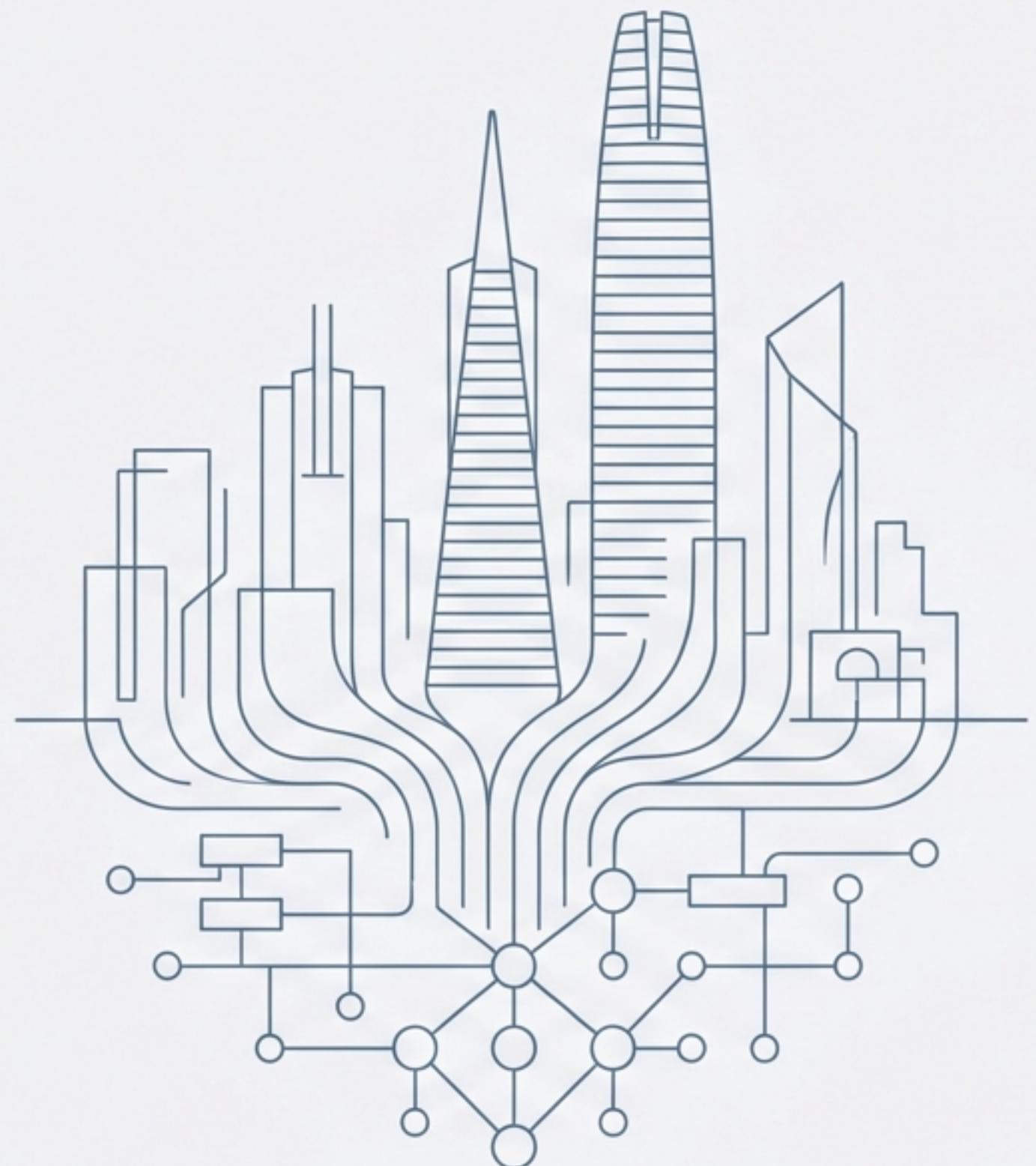


AI Literacy for K-5 in SFUSD: A Research-Informed Framework

Synthesizing UNESCO Competencies,
California Computer Science Standards,
and Peer-Reviewed Empirical Evidence.

INDEPENDENT RESEARCH REPORT

The views and recommendations in this report are those of the author and do not represent the official position of San Francisco Unified School District.



