UCLA School of Education & Information Studies Department of Education

# Engaging Future Scientists: The Effect of Science Museum Visits on High School Students' Science Identity Development?

AERA, Los Angeles
2026/04/09

Presenter: Shuhan (Alice) Ai

School of Education and Information Studies
University of California, Los Angeles

# Introduction

- Broadening STEM Participation Through Informal Learning
  - Expanding STEM participation has been a longstanding national priority (National Science Board, 2020).
  - Informal learning play a critical role in developing students‘ interests, science identities, and preparation for STEM pathways (Allen et al., 2019; Chan et al., 2020; Kim et al., 2025).
- Science Museums as Promising Contexts
  - Provide personalized, interest-driven engagement outside standardized curricula and grades (Zheng et al., 2021).
- Research Gaps
  - Mixed evidence
  - Qualitative insights (Dawson, 2014; Shaby & Vedder-Weiss, 2020, 2021)
  - Large-scale quantitative evidence using nationally representative samples remains limited

# Research Questions

- **RQ 1:**
  - What individual and contextual factors are associated with students' likelihood of visiting science museums and planetariums during high school?
- **RQ 2:**
  - Do students who visited science museums and planetariums between ninth and eleventh grade demonstrate higher science identity at the end of eleventh grade compared to peers with similar demographic and academic backgrounds who did not visit?

# Literature Review

- **Science Museums & Informal Science Learning**
  - Science museums engage visitors through interactive, exhibit-based environments (Shaby & Vedder-Weiss, 2020).
  - **Short-term:** increased science interest, learning performance, creative thinking (Zheng et al., 2021).
  - **Long-term:** sustained museum programs linked to strong science identities (Adams et al., 2014).

- **Equity & Access in Informal Science Learning**
  - SES, race/ethnicity, and gender predict who participates in out-of-school STEM (Dawson, 2014; Lareau, 2015).
  - Affluent families leverage cultural capital for enrichment (Lareau, 2018; Jayakumar & Page, 2021).
  - Science museums disproportionately serve White, middle-class audiences (Dawson, 2014).
  - Gender differences vary by activity type (DeWitt & Archer, 2017).

# Conception Framework

## Science Identity Theory

- Science identity comprises competence, performance, recognition, and interest (Carlone & Johnson, 2007; Hazari et al., 2010).
- Becoming a "science person" requires knowledge, public enactment of scientific practices, and acknowledgment by meaningful others. Museum visits may activate identity-forming processes, particularly recognition and interest.

## Situated Expectancy-Value Theory (SEVT)

- Achievement-related choices determined by expectations of success and subjective task value (Eccles & Wigfield, 2020, 2023).
- Attainment value as key identity indicator: the importance of science to one's sense of self (Eccles, 2009).
- Museum experiences may enhance attainment value through self-directed exploration.

# Data

- **Dataset**
  - Student-level data: High School Longitudinal Study of 2009 (HSLS:09), public-use version.
  - Baseline ninth-grade survey (2009) and first follow-up at end of eleventh grade (2012). Nationally representative cohort of ~23,000 ninth graders.

- **Study Sample**
  - Students with complete data on museum visitation and science identity.
  - Students with nonzero longitudinal analytic weight (W2W1STU).
  - Schools with at least one student reporting museum visit (common support).
  - Analytic sample: N = 7,290 students across 935 high schools.

# Variables

**Outcome (Y):**

– Science identity at end of 11th grade (standardized composite from NCES).

**Treatment (D):**

– Binary indicator of museum/planetarium visit between 9th and 11th grade (40.5% visited).

**Covariates (X):**

– School context, student demographics, academic competence, science interest, educational expectations, STEM course-taking, informal science experiences, baseline science identity.

