

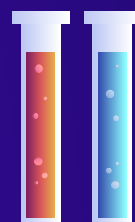


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INTEGRATED EXPLORATION: CREATIVE THINKING AND SUSTAINABLE SOLUTIONS

2024-1-PL01-KA210-SCH-000243609

Small-scale partnerships in school education (KA210-SCH)



MODULE 2

Arts and Science Integration

Digital Content Guide · Student & Teacher Edition

5 Detailed Lesson Plans

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How to Use This Guide

Module 2 can be used as a standalone STEAM unit or as the second part of the full Integrated Exploration curriculum. Students do not need to have completed Module 1, though those who have will be able to bring their Scratch skills into their creative projects.

The module works best when students have access to both physical art materials and digital tools. All activities scale from low-resource settings (basic drawing materials, a shared computer) to fully equipped classrooms.

What This Guide Contains

-  Five 60-minute lesson plans covering gallery exploration, data art, digital creativity, group projects, and exhibition
-  A 5-day intensive workshop programme that culminates in a public Grand Exhibition
-  Pre/post quiz, project rubric with radar chart, peer gallery feedback form, and self-reflection
-  Compatible with art, science, computing, and cross-curricular project weeks
-  Builds on Module 1 Scratch skills; connects forward to Module 3 sustainability projects

Module Overview

Module 2 explores the rich relationship between artistic expression and scientific thinking. Students discover that these two disciplines are not opposites — they share a commitment to observation, curiosity, and communication. By combining them, students produce something neither discipline can achieve alone.

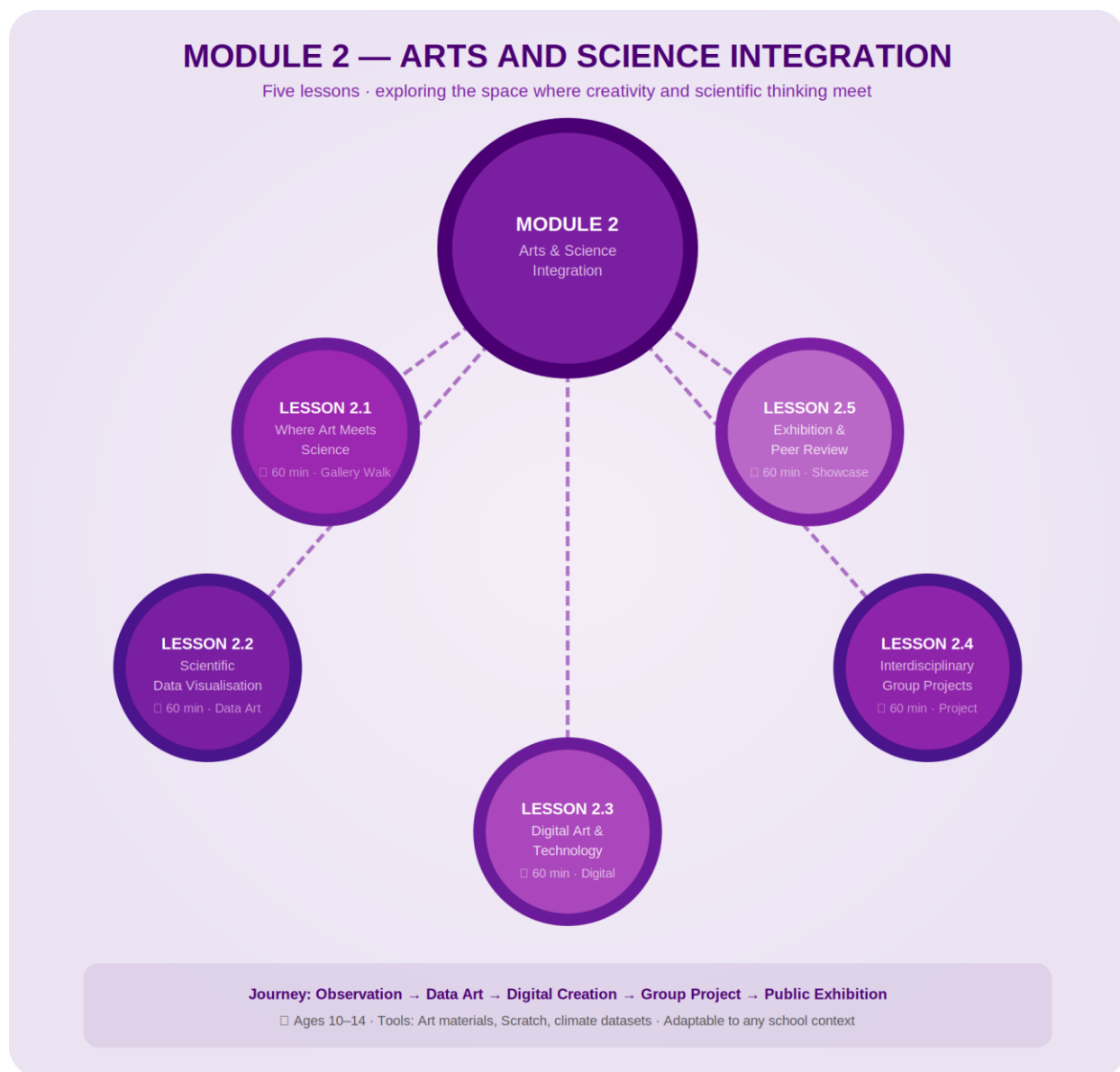


Figure 1 — Module 2: five lessons building toward a public art-science exhibition

