ARCADE ENTREPRENEUR · 6TH GRADE DATA CHALLENGE

Planning Guide

Duration: ~1 Week (5 Class Periods) | Grade 6

Activity Overview and Pacing

Activity	Name	Day	Time	Essential Question
1	What is Data?	Day 1	~60 min	How can data help us make better decisions?
2	Introducing the Arcade Challenge	Day 2	~40 min	How can engineers use data to help a business solve a problem?
3	Class Data Visualization	Day 3	~50 min	How does the way we display data change what we can learn from it?
4	Working as Engineers	Days 2 & 4	~50 min total (split across Days 2 & 4)	How do engineers use a process to break apart a complicated problem?
5	Determining Costs and Profit	Day 4	~70 min	How do we use cost and profit data to evaluate whether a game is worth keeping?
6	Recommendations to the Arcade Owner	Day 5	~60 min	How do we communicate a data-backed recommendation clearly and persuasively?

Activity Descriptions and Materials

Activity 1 — What is Data? | Day 1 | ~60 min

Essential Question: *How can data help us make better decisions?*

Students warm up with a "Data Lineup" (human histogram), complete a class survey about their interests and arcade preferences, and explore how arcades use data to make business decisions. The survey doubles as market research used throughout the unit.

Materials:

- Handout 1 — Your Favorite Things Survey (print or Google Form)
- Space along one wall for Data Lineup warm-up
- Projector/screen for optional industry video

Activity 2 — Introducing the Arcade Challenge | Day 2 | ~40 min

Essential Question: *How can engineers use data to help a business solve a problem?*

Students read an RFP from Pat Manning, owner of Pixel Palace Arcade. They make predictions about game profitability on a sticky-note Prediction Wall, write an initial problem statement, and identify requirements and constraints embedded in the RFP.

Materials:

- Handout 2 — Games at Pixel Palace Arcade Reference Sheet
- RFP (included in facilitation guide)
- Chart paper for Prediction Wall (3 columns: Money-Maker / OK / Loser)
- Sticky notes (one color per group)
- Engineering Design Logs

Activity 3 — Class Data Visualization | Day 3 | ~50 min

Essential Question: *How does the way we display data change what we can learn from it?*

Students build a class two-axis chart from the survey data, practice sorting qualitative responses into categories, and decide which survey findings are most relevant for their recommendation.

Materials:

- Compiled class survey responses
- Large two-axis chart (laminated wall chart recommended)
- Printed qualitative responses cut into strips (1 set per group)

Activity 4 — Working as Engineers | Days 2 & 4 | ~50 min total (split across Days 2 & 4)

Essential Question: *How do engineers use a process to break apart a complicated problem?*

Part 1 (Day 2, ~25 min): Students are introduced to the Engineering Design Process using the EDP poster. Emphasis on the non-linear, iterative nature of engineering. Part 2 (Day 4, ~25 min): Students anchor the arcade problem in the EDP — refining their problem statement and listing requirements and constraints.

Materials:

- Engineering Design Process (EDP) Poster
- RFP and Games Reference Sheet from Activity 2
- Engineering Design Logs

Activity 5 — Determining Costs and Profit | Day 4 | ~70 min

Essential Question: *How do we use cost and profit data to evaluate whether a game is worth keeping?*

Students sort Cost Detective cards to distinguish revenue, prize cost, and operating cost, then walk through a class example (Skee-Ball) before computing cost-per-play, revenue-per-play, profit-per-play, and daily profit for all eight arcade games. They return to the Prediction Wall to compare predictions with data.

