6th Grade DATA CHALLENGE

Arcade Entrepreneur

Teacher Facilitation Guide

Duration: ~1 Five 60-Minute Class Periods

CHALLENGE OVERVIEW

Students step into the role of market researchers for the owner of Pixel Palace Arcade — a struggling neighborhood arcade losing money. Working in teams, students respond to a Request for Proposals (RFP) by collecting and visualizing class data, calculating cost and profit for each game in the arcade, and writing a recommendation proposal that tells the owner which games to keep, change, or remove.

Along the way, students practice data collection and visualization, learn to distinguish revenue, cost, and profit, and use the Engineering Design Process to make sense of an open-ended business problem. The unit sets up the Systems and Design challenges that follow, in which students will test the odds of winning and design a better game.

BY THE END OF THIS CHALLENGE, STUDENTS WILL BE ABLE TO:

- Collect, visualize, and interpret survey data to inform a real-world decision
- Calculate price-per-play, cost-per-play, and profit-per-play for an arcade game
- Distinguish between price (revenue) and operating cost
- Use both quantitative and qualitative data to support a recommendation
- Apply the Identify and Understand stages of the Engineering Design Process
- Communicate a data-backed recommendation through a structured proposal

MODULE STRUCTURE

Activity 1— What is Data? (Day 1)
Activity 2 — Introducing the Arcade Challenge (Day 2)
Activity 3 — Class Data Visualization (Day 3)
Activity 4 — Working as Engineers (built into Day 2 + Day 4)
Activity 5 — Determining Costs and Profit (Day 4)
Activity 6 — Recommendations to the Arcade Owner (Day 5)

MATERIALS

Sticky notes (one color per group)

Chart paper for Prediction Wall (labeled Money-Maker / OK / Loser)

Engineering Design Process (EDP) Poster

Engineering Notebooks

Projector/screen for class chart and optional video

Handout 1 - Your Favorite Things Survey (print or share as Google Form)

Handout 2 – Pixel Palace RFP

Handout 3 – Games at Pixel Palace Arcade Reference Sheet

Handout 4 – Cost Detective Cards (print on cardstock, one set per group)

Handout 5 – Cost and Profit Calculation Sheet

Handout 6 – Arcade Recommendation Template

Cost and Profit Calculation Sheet Teacher Key

STANDARDS ALIGNMENT

NGSS Engineering Design

- MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision
- MS-ETS1-2: Evaluate competing design solutions using a systematic process

Science and Engineering Practices

- Practice 4: Analyzing and interpreting data
- Practice 5: Using mathematics and computational thinking
- Practice 7: Engaging in argument from evidence
- Practice 8: Obtaining, evaluating, and communicating information

Common Core Standards for Mathematical Practice

- SMP 1: Make sense of problems and persevere in solving them
- SMP 2: Reason abstractly and quantitatively
- SMP 3: Construct viable arguments and critique the reasoning of others
- SMP 4: Model with mathematics
- SMP 5: Use appropriate tools strategically
- SMP 6: Attend to precision

See the Arcade Entrepreneur Data Challenge Planning Guide for complete alignment details.

ACTIVITY 1

What is Data?

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

TIME
~60 min

Students are introduced to the concept of data. They warm up with a quick whole-class "Data Lineup," complete a short class survey about their favorite activities and arcade games, and then explore an arcade-industry framing piece that motivates the use of data in business decisions. The survey doubles as market research that students will analyze and use throughout the unit.

SETUP & MATERIALS

- Print the "Your Favorite Things" survey or prepare to share link to digital version (Google Form). We recommend giving this survey using Google Forms (or a similar tool). Online responses are much easier to compile and visualize in Activity 3.
- If you must use paper, set aside time after class to compile responses before the data visualization activity.
- Pre-load the optional arcade-industry framing video (see Part 2 for suggestions).
- Clear a space along one wall of the room for the Data Lineup warm-up.

Part 1 — Data Lineup Warm-Up & Survey: 25 min

Begin with a brief, hands-on warm-up that gets students moving and turns the class into a "human histogram."

Data Lineup (8–10 min):

Have students stand and form a line along one wall, ordering themselves by their answer to a single question. Run two or three quick rounds, switching the question each time:

- How many minutes did you spend on a screen yesterday? (low to high)
- How much would you pay to play one arcade game? (low to high)
- How often do you go to an arcade? (never → weekly+)

After each round, ask the students at the two ends to share their answer, and ask the class what they notice. Point out that the line itself is a data display — they have just made a histogram with their bodies.

Survey (15 min):

Each student completes the "Your Favorite Things" survey. The survey mixes general questions about students' lives and interests with arcade-specific questions. The general questions give students varied data to practice visualizing and interpreting; the arcade-specific questions serve as market research for the unit.

DISCUSSION PROMPTS — WHAT IS DATA?

- How could the data in the survey be useful? Who might use this sort of data?
- Are numbers the only kind of data? Can words be used as data?
- What kind of data did the Data Lineup just produce — words, numbers, or pictures?

