Think, Code, Play: Game Design with Scratch Coding

Sebastian Saldarriaga

Background

Biomedical Engineer
MA in Science Education

Current Role

Professional Development
Instructor at Geering Up, UBC

E-mail:
sebas.salda@ubc.ca

Who are we?

UBC Geering Up Engineering Outreach

Promoting diversity in STEAM, helping students discover they can do STEAM!

Programs:

- Events, Clubs, and Camps for Kids
- Workshops and Pro-D for Teachers
- Outreach

STEAM → Science, Technology, Engineering, Arts, Math

(Dis)Connection Moment

5 min

Emoji Algorithms

Fn/🌐 + E

Windows key ⊞ +. (period).

Here are two emoji programs. What's the scenario?

A chef mixes eggs, milk, and chocolate, bakes them, makes a cake, and celebrates.

If it's sunny, wear sunglasses and go to the beach.
If it's rainy, use an umbrella and read a book

Now it's your turn! Write a short 'emoji algorithm' (5–8 emojis) that describes your daily routine.

Example:

Wake up, drink coffee, take a shower, work on the computer, study, have dinner, go to bed, and sleep.

Introduction to Game-Based Learning

Game-Based Learning

Learning through the game itself

The game is the learning activity

Ex: Students use a boardgame to learn about photosynthesis

Engaging Mechanics & Feedback	Clear Learning Goals	Narrative & Characters
Social & Collaborative Features	Inquiry & Problem Solving	Emotional Engagement

Plass et al. (2015)

WHAT DO WE WANT STUDENTS TO LEARN?

Technical

- Computational thinking (sequences, conditionals, variables)

Creative

- Story design, visual and sound design, creative coding

Social

- Teamwork, peer feedback, design iteration

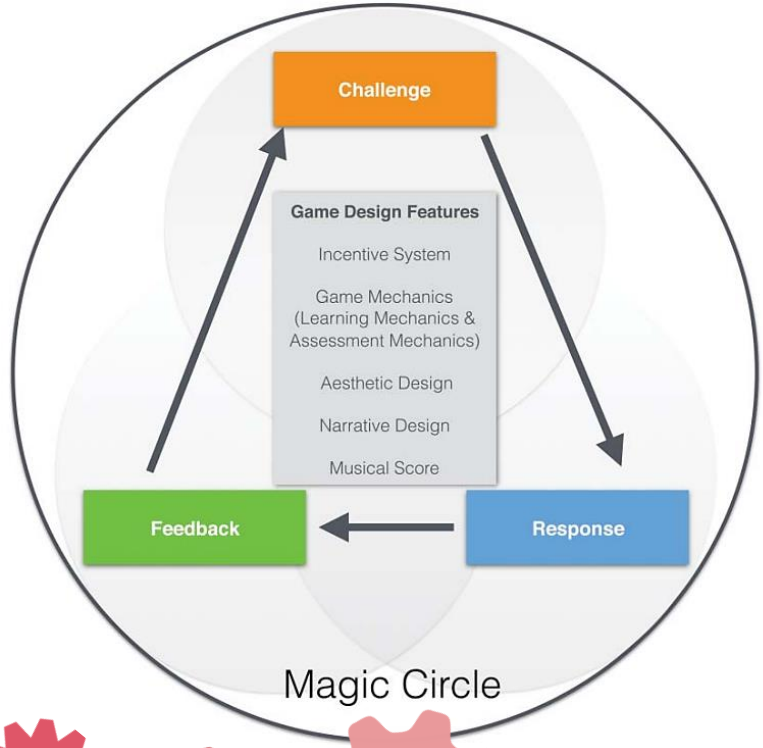
Metacognitive

- Planning, testing, debugging, reflection

Conceptual

- Deepened understanding of curriculum content through meaningful game mechanics or story-driven interactions

Key elements



Challenge

Engages players and promotes learning.

Response

How players interact with the game content.