January 2026

Evidence-to-Action: Executive Summary

172

Sources Analyzed

107 Peer-Reviewed Academic Studies

0.351

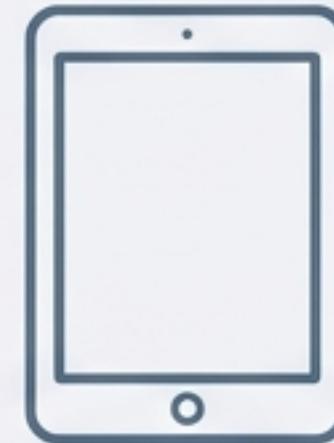
Measurable Effect Size

On Elementary Achievement

3

Aligned Frameworks

UNESCO, CDE, SFUSD



Unplugged First

No-tech activities promote deeper conceptual understanding than tech-first approaches in K-2.



Equity Gap

Tangible, collaborative pedagogies effectively close gender achievement gaps in AI literacy.



Teacher Impact

Addressing teacher misconceptions regarding "AI objectivity" is the strongest predictor of student outcomes.

The Imperative: From Coding to Human-Centered Reasoning

The Reality: AI is embedded in student life.

- Voice assistants & recommendations
- Misconceptions: “AI is human”, “AI is always fair”
- California Dept of Education (2025) emphasizes human-centered AI over advanced coding.

Strategic Shift



The SFUSD Approach: Culturally Responsive.

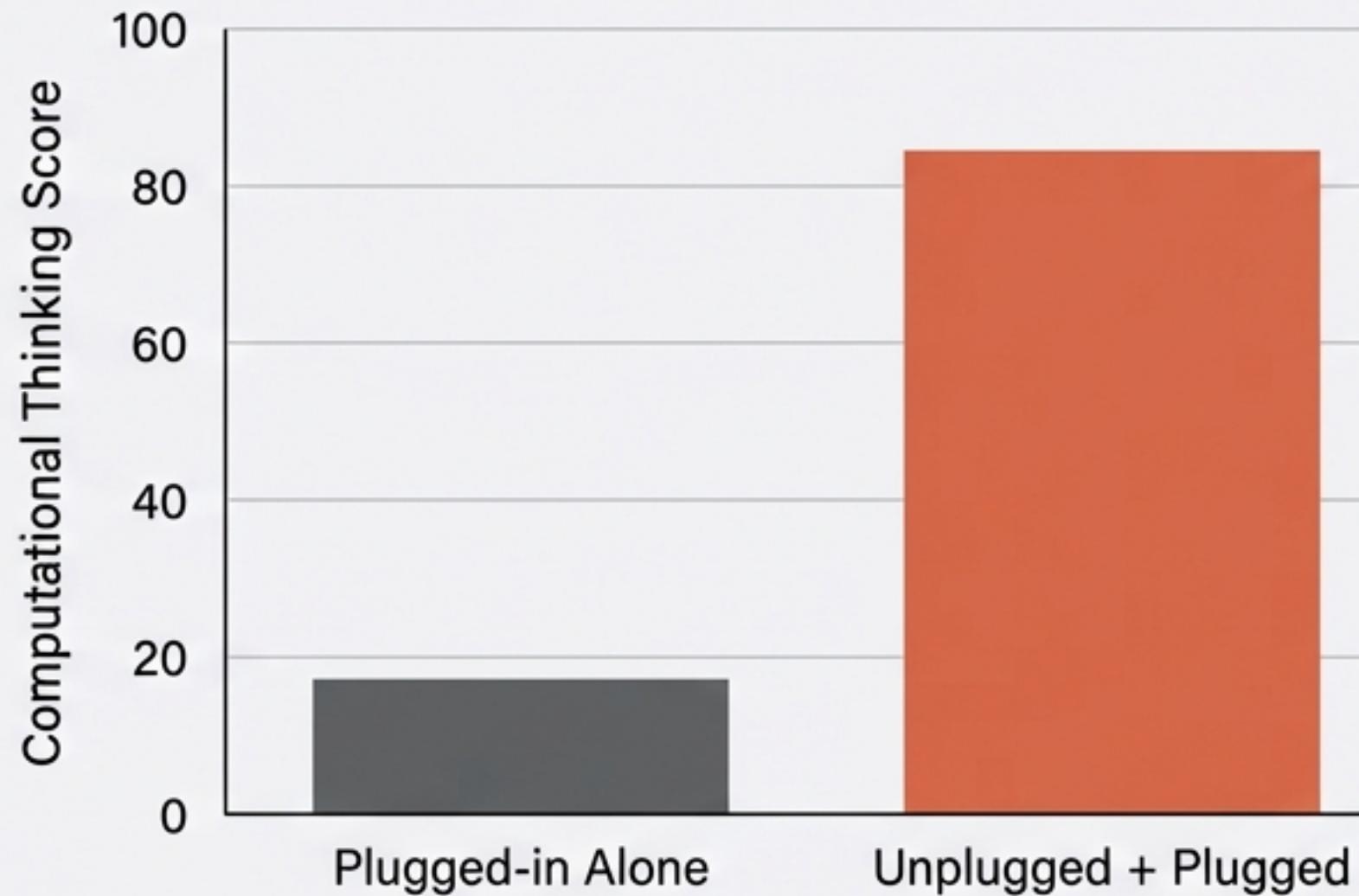
- Leverage Local Context: Tech capital of the world.
- Address Diversity: Multilingual student population.
- Focus Areas: Ethical Reasoning & Early Literacy Development.