Part 2 (Optional) — Inside the Arcade Industry: 25 min

Show a short video or article on how arcades use data to make business decisions. Choose one of the options below. The goal is to introduce students to the idea that businesses use data and customer information to make decisions, and to set up the arcade context they will work in for the rest of the unit.

VIDEO/ARTICLE OPTIONS

Recommended — "How Arcades Choose Their Games" (10–12 min). A short article or curated video clip on how modern arcades and family entertainment centers (Dave & Buster's, Round1, local family arcades) decide which games to add or remove. Talking points to highlight: arcades track which games earn money per square foot, watch how long kids play, and use customer feedback.

Alternate — "The Math Behind a Carnival Game" (8–10 min). A short clip introducing the idea that physical games of skill have hidden math (odds, costs, profit). This option foreshadows the Systems Challenge more strongly.

Both options need a teacher-vetted source. Final selection will depend on what is approved for classroom use in your district.

DISCUSSION PROMPTS — AFTER THE VIDEO

- How do you think an arcade owner figures out which games are popular?
- What kinds of data could an arcade collect about its customers? About its games?
- If a game in the arcade isn't making money, what could the owner do about it?

Part 3 — Reflection: 5–10 min

Use these prompts as a whole-class discussion or as a ticket-out-the-door:

- What kinds of data do arcade owners use to make decisions?
- What data did we collect about ourselves today? How could that data be useful to a business?
- What information would you want to have if you were running an arcade?

ACTIVITY 2

Introducing the Arcade Data Challenge

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

TIME
~40 min

Students are introduced to the challenge through an RFP (Request for Proposals) from the owner of Pixel Palace Arcade, whose business is losing money. Working in groups of 3–5, students read the RFP, review the games currently in the arcade, make predictions about which games they think are profitable, and identify the problem they have been hired to investigate.

SETUP & MATERIALS

- Print one copy of the Pixel Palace RFP per group (also project on the screen).
- Print and project the "Games at Pixel Palace Arcade" reference sheet
- Prepare a large piece of chart paper labeled "Predictions" with three columns: Money-Maker / OK / Loser.
- Have a stack of sticky notes ready for the prediction activity – one color per group.
- Decide how to group students (3–5 per team).
- Student Engineering Notebooks for drafting problem statement.

Part 1 — Reading the RFP: 20 min

Divide the class into their groups and introduce the challenge. Pass out individual copies of the RFP and read as a class. The full text is reproduced below:

REQUEST FOR PROPOSAL — Pixel Palace Arcade

Dear Student Engineers,

My name is Pat "Pac" Manning, and I am the owner of Pixel Palace Arcade — a small arcade with about a dozen games that has been part of this community for almost ten years. For the past two years, my arcade has been losing money. I think I know one possible reason, but I am not sure, and that is why I am writing to you.

Here is what I have noticed: most of the kids who come into Pixel Palace head straight for the easiest games — the ones where almost everyone wins a small prize. Those are also the games where I am giving away the most prizes, which means those games are costing me money. The harder games — the ones with the bigger prizes — sit empty most of the time. My theory is that my games are too easy, my prizes are too cheap, and kids are losing interest. But I might be wrong. Maybe the problem is something else entirely.

I have hired your team to do market research and help me decide what to do. I would like your team to:

1. Use survey data from kids your age to figure out what they actually want from an arcade.

2. Look at the games I currently have, calculate how much each game costs me to run and how much profit each one is making, and tell me which games are helping my business earn money and which ones aren't.

3. Give me your recommendations: which games should I keep, which should I change, and which should I remove? Tell me what the data says, not just what you think.

Thank you for your help.

Pat "Pac" Manning

Owner, Pixel Palace Arcade

After reading the RFP, distribute the "Games at Pixel Palace Arcade" reference sheet. This sheet lists eight games currently in the arcade along with the price per play, prize cost per play, operating cost per play, plays per day, and a notes column. Students will use this list throughout the rest of the unit.

Walk students through the requirements and constraints embedded in the RFP. Make these explicit, since students will reference them in Activity 4:

Requirements (what your recommendation must include):

- A summary of what the survey data (collected in Activity 1) tells us about kids your age
- A cost analysis and profit analysis for each game in the arcade
- A clear set of recommendations: keep, change, or remove — with reasoning
- Evidence from the data, not just opinions

Constraints (the limits you must work within):

- You must use the games already in the arcade
- Your recommendations must use survey data the class actually collected in Activity 1
- Your final proposal must fit on the proposal template (one to two pages)
- You have five class sessions total to complete the work

Part 2 — Prediction Wall (Sticky Notes): 15 min

Before any analysis, have each group make predictions about Pat's games. Hand each group a stack of sticky notes (one color per group) and direct them to the prediction chart.

