eat the cabbage. Show how the man can get all these "passengers" to the other side.'* ("Puzzle | Farmer, Goat, Wolf and Cabbage - GeeksforGeeks", 2022)

- ***Activity 6: '****Once upon a time, there was a city that had no roads. Getting around the city was particularly difficult after rainstorms because the ground became very muddy -- cars got stuck in the mud and people got their boots dirty. The mayor of the city decided that some of the streets must be paved, but did not want to spend more money than necessary because the city also wanted to build a road. The mayor, therefore, specified two conditions:*
  1. Enough streets must be paved so that everyone can travel from their house to anyone else's house only along paved roads.
  2. The paving should cost as little as possible. Use as few stones as possible.
  In the map of the city, the number of paving stones between each house represents the cost of paving that route. Find the best route that connects all the houses, but uses as few counters (paving stones) as possible. What kind of strategies did you use to solve the problem? Enough

streets must be paved so that everyone can travel from their house to anyone else's house only along paved roads. The paving should cost as little as possible. Use as few stones as possible.'
("The Muddy City Problem", 2022)



STEP 1

Standard: Identify, define, and analyze a problem, and apply algorithmic thinking and problem-solving strategies to develop step-by-step solutions to solve problems.

Student Learning Outcomes 2: Students will be able to apply the concepts of nesting in algorithmic design thinking.

Knowledge:
Students will be able to:

- Discuss the concept of nesting.
- Discuss the concept of constants and variables.
- Distinguish scenario/problem where If, If then else, and If with multiple conditions can be applied.

Skills:
Students will be able to:

- Apply the concept of nesting up to level 2 in looping and conditions.
- Apply repeat and forever loops in Algorithm building.
- Identify problems using the IF statement with multiple conditions.
- Identify problem-solving techniques (sequence, loop, and conditions) applicable to a specific problem.

STEP 2

Assessments

Assessment 1*: Create a nested loop program within certain parameters e.g. contains at least 18 total sounds (This program should be created in the form of the script on a piece of paper)*
Assessment 2*: Create an algorithm with the most sounds.*
Assessment 3*: Make a program using loops and variables*
Assessment 5*: There is a basket, which needs to be filled with 15 apples. Consider the following algorithm with two variables: apple and basket. Determine the output of the program? Basket=0, Apple=0*

IF basket<5 then
Change apple by 5
Change basket by 1
ELSE end

Assessment 6: *Predict the value of variables*
1. Pizza=10, Soda=2
IF the cost of soda>6 then
Change cost of pizza by +10
IF the cost of soda<4 then
Change cost of pizza by +3
IF the cost of soda>8 then
Change cost of pizza by +4
Soda=? Pizza=?

In-class or Homework Prompt: *Students should be presented with different problems where they have to apply Sequencing, Loops, and Conditions concepts.*

Student Self-Assessment/Reflection: *Ask students to brainstorm as a class some ideas of things that repeat over and over:*
a. The minute or second hand on a clock.
b. The Earth rotating around the sun.
c. A stopwatch

Summative Assessments
Monthly tests, Mid-year exams, End-of-Year exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

1. Key vocabulary terms (Nesting, variables, constants, if, if then else) are introduced as needed by the various learning activities and performance tasks.
2. In-class activities to understand the concept of nesting.

Activity 3*: Take a* ***computer problem****, and identify whether it's a sequencing/loops/condition problem or a combination of all and apply the concept and write step by step solution by applying algorithmic thinking.*

- ***Activity 4:*** *Design an activity where students can create different Objects by using Origami (boat, house, doll, robot, airplane, etc.), and identify whether it's a sequencing/loops/condition problem or a combination of all and apply the concept and write step by step solution by applying algorithmic thinking.*
- ***Activity 7:*** *Design an activity like celebrating a day/planning a festivity activity (Group activity), and identify whether it's a sequencing/loops/condition problem or a combination and apply the concept and write step by step solution by applying algorithmic thinking.*
- ***Activity 8:*** *For activities 1- 7, ask students to write step-by-step solutions to the problem (complete algorithm) with steps; must have start and stop along with finite numbers of steps.*

DOMAIN *D*: *Programming*

STEP 1

Standard: Understand and apply fundamental programming constructs using visual and textual programming tools.

