Empirical Education

EMPOWERING EDUCATORS THROUGH EVIDENCE AND INSIGHT

September 2020

Supporting Content-area Learning in Biology and U.S. History

empiricaled

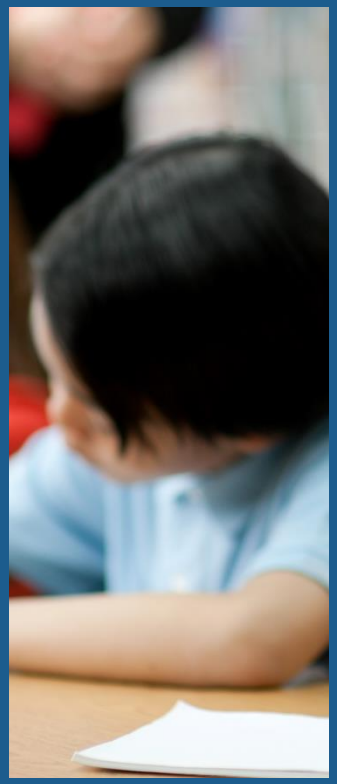
empiricaleducation

empirical-education

empiricaleducation

empiricaleducation

Empiricaleducation.com



Presenters

Hannah D'Apice, Research Manager & Stanford Doctoral Student

Andrew Jaciw, Chief Scientist

Jenna Zacamy, VP of Research Ops

Li Lin, Statistician

Agenda

- What are *Enhanced Units*?
- Study overview
- Results
- Conditions to support impact
- Areas for improvement & follow-on research

Enhanced Units

- Developed by SRI, CAST, and research and practitioner partners
- Goal to improve student content learning and higher order reasoning in secondary school, especially for students with learning challenges
- Funded by i3 Development grant (2014)

Enhanced Units

- Integrated research-based content enhancement routines (CER)s
- Routines used in the study are based on the Strategic Instruction Model (SIM)
  - unit organizers
  - question/exploration guides
  - cause and effect guides
  - comparison (compare and contrast) tables
- CORGI – online CER component

Unit Organizer

Red print indicates routines to be used in pilot study.

4 BIGGER PICTURE: Civil Liberties and National Security

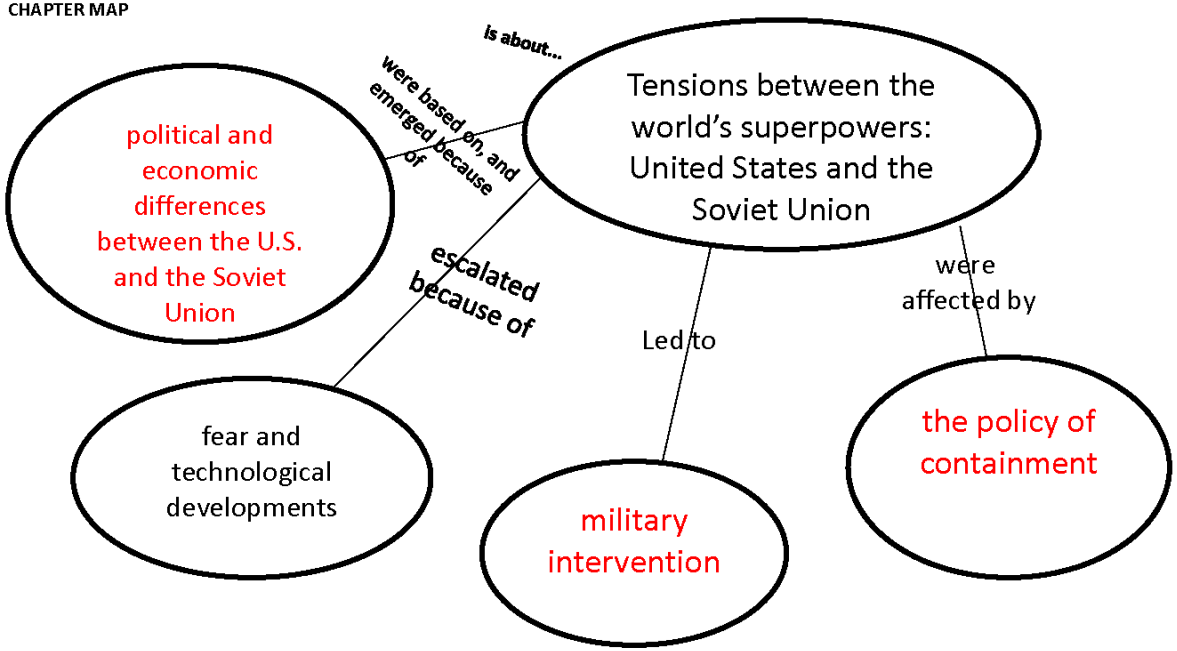
2 LAST CHAPTER: WWII

1 CURRENT UNIT: Cold War (1945-1989)

3 NEXT CHAPTER: Civil Rights Movement

8 CHAPTER SCHEDULE

5 CHAPTER MAP



7 SELF-TEST QUESTIONS

1. What were the causes and effects of the Cold War?
2. How did the rise of espionage and advancements in technology escalate Cold War tensions?
3. How were the military interventions of the Soviet Union and the United States during the Cold War (1945-1960) similar and different?
4. How did the policy of containment affect tensions between the United States and the Soviet Union in the early Cold War years (1945-1952)?