At a Glance

- 🎯 Target Group: Students aged 10–14 and their teachers
- 🕒 Lesson Time: 5 × 60-minute lessons + 5-day intensive workshop

-  Tools: Art materials, Scratch, climate data sets, digital cameras (optional)
-  Assessment: Pre/post quiz, project rubric, peer gallery feedback, self-reflection
-  Key Skills: Observation, data literacy, creative thinking, scientific communication

The STEAM Framework — Why Arts Belongs

STEAM adds Arts to the STEM disciplines — not as decoration, but as a critical thinking and communication tool. In this module, art is the primary vehicle through which students communicate, interrogate, and deepen their scientific understanding.

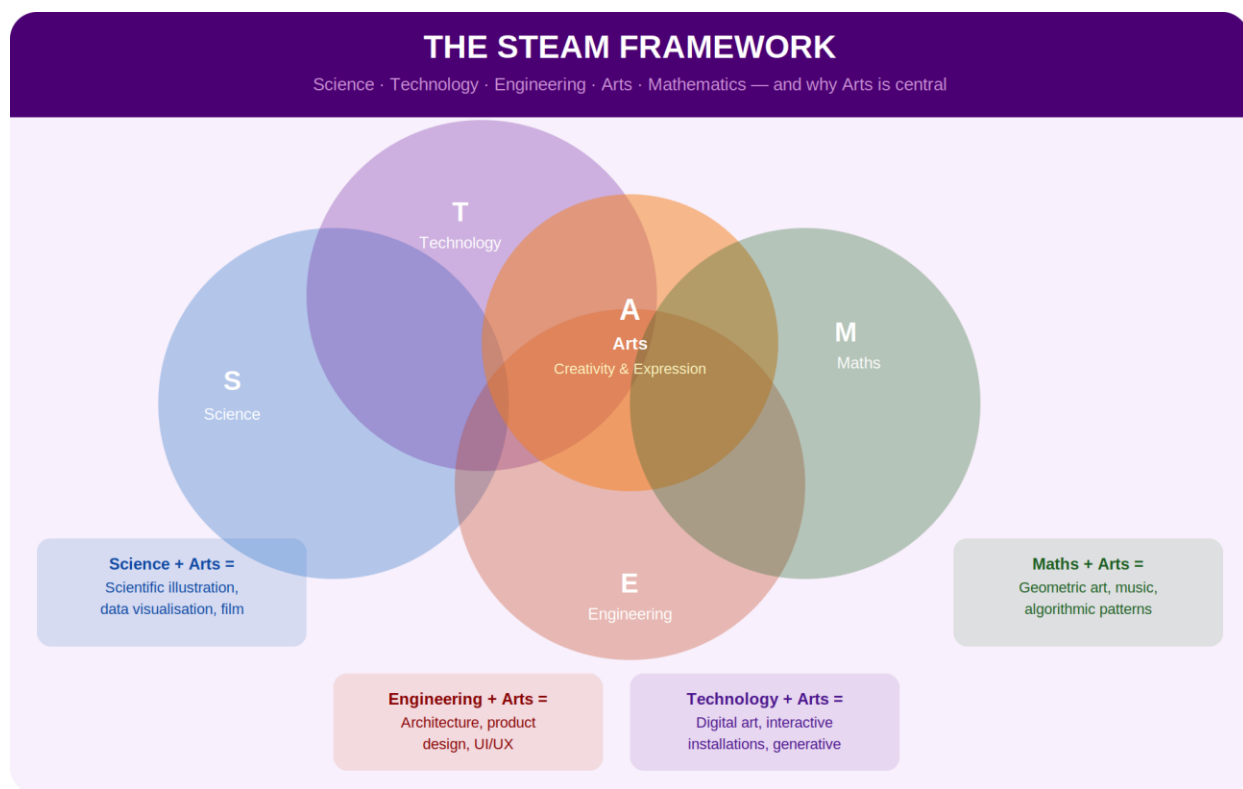


Figure 2 — STEAM: Arts sits at the centre, connecting all other disciplines

Shared Value	In Science	In Art
Observation	Recording data precisely; noticing anomalies	Observational drawing; noticing light and texture
Curiosity	Asking 'What if?' and designing experiments	Asking 'What if?' and experimenting with materials
Communication	Presenting findings to peers and public	Expressing ideas to an audience
Revision	Testing, failing, refining a hypothesis	Iterating on a sketch; editing a piece
Pattern recognition	Finding trends in data sets	Finding rhythm, repetition, and form

Art–Science Pioneers

One of the most powerful ways to inspire students is to show that the boundary between art and science is a human invention. These six figures refused to choose between the two disciplines — and their work is richer for it.