Feedback

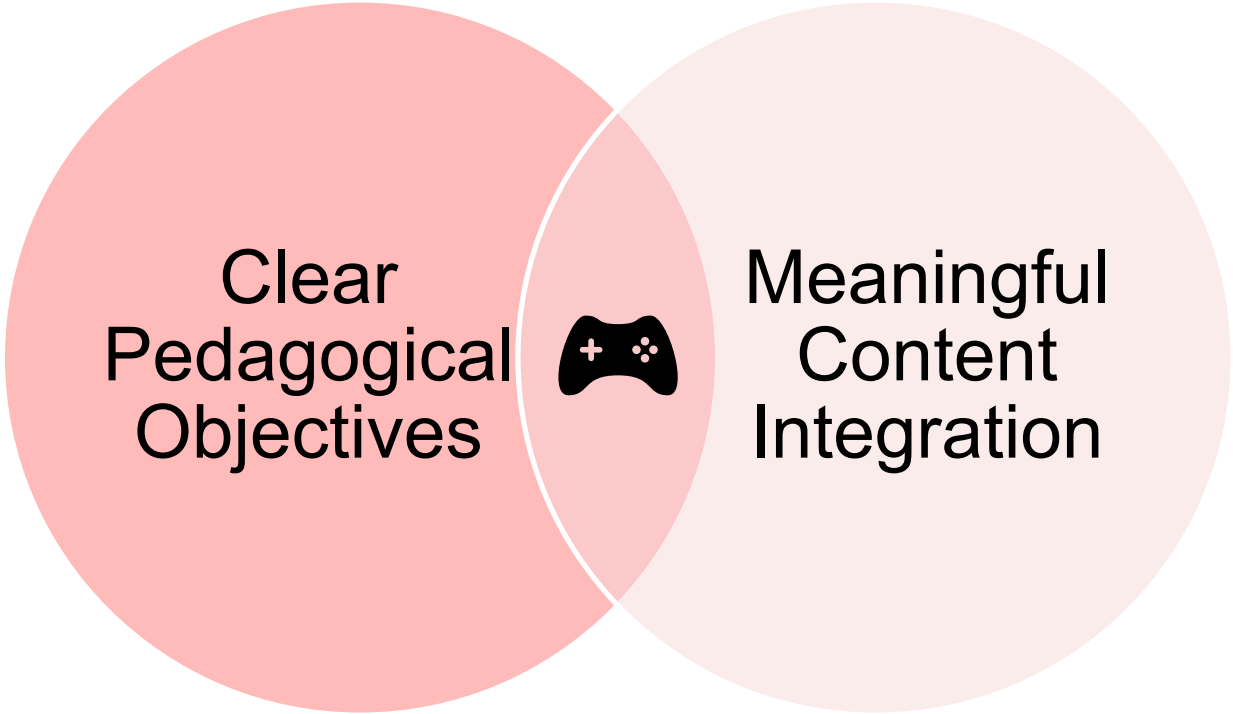
Guides player progress and learning.

Game Design Elements

Narrative, mechanics, incentives, and aesthetics.

Plass et al. (2015)

Learning First, Then Gameplay



Engagement does not always correlate with improved learning outcomes

(Lester et al., 2014; Li & Tsai, 2013; Plass et al., 2015)

Exploring Scratch as a Creative Tool

Coding vs Programming

Programming

- Solving problems with computers
- Giving computers instructions
- Everyone does this
- Runs code behind the scenes

Coding

- Using “code”
- Writing specific instructions
- Precise
- Flexible

Coding vs Programming

Programming — Less Technical

Coding — More Technical

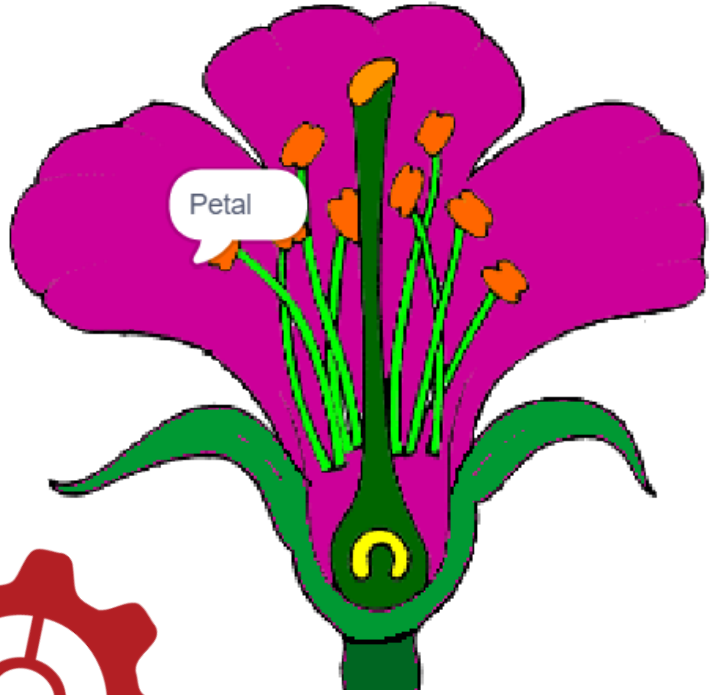
Why Scratch?

