Teacher Guide for Scatterplot Correlation Project

1 Purpose and Learning Objectives

This hands-on project strengthens student understanding of bivariate relationships, specifically:

- Describing association (form, direction, strength) in context

- Quantifying linear strength using correlation coefficient r

- Applying the ellipse method as a visual tool for estimating r

- Distinguishing correlation from causation

2 AP Statistics Standards Alignment

Standard	Description	Project Component
DAT-1.A.1	Describe patterns in bivariate data including form, direction, strength, and unusual features	DUFS statement
DAT-1.A.2/3	Identify and explain positive vs negative associations in context	Direction identification
DAT-1.A.5	Describe strength of association using appropriate language	Strength description with r
DAT-1.B.1	Calculate and interpret correlation coefficient r	Ellipse method calculation
DAT-1.C.1	State properties of r (unit-free, $-1 \leq r \leq 1$)	Understanding r bounds
DAT-1.C.2	Explain that correlation does not imply causation	Causation disclaimer
DAT-1.A.3	Identify explanatory and response variables	Variable labeling

3 Pre-Class Preparation (15 minutes)

3.1 Materials to Prepare

- **Google Form** with 6–8 quick survey questions (see suggestions below)

- **Equal-scale graph paper templates** (print on 11×17 paper if possible)

- **Station supplies** for measurement pairs:

  - Tape measures/meter sticks (at least 3)
  - Rulers for reaction test (2–3)
  - Stopwatches or phone timers
  - Masking tape for marking distances

- **Sticky notes** in two colors for gallery walk

- **Posted materials:**
  - Variable choice board (on board or projected)
  - DUFS sentence frames
  - Equal scaling reminder poster

3.2 Google Form Survey Questions

Include these for shared data collection:

1. Hours of sleep last night (to nearest 0.5)

2. Screen time yesterday (hours)

3. Minutes since you last ate

4. Current hunger level (0–10 scale)

5. Number of apps on your phone

6. Birthday (day of year, 1–365)

7. Number of siblings

8. Estimated hours spent on homework weekly

4 Class Timeline (45 minutes total)

> **Timing Adjustment:** Full activity requires 45 minutes (40 min work + 5 min gallery)

4.1 Launch (0–5 minutes)

- Show example scatterplot on board
- Quick review: "What's the direction? Strength?"
- Emphasize: **"Equal scales are essential for the ellipse method!"**
- Display the ellipse formula prominently

4.2 Group Formation & Variable Selection (5–8 minutes)

- Form groups of 2–3 students
- Each group selects unique variable pair from board
- Assign roles: data collector, plotter, calculator, writer
- Distribute materials to each group

4.3 Data Collection Phase (8–20 minutes)

- **All students:** Complete Google Form (2 min)

- **Survey variable groups:** Pull data from form responses

- **Measurement groups:** Set up station and collect from 12–18 classmates

- **Teacher:** Circulate to ensure efficient data collection

4.4 Plotting & Analysis (20–32 minutes)

- **Minutes 20–24:** Create scatterplot with equal scales

- **Minutes 24–28:** Draw ellipse, mark axes

- **Minutes 28–32:** Calculate r, determine sign

- **Teacher:** Check equal scaling before groups draw ellipses!

4.5 DUFS Statement Writing (32–37 minutes)

- Groups write contextual conclusions

- Include all required elements

- Add "correlation $\neq$ causation" statement

4.6 Gallery Walk (37–45 minutes)

- Post all posters

- Students rotate with sticky notes

- Quick whole-class debrief: Which shows strongest $|r|$? Any surprises?

5 Variable Pair Options

Variable Pair	Expected Pattern	Expected r	Type
Height vs Wingspan	Strong positive linear	+0.8 to +0.95	Measurement
Hand span vs Foot length	Moderate positive	+0.5 to +0.7	Measurement
Shoe size vs Height	Strong positive	+0.7 to +0.9	Mixed
Screen time vs Sleep hours	Moderate negative	−0.3 to −0.6	Survey
Ruler drop vs Reaction taps	Moderate negative	−0.4 to −0.7	Measurement
Minutes since ate vs Hunger	Curved positive	r misleading	Survey
Phone apps vs Homework hrs	Weak/none	−0.2 to +0.2	Survey
Birthday vs Shoe length	No association	−0.1 to +0.1	Mixed
Birth month vs Siblings	No association	−0.1 to +0.1	Survey

6 Assessment Rubric

Component	Criteria	Points
Data & Labels	- Variables clearly identified with units x and y axes properly labeled - Data table complete (12–18 pairs)	2
Graph Quality	- Equal scales used and explicitly stated - Points plotted accurately - Axes have appropriate range	2
Ellipse & r Calculation	- Symmetric ellipse drawn - Major/minor axes marked and measured - Formula correctly applied - Correct sign assigned	3
DUFS Statement	- Form, direction, strength described - Uses calculated r value - Context maintained throughout - Includes causation disclaimer	3
	Total	**10**

7   Common Issues & Solutions

> **Critical Issues to Monitor**
>
> 1. **Unequal Scales**
>
>   - Check each group's axes before they draw ellipse
>   - Have them write "1 cm = __ units" for both axes
>   - Provide pre-scaled templates if needed
>
> 2. **Ellipse Drawing**
>
>   - Emphasize symmetry
>   - Major axis goes through "longest" direction
>   - Minor axis is perpendicular to major
>
> 3. **Sign Confusion**
>
>   - Positive: points trend up-right
>   - Negative: points trend down-right
>   - Near zero: no clear trend

8   Differentiation Strategies

8.1   For Struggling Students

- Provide pre-made equal-scale grids
- Pair with stronger peer
- Give "high correlation" pairs (Height vs Wingspan)
- Provide completed example as reference

8.2   For Advanced Students

- Have them calculate actual r using technology
- Compare ellipse estimate to calculated value
- Explore residual plots (preview of Unit 2.6)
- Investigate effect of outliers on r

9   Extensions for Next Class

1. **Technology Comparison**

   - Calculate actual r using Desmos or calculator
   - Discuss sources of discrepancy with ellipse method

2. **Regression Preview** (Unit 2.6)

   - Add least-squares regression line
   - Calculate and interpret slope
   - Make predictions using the model

3. **Class Meta-Analysis**

   - Combine all groups' r values
   - Discuss range of correlations observed
   - Which variables were most predictable?

10 Safety Reminders

- No collection of weight, grades, income, or medical information

- All participation is voluntary with opt-out options

- Measurement activities should be done safely (no running for reaction tests)

11 Success Indicators

Students successfully complete this project when they:

- Accurately identify direction from their scatterplot

- Reasonably estimate r using the ellipse method

- Describe strength using their calculated r

- Write conclusions in context

- Distinguish correlation from causation

Note: This project directly addresses the learning gaps you identified—students will leave with a tactile, visual understanding of correlation that connects the abstract r value to the concrete pattern they see in their data.