On the chart, students place sticky notes for each of the eight games into one of three columns:

- Money-Maker — we predict this game is making the arcade money
- OK — we predict this game is breaking even or making a little money
- Loser — we predict this game is losing the arcade money

Groups should write a short reason on the back of each sticky note. The class will return to this prediction wall in Activity 2.4 (after the cost and profit analysis) to compare predictions to the data.

DISCUSSION PROMPTS

- In your own words, what problem is Pat asking us to solve?
- What does Pat think the problem is? Do you think Pat is right? Why or why not?
- What information do we already have? What do we still need?
- Look at the games in the arcade. Which ones do you predict will be most profitable? Which ones do you think kids actually want to play? Are those the same games?

Have each group write a one-sentence problem statement in their engineering design log. They will revisit and revise this statement in Activity 4.

Part 3 — Reflection: 5 min

As a class or as a ticket-out-the-door:

- What is the difference between an opinion and a recommendation backed by data?
- If Pat could only ask kids one question to help fix the arcade, what should the question be? Why?

ACTIVITY 3

Class Data Visualization

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

TIME
~50 min

Students explore how data can be visualized to support decision-making. They analyze the data collected in the "Your Favorite Things" survey, create a class-level visualization, and identify which survey data will help them make recommendations to Pat.

SETUP & MATERIALS

- Compile the class's survey responses.
- Prepare a blank two-axis chart for arcade survey data visualization (large laminated wall chart works well across class periods).
- Print responses to qualitative survey question and cut into individual strips of paper (1 set per group)

Part 1 — Building the Class Chart: 20 min

This activity introduces data visualization — how data can be graphed and represented to help people extract meaning.

Use the two-axis chart to plot students' answers to two of the survey questions. The recommended pairing is:

- Rows: How often do you go to an arcade? (never / a few times a year / monthly / weekly+)
- Columns: Favorite type of arcade game (Skee-Ball / target games / basketball or sports / claw or prize machines / racing or driving / other)

Each student places a dot in the cell that fits them. Once the chart is filled in, lead a discussion using guiding questions like the ones below.

DISCUSSION PROMPTS — READING THE CHART

- How many students go to an arcade weekly or more? How many never go?
- Of the students who go to arcades often, which game type is most popular?
- Are there patterns? Are the most popular games different for kids who visit often vs. rarely?
- If you were Pat, which group of customers would you most want to attract?

Part 2 — Qualitative Data Sort: 20 min

Remind students that data can be quantitative (numbers) or qualitative (words) — both forms are useful.

Give student groups the responses from the open-ended survey question ("What is one thing that would make you want to go to an arcade more often?") printed on individual strips of paper.

Ask students to group the responses into categories of their choosing.

Ask: What can we learn from this data? Do you notice any patterns?

Part 3 — What Data Matters for the Arcade?: 10 min

Lead a discussion about which survey data will actually help students make recommendations to Pat. Students should identify the survey questions they think are most relevant and explain why. Capture their answers on the board so groups can reference them throughout the unit.

DISCUSSION PROMPTS — WHICH DATA MATTERS?

- Which survey questions tell us what kids want from an arcade?
- Which questions tell us what kids are willing to pay?
- Are there any questions that don't help us at all? (That's okay — not all data is useful for every problem.)
- Numbers aren't the only useful data. What words or descriptions in the survey could help Pat?