Open access!

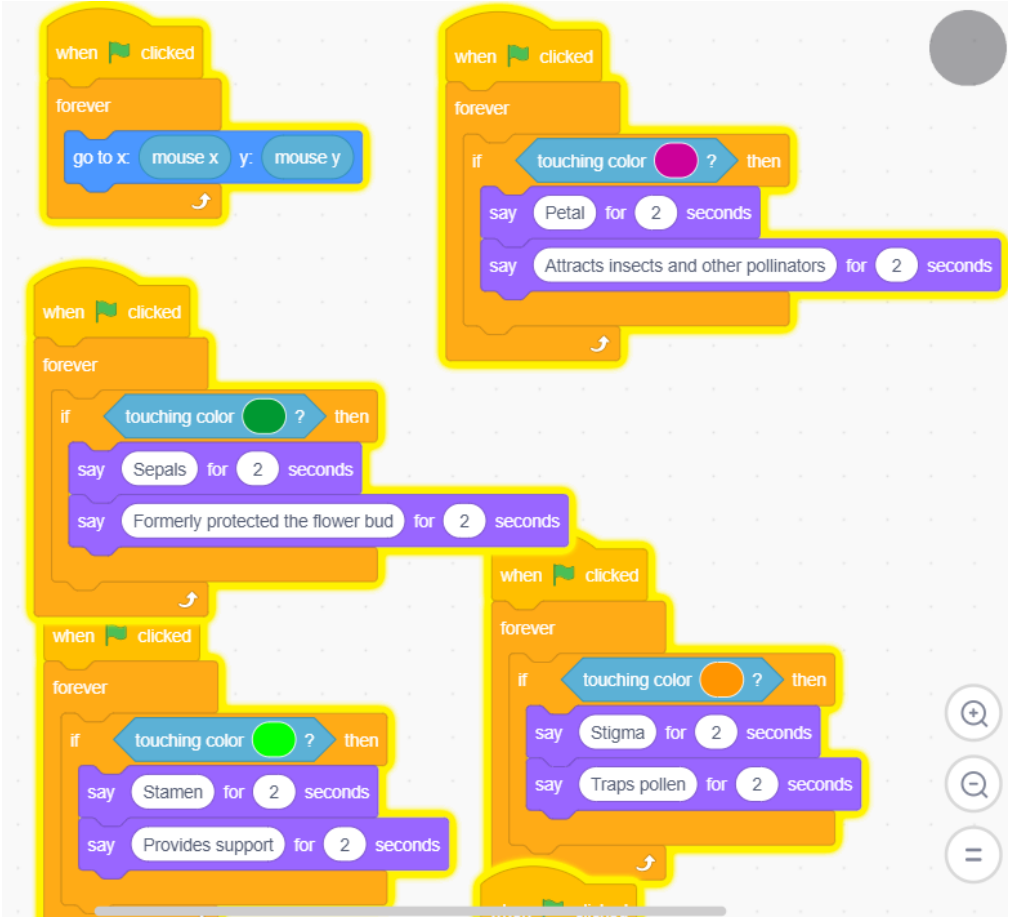
Visual block programming

Massive community

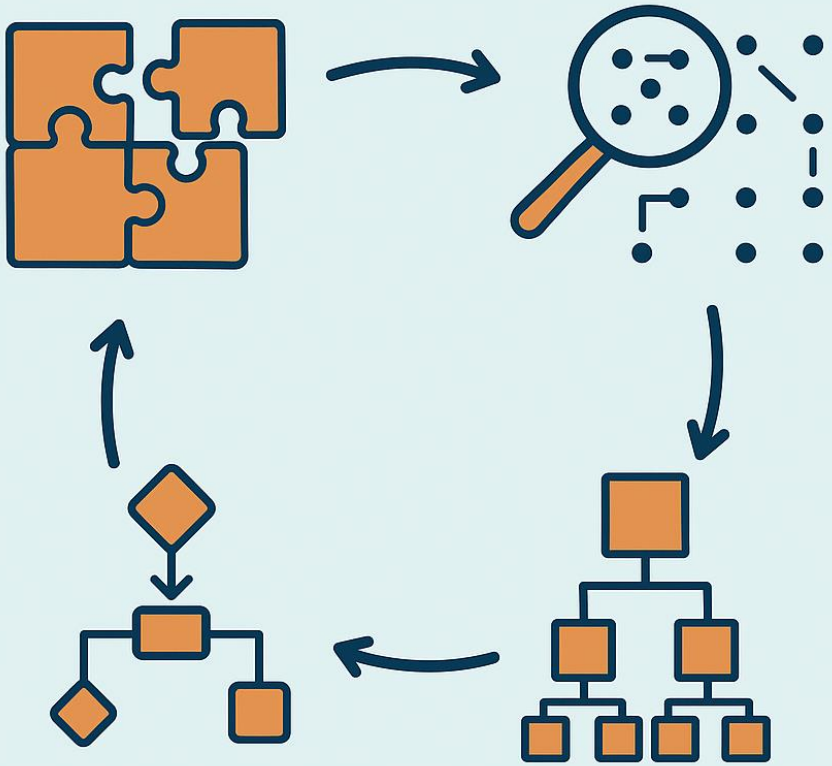
How it works?



Parts of a Flower on Scratch



Computational Thinking

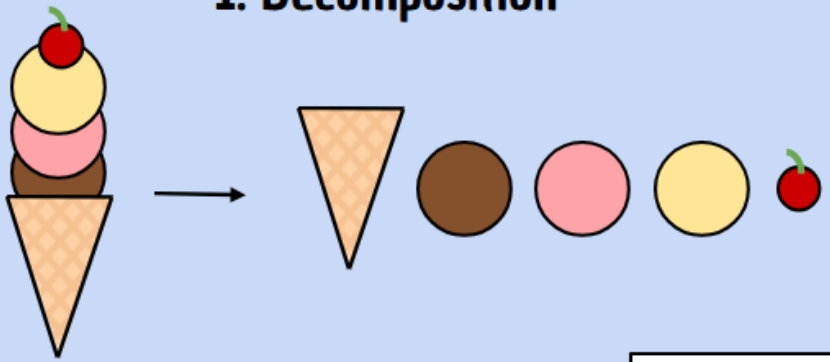


Computational thinking

A type of problem solving which involves expressing problems and solutions in terms which could be understood and executed by a computer