Student Learning Outcome 1: Students will be able to apply intermediate-level programming constructs (e.g. functions, cloning, conditional movement); by creating mini-games using a visual programming tool.

Advanced SLO:
Students will be able to apply intermediate-level programming constructs (e.g. functions, cloning, conditional movement); by creating mini-games using a textual programming tool.

Knowledge:
Students will be able to:

- Use simple as well as complex loops.
- Use simple as well as complex conditions.
- Discuss the concept of Functions in a computer program.
- Discuss the concept of cloning in a computer program.

Skills:
Students will be able to:

- Use simple and complex loops in computer programs.
- Differentiate between 'repeat', 'forever', and 'repeat until' loops.
- Use different types of loops together in a program.
- Nest different types of loops together in a program.
- Differentiate between If, If-Then, and If/Else conditions.
- Use different types of conditions together in a program.
- Nest different types of conditions together in a program.
- Use simple functions in a computer program.
- Use cloning blocks in a computer program.
- Design high-level games like tic-tac-toe, maze with multiple levels, etc.

Formative Assessments

Quiz 1 – definitions and applications of cloning, functions, conditional statements, loops, and variables.

Student Reflection – What are the advantages/applications of cloning? Why can we not just duplicate the same sprite and code it differently?

Summative Assessments

Monthly tests, Mid-year exams, End-of-Year exams

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

- **In-class Coding Task #1** – CLONING: When the program starts (e.g. in block coding using the event block "When green flag clicked"), create a clone. When the clone is created, make the clone do a certain action (e.g. make a clone do something like change color and move right), and then delete the clone.

- **In-class Coding Task #2** – CLONING: Students can create a mini-game called “asteroid belt” by creating a ‘player’ sprite that moves with right and left keys, and an “asteroid” sprite that clones itself every few seconds. The clone should start moving down, and delete itself when it touches the end of the screen. The game should end when the asteroid touches the player. Sample game with code can be found here: https://scratch.mit.edu/projects/621128947/

- **In-class Coding Task #3** – FUNCTIONS: Create a new function (e.g. function jump) which should run a sequence of two or three instructions (e.g. in block coding make the sprite change y-coordinate by 100, wait 1 second, and change y-coordinate by -100). Now “call” the function when an event occurs (i.e. when keyspace pressed call function jump). Reflection question – What are the advantages of writing a function? Why did we not just write these instructions directly? Sample code can be found here: https://scratch.mit.edu/projects/621130010/

- **In-class Coding Task # 4** – students can build a real-life maze and write out instructions in pseudocode to the “sprite” (played by a fellow student)

- **In-class Activity # 5 (follow on from activity # 4) –** Students can learn to integrate various constructs in creating scripts in response to coding prompts by coding a MAZE GAME. Students can draw a maze or generate one on sites such as https://mazegenerator.net/ and upload it as a sprite. Create a player sprite, and create functions for the player sprite to move right (change x by 10) if the right arrow key is pressed. If the player sprite is touching the maze wall (i.e. touching the wall color) then the player sprite should move back (change x by -10). This step should be repeated for creating functions for moving up, down, and left. The sample project can be found here: https://scratch.mit.edu/projects/484415216/

- **In-class Coding Task # 6:** Students can learn to integrate various constructs in creating scripts in response to coding prompts by coding a JUMP GAME. Create a player sprite, background, and obstacle sprite. The player sprite should be placed on the left side of the stage and should jump when the player presses the space key (i.e. change the y-coordinate by 100, wait, and then change y-coordinate by -100). When the game starts, the obstacle should go to the right of the screen and glide across the screen, and this instruction should be repeated forever. If the obstacle hits the player, the game ends.

  Challenge exercise 1 – students can use create a variable “lives”, set it to 3 lives when the game starts, and change the variable when the obstacle hits the player. The game should only end if the lives are zero.

Challenge exercise 2 – students should add a new backdrop and change the level once the player sprite reaches a certain score.

Challenge exercise 3 – using IF-then/else condition to check if the player is on the ground before jumping.