ACTIVITY 4

Working as Engineers

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

TIME
~50 min

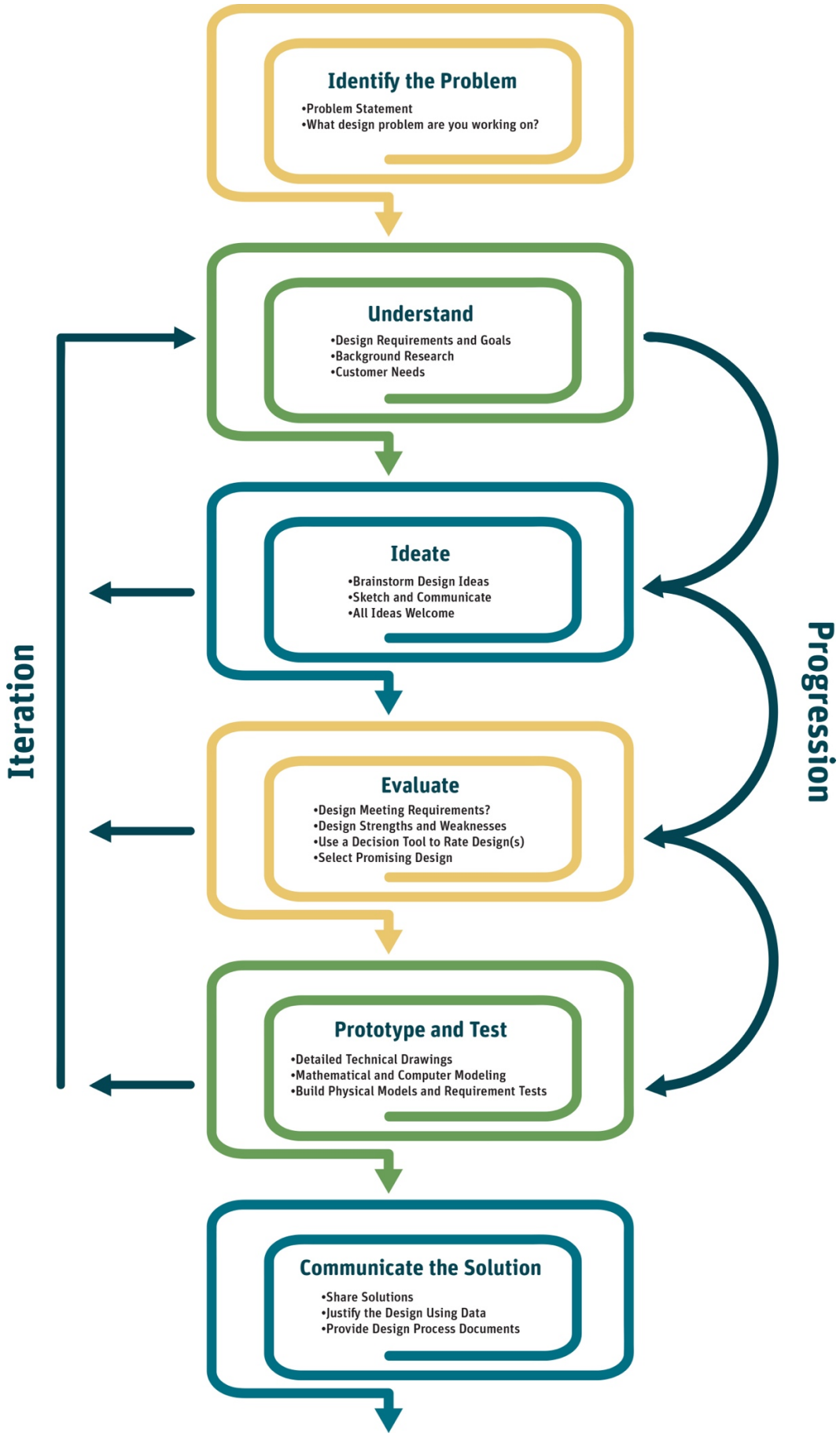
Students are introduced to the Engineering Design Process (EDP) and use it as a framework for tackling the arcade challenge. Part 1 (introducing the EDP) can be taught at the end of Day 2 after the RFP. Part 2 (anchoring the arcade problem in the EDP) is taught at the start of Day 4 to set up the cost and profit work.

SETUP & MATERIALS

- Engineering Design Process (EDP) poster
- RFP and Games at Pixel Palace Arcade reference sheet from Activity 2
- Engineering Notebooks

Part 1 — Working as Engineers: 25 min (Day 2)

As engineers design and develop concepts, they use the Engineering Design Process. Guide students through the parts of the EDP using the EDP Poster. Emphasize that the process is not linear — engineers often go through many rounds of ideating, evaluating, prototyping, and testing before settling on the best solution.


Identify the Problem
•Problem Statement
•What design problem are you working on?
Understand
•Design Requirements and Goals
•Background Research
•Customer Needs
Ideate
•Brainstorm Design Ideas
•Sketch and Communicate
•All Ideas Welcome
Evaluate
•Design Meeting Requirements?
•Design Strengths and Weaknesses
•Use a Decision Tool to Rate Design(s)
•Select Promising Design
Prototype and Test
•Detailed Technical Drawings
•Mathematical and Computer Modeling
•Build Physical Models and Requirement Tests
Communicate the Solution
•Share Solutions
•Justify the Design Using Data
•Provide Design Process Documents
Iteration
Progression

Part 2 — Anchoring the Arcade Challenge in the EDP: 25 min (Day 4)

In their groups, students use the EDP to make sense of the arcade problem they were introduced to in Activity 2. The focus here is on Identify the Problem and Understand — the early stages of the design process. This sets up the cost and profit analysis later in the same day.

Walk students through the following sequence in their engineering design logs:

1. Identify the Problem: Each group revises the problem statement they wrote in Activity 2. A strong problem statement names who has the problem (Pat, the arcade owner), what is going wrong (losing money, kids favoring easy games), and what data we have access to (the class survey, the arcade game list).
2. Understand — Requirements: Have each group list every requirement from the RFP. Compare lists as a class. A complete list should include: must use survey data, must include a cost analysis, must include a profit analysis, must give specific recommendations (keep / change / remove), must back up recommendations with evidence.
3. Understand — Constraints: Have each group list the constraints. A complete list should include: cannot design new games, must use only the games on the arcade game list, must fit on the proposal template, must finish within five class sessions.
4. Where are we now?: As a class, point to the EDP poster. Students should recognize that they are still in Identify the Problem and Understand. Ideating (in this challenge, choosing recommendations) comes after the cost and profit work in Activity 5.