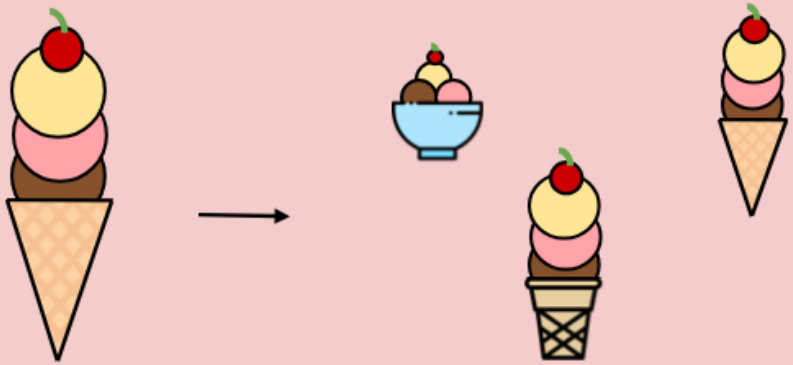
Computational Thinking

1. Decomposition

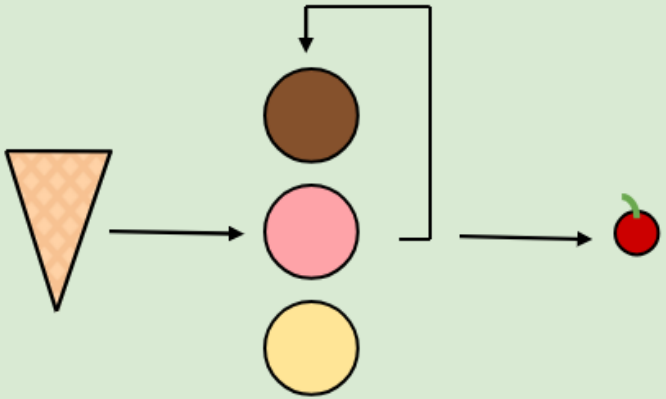


2. Pattern Recognition

3. Abstraction



4. Algorithm Design



If –> Then

IF you all pay attention, **THEN** you can go outside early for recess

IF you do your homework, **THEN** you can go play video games

IF (question/condition), **THEN** (result)

If –> Then

IF you all pay attention

THEN you can go outside early for recess

ELSE you have to do math for longer!

IF you do your homework,

THEN you can go play video games

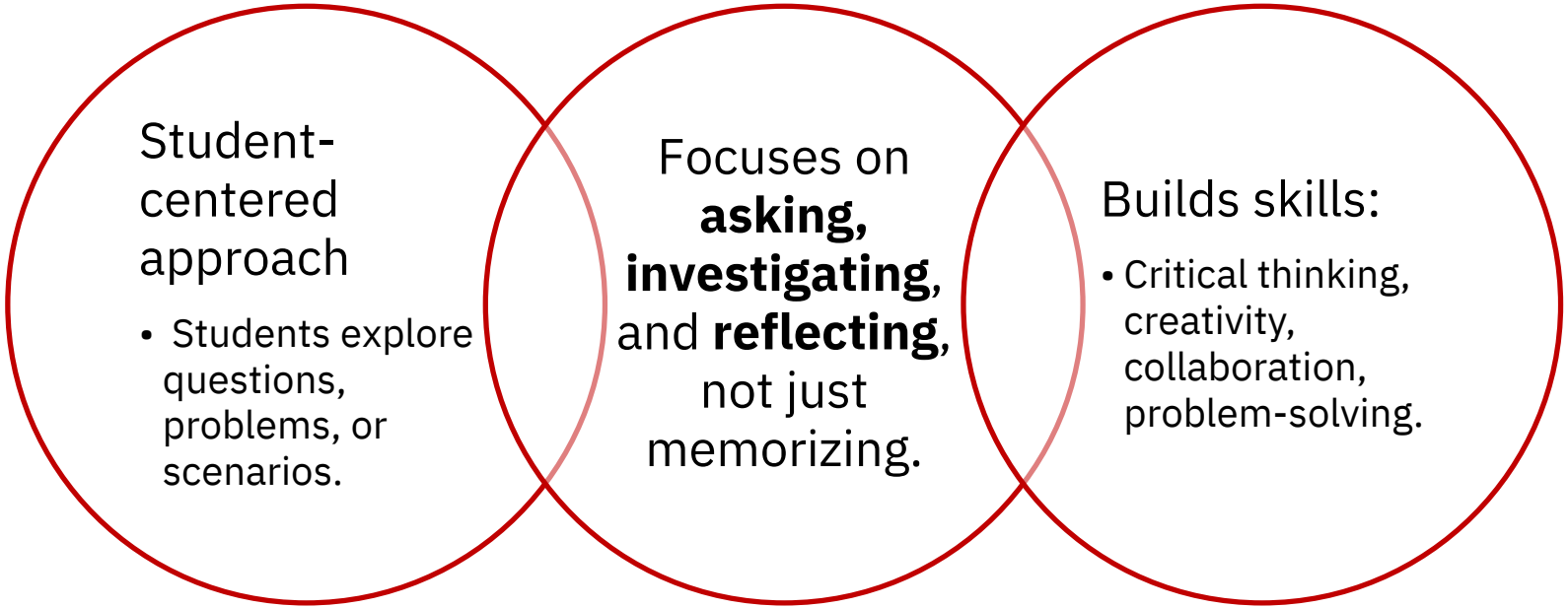
ELSE you are grounded

Build your own Maze game!