Sample project tutorial can be found here: https://www.youtube.com/watch?v=1jHvXakt1qw

- **In-class Coding Task # 6:** Students can learn to integrate various constructs in creating scripts in response to coding prompts by coding a FLYING GAME. Sample project tutorial can be found here: https://www.youtube.com/watch?v=RSZgqg6USQ4

- **In-class discussions** - Students can present and play each other's games and explain code.
- **"Speed code" competition** – students create a game within a limited time. The first group/student to finish wins.
- **Coding drills** – the teacher demonstrates a simple application in class, and students code it on their own, in a timed drill.
- **Cubing –** students, in groups of six, can roll a dice, the number on the dice selects the student who has to answer the question. Questions could be regarding Quiz 1 (definitions and uses of cloning, functions, conditionals, loops, variables) or could be from any other resource.

STEP 1	
Standard: Understand and apply fundamental programming constructs using visual and textual programming tools.	
Student Learning Outcome 2 (Advanced SLO): *Students will be able to analyze constructs and fundamentals of textual (syntax-based) programming.*	
Knowledge: Students will be able to: ● *Identify the link between visual programming and textual programming.* ● *Discuss the features and applications of different types of languages (e.g. Assembly Language, C++, Java, Python, etc).*	**Skills:** Students will be able to: ● *Convert block-based programs into syntax-based programs (e.g. Scratch to python, scratch to C++, etc).* ● *Covert the following programming constructs of visual programming to textual programming:* ○ *Loops;* ○ *Conditional statements;* ○ *Variables;* ○ *Functions.* ● *Write simple programs using any textual programming language.*

Formative Assessments

Quiz 1 – Converting block-based programs into syntax-based programs.

Summative Assessments

Monthly tests, Mid-year exams, End-of-Year exams

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

- **In-class activity** - matching typed out coding syntax to blocks or descriptions.
- **In-class or homework activity** – Students can be asked to research which programming language was used to create their favorite computer or phone game.
- Activity on "inspecting" a website and looking at the code (right-click and view source on any web page) to see what typed-out syntax looks like.
- **In-class coding activity -** CALCULATOR IN PYTHON: Create a calculator in python. Sample project with instructions and code here: https://www.programiz.com/python-programming/examples/calculator
- **In-class coding activity** - TURTLE IN PYTHON: create a pen application using the turtle library. Sample project with instructions and code here: https://www.geeksforgeeks.org/turtle-programming-python/
- **In-class coding activity -** ATM IN PYTHON: Sample pseudocode here: https://www.slideshare.net/kakirin/atm-flowchart
  Sample code and instructions here: https://itsourcecode.com/free-projects/python-projects/atm-program-in-python-with-source-code/

DOMAIN *E*: *Digital Citizenship*

STEP 1	
Standard: *Learn the basics of the internet, write an email, identify risks involved in an online exchange of information and apply digital safety protocols.*	
Student Learning Outcomes 1: Students will identify ways of protecting against cybercrimes.	
Knowledge: Students will be able to… o Discuss the ethics and ethical issues in digital environments.	**Skills:** Students will be able to… ● Identify appropriate and inappropriate behaviour when navigating the digital environment.

o Explain the importance of being safe, responsible, and respectful online. o Define the key concepts of copyright, plagiarism, and piracy. o Identify o Improper use of computer resources. o Steps to secure information privacy and confidentiality. o The possible dangers of the internet and related security measures. Students will know… o Identify the purpose of major internet uses such as business, social networking, entertainment, information/news. o Evaluate digital media bias and messaging.	● Identify threats and actively protect devices and networks from viruses, intrusion, vandalism, and other malicious activities. ● Describe and use safe, appropriate, and responsible practices (netiquette) when participating in online communities ● Identify positive and negative impacts of using social media, both online and offline.