End the activity by setting up Activity 5: in order to make good recommendations to Pat, the team needs to know which games are profitable and which are not.

ACTIVITY 5

Determining Costs and Profit

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

TIME
~70 min

Students analyze the cost and profit of every game in Pat's arcade. After a hands-on "Cost Detective" sort that establishes the difference between price-to-play and operating cost, students walk through Skee-Ball as a class example, then complete the cost-per-play and profit-per-play analysis for the rest of the games. The output of this work directly informs the recommendation proposal in Activity 6.

SETUP & MATERIALS

- Print one Arcade Game Cost & Profit Calculation Sheet per group.
- Pixel Palace Arcade Reference Sheet from Activity 2.
- Print and cut Cost Detective Sort Cards (one set per group). Each set has 12–15 cards: items like "the $1 a kid pays," "electricity," "small plush toy," "staff time," "tickets," "maintenance."

Part 1 — Cost Detective + Vocabulary: 15 min

Open with a quick hands-on sort that surfaces a common misconception: students often confuse revenue (the price a customer pays) with costs (what the game actually costs the arcade to run). Doing this with cards before the calculation work makes the difference concrete.

Cost Detective Card Sort (8 min):

Give each group a stack of Cost Detective cards. On chart paper or their desks, students sort the cards into three columns:

- Revenue (money the arcade gets from the customer)
- Prize Cost (money the arcade spends on prizes)
- Operating Cost (everything else the arcade spends to keep a game running)

After 4–5 minutes, do a quick share-out. Most groups will sort some cards correctly and miss others — that's the point. Specifically draw out the Operating Cost pile: electricity, share of staff time, maintenance/repairs, replacement parts, share of rent, share of cleaning supplies. These are costs that don't go away, whether or not anyone plays the game today, but they have to be split across the plays that do happen.

DISCUSSION PROMPTS — COST DETECTIVE

- Which cards were easy to sort? Which were hard?
- Where does the $1 a kid pays go? (revenue) Where does the electricity go? (operating cost)
- Why are operating costs split across each play instead of being one big number?
- If only one person played Skee-Ball all day, would the operating cost per play be higher or lower than if 100 people played?

Vocabulary (5 min):

Introduce or review the cost-and-profit terms students will use throughout this activity. Have students copy them into their engineering design log.

KEY VOCABULARY	
Price per play	The amount of money a customer pays the arcade to play one round of a game. This is the arcade's revenue per play.
Prize cost per play	The average amount the arcade spends on prizes (tickets, plush toys, etc.) per play.
Operating cost per play	The share of behind-the-scenes costs (electricity, staff time, maintenance) attributed to one play of a game.
Plays per day	The estimated number of times the game is played in a typical day.
Revenue	Money the game brings in. For an arcade game, revenue = price per play × plays per day.
Profit	Revenue minus cost. If a game's profit is negative, the game is losing money.

Part 2 — Walking Through Skee-Ball Example Together: 20 min

Walk through the cost analysis for one game as a class — Skee-Ball is a great starting point because most students recognize it. Use the scaffolded prompts below; let students answer before you reveal each piece.

SCAFFOLDED CLASS PROMPTS — SKEE-BALL

Set the scene. “A kid walks up to the Skee-Ball machine, puts in a dollar, plays one round, wins a few tickets, and walks away. Let’s figure out exactly what just happened to Pat’s money.”

Q1 (revenue side). “What does Pat GET when someone plays Skee-Ball?” → Answer: $1. That’s the price per play, also the revenue per play.

Q2 (prize side). “What does Pat SPEND on prizes when someone plays Skee-Ball?” → Lead students to: a typical Skee-Ball play earns about 5 tickets, and tickets cost the arcade about $0.04 each. 5 × $0.04 = $0.20 in tickets per round of play. That’s the prize cost per play.

Q3 (the tricky one — operating cost). “What ELSE does it cost Pat to keep this Skee-Ball machine running, even if no one was playing right now?” → Brainstorm together: electricity, share of staff time to fix a jam, maintenance and replacement parts, share of cleaning the building, share of rent. These are operating costs.

Q4 (splitting operating cost). “If electricity for the Skee-Ball machine costs $6 a day and 60 people play it per day, how much electricity is that PER PLAY?” → $6 ÷ 60 = $0.10 per play. (Round numbers from the reference sheet say total operating cost per play for Skee-Ball is about $0.20.)

Q5 (total cost). “Add prize cost per play and operating cost per play. What’s Pat’s total cost for one play of Skee-Ball?” → $0.20 + $0.20 = $0.40. Write this on the board.

Q6 (profit per play). “Pat got $1 from the kid. Pat spent $0.40 on prize and operating costs for that one play. So how much money did Pat actually make?” → $1.00 − $0.40 = $0.60 profit per play.