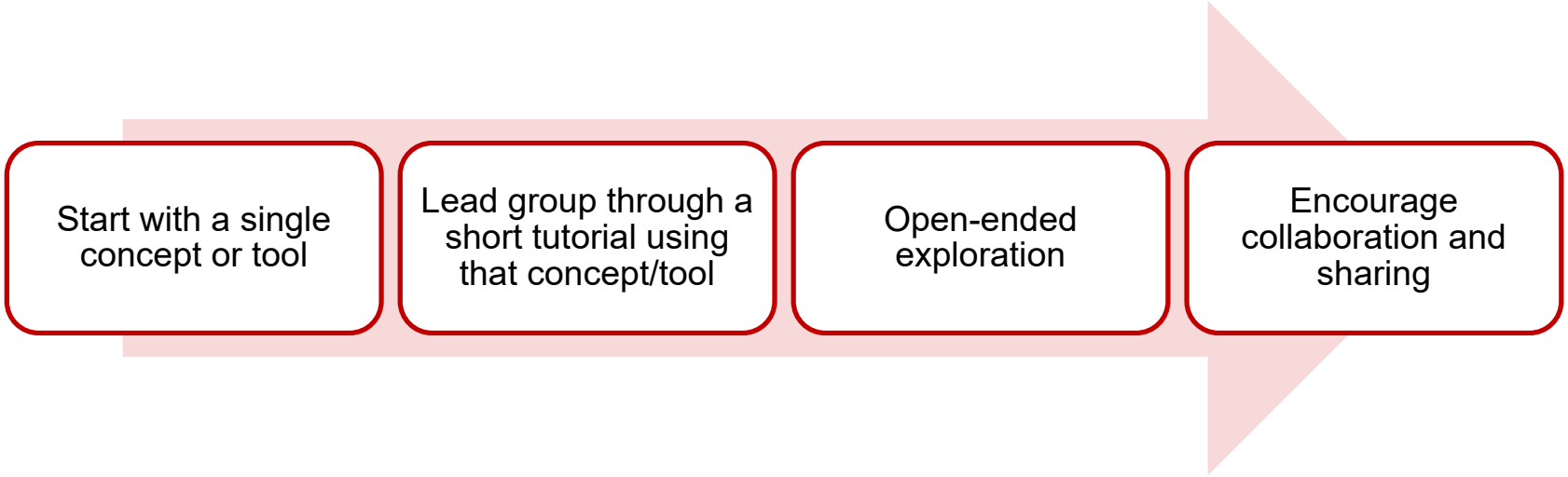
scratch.mit.edu/

Inquiry-Based Learning

What is Inquiry-Based Learning?



Inquiry-Based Coding



- ✓ More accurately reflects real world coding
- ✓ Better at teaching all 4 aspects of computational thinking
- ✓ More flexible for ability levels

Example

Maze or logic games can become powerful tools to teach systems thinking, math, or strategy.

- https://scratch.mit.edu/projects/1233389169
- https://scratch.mit.edu/projects/1192819990

Prototyping Your Game

1. Choose your scope – Decide if your game will be one complete module or multiple connected levels.
2. Use a GDD – Follow the elements of a Game Design Document (story, characters, mechanics, learning goal).
3. Sketch first – On your large sheet or whiteboard, map out levels, interactions, and key scenes.
4. Start building in Scratch – Use sprites, backdrops, and code blocks to bring your concept to life.
5. Test as you go – Play your game frequently to spot bugs and refine mechanics.
6. Document ideas – Note changes, new ideas, and reflections for future iterations.