STEP 2

Formative Assessments (**Descriptions of Formative Assessment Strategies can be found at the end of the document in 'Bank of Formative Assessment Strategies'.*)

- **P-E-O (Predict-Explain-Observe)**
- **Question Shells**
- **Heads and tails**
- **Mind-maps**

Summative Assessments (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

In-class activity
Teachers can show videos on protecting your computer in class, and lead a discussion on ways to protect computers. Reflection questions can include (but not be limited to) What are some common ways in which computers can be protected? What happens when computers are not protected? Suggested video: https://www.youtube.com/watch?v=6mMZFoXbKqI

Activity 2:
Students will then work in groups to create a presentation that will teach parents how to protect their online identity and computer. Students can choose the tool they want to use to create their presentations. They can: (1) record a skit with a video camera, (2) create an interactive lesson with

Office Mix, (3) create a Sway, or (4) design a brochure using Word templates. (reference: Microsoft Digital Citizenship Module)

In-class activity
The teacher will place students in groups, and request each group to prepare a chart of ethical rules regarding the use of ICT. Students will present their posters, and the teacher can display posters in class.

In-class activity
The teacher can hold a debate, where two students can argue for and against the impact of using social media. The debate can include positives of social media, and students listening to the debate can vote for the winning debater. The teacher can ask reflection questions about the advantages of social media, such as connection to distant friends and relatives, selling goods & services, advertising revenue, learning more about culture and the world, entertainment, etc. The teacher can also ask reflection questions related to the negative impact of social media, such as health consequences, addictive behaviour, sale of personal data, identify fraud, cyberstalking, etc.

DOMAIN *F*: *Entrepreneurship in Digital Age*

STEP 1	
Standard: *Students should have the tools and mindsets to bring their own technology-enabled business ideas to life.*	
Advanced SLO** ***Student Learning Outcomes 1****: Students will develop an understanding of the basics of digital marketing platforms and social media marketing to develop a marketing plan for a business.*	
Knowledge: Students will be able to: ● *Explain the concept of promotion, value proposition, and quality assurance.* ● *Define Business Plan and its components.* ● *Understand the difference between payment and transactions; choose safe transaction methods.* ● *Discuss Search Engine Optimization (SEO), using social media websites such as Instagram, Twitter, and blogs.*	**Skills:** Students will be able to: ● *Describe and apply the tools and techniques used for digital marketing.* ● *Design and develop a digital marketing plan and its component.*
STEP 2	

Formative Assessments (**Descriptions of Formative Assessment Strategies can be found at the end of the document in 'Bank of Formative Assessment Strategies'.*)

- **Know Want Learn Chart**
- **Quick write**
- **Fist of Five**

Summative Assessments (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Activity 1: (Class Activity)

In-class activity: Students can watch a video on social media, and discuss. Discussion questions can include "What is social media marketing? How can it help a start-up? What would be the components of a social media marketing plan?"
Sample video: What is Social Media Marketing in 2 minutes
https://www.youtube.com/watch?v=9m45nVsvvEY

STEP 1

Standard: *Students should have the tools and mindsets to bring their own technology-enabled business ideas to life.*

Advanced SLO**
Student Learning Outcomes 2: *Students will be able to identify and create different components of a business plan i.e. market need, product design, costing, operations, and marketing.*

Knowledge:
Students will be able to:

- *Analyse how technology is an enabler in entrepreneurship.*
- *Name and describe the digital platforms that can be used for entrepreneurship*
- *Describe the basics of the components of a business plan, i.e. market need, product design, costing, operations, and marketing.*

Skills:
Students will be able to:

- *Discuss the importance of project management and media literacy as a tool for a business plan.*

STEP 2

Formative Assessments (**Descriptions of Formative Assessment Strategies can be found at the end of the document in 'Bank of Formative Assessment Strategies'.*)

- **Mind-maps**
- **Matching Activities**
- **Inside-Outside Circle**
- **Oral Questioning** – based on how, why, what if.

Summative Assessments (Theory & Practical)

- Term Assessment
- Mid-Year Exams
- Final Exams

STEP 3

Learning Activities (The activities below are neither listed in any particular order nor is this an exhaustive list. View them as recommendations)

Activity 1: (Class Activity)

Students can watch a video on business plans and comment on the key learning outcomes. Reflection questions can include "What are the key components of the business plan. What are the benefits of a business plan? What would happen if you didn't use a business plan"