Q7 (daily profit). “If 60 people play Skee-Ball each day, how much profit does Skee-Ball make Pat in a day?” → 60 × $0.60 = $36 per day. That’s real money — Skee-Ball is one of Pat’s best-earning games.

Big idea to land. Price is what the customer pays. Cost is what the arcade spends. Profit is what’s left after subtracting cost from revenue.

After the walkthrough, have each group complete the cost-per-play column for every game on the reference sheet, using their Calculation Sheet. Alternatively, assign games for each group to complete calculations for and then have them share their answers to complete the cost-per-play column as the class. Circulate and look for groups confusing price and cost.

DIFFERENTIATION

For groups that finish early, ask them to identify which costs are fixed (don’t depend on how many people play) versus variable (go up the more people play). This sets up a richer profit conversation in Part 3.

Part 3 — Profit Analysis and Looking at the Notes Column: 30 min

Once cost-per-play is calculated for each game, students estimate daily profit. The reference sheet provides estimated plays per day for each game (based on Pat's observations) so students don't need to invent their own numbers.

Worked example: Skee-Ball (continued from Part 2)

- Plays per day: 60
- Daily revenue: 60 × $1.00 = $60.00
- Daily cost: 60 × $0.40 = $24.00
- Daily profit: $60.00 − $24.00 = $36.00

Have students compute daily profit for every game on the list. Then, ask students label games according to the three categories: Money-Maker, OK, and Loser.

DON'T FORGET THE NOTES COLUMN — QUALITATIVE DATA

The Notes column on the Games reference sheet is qualitative data — observations and descriptions Pat shared. It's just as important as the numbers. Pause the class when groups have completed the bucket sort and prompt:

- "What do the Notes tell you that the numbers don't?" (e.g., a game might be profitable per play but "rarely played" or "popular with younger kids only.")
- "If two games are both Money-Makers, but one is 'popular with all ages' and the other is 'only popular with kids under 8,' which is the safer bet for Pat?"

Make sure students understand that they can use both the numbers AND the Notes to inform their recommendations.

Have each group circle three findings on the calculation sheet that they think are most important for Pat to know. These will become the backbone of their recommendation proposal in Activity 6.

Return to the Prediction Wall:

Walk over to the prediction wall from Activity 2. As a class, compare the predictions to what the data showed. Which predictions were right? Which were surprising? Did Pat's theory (games too easy, prizes too cheap) hold up so far?

Cost and Profit Calculation Sheet (Teacher Key)

TEACHER USE ONLY

This filled-in key matches the numbers on the Games Reference Sheet (Handout 2). Use it to check student work and as a reference during the bucket sort discussion.

Note that two games — Claw Machine and Storm-the-Castle — are clear losers (negative profit). The remaining games are either solid money-makers or borderline (Ring Toss is the only OK bucket case).

Game	Plays / day	Cost / play	Revenue / play	Profit / play	Daily profit & bucket
Skee-Ball	60	$0.40	$1.00	$0.60	**$36.00** Money-Maker
Basketball Hoops	45	$0.40	$1.00	$0.60	**$27.00** Money-Maker
Claw Machine	25	$2.60	$2.00	−$0.60	**−$15.00** Loser
Whack-a-Mole	50	$0.30	$1.00	$0.70	**$35.00** Money-Maker
Storm-the-Castle	10	$1.80	$1.50	−$0.30	**−$3.00** Loser
Ring Toss	40	$0.15	$0.50	$0.35	**$14.00** OK
Racing	35	$0.30	$1.50	$1.20	**$42.00** Money-Maker
Air Hockey	40	$0.30	$1.00	$0.70	**$28.00** Money-Maker

DISCUSSION ANSWERS — FOR REFERENCE

"Three findings I want Pat to notice": Claw Machine is losing $15/day, Storm-the-Castle is losing $3/day, but Skee-Ball, Whack-a-Mole, and Racing are all making solid daily profit.

"What do the Notes tell you that the numbers don't?": Whack-a-Mole, the game Pat thinks is a problem ("almost everyone wins"), is actually one of Pat's best earners because so many kids play it. The actual losers are the hard games no one plays.

"Was Pat right?": The data does not support Pat's theory. The easy games with cheap prizes (Whack-a-Mole, Skee-Ball, Ring Toss) are mostly money-makers. The losers are the hard, expensive-to-maintain games (Claw Machine, Storm-the-Castle).

ACTIVITY 6

Recommendations to Pat

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

TIME
~60 min

Students synthesize their survey analysis and cost/profit work into a recommendation proposal for Pat. The proposal is structured by a scaffolded template so all groups produce a comparable artifact within the time available.

The class wraps the unit with a short Recommendations Roundtable — a quick, debate-style sharing format — to surface disagreements and reasoning.

SETUP & MATERIALS

- Print one Arcade Recommendation Proposal Template per group
- Have students bring their completed Cost & Profit Calculation Sheets and any survey notes.
- Arrange the room so groups can stand or sit in two camps for the Roundtable.