Curriculum Connections

Curriculum Alignment

ADST

- Ideating: Generating and evaluating ideas for digital games
- Prototyping: Developing working solutions (games) using code
- Testing and Making: Iterating based on feedback
- Sharing and Reflecting: Presenting projects and explaining decisions

Cross-Curricular

- Science (e.g., ecosystems, environmental impact, body systems)
- Social Studies (e.g., local/global issues, identity, Indigenous knowledge)
- Language Arts (e.g., narrative structure, dialogue, storytelling)
- Arts Education (e.g., character design, visual storytelling)
- SEL (Social Emotional Learning) (e.g., empathy through story-driven games)

Curriculum Alignment

Computational Thinking

- Simple algorithms that reflect computational thinking
  - Sorting, searching, sequence, selection, repetition
  - Specific statements to complete simple tasks
- Visual Programming

Computers and Communications Devices

- Computer system architecture
- Strategies for identifying and troubleshooting simple software problems

Assessment alternatives

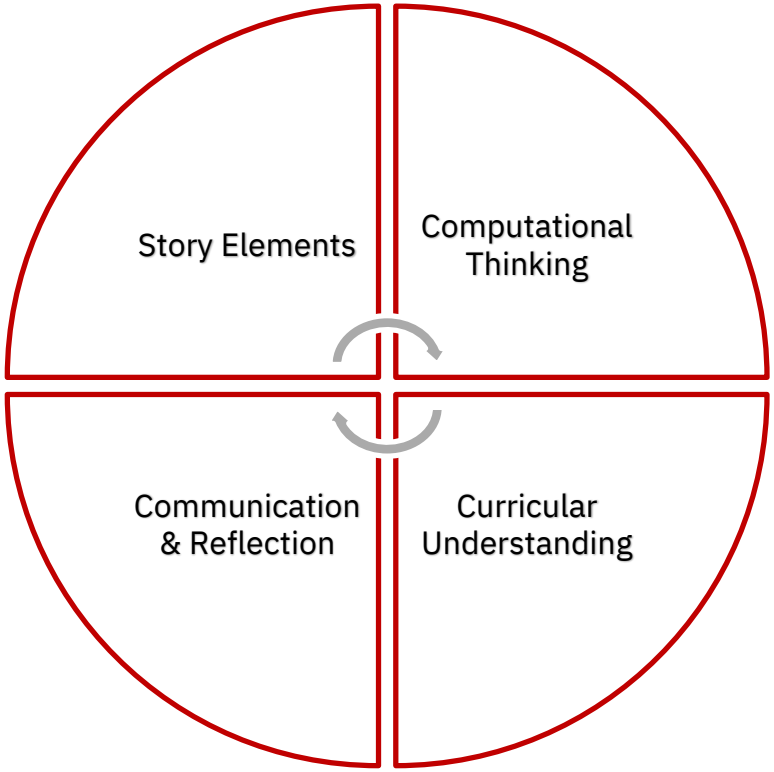
Formative Assessment

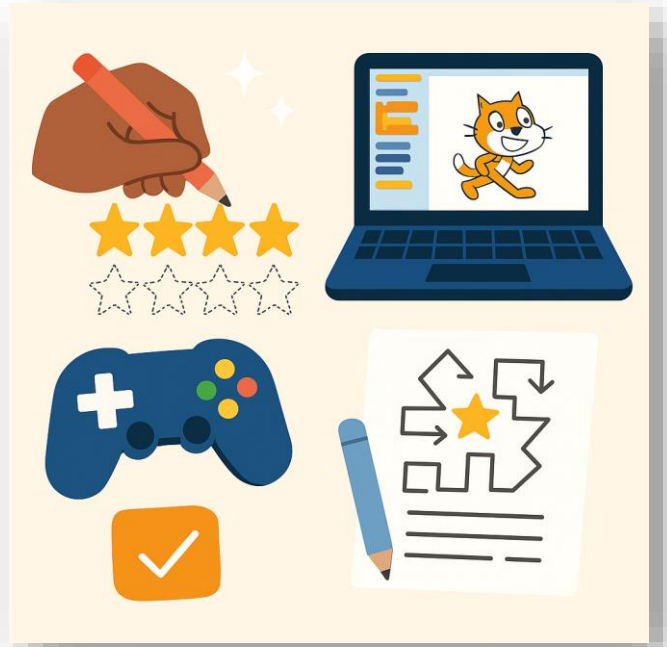
Formative Assessment can focus on the process, not just the final game:

What to Assess?