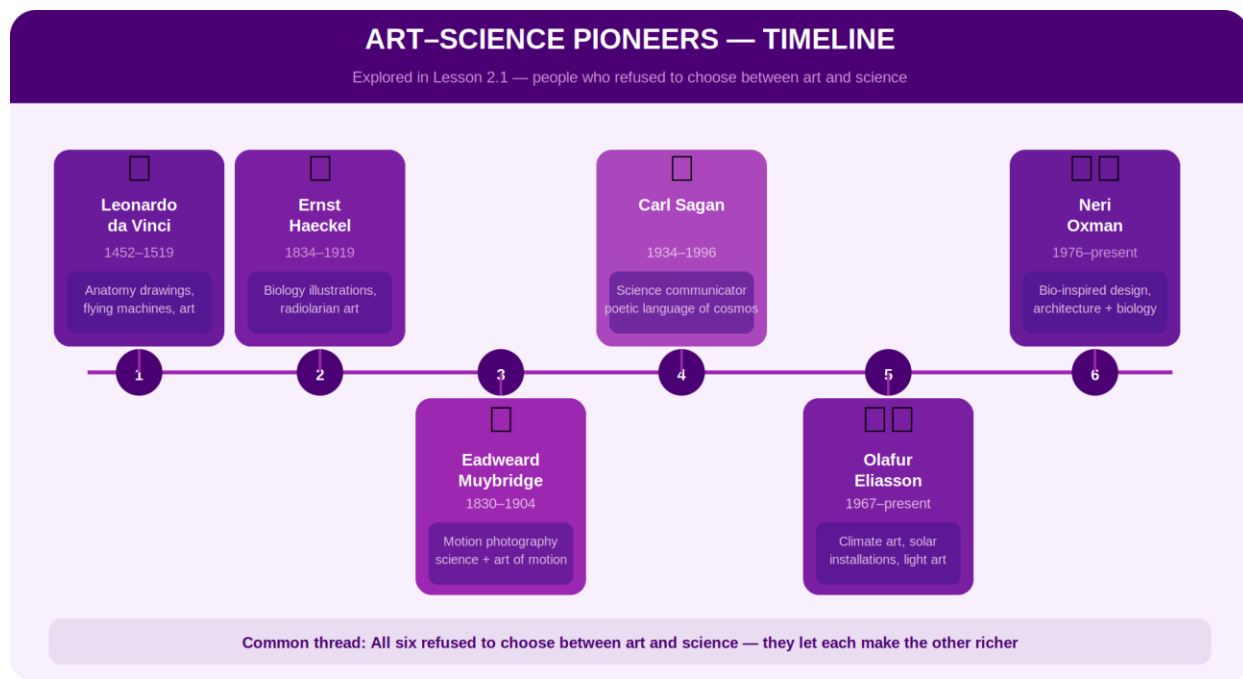


Figure 3 — Six pioneers who crossed the art-science boundary: from Leonardo da Vinci to Neri Oxman

LESSON PLANS

Lesson 2.1 — Where Art Meets Science

Duration	Materials	Grouping	Lesson Type
60 minutes	Pioneer cards/slides, natural objects, drawing paper, pencils, sticky notes	Individual, then pairs	Gallery walk + observational drawing

Learning Objectives



Learning Objectives:

1. Name at least three figures who worked across art and science
2. Make a detailed observational drawing of a natural object
3. Compare scientific and abstract representations of the same subject
4. Complete the exit sentence: 'Art and science are similar because ____ and different because ____'

Lesson Flow

Part 1 — Gallery Walk (15 minutes)

Display 8–10 images at stations (printed cards or projected). Include: Haeckel's radiolarian illustrations, da Vinci's anatomy notebooks, a NASA climate spiral, a wind map data visualisation, Olafur Eliasson's 'The Weather Project'. Students move with sticky notes, writing one word per image. Collect and build a class word cloud.

Part 2 — Pioneer Presentations (15 minutes)

Pre-assigned student groups present their pioneer in 2 minutes each. Focus question: What motivated these people to cross boundaries? Guide discussion: both science and art require deep observation; both communicate ideas to others; both involve repeated testing and revision.

Part 3 — Observational Drawing Challenge (25 minutes)

Each student chooses a natural object (leaf, stone, feather, seed pod, shell). Two rounds:

1. SCIENTIFIC DRAWING (10 min): As accurate as possible; label at least 3 features
2. ABSTRACT VERSION (10 min): Inspired by the same object; viewer should not immediately recognise it

Pin both side by side. Discussion: What does each version reveal that the other cannot? Which contains more information? Which communicates more feeling?

Part 4 — Exit Ticket (5 minutes)

Each student completes: 'Art and science are similar because ____ and different because ____.' Collect the cards — return them at the end of the module as a 'how has your thinking changed?' comparison.