Sample video: How to Write a Business Plan to Start Your Own Business

https://www.youtube.com/watch?v=Fqch5OrUPvA

Glossary of terms

Advanced SLO	Optional student learning outcomes for more advanced programs.
BODMAS	BODMAS is an acronym to help children remember the order of mathematical operations – the correct order in which to solve maths problems. Bodmas stands for B-Brackets, O-Orders (powers/indices or roots), D-Division, M-Multiplication, A-Addition, S-Subtraction.
Human-Computer Partnerships	An interactive system where the user controls the interaction.
KWL Chart	An acronym for an assessment where a student writes down what they Know, Want to Know, and Learned.
Navigating	The term navigation in the context of this document refers to being familiar with a program's interface and being able to use various menus and options to get the desired outcome.
Programming Construct (Basic, Intermediate, Advanced)	Programs are designed using common building blocks. These building blocks, known as programming constructs (or programming concepts), form the basis for all programs.
RAM	RAM (Random Access Memory) is the hardware in a computing device where the operating system (OS), application programs, and data in current use are kept so they can be quickly reached by the device's processor. RAM is the main memory in a computer.
ROM	Read-only memory (ROM) is a type of storage medium that permanently stores data on personal computers (PCs) and other electronic devices.
Raw Data	Raw data (sometimes called source data, atomic data, or primary data) is data that has not been processed for use.
Script	In computer programming, a script is a program or sequence of instructions that is interpreted or carried out by another program.
SDG	The Sustainable Development Goals or Global Goals are a collection of 17 interlinked global goals designed to be a "blueprint to achieve a better and more sustainable future for all". The SDGs were set up in 2015 by the United Nations General Assembly and are intended to be achieved by the year 2030.
Sprite	In computer graphics, a sprite is a two-dimensional bitmap image.
Tinker	Tinkering is a hands-on experience where children are given time to explore and invent. It involves experimenting with tools to help a child understand how things work.

Bank of Formative Assessment Strategies (Full Descriptions)

- **3-2-1** (Three things you found out, two interesting things, and one question you still have).
- **ABCD Whisper** - Students should get in groups of four where one student is A, the next is B, etc. Each student will be asked to reflect on a concept and draw a visual of his/her interpretation. Then they will share their answer in a zigzag pattern within their group.
- **Ask —** Ask your students what they have learned during a unit. Have students identify what skills they need to practice or what information they require to help with their understanding of the topic. Students are often aware of the type of assistance they need. There are several ways to collect this information. Pose the question to the entire class and have them jot down their responses and hand them in. Meet with students one-on-one and have a conversation that focuses on the current unit of study and asks students what they need to help them continue to learn about the topic. Students can identify what they need to do to further their understanding and what the teacher can do to help.
- **Circle, Triangle, Square** - (Circle) Something that is still going around in your head (Triangle) Something pointed that stood out in your mind (Square) Something that "Squared" or agreed with your thinking.
- **Examples/Non-Examples —** Encourage your students to provide you with examples and non-examples of a topic being studied. The examples and non-examples provide you with information regarding the depth of understanding of your students. For example, during a unit on recycling, ask your students to provide you with examples of recycling and examples that do not involve recycling. While studying a unit on mixtures and solutions in science, review mixtures and determine students' understanding by asking them to provide you with examples and non-examples of mixtures. Ask students to explain their reasoning for the classification of each example and non-example.
- **Fist of Five** – A quick, immediate assessment: ask your students a question and have them respond by showing you their level of understanding. Students hold up one finger if they are still unsure of a topic and need to be provided with more information. If they are on their way to fully understanding, they might hold up three or four fingers. Students who have mastered the unit and can demonstrate their knowledge and understanding by holding up five fingers. A glance around the classroom provides you with information about student learning and allows you to adapt your instruction accordingly.
- **Graffiti Wall —** The graffiti wall is a fun activity for students and gives you a visual representation of what your students have learned during a unit of study. Cover a part of a wall with white paper. Encourage students to write or draw what they have learned about a topic. Students can jot down facts, write personal opinions, connect their learning to other areas of study, etc. Using the graffiti wall activity part way through a unit provides you with information for further planning of instruction. If there appear to be gaps in your students' learning, you can target those areas and do further assessments to see if there is indeed a deficit that you need to focus on in future lessons. Students may have made connections that you were not expecting or hadn't even thought of when planning the unit. The information you collect from the graffiti wall is valuable formative assessment data. Leave the graffiti wall up during the remainder of the unit and students can continue to add comments and drawings.
- **Heads and tails**—Students match up keywords/terms with definitions which would also work as a card sorting activity.
- **Inside-Outside Circle** - Inside and outside circles of students face each other. Within each pair of facing students, students quiz each other with questions they have written. The outside circle moves to create a new pair & repeat.