# Method

- **PS Estimation & IPW**
  - Logistic regression with all baseline covariates;
  - Trimmed 29 extreme cases for common support
  - Post-weighting SMDs fell below 0.10

- **DR Estimation**
  - Combined IPTW with covariate-adjusted OLS regression
  - Used HC2 robust standard errors
  - Assessed stability through nested models progressively adding covariates

- **Sensitivity Analysis & Missing Data**
  - Used RV quantify how strongly an unmeasured confounder would need to relate to both treatment and outcome to nullify the effect
  - Missing data 0%–2.1%; handled via MICE imputation

# Findings

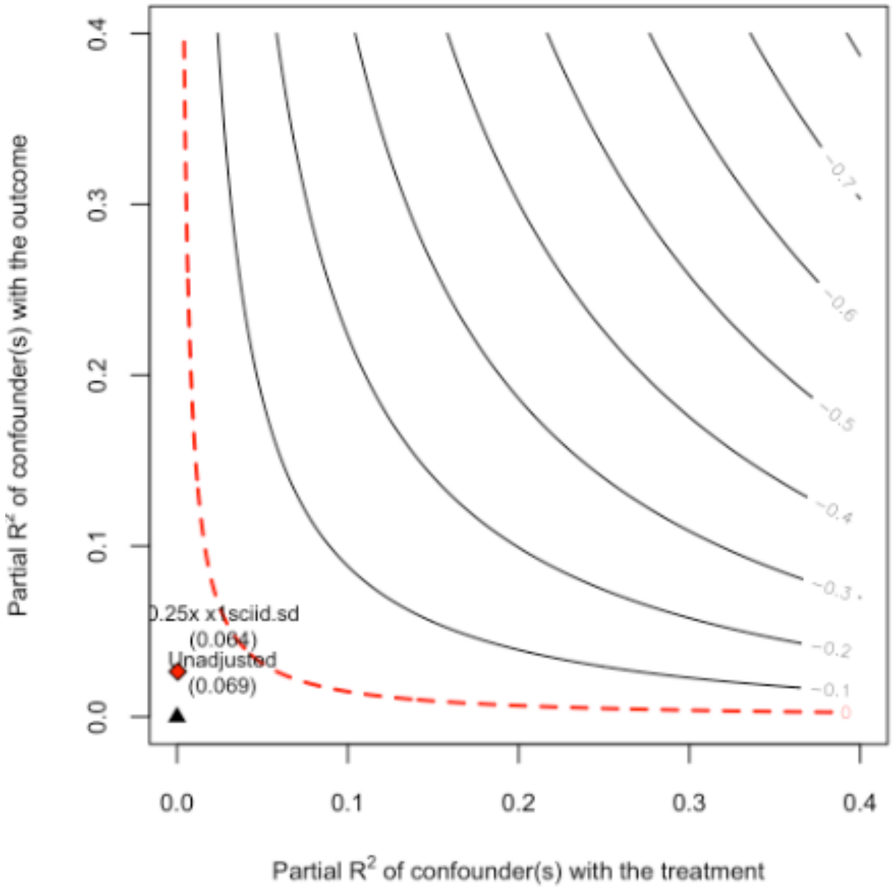
- **Descriptive**
  - Students from the highest SES quintile constituted 36.4% of museum visitors but only 23.8% of nonvisitors (SMD = 0.124).
  - Visitors often come from Suburbs.
  - Visitors demonstrated higher ninth grade science identities than their nonvisiting peers (SMD = 0.180).

- **Who Visits Science Museums? (RQ1)**
  - SES is the strongest predictor
  - Women and Latino students had higher odds of visiting; Black students were less likely
  - Science club participation and internet use for science

# Findings

- **Effect on Science Identity (RQ2)**
  - Museum visitors scored 0.07 SD higher on science identity than nonvisitors
  - Educational aspirations: master's or doctoral degree
  - Science club participation
  - Women reported lower science identity
  - Asian students reported higher, while Latino and Multiracial students reported lower

- **Sensitivity Analysis**
  - RV: 3.97%
  - Ninth-grade science identity set as the benchmark
  - Association between museum visitation and science identity is not easily attributable to a single unmeasured factor



# Discussion and Conclusion

- Museum Visits Contribute to Science Identity Development

- Socioeconomic Stratification in Museum Access
  - Museum visits are embedded in a broader ecology of enrichment that systematically advantages socioeconomically privileged youth.

- The Access-Identity Paradox
  - Women and Latino students visit museums at higher rates yet report significantly lower science identity than male students and the broader population

- Implication for P&P
  - School-organized museum field trips
  - Structural and system support
  - Equity-focused intervention

# Future Research Directions

- Granular measures of museum experiences
- Heterogeneous treatment effects
- Qualitative and mixed-methods design to explore mechanisms for science identity development

# Q & A

- **Thanks for listening!**
- **Welcome questions and constructive feedback.**


- **aishuhan@ucla.edu**
- **https://aliceaii.github.io/**