Lesson 2.2 — Scientific Visualisation Through Art

Duration	Materials	Grouping	Lesson Type
60 minutes	Printed climate data sets, graph paper, watercolour or coloured pencil, collage materials	Individual	Data art creation

Learning Objectives

🎯 Learning Objectives:

1. Read and interpret a simple data set (e.g., monthly temperature averages)
2. Transform data into a visual artwork using at least one deliberate visual encoding
3. Annotate the finished work explaining each visual choice
4. Give structured feedback on a peer's data artwork

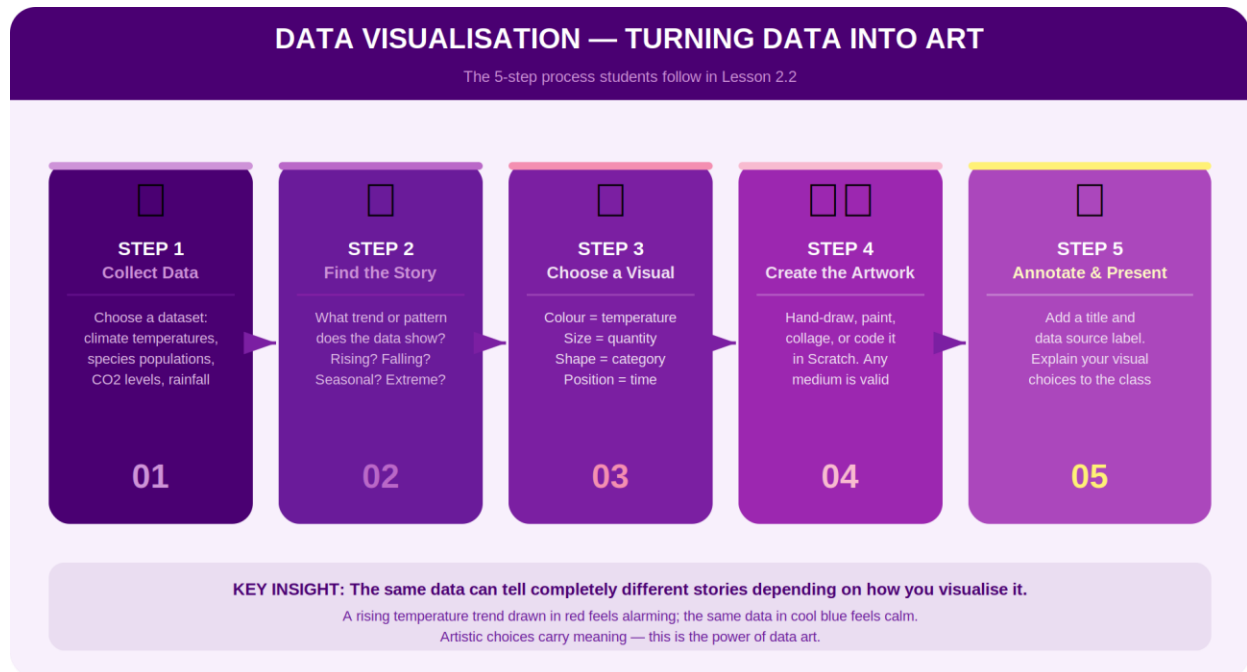


Figure 4 — The 5-step data visualisation process: from raw data to annotated artwork

Lesson Flow

Part 1 — What is Data Visualisation? (10 minutes)

Show four compelling examples: Ed Hawkins' Climate Stripes, a real-time wind map, the Dear Data project (hand-drawn personal data), a NASA temperature anomaly map. For each: What data is shown? What emotion does it evoke? Could a standard bar chart do the same?

Part 2 — My Climate Data Art (35 minutes)

Each student receives a data card: monthly average temperatures for a region over 30 years. The data shows a clear warming trend. Rules for the artwork:

- The trend must be visible to a viewer who has not seen the data
- Use at least one clear visual encoding: colour = temperature, size = value, etc.
- Any medium permitted: drawing, painting, collage, or digital
- Annotate with: data source, what visual elements represent, trend identified

💡 Prompts for students who are stuck: What colour IS the temperature of 1990? Of 2020? If each year were a thread in a fabric, what would the fabric look like? What shape would you draw if you could FEEL the warming in your hands?

Part 3 — Gallery Critique (10 minutes)

Pin up all artworks. Structured sticky-note feedback: 'The data I can read from this artwork is...' This forces engagement with the scientific content, not just the aesthetic.

Part 4 — Bridge to Lesson 2.3 (5 minutes)

Preview: the same data can be visualised interactively in Scratch. An interactive version can respond to the viewer — what might it do that the hand-made version cannot?

Lesson 2.3 — Digital Art and Technology

Duration	Materials	Grouping	Lesson Type
60 minutes	Computers with Scratch, starter code file, audio recording (optional)	Individual, paired support	Digital creation + experimentation

Learning Objectives

 Learning Objectives:

1. Create an interactive artwork in Scratch that responds to mouse or key input
2. Use Scratch pen tools to generate visual patterns with loops
3. Write a two-sentence artist's statement connecting creative choices to coding
4. Describe one example of generative or algorithmic art

Lesson Flow

Part 1 — Generative Art Examples (10 minutes)

Show three examples: Sol LeWitt's Wall Drawings (instructions that generate art), a Processing generative pattern, a Scratch pen project drawing spirals and mandalas. Question: Does knowing this was made by code make it less artistic? Is writing the algorithm an artistic act? Encourage genuine debate — there is no correct answer.