Alignment with Global and State Standards



The ‘Unplugged’ Advantage

Physical interaction must precede abstract coding.



Data based on Grade 1-2 quasi-experimental study [web:139].

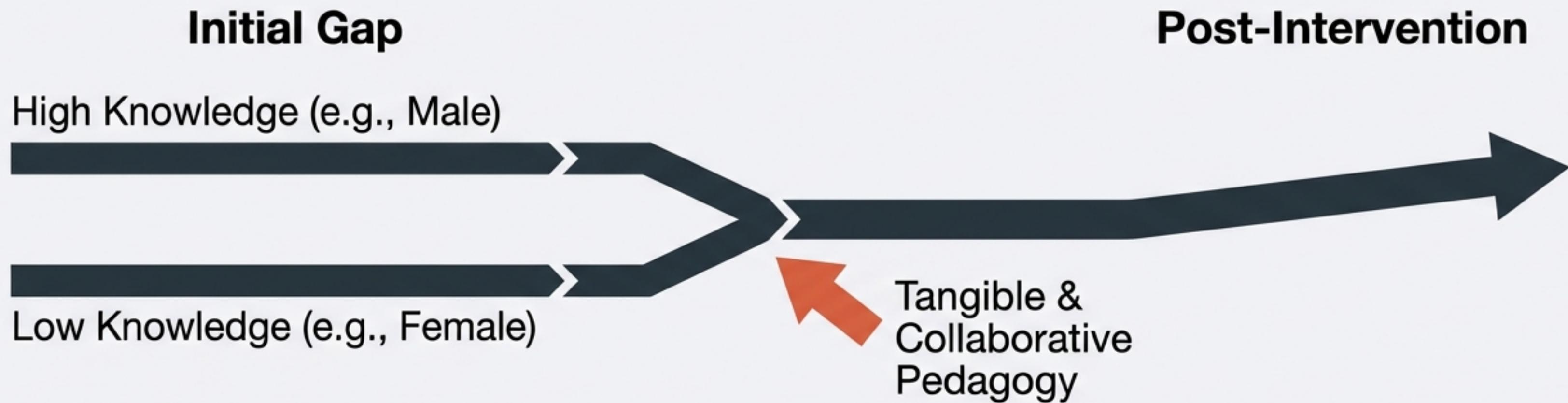
Efficiency

Teachers achieved identical learning objectives with less programming time [web:136].

Accessibility

Unplugged activities serve as a “non-threatening entry point” for students without prior tech access, building motivation [web:133].

Closing the Gender Achievement Gap

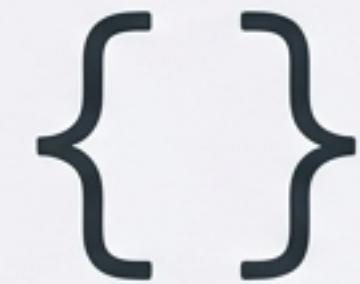
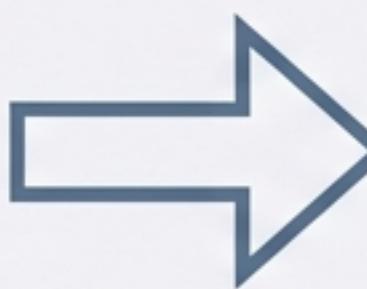
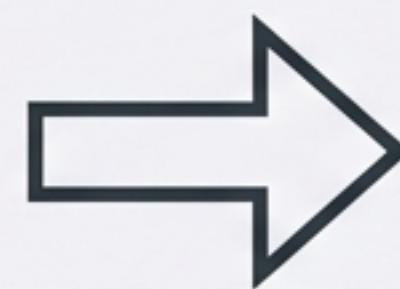


- **Evidence** [web:118]: Initial gender gaps in AI knowledge **closed completely** when using **tangible/collaborative** methods.
- **Insight**: Female and lower-knowledge students often show “AI appreciation bias” (uncritical acceptance). High-knowledge students are more critical. Tangible storytelling levels the playing field [web:164].