Part 1 — Walking Through the Proposal Template: 10 min

Project the Arcade Recommendation Proposal Template and walk through each section. Emphasize that every claim in the proposal must be supported with evidence from the survey OR the cost/profit analysis (and ideally both). The template has these sections:

1. Problem Statement — In your own words, what is Pat's problem?
2. What the Survey Data Tell Us — Two or three findings from the class survey relevant to the arcade.
3. What the Cost and Profit Data Tell Us — Two or three findings from the cost/profit analysis.
4. Our Recommendations — For each game in the arcade: KEEP, CHANGE, or REMOVE, with one-sentence reasoning grounded in the data. Remind students that they can us both numbers (quantitative data) and notes (qualitative data).
5. Big Picture — Do you agree with Pat's theory that the games are too easy and prizes are too cheap? Why or why not?

Part 2 — Drafting the Proposal: 25 min

Groups work together to fill in the proposal template. Circulate and prompt:

- What evidence supports that recommendation?
- Are your reasons grounded in survey data, cost data, qualitative notes, or all three?
- If two groups disagree about a game, that's fine — but each group needs to defend its reasoning.

Part 3 — Recommendations Roundtable: 20 min

Wrap the unit with a short, debate-style sharing format. Pose the central question to the class:

THE BIG QUESTION

- Was Pat right? Are the games at Pixel Palace too easy and the prizes too cheap?
- Or is the real problem something else?

Run the Roundtable in three quick rounds:

1. Round 1 — Take a stand (3 min): Have students physically move to one of two sides of the room — "Pat is right" or "Pat is wrong." Groups can split if members disagree. The visual takes the temperature of the class.
2. Round 2 — Make your case (10 min): Each side gets two minutes to present their best evidence. Then each side gets two minutes to respond to the other. Limit each turn to data-backed reasoning — no repeating, no opinions without evidence.
3. Round 3 — Move if you've been convinced (5 min): Invite students to switch sides if the other team's evidence changed their mind. Note any movement and discuss what evidence was most persuasive.

SUBMISSION

Groups submit their completed proposals at the end of the period. The Roundtable is not graded — it's a way to make the reasoning visible.

OPTIONAL EXTENSION — SLIDE DECK OR VIDEO

If your class has time and you want a presentation component, give each group the option to also prepare a 2-minute slide deck (no more than 3 slides) or a 60-second video summarizing their proposal.

LOOKING AHEAD — THE SYSTEMS CHALLENGE

"Pat's arcade is still losing money. Your data work helped narrow down the problem — but no one has actually tested whether the games are too easy. In the next unit, you will design and build catapult-based games and use experiments to test the odds of winning. Did the data tell you the truth? Time to find out."

Companion Handouts

Handout 1 — Your Favorite Things Survey

Name: _____ Date: _____

INSTRUCTIONS

- Answer each question honestly. There are no right or wrong answers.
- For multiple-choice questions, fill in the circle next to your choice.
- If a question has an “other” option, fill in the circle and write your answer on the line.

General Section

1. **How many siblings do you have?**
   - ○ 0
   - ○ 1
   - ○ 2
   - ○ 3
   - ○ 4
   - ○ 5 or more
2. **What is your favorite weekend activity?**
   - ○ Sports
   - ○ Video games
   - ○ Hanging out with friends
   - ○ Reading
   - ○ Watching TV / movies
   - ○ Outdoor activities
   - ○ Art / music
   - ○ Other: _____
3. **What is your favorite kind of snack?**
   - ○ Sweet
   - ○ Salty
   - ○ Sour
   - ○ Spicy
   - ○ No preference
4. **Which best describes you?**
   - ○ I love trying new things
   - ○ I like sticking with what I know
   - ○ Somewhere in between

Arcade & Game Section

5. **How often do you go to an arcade?**
    - ○ Never
    - ○ A few times a year
    - ○ Monthly
    - ○ Weekly or more

6. **If you have been to an arcade, what is your favorite type of game?**
    - ○ Skee-Ball or target games
    - ○ Basketball / sports games
    - ○ Claw or prize machines
    - ○ Racing or driving games
    - ○ Ticket-redemption games like Whack-a-Mole
    - ○ Other: _____

7. **How much would you pay to play one game at an arcade?**
    - ○ $0.50
    - ○ $1
    - ○ $2
    - ○ $3
    - ○ More than $3

8. **What kind of prize would make you want to keep playing?**
    - ○ Small toys
    - ○ Candy
    - ○ Big stuffed animals
    - ○ Electronics
    - ○ No prize — I just want to win

9. **What is more fun?**
    - ○ A game where almost everyone wins a small prize
    - ○ A game where almost no one wins but the prize is huge

10. **If you went to an arcade and didn't have fun, what was probably the reason?**
    - ○ The games were too easy
    - ○ The games were too hard
    - ○ The prizes were boring
    - ○ The games were too expensive
    - ○ The arcade was too crowded
    - ○ Other: _____

11. **What is one thing that would make you want to go to an arcade more often?**

_____

_____

_____

_____

Handout 2 — REQUEST FOR PROPOSAL — Pixel Palace Arcade

Dear Student Engineers,

My name is Pat "Pac" Manning, and I am the owner of Pixel Palace Arcade — a small arcade with about a dozen games that has been part of this community for almost ten years. For the past two years, my arcade has been losing money. I think I know one possible reason, but I am not sure, and that is why I am writing to you.