Part 2 — Interactive Digital Artwork (35 minutes)

Distribute the starter Scratch file (pen drawing enabled, no output yet). Students modify and extend it. Challenge levels:

Level	Challenge	Scratch Concepts
 Starter	Draw a continuous spiral by changing move and turn amounts	Loop, pen, motion
 Developing	Artwork responds to mouse position — distance changes line thickness or colour	Sensing, variables, conditionals
 Advanced	Gradually shifting colours or expanding patterns that reset and repeat	Incrementing variables, nested loops
 Creative	Encode the temperature data from Lesson 2.2 into the visual pattern	All concepts + personal data integration

Part 3 — Sound Extension (10 minutes)

Record a sound using the Scratch recording tool. Add it to the artwork on a key press. Discussion: music also has algorithmic structure — beats, bars, patterns. Is music generative art?

Part 4 — Artist's Statement (5 minutes)

Two sentences in the learning diary: (1) Name your artwork. (2) 'I used [coding concept] to create [visual effect] because [creative intention].'

Lesson 2.4 — Interdisciplinary Group Projects

Duration	Materials	Grouping	Lesson Type
60 min + project time	Project planning canvas, all previous materials, computers and art supplies	Groups of 3–4	Design thinking + project-based

Learning Objectives

🎯 Learning Objectives:

1. Choose a project type that combines a scientific concept with an artistic medium
2. Apply the SCAMPER brainstorming technique to generate 10+ ideas
3. Complete a Project Planning Canvas with all required sections
4. Assign team roles and create a task timeline

INTERDISCIPLINARY PROJECT TYPES — Lesson 2.4

Six creative directions for art-science integration projects — choose one or combine



Visual Artwork

Scientific basis: biodiversity data
Artistic form: mosaic, painting, or collage using natural materials

Skills: observation, data reading, artistic composition, colour theory
Links to Module 3: Biodiversity



Digital Installation

Scientific basis: sound frequency
Artistic form: interactive Scratch programme visualising music

Skills: coding (Module 1), audio analysis, interactive design
Links to Module 1: Scratch coding



Engineering Sculpture

Scientific basis: structural engineering
Artistic form: sculpture that must bear weight while being beautiful

Skills: physics, materials science, 3D design, creative problem-solving
Links to Robotics: structural design



Science Performance

Scientific basis: human body systems
Artistic form: choreography representing cells, organs, or the nervous system

Skills: biology, movement, spatial awareness, teamwork, storytelling
Links to Module: body awareness



Photo Documentation

Scientific basis: seasonal change
Artistic form: photo series with data overlays and annotations

Skills: observation, photography, data recording, composition
Links to Module 3: climate change



Documentary Film

Scientific basis: animal migration
Artistic form: short documentary with infographic overlays

Skills: research, storyboarding, narration, editing, data literacy
Links to Module 3: ecosystems

Figure 5 — Six interdisciplinary project directions: scientific basis meets artistic form