Pedagogy: The Concept of “Be-greifbarkeit”

“Be-greifbarkeit” (German)

Intellectual and tangible ‘graspability’.
Understanding through touching.



1. Physical/Tangible
(Yarn, Objects)

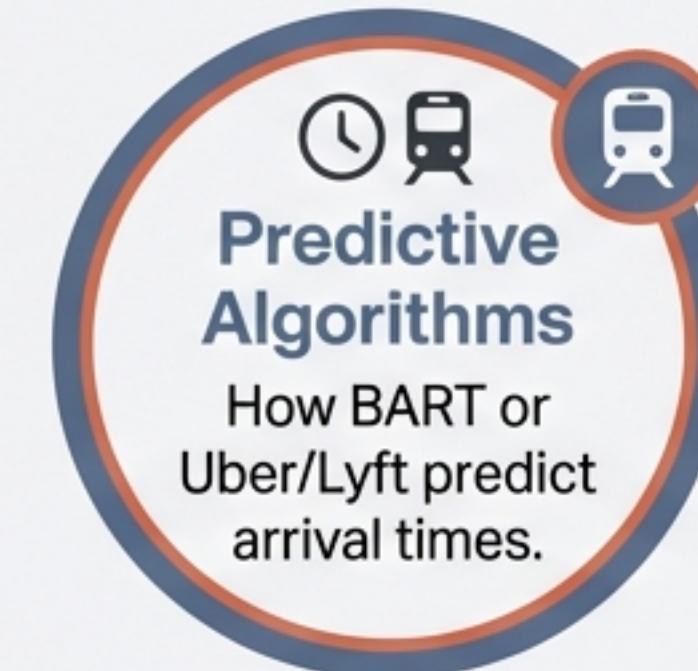
2. Visual
(Mapping/Drawing)

3. Abstract
(Coding/Algorithms)

Nordic research confirms this progression builds the highest self-efficacy and prevents the ‘Black Box’ problem [web:133].

Culturally Responsive AI (CTCA) in San Francisco

Making abstract concepts real using local context.



Research Basis:
CTCA study (N=105) showed statistically significant learning gains ($F=103.01$) when content integrated cultural illustrations [web:121].

K-2 Learning Arc: “Notice & Name”

Goal: Demystify AI by defining it as a tool, not a person.



Vocabulary Guide

Artificial: Human-made (not natural).

Algorithm: Step-by-step list.

Training: Showing examples.

Activity Spotlight (K–2): The “If-Then Robot”