Here is what I have noticed: most of the kids who come into Pixel Palace head straight for the easiest games — the ones where almost everyone wins a small prize. Those are also the games where I am giving away the most prizes, which means those games are costing me money. The harder games — the ones with the bigger prizes — sit empty most of the time. My theory is that my games are too easy, my prizes are too cheap, and kids are losing interest. But I might be wrong. Maybe the problem is something else entirely.

I have hired your team to do market research and help me decide what to do. I would like your team to:

1. Use survey data from kids your age to figure out what they actually want from an arcade.

2. Look at the games I currently have, calculate how much each game costs me to run and how much profit each one is making, and tell me which games are helping my business earn money and which ones aren't.

3. Give me your recommendations: which games should I keep, which should I change, and which should I remove? Tell me what the data says, not just what you think.

Thank you for your help.

Pat "Pac" Manning

Owner, Pixel Palace Arcade

Handout 3 — Games at Pixel Palace Arcade Reference Sheet

Name: _____ Date: _____

INSTRUCTIONS

- This is the list of games Pat currently has in the arcade. Use it to calculate cost and profit for each game in Activity 5.
- Pay attention to the Notes column — those observations are data too.

Game	Price / play	Prize cost / play	Operating cost / play	Plays / day	Notes
Skee-Ball	$1.00	$0.20	$0.20	60	Easy to win small prizes; popular with younger kids.
Basketball Hoops	$1.00	$0.30	$0.10	45	Mid-difficulty; popular with older kids.
Claw Machine	$2.00	$2.30	$0.30	25	Hard to win; expensive plush prizes when someone does.
Whack-a-Mole	$1.00	$0.15	$0.15	50	Almost everyone wins; tickets only.
Storm-the-Castle (catapult target)	$1.50	$1.30	$0.50	10	Fun to watch but rarely played; nobody wins the big prize.
Ring Toss	$0.50	$0.10	$0.05	40	Cheap to play; small prizes for almost everyone.
Racing (2-player)	$1.50	$0.00	$0.30	35	No prizes; energy and maintenance costs only.
Air Hockey (2-player)	$1.00	$0.00	$0.30	40	No prizes; very popular with groups.

Handout 4 — Cost Detective Cards

The $1 a kid pays for one Skee-Ball play	5 tickets at $0.04 each	Electricity for the Skee-Ball machine	The $2 a kid pays for one Claw Machine play
A $1.50 plush prize	Paying staff for time to fix a jam	The quarters in the cash register	A small candy from the prize counter
Replacement parts for a broken claw	Arcade game maintenance and repairs	The building’s rent	Cleaning supplies

Handout 5 — Arcade Game Cost and Profit Calculation Sheet

Name: _____ Date: _____

INSTRUCTIONS

- For each game, fill in the right-hand columns using the Games Reference Sheet (Handout 2).
- Cost / play = prize cost / play + operating cost / play
- Profit / play = price / play − cost / play
- Daily profit = profit / play × plays / day
- In the last column, label each game as Money-Maker, OK, or Loser.

Game	Plays / day	Cost / play	Revenue / play	Profit / play	Daily profit & bucket
Skee-Ball	60				
Basketball Hoops	45				
Claw Machine	25				
Whack-a-Mole	50				
Storm-the-Castle	10				
Ring Toss	40				
Racing	35				
Air Hockey	40				

Three findings I want Pat to notice:

_____

_____

_____

What do the Notes column tell you that the numbers don't?

_____

_____

Was Pat right that the games are too easy and the prizes are too cheap? What does the data say?

_____

_____

Handout 6 - Pixel Palace Arcade Recommendation Template

Team / Group: _____

Group members: _____

INSTRUCTIONS

- Fill in the right-hand column for each section. Aim for 1–2 pages total.
- Every claim should be supported by evidence — either from the survey or from the cost/profit data.

Section	Your team's response
1. Problem Statement In your own words, what is Pat's problem?	
2. What the Survey Data Tell Us Two or three findings from the class survey.	
3. What the Cost and Profit Data Tell Us Two or three findings from your cost/profit analysis.	

4. Our Recommendations

Place each game in either the KEEP, CHANGE, or REMOVE column.
Use the data (numbers AND notes).

KEEP	CHANGE	REMOVE

If you recommend changing any games, describe the changes you suggest:

_____

_____

_____

5. Big Picture Do you agree with Pat's theory that the games are too easy and the prizes are too cheap? Why or why not?

_____

_____

_____

_____

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