- **Know Want Learn Chart** (What do you know, what do you want to know, and what have you learned?) Students respond as a collective group, small group, or individually to a topic as to "What they already know, what they want to learn, and what they have learned". PLUS (+) asks students to organize their new learnings using a concept map or graphic organizer that reflects the key information. Then, each student writes a summary paragraph about what they have learned.
- **KWL Chart** What do you know, what do you want to know, and what have you learned?
- **List 10 Things** - Students can list ten things they have learned during the unit. Collect these lists and read through them to get an idea of where students are regarding their understanding level. Look for gaps in learning or possible misunderstandings. These gaps and misunderstandings can be addressed in future lessons.
- **Matching Activities** —A fun way to assess student knowledge of vocabulary or facts is to match words with their definitions or group facts into given categories. Provide each student or pair of students with a set of cards. Be sure that there is only one word or one definition on each card. Students can also play a game of memory and matching with these cards. All cards are turned over so that the words and definitions are hidden. Students play this game with a partner. One student turns over two cards. If the two cards contain a word and a definition that matches, they keep the pair of cards. Cards that do not match are turned back over and the other student takes a turn at finding a match. The activity continues until all words and their definitions have been found.
- **Mind-maps**—Student produces a mind-map/bulleted list of keywords/terms from the previous lesson or can predict what keywords/terms will be used in that lesson (referring to the learning objective written on the board as they arrive).
- **Muddiest (or Clearest) Point –** At the end of the class ask the students "What was the "muddiest point" in today's lecture?" or, perhaps, you might be more specific, asking, for example: "What (if any) do you find unclear about the concept of 'personal identity' ('inertia', 'natural selection', etc.)?".
- **One Minute Fluency** — assess the familiarity of students with key terminology by having a "one-minute fluency" drill on the networking components.
- **Onion Ring** - Students form an inner and outer circle facing a partner. The teacher asks a question and the students are given time to respond to their partner. Next, the inner circle rotates one person to the left. The teacher asks another question and the cycle repeats itself.
- **Open-Ended Questions** — Using open-ended questions allows you to determine the depth and breadth of student learning. Ask students questions that cannot be answered with a "yes" or a "no" or another one-word answer. Open-ended questions require students to think about their answers and use their knowledge and understanding of a topic in their responses. Questions that involve the word "why" often encourage deeper thinking.
- **Oral Questioning** – based on how, why, what if
- **P-E-O (Predict-Explain-Observe)** —The teacher presents a phenomenon, and students are asked to make a (P) prediction about what will happen, (E) explain why they think that will happen, and then (O) observe what happens.
- **Paper Pass** — Paper pass is a form of brainstorming that gets students up and moving from their desks. Chart papers with different target words or questions are posted around the classroom. Students rotate around the room to the different brainstorming sheets and add their comments about the topics and other students' responses. The process for the paper pass can be informal or formal. Informal use of the paper pass permits students to move around the classroom and respond to the topic words or questions of their choosing. A more formal use involves students being divided into groups and systematically rotating around the room and responding.
- **Peer-Assessments** — Assessments by peers are a powerful way to gather information about students and their understanding. Students can use a set criterion to assess the work of their classmates. Peer-assessment can be used in different subject areas. In writing, for example,

students can assess another student's piece of writing and provide feedback about what they noticed. Whenever students work in groups, the conditions exist for students to assess their peers.