Materials

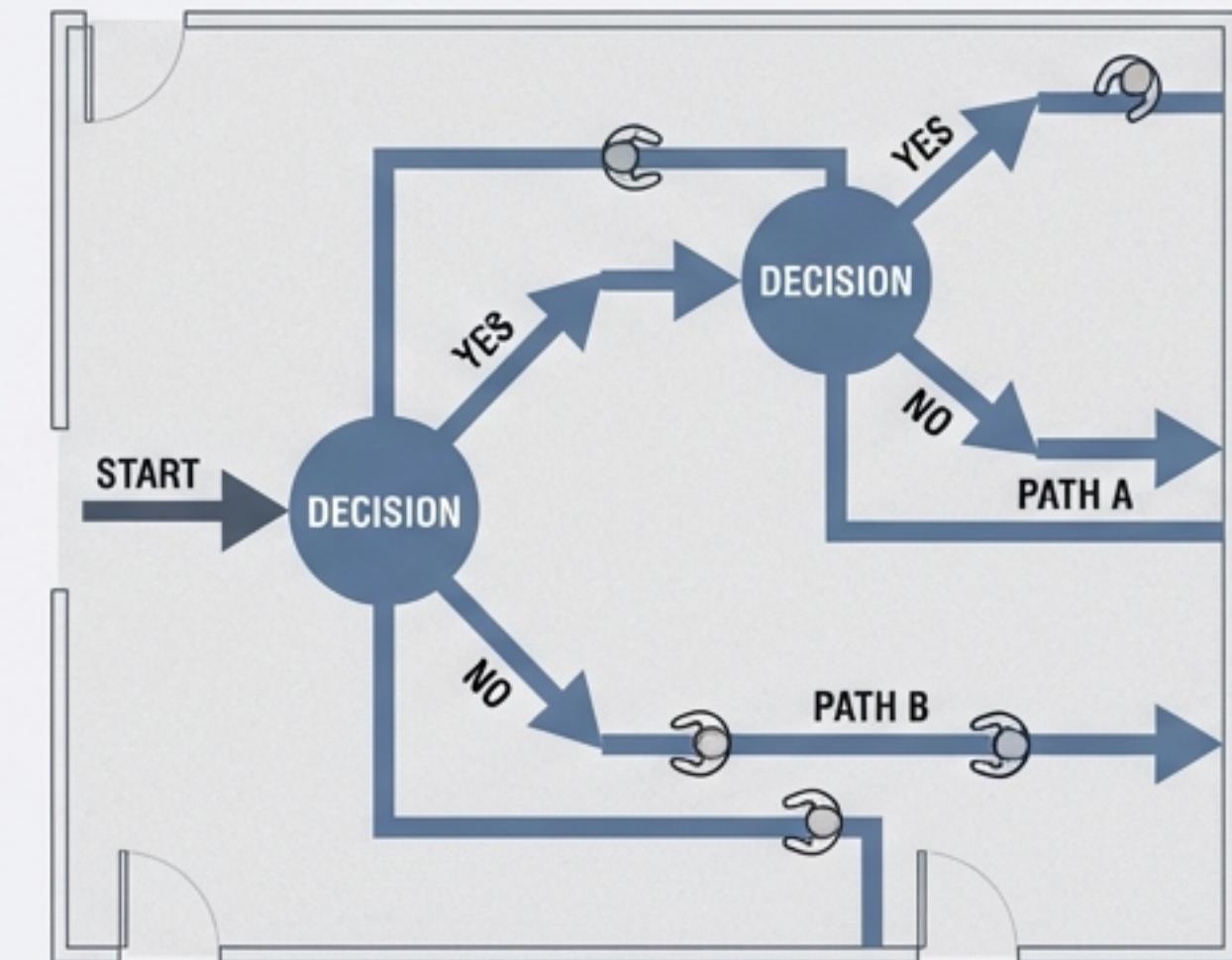
Floor tape or yarn.

Why It Works (Research Badge)

Physical decomposition scaffolds algorithmic thinking [web:136]. Addresses Standard K-2.AP.10.

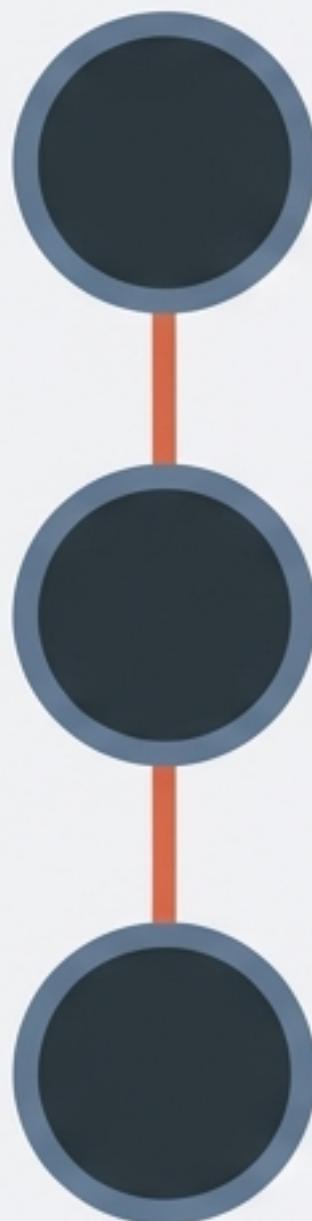
Instructions

1. Create a physical decision tree on the floor.
2. Students take turns being the “robot” following exact YES/NO paths.
3. Discussion: “Why did the robot need exact questions? Why couldn’t it use feelings?”



Grades 3–5 Learning Arc: “Interact & Question”

Critical Shift: Moving from “How does it work?” to “Is it fair?”



Data shapes output

Different training data = different results [web:87].

Bias is systemic

AI can be unfair if the data is incomplete [web:109].

Humans are responsible

We design and guide the systems.
Humans have agency.



Activity Spotlight (3–5): The “Biased Decision-Maker”

Learning Target: Identify whose perspective is missing from the data.