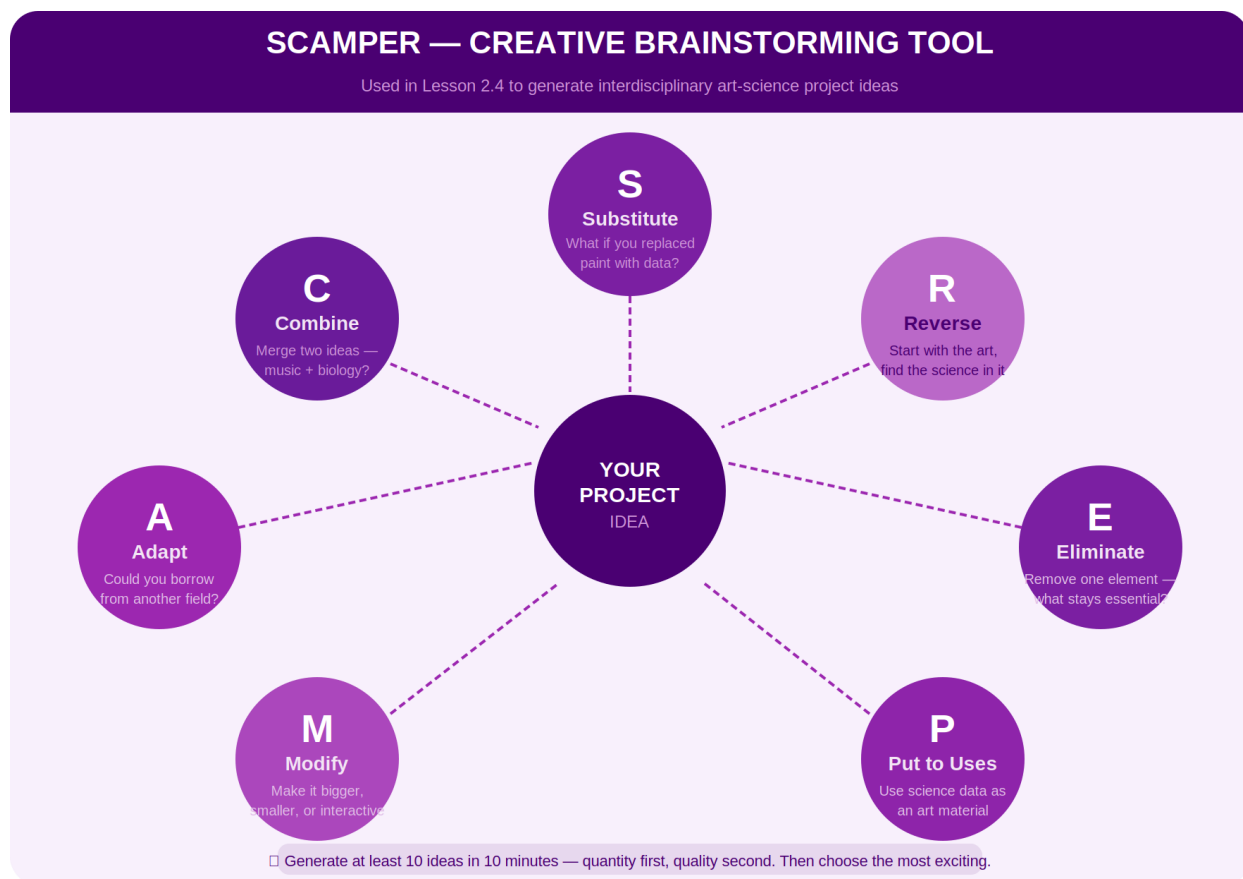


Figure 6 — SCAMPER: seven prompts for generating creative project ideas

Lesson Flow

Part 1 — Project Brief and SCAMPER Sprint (20 minutes)

Project requirements: (1) a genuine scientific concept or real dataset as foundation, (2) expressed through an artistic medium, (3) communicating a message to an identified audience. SCAMPER sprint: 10 minutes, 10 ideas minimum. Quantity over quality. Then vote for one.

Part 2 — Project Planning Canvas (25 minutes)

Canvas Section	What to Complete	Why It Matters
Project Title	A creative, evocative name	Creates ownership and identity
Scientific Basis	Which concept, dataset, or phenomenon?	Ensures genuine STEAM — not decoration
Artistic Medium	Exactly what will be made	Focuses effort; guides material planning
Target Audience	Who will see or experience this?	Shapes design and communication choices

Canvas Section	What to Complete	Why It Matters
Key Message	What should the audience think, feel, or know?	Connects back to scientific content
Integration Statement	How does the art ENHANCE the science?	The critical STEAM thinking challenge

Part 3 — Role Assignment and Begin (15 minutes)

Assign roles: Lead Artist, Lead Scientist, Technology Coordinator, Communication Lead. Each leads their area but everyone contributes to all. Spend the final 10 minutes making the first move — first sketch, first code line, first data lookup.

Lesson 2.5 — Exhibition and Peer Review

Duration	Materials	Grouping	Lesson Type
60 minutes	Completed projects, display space, feedback forms, award certificates	Groups + whole class	Public exhibition + critique

Learning Objectives

🎯 Learning Objectives:

1. Set up and present an interdisciplinary project to an audience
2. Give specific, evidence-based feedback on peers' projects
3. Receive and respond constructively to critique
4. Reflect on the learning journey across all five lessons

Exhibition Standards — What Every Project Must Include

Required Element	Purpose	Format
The artwork itself	Central piece — what the audience experiences	Physical, digital, performance, or installation
Scientific explanation	Shows the STEAM connection	150 words maximum, displayed beside artwork
Artist's statement	Explains creative choices and intentions	100 words, first person, written by team
Data source	Grounds the work in real science	Citation of dataset or research used
Interaction guide	Tells viewer how to engage	QR code, instructions, or invitation to participate

Lesson Flow

Part 1 — Exhibition Set-Up (10 minutes)

Groups prepare their display. Teacher checks: Is the science accurate? Is the artist's statement in first person? Does the display invite the viewer in?

Part 2 — Gallery Rotation (30 minutes)

Visitors rotate in groups of 3–4. At each station: 3 minutes to engage, then complete structured feedback form: What scientific concept does this communicate? What is the most effective artistic choice and why? One question for the creators.

Part 3 — Presentations (15 minutes)

Each group presents for 2 minutes: What is our project? What is the scientific basis? What artistic choices did we make and why? What did we learn about how art and science enhance each other? What would we do differently?

Part 4 — Awards (5 minutes)

Award	What It Recognises
Most Creative	Most original combination of art form and scientific concept
Best Science Communication	Science most clearly and accurately expressed through the artwork
Most Impactful Message	Message you will still remember in a month
Best Integration	Art and science most inseparably connected — neither could exist without the other

5-DAY INTENSIVE WORKSHOP PROGRAMME

Five-Day Workshop — Arts and Science Integration

This workshop is the intensive version of Module 2. Students arrive on Day 1 having at least some familiarity with the art-science connection (ideally having completed the five lessons). The week culminates in a Grand Exhibition open to the wider school community or public.