- **Practice on Computer** (draw a freehand drawing, draw 2D shape & 3D shape image, add text to the drawing, make a greeting card, character or house, etc.)
- **Problem Solving** - Pose a problem to students and ask them how they would solve it. Students can respond orally or written. The responses given by the students indicate their level of understanding regarding the unit being studied. Information provided by the students gives you an indication of what type of instruction is needed during future lessons.
- **Question Shells**—The "Question Shells" technique provides a framework for asking questions that draw out student understanding. The teacher determines what questions are important to understanding student thinking during a lesson. Then, the teacher reframes the questions to elicit student reasoning. An example of this is the question 'What is an insect?' can be asked as 'Why is an ant an insect and a spider not?
- **Quick Writes** — Quick writes give teachers a visual of student learning. Provide students with an open-ended question and set an amount of time for having them write--from two to five minutes. Tell students not to worry about the conventions of writing but rather focus on getting their ideas down on paper. When the time is up, ask students to put their pencils down. Look through the quick writes for valuable information regarding the knowledge and understanding your students have about a given topic. Using a quick write at the start of class is also a great way to activate the prior knowledge of your students.
- **ReQuest/ Reciprocal Questioning** - ReQuest, or reciprocal questioning, gives the teacher and students opportunities to ask each other their own questions following the reading of a selection. The ReQuest strategy can be used with most novels or expository material. The strategy must be modeled by the teacher using each genre. A portion of the text is read silently by both the teacher and the students. The students may leave their books open, but the teacher's text is closed. Students then are encouraged to ask the teacher and other students questions about what has been read. The teacher assists students to get answers to their questions. The roles then become reversed. The students close their books, and the teacher asks the students for information about the material. This procedure continues until the students have enough information to predict logically what is contained in the remainder of the selection. The students then are assigned to complete the reading.
- **Self-Assessments** — Provide each student with a self-assessment related to each unit of study. Self-assessment involves students reflecting on their own learning in comparison to unit goals or outcomes. Checklists or open-ended questions can be used to assist students with their reflections. Include questions that deal with students' understanding of the topic and with the identification of areas that need more information or more practice. Students are often able to articulate their learning needs to us. We just need to ask the right questions. Self-assessments are one way of asking students about their learning and the information can then be used to help plan future instructions.
- **Sentence Prompts** — Sentence prompts can be used in a variety of ways to informally assess students and gather information to inform instruction. Simple sentence starters such as the following could be used: • I understand .... • I don't understand .... • I need more information about ...
- **Take and Pass**: Cooperative group activity used to share or collect information from each member of the group; students write a response, then pass to the right, add their response to next paper, continue until they get their papers back, then group debriefs. Students can use this activity for core networking components.
- **Teach a Friend** — A good strategy for determining if students understand a concept or process is to have them teach it to a friend. Students need to think about the knowledge and skills needed for

understanding and include that information in their teaching. Pair students up and have them "teach" their partner about the concept or process.

- **The Minute Paper** In one minute, describe the most meaningful thing you've learned.
- **Think-Pair-Share** — The think-pair-share strategy is a way to gather information about the level of understanding of your students and can be used several times throughout a unit of study. Ask students questions such as, "What did you learn during today's lesson?" or "What connections can you make to your own life based on what you have learned so far?" Give students a few minutes to think about these questions. Pair students up with partners. Students share their thoughts with each other and then join a larger group or the whole class. Randomly call on students to share their ideas. By going through this process, students can solidify and refine their thinking before having to share their answers. Circulate throughout the class as students are sharing their thoughts and ideas to assess the overall depth of understanding.
- **Three-Minute Pause** — The three-minute pause is a strategy that allows students to stop and reflect on learning, make connections to personal experiences, and ask for further information or clarification. Assign students to groups. Give students three minutes to complete this activity. First, the students summarize the main points of the new learning. Next, they make connections to personal experiences. Finally, they ask questions to further enhance their understanding of the learning.
- **Turn and Talk** — The turn and talk strategy allow all students to talk about a question or topic that they have introduced in class. Students turn to a neighbour and discuss their thoughts and what they have learned about the question or topic. Both students are given turns to speak. Circulate throughout the classroom during the turn and talk activity to get an idea of what the students know and have learned about the question or topic being studied.
- **Whip Around** — Whip around is a formative assessment strategy that involves all the students in the class. First, you pose a question to the students. The students are given a few minutes to formulate their answers and make brief notes. You then repeat the question and "whip around" the room and have each student give one response from their notes. The whip around assessment strategy provides general information about student learning and can help you plan future instruction.

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