Helvetica Now Display Muted Scenario: Book Recommendations

An app learns from students, but only 15% of the books are by authors of color. What happens to the suggestions?

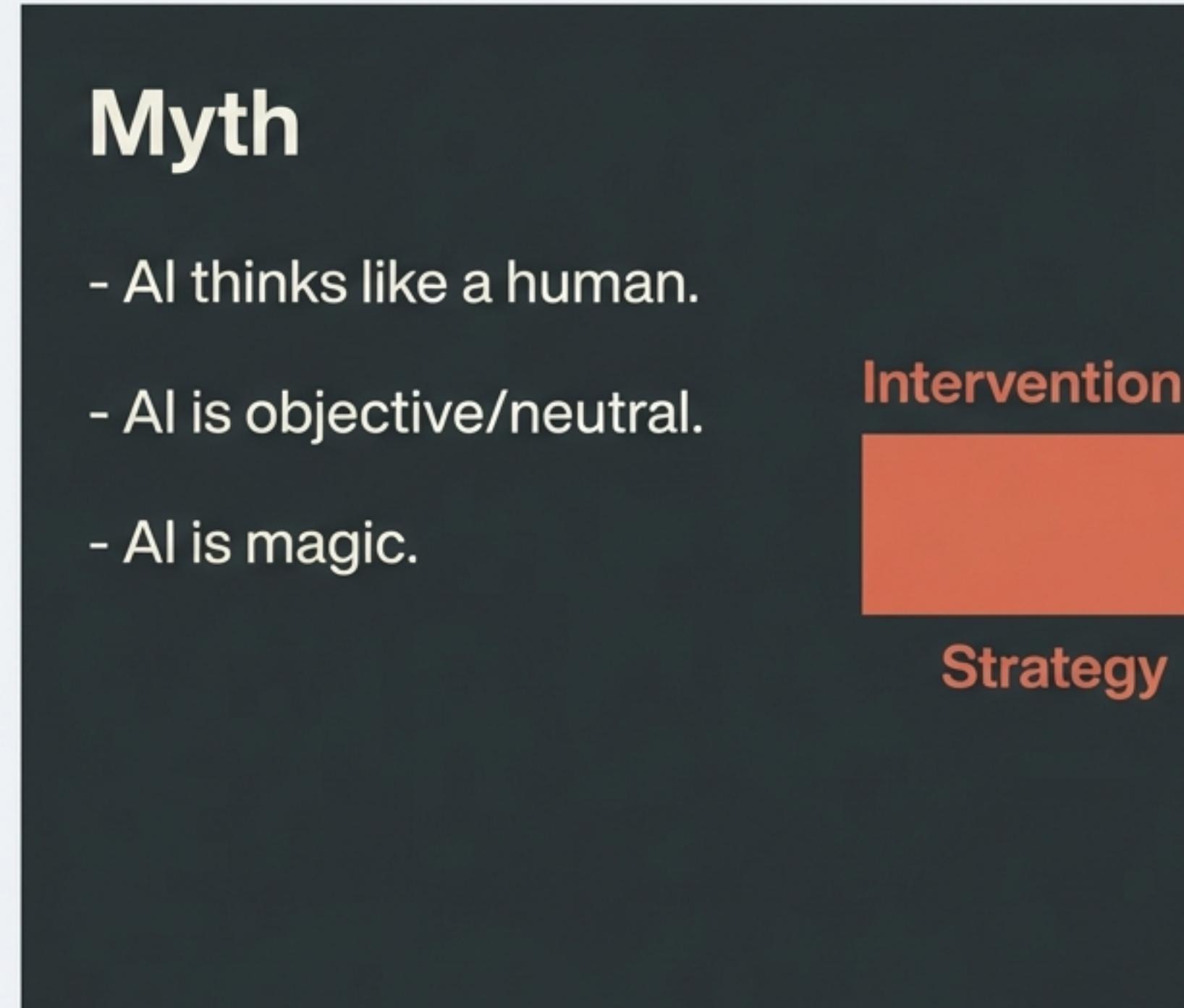
Helvetica Now Display Slate Blue Scenario: The New Student

An AI suggests friend groups based on past play data. Maria is new. Why is she excluded?

Research Connection: Helvetica Now Display Muted International Orange:

Concrete scenario analysis helps students recognize systemic bias perpetuation [web:109].

Evidence-Based Misconception Intervention



Reality & Research

Correction: Training Data Detective activity—show how limited examples restrict understanding.