Materials:

- Handout 3 — Cost Detective Cards (print on cardstock, one set per group)
- Card Stock (assorted colors) — for printing the Cost Detective Cards (Handout 3).
- Handout 4 — Arcade Game Cost and Profit Calculation Sheet (one per group)
- Handout 5 — Teacher Key
- Handout 2 — Games Reference Sheet from Activity 2
- Calculators (optional)

Activity 6 — Recommendations to the Arcade Owner | Day 5 | ~60 min

Essential Question: *How do we communicate a data-backed recommendation clearly and persuasively?*

Groups synthesize survey and cost/profit data into a structured recommendation proposal. The unit wraps with a Recommendations Roundtable — a debate-style format where students take positions, present evidence, and move sides if they are convinced by peer arguments.

Materials:

- Arcade Recommendation Proposal Template (included in facilitation guide appendix)
- Completed Cost and Profit Calculation Sheets
- Survey notes
- Room arranged for two-camp Roundtable debate

Standards Alignment

This unit was designed to support the Next Generation Science Standards (NGSS) Engineering Design performance expectations and Science & Engineering Practices, and the Common Core State Standards for Mathematical Practice (SMP). The tables below summarize the strongest alignment points and where they show up in the challenge. The NGSS engineering design performance expectations map cleanly to most state engineering and technology standards. If your state uses different standards (e.g., Georgia Standards of Excellence, TEKS, NYS Next Generation Standards), align using the descriptions in the tables below.

NGSS Engineering Design Performance Expectations

Standard	Description	Where It Shows Up	Classroom Connection
MS-ETS1-1 Engineering Design	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution.	Activities 2 and 4	Students extract specific requirements and constraints from Pat's RFP and write a precise problem statement that names who has the problem, what is going wrong, and what data are available.
MS-ETS1-2 Engineering Design	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	Activity 5	Students systematically evaluate every game against the criteria of profitability and customer interest, sorting them into Money-Maker / OK / Loser buckets using both quantitative (cost and profit) and qualitative (Notes column) evidence.

Science and Engineering Practices

Practice	Where It Shows Up	Classroom Connection
Practice 4 Analyzing and Interpreting Data	Activities 1, 3, and 5	Students collect class survey data, build class-level visualizations, and interpret both numerical and descriptive data from the arcade game reference sheet.
Practice 5 Using Mathematics and Computational Thinking	Activity 5	Students use arithmetic reasoning to compute cost-per-play, revenue-per-play, profit-per-play, and daily profit for eight games.
Practice 7 Engaging in Argument from Evidence	Activity 6	The Recommendations Roundtable explicitly requires students to defend their recommendations with data-backed arguments and respond to competing arguments using evidence.
Practice 8 Obtaining, Evaluating, and Communicating Information	Activity 6	Students communicate their findings and recommendations through a structured written proposal to the arcade owner.

Common Core Standards for Mathematical Practice

Standard	Where It Shows Up	Classroom Connection
SMP 1 Make sense of problems and persevere in solving them	Throughout	The arcade RFP is intentionally ambiguous. Students return to the problem repeatedly across five sessions, refining their understanding as more data accumulates.
SMP 2 Reason abstractly and quantitatively	Activity 5	Students move fluently between concrete dollars ($1 per play, $0.20 in tickets) and abstract relationships (revenue minus cost = profit).
SMP 3 Construct viable arguments and critique the reasoning of others	Activity 6	Students defend their recommendations in writing and in the Roundtable, where they must respond to opposing arguments with their own evidence.
SMP 4 Model with mathematics	Activity 5	Students build a mathematical model of arcade economics (cost-per-play x plays-per-day = daily profit) and use it to make a real-world business recommendation.
SMP 5 Use appropriate tools strategically	Activities 3 and 5	Students choose among calculators, sticky-note charts, class data visualizations, and qualitative observations as they work through the unit.
SMP 6 Attend to precision	Activity 5	The Cost Detective sort and the Skee-Ball walkthrough directly target precise vocabulary — distinguishing revenue from cost, price from operating cost, and per-play from per-day quantities.

This STEM Innovation and Design module was produced by Georgia Institute of Technology's Center for Education Integrating Science, Mathematics, and Computing with support from National Science Foundation Award #2101441.