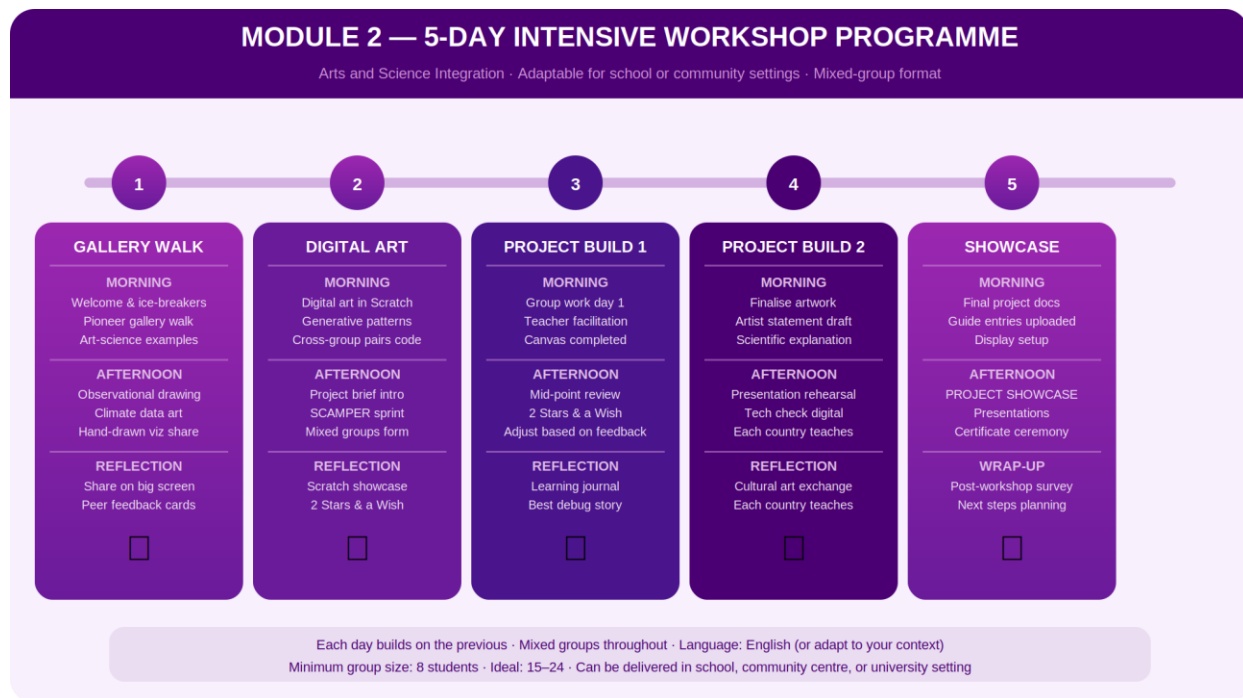


Figure 7 — Five-day workshop: building toward the Grand Exhibition on Day 5

Day	Theme	Morning Focus	Afternoon Focus	Reflection Activity
1	Observation	Gallery walk; pioneer introductions	Observational drawing; climate data art	Class word cloud review; how has thinking changed?
2	Digital Creation	Digital art in Scratch; cross-group pairs	Project brief intro; SCAMPER sprint; groups form	Evening site visit: gallery, museum, or science centre
3	Build Day 1	Group project work; teacher facilitation	Mid-point peer review: 2 Stars & a Wish	Reflection journals: biggest learning so far
4	Build Day 2	Finalise artwork; artist's statement draft	Presentation rehearsal; peer coaching	Cultural art exchange: each group shares a creative tradition

Day	Theme	Morning Focus	Afternoon Focus	Reflection Activity
5	Grand Exhibition	Final prep; display setup; QR codes	Grand Exhibition open to community; award ceremony	Post-workshop survey; exit ticket comparison with Day 1

🧠 Protect the artistic voice: Resist correcting aesthetic choices. The science must be accurate; the art is the student's expression. A 'wrong' colour choice is a creative decision.

🔍 Science accuracy is non-negotiable: Review each group's scientific explanation before the exhibition. The data must be real; the scientific statement must be correct.

🌐 Language of art is universal: In multilingual groups, students can communicate through sketches, gestures, and shared creative work. This is a feature, not a barrier.

👥 Mixed groups throughout: Homogeneous groups produce more predictable work. Mixed groups consistently generate more creative and unexpected combinations.