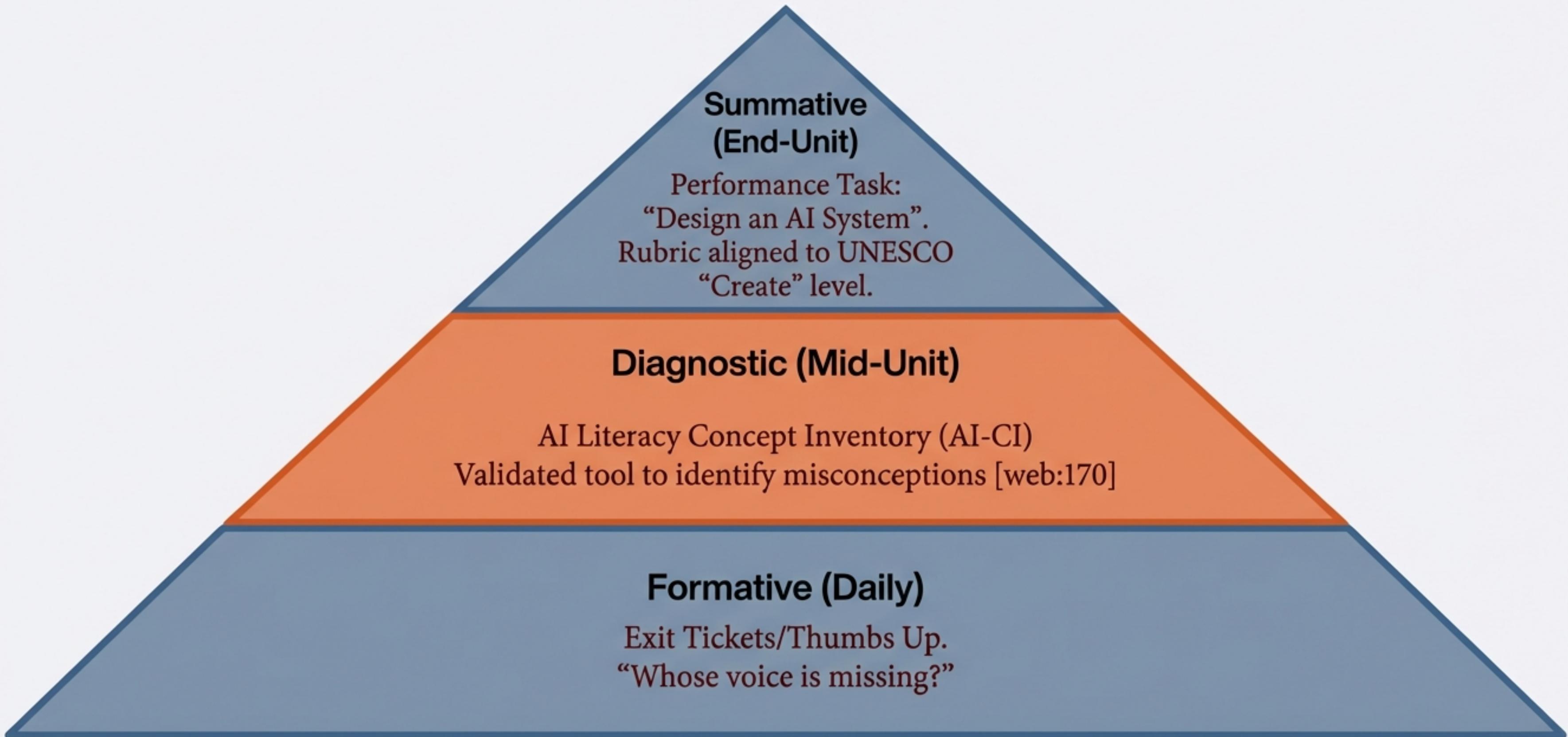
Correction: Explicitly teach that bias stems from human-selected training data.

Correction: Inventory daily AI use (autocorrect, Netflix) to show it is a designed utility.

