STEM EXCELLENCE ACADEMY

SAMPLE / PREVIEW EDITION

A Guided Tour Through the 64-Mission Grade 6 STEM Program

MATHEMATICS • DATA • SCIENCE • ENVIRONMENT • CODING • ENGINEERING

PROJECT AURORA

PREVIEW PURPOSE This short edition demonstrates the student experience, progression of rigor, evidence habits, and capstone design. It is not a substitute for the complete Student Publication Master.

What You Are Previewing

The complete STEM Excellence Academy program contains 64 sequential missions. This preview uses representative mini-missions to show how students move from quantitative reasoning to data analysis, scientific investigation, environmental systems, computational thinking, engineering design, and final evidence defense.

Representative preview	Shows
Quantitative Mission	Modeling, proportional reasoning, units, checking.
Data Mission	Statistical question, center/spread, evidence-based comparison.
Scientific Discovery Mission	Variables, controlled investigation, data, CER.
Chesapeake Watershed Mission	Systems thinking, local environmental evidence, solution tradeoffs.
Coding & Robotics Mission	Algorithm, conditional logic, trace, boundary and safety testing.
Project AURORA Preview	Requirements, prototype evidence, failure/revision, responsible AI, final defense.

DESIGN PRINCIPLE Students are repeatedly asked to show how they know - not merely what answer they obtained.

The Student Mission Cycle

Stage	Student experience
Launch	Understand the problem, context, goal, and success criteria.
Learn & Model	Study a strategy, representation, scientific model, or algorithm.
Guided Practice	Practice with structured support and visible reasoning.
NOVA Challenge	Transfer the skill to a richer problem, investigation, design, or system.
Independent Check	Demonstrate the target with reduced support.
Portfolio & Reflection	Save evidence, respond to feedback, revise, and identify next steps.

Evidence Habits Across the Program

• Label quantities, variables, diagrams, axes, and units.

• Estimate or independently check important results.

• Keep unusual data and failed tests visible until investigated.

• State uncertainty and limitations honestly.

• Revise designs or claims when evidence demands it.

• For consequential AI-supported work, verify independently and preserve human judgment.

MISSION 6 - Rates in the Real World

QUANTITATIVE FOUNDATIONS - REPRESENTATIVE PREVIEW

MISSION GOAL Use a unit rate to compare options and defend a decision.

Launch

A school STEM club is buying wire for prototype circuits. Store A sells 18 meters for $27. Store B sells 25 meters for $35. Which option gives the lower cost per meter?

Learn & Model

A unit rate compares a quantity to 1 unit. Divide total cost by total meters, then keep the units attached to the result.

Store	Calculation	Unit rate
A	$27 ÷ 18 m	$1.50 per meter
B	$35 ÷ 25 m	$1.40 per meter

Store B has the lower cost per meter. A strong answer includes the calculation, units, and a sentence connecting the comparison to the decision.

Guided Practice

A sensor kit records 240 measurements in 6 minutes. What is the recording rate per minute?

_____

_____

NOVA Challenge

A team needs at least 60 meters of wire. Compare the total cost of buying enough wire from Store A versus Store B. Packages cannot be split. Which option should the team choose, and what tradeoff appears when package size is considered?

_____

_____

_____

_____

Independent Check

A robot travels 14 meters in 20 seconds at a constant rate. Find the distance per second and explain what the number means.

_____

_____

_____

MISSION 27 - Data That Tells a Story

DATA, PROBABILITY & EVIDENCE - REPRESENTATIVE PREVIEW

MISSION GOAL Compare two data sets using center and spread, then make a cautious evidence-based claim.

Launch

Two prototype launchers were each tested five times. Distance traveled, in centimeters:

Launcher A	Launcher B
48	35
50	43
51	51
49	59
52	67

Analyze

1. Find the mean of each set. 2. Find the range of each set. 3. Which launcher appears more consistent?

_____

_____

_____

_____

Evidence Note

The same or similar center does not imply the same consistency. Spread describes how variable the results are.

NOVA Challenge

Suppose a sixth trial for Launcher A is 80 cm. Predict how this would affect the mean and range. Which measure changes more dramatically, and what does that teach you about unusual values?

_____

_____

_____

_____

Independent Check

Write a two-sentence comparison that uses both center and spread. Do not claim that one launcher is 'better' unless you define what better means.

_____

_____

MISSION 33 - Design a Fair Investigation

SCIENTIFIC DISCOVERY SYSTEMS - REPRESENTATIVE PREVIEW

MISSION GOAL Design a controlled investigation that can produce interpretable evidence.

Question

How does water temperature affect the time needed for a fixed amount of sugar to dissolve?

Investigation element	Your plan
Independent variable	_____
Dependent variable	_____
Three controls	_____
Measurement units	_____
Number of trials	_____
Safety consideration	_____

NOVA Challenge

Create a procedure that another student could follow. Include at least three temperatures, repeated trials, a consistent stirring rule, and a table structure for recording data.

_____

_____

_____

_____

_____

CER Preview

Claim: _____

Evidence: _____

Reasoning: _____

Limitation / next evidence: _____

MISSION 47 - Chesapeake Bay Evidence Mission

EARTH, ENVIRONMENT & LIVING SYSTEMS - REPRESENTATIVE PREVIEW

LOCAL SYSTEMS THINKING Students connect upstream actions, watershed pathways, evidence, stakeholders, and solution tradeoffs.