ASSESSMENT TOOLS

Pre/Post Knowledge Quiz — Arts & Science Integration

#	Question	Correct Answer
1	Which of these people was both a scientist and an artist?	B — Leonardo da Vinci
2	What is 'data visualisation'?	B — Representing information through visual elements
3	STEAM stands for:	A — Science, Technology, Engineering, Arts, Maths
4	Which artist is known for climate science installations?	C — Olafur Eliasson
5	Generative art is art that:	B — Is created using algorithms or rules, often with code
6	Observational drawing in science is used to:	B — Record accurate visual details for scientific purposes
7	In a STEAM project, Arts contributes by:	B — Adding creative expression and communication of ideas
8	Which communicates a scientific message through art?	B — An animated film about ocean pollution
9	What does 'interdisciplinary' mean?	B — Involving multiple fields of study working together
10	The best peer feedback on an art-science project:	C — Gives specific observations about strengths and improvements

Project Rubric — Arts & Science Integration

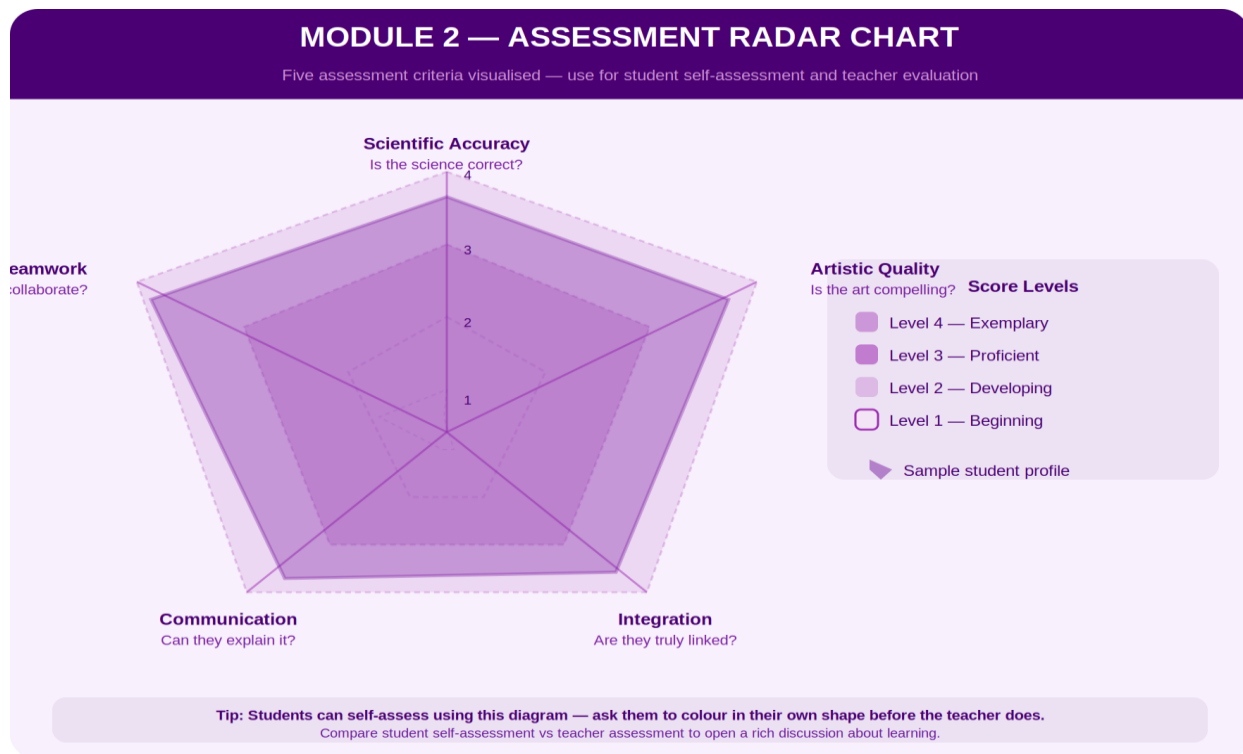


Figure 8 — Assessment radar: five criteria visualised — for both self-assessment and teacher evaluation

Criterion	Beginning (1)	Developing (2)	Proficient (3)	Exemplary (4)
Scientific Accuracy	Concept absent or substantially wrong	Basic concept with significant errors	Concept accurate and clearly identified	Deep understanding; evidenced with data
Artistic Quality	Incomplete or unintentional	Basic effort; limited creative choices	Clear decisions; artwork complete and coherent	Original, compelling; mastery of medium
Integration	Art and science separate; no genuine link	Loose connection; art illustrates but doesn't enhance	Meaningfully connected; art deepens the science	Inseparable; science cannot be as well understood without the art
Communication	Cannot explain the project	Basic description of what was made	Scientific basis and creative choices explained clearly	Engaging; articulates learning; handles questions
Teamwork	No collaboration evidence	Participates minimally	All voices visible in the work	Peer teaching; constructive conflict resolution

Student Self-Reflection — Module 2

Question	Response Format
What surprised me most about the art-science connection?	Open text (2–3 sentences)
Which scientific concept did I understand better through making art?	Open text (2–3 sentences)
What artistic skills did I develop or strengthen?	Open text (1–2 sentences)
My confidence combining art and science before this module (1–5):	Circle: 1 2 3 4 5
My confidence combining art and science after this module (1–5):	Circle: 1 2 3 4 5
The project I am most proud of from this module is:	Open text (1 sentence + reason)
One question I am now asking that I wasn't asking before:	Open text