- Story Planning: character, setting, problem, message
- Programming Thinking: use of loops, conditionals, events
- Curricular Understanding: connection between game content and subject matter
- Collaboration & Communication: group decision-making and peer feedback

Focus on process and creativity, not technical perfection.





Beyond Coding: A Creative Alternative for Project-Based Learning

Learning Scratch can be used not just in tech classes, but also as an alternative format for student projects in Science, Social Studies, Language Arts, and more.

A creative, multimodal way for students to show understanding

Combines storytelling, design, and interactivity

Teachers can use it to:

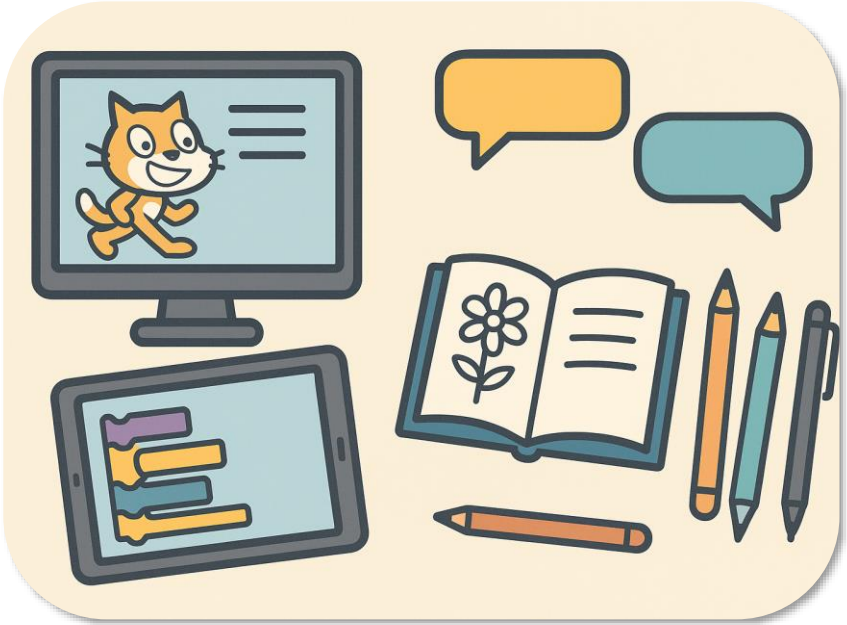
Highlight student voice and creativity	Support project-based learning	Deepen engagement with curricular content

Instead of writing a report or making a poster, what if a student could build a game to explain the water cycle, Indigenous land stewardship, or a narrative about empathy?

Extra Resources

Final Discussion

- What will you take away from today?
- Do you have any questions that are still unanswered? Or maybe new questions?



Liked this workshop?

Request a FREE Pro-D Workshop for your school:

pro-d.geeringup@ubc.ca

We cover topics such as ChatGPT, Engineering Design Challenges, coding in the classroom and more!

Other Resources:

- *https://pro-d.geeringup.ca* : STEM Lesson Plans, Online Courses, information about future Pro-D events, tutorials on online teaching tools
- 1:1 Support - any pinch points when trying to incorporate EDC in classrooms? Give us a call and we would be happy to brainstorm some solutions

In-Classroom Workshops

Led by two Geering Up instructors, workshops consist of hands-on STE(A)M activities covering BC curricular competencies and content.

Cost (1-1.5hrs)

1 workshop: $195

3 workshops (on same day): $175

6+ workshops: $155

*financial support available.

Scan to learn more!

Dates: January – April

Feb. 13, 2026, Pro-D @ UBC

Mathematical Masterpieces:

Exploring Math Concepts Through Art

This interactive workshop will explore hands-on projects that turn learning math into a work of art. You'll leave energized and equipped to help your students see the math hiding in the art around them.

Aimed for educators of grades 3-7.

Scan to register!

Or use link: https://bit.ly/4nZpXhP

Exploring Stories, Science & Culture in Education

Research project on culturally grounded digital storytelling in STEAM education

Want to stay informed as my UBC thesis project develops?
(No commitment — just to stay in touch!)

This project is led independently by Sebastián, a UBC MA student. Geering Up is not involved.

Thank you

Feedback form

bit.ly/475Y6nF