Differentiation for Multilingual Learners (ELLs)



Measuring Success: From Exit Tickets to Validated Tools



Teacher PD: The “Experience First” Model



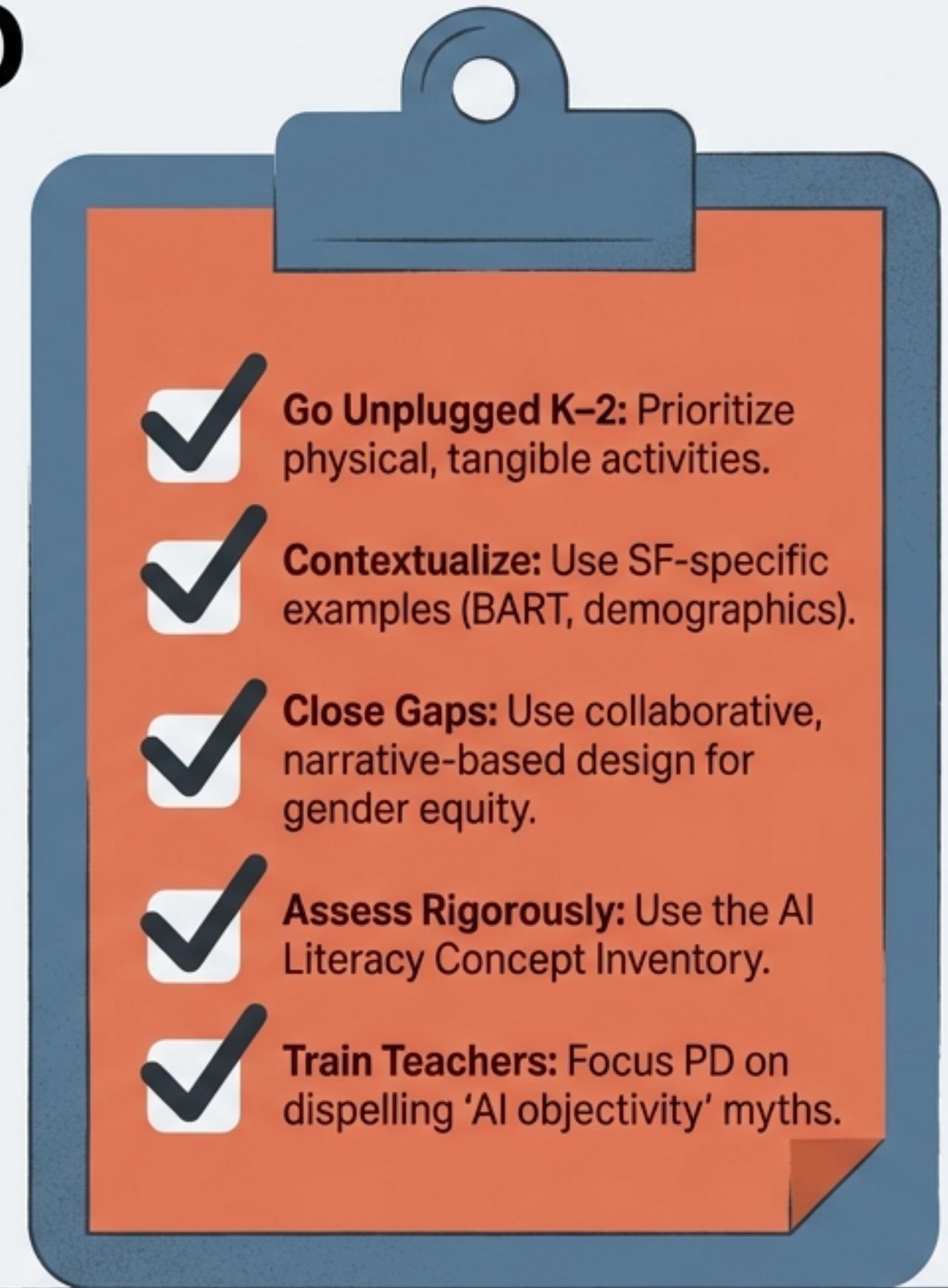
Teachers do the “If-Then Robot” and “Data Detective” tasks. Build self-efficacy.

Discuss “Begreifbarkeit” and differentiation strategies.

Map AI concepts to existing Math/ELA lessons.

Key Support: Monthly “Communities of Practice” to reduce isolation.

Key Takeaways for SFUSD Implementation



Selected References & Evidence Base

Standards

UNESCO AI Competency Frameworks (2024)

California Computer Science Standards (2018)

Empirical Studies

Gender/Equity: [web:118], [web:164]

Unplugged/Pedagogy: [web:133], [web:136], [web:139]

Cultural/Context: [web:121], [web:162]

Assessment: [web:170] (AI-CI)

Report Details

Analysis of 172 total sources.

Independent Report, Jan 2026.

107 Peer-Reviewed Academic Studies.