Scenario

After several heavy rain events, a local stream shows cloudier water and increased nutrient measurements. The stream eventually connects to the Chesapeake Bay watershed.

System Model

Draw or describe a pathway showing how rainfall can move material from land to stream to larger waterways. Include at least one human activity and one possible ecological effect.

_____

_____

_____

_____

Evidence Check

Evidence	What it may suggest	What it does NOT prove by itself
Higher turbidity after rain	More suspended material entered the stream	The exact source of all sediment
Higher nutrient reading	More nutrient material is present at that place/time	Which single land use caused it
Algal growth later	Conditions may support increased algae	That nutrients were the only cause

NOVA Challenge

Choose one intervention - vegetated buffer, stormwater capture, fertilizer-management change, or another defensible option. State one benefit, one tradeoff, one stakeholder concern, and the evidence you would collect to evaluate success.

_____

_____

_____

_____

MISSION 50 - Decision Engine

CODING, ROBOTICS & RESPONSIBLE AI - ACADEMY ENRICHMENT PREVIEW

MISSION GOAL Translate a requirement into precise conditional logic and test the boundary.

Requirement

A rover must stop when an obstacle is closer than 20 cm.

Pseudocode

IF distance < 20 cm THEN STOP
ELSE CONTINUE according to route logic

Boundary Test

Sensor reading	Expected behavior	Why
19 cm	STOP	19 < 20 is true
20 cm	CONTINUE under the exact rule	20 < 20 is false
21 cm	CONTINUE	21 < 20 is false

ENGINEERING DISCUSSION If the safety intent is to stop at 20 cm too, the requirement must change to distance <= 20 cm. Precise operators matter.

NOVA Challenge

Add two safety rules: low battery below 20% and an emergency-stop signal. Write pseudocode so the emergency stop overrides normal movement. Then test 19%, 20%, and 21% battery.

MISSION 60 - Prototype & Fabrication Sprint

PROJECT AURORA - CAPSTONE PREVIEW

AURORA EVIDENCE CHAIN Problem -> measurable requirement -> design -> test -> failure/limitation -> revision -> retest -> recommendation.

Design Brief

Your team is developing a small environmental monitoring station. One must-have requirement is: 'The sensor housing must remain upright when placed on a 10-degree test surface.'

Prototype Evidence

Artifact	What must be visible
Dimensioned sketch	Relevant dimensions and units.
Calculation	A mathematical quantity that informs the design.
Test protocol	Setup, measurement, repetitions if needed, and pass/fail rule.
Test result	Actual observation/data - including failure if it occurs.
Revision	A change justified by the evidence.
Retest	Evidence showing whether the revision improved performance.

Failure Is Evidence

Suppose the first prototype tips over on two of three trials. A strong engineering response does not hide the failure. It identifies a plausible design cause, changes one relevant feature, and retests the same requirement.

Your revision idea

_____

_____

_____

Project AURORA - Final Defense Preview

At the end of Mission 64, students defend an evidence chain rather than simply display a finished product.

Defense question	What a strong response includes
What was your hardest requirement?	Target, test, evidence, current pass/fail status.
What failed?	Specific failure, evidence, revision, and retest outcome.
What evidence do you trust least?	Source plus a reason involving reliability, coverage, calibration, timing, or uncertainty.
Where does human judgment override automation or AI?	A specific safety, evidence, stakeholder, or ethical decision.
What tradeoff remains?	Competing criteria or stakeholder/environmental effects.
What should be tested next?	A feasible test that reduces an important remaining uncertainty.

RESPONSIBLE AI GATE A.L.G.O.: Ask what the AI produced. Look for independent evidence. Gauge limitations and coverage. Own the human decision. AI output cannot independently verify itself.

What the Complete Program Includes

Resource	Complete edition
Student Publication Master	428 pages; all 64 missions, references, portfolio system, and Project AURORA.
Teacher Publication Master	86 pages; synchronized keys, evidence anchors, scoring, differentiation, reteach, and AURORA defense support.
Administrator Program Guide	School-facing program architecture, implementation options, and review checklist.
Maryland Standards Audit	Mission-level alignment with enrichment transparency.
Master Content Inventory	Editorial and program architecture record.
School Presentation Deck	Concise launch presentation for schools and partners.

Eight-Strand Program Map

Missions	Strand
1-8	Quantitative Foundations
9-16	Algebra, Coordinates & Modeling
17-24	Geometry & Fabrication
25-32	Data, Probability & Evidence
33-40	Scientific Discovery Systems
41-48	Earth, Environment & Living Systems
49-56	Coding, Robotics & Responsible AI
57-64	Project AURORA

PREVIEW COMPLETE This sample intentionally shows only a small portion of the instructional sequence. The complete publication set preserves the full scaffold, practice progression, assessment system, and teacher synchronization.

School Review Notes

What stands out about the student experience?

_____

_____

_____

_____

Which implementation model would best fit our setting?

_____

_____

_____

What materials, scheduling, professional learning, or technology questions should we resolve?

_____

_____

_____

_____

What would we want to see in a pilot?

_____

_____

_____

_____

Learn it. Test it. Explain it. Improve it. Defend it.