6 RELATIONSHIPS

Cause-Effect	
Explanation	
Compare-Contrast	
Explanation	

EU Logic Model

INPUT	PROXIMAL OUTPUTS	LONGER TERM OUTPUTS	TEACHER OUTCOMES	STUDENT OUTCOMES
Classroom level Biology and U.S. History teachers receive curricular materials for i3 *EU* **Key Component 1:** Biology and U.S. History teachers receive sufficient support: In-Person PD: Biology and U.S. History teachers receive sufficient support to use i3 *EU* materials by attending 3 days of PD Ongoing coaching: Biology and U.S. History teachers receive sufficient support by receiving at least 8 hours of coaching from SIM professional developers	Teacher **Key Component 2:** Teacher use of *EU*: Biology and U.S. History teachers use *EU*. Biology and U.S. History teachers implement one practice *EU* and two study *EU*s as per study design. Teachers deliver quality instruction, adhere to dosage, and report on likely effectiveness of the intervention on student performance. Student Students understand the purpose and application of the *EU*s in their biology and U.S. History classes	Teacher Improved implementation of, adherence to, and quality of *EU* instructional practices; improved effectiveness of *EU*	Teacher Improved/ increased implementation of SIM strategies (particularly the content enhancement routines specified in *EU*)	Student Improved achievement on end-of-unit content assessment measures

2018 Field Study Primary & Secondary Research Questions

Primary questions compared participants to the scores of similar grade BAU students:

- Did students in grades 9-12 who attended HS *EU* **Biology** classes demonstrate higher order content knowledge in the **Biology** unit test scores?
- Did 11th grade students who attended HS *EU* **U.S. History** classes demonstrate higher order content knowledge in the **U.S. History** unit test scores?
- Did both groups of *EU* students, as a group, demonstrate higher order content knowledge in their respective unit test scores?

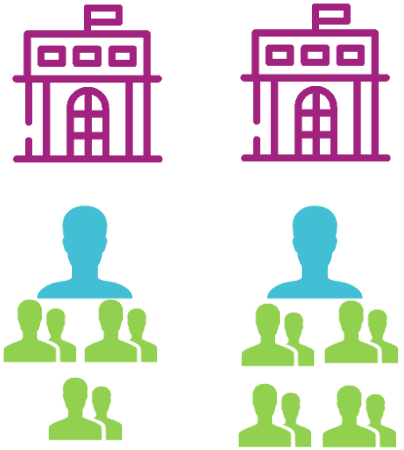
Secondary questions are the same, but specific to students that received special education services.

2018 Field Study
Exploratory Research Questions

- Is there a difference in impact on student achievement depending on:
  - teachers' self-reported levels of comfort with technology?
  - biology content area, specifically, evolution compared to ecology?
- Is there a positive impact of *EU* on achievement by Biology content area, or by U.S. History content area?
- What is the level of the treatment-control contrast in the use of SIM instructional practices deemed central to implementation of *EU*?
- Is there evidence that *EU* had impact on instructional practices posited to mediate impacts on student achievement?

2018 Field Study: Design
(Spring semester of 2017/18 school year)

2 states

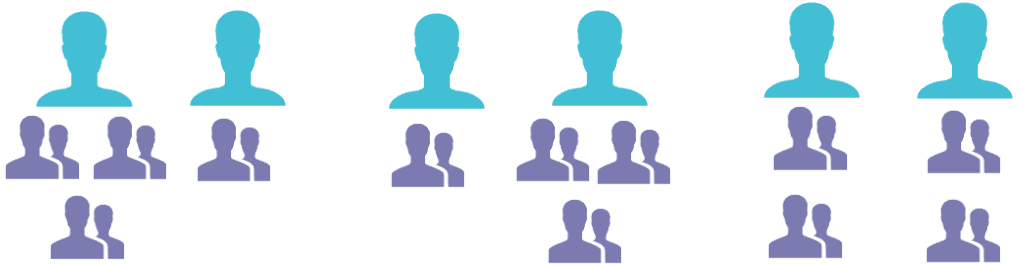


5 high schools

13 teachers

18 Biology classes

12 U.S. History classes

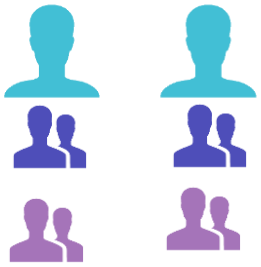


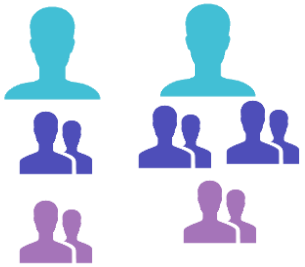
2018 Field Study: Design
(Spring semester of 2017/18 school year)

2 states

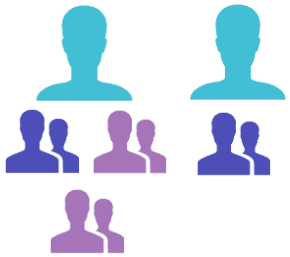
5 high schools

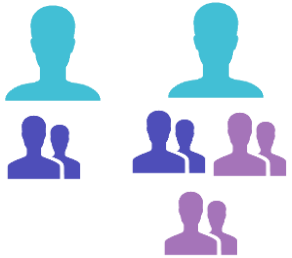
15 *EU* classes

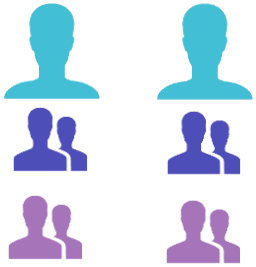




15 control classes







2018 Field Study: Data (Spring semester of 2017/18 school year)

Baseline

- Teacher baseline survey
- Class rosters
- Student demographics

During implementation

- Daily implementation logs
- Instructional practice surveys
- End-of-unit student assessment – Cronbach alphas above .75 for all

End of study

- Student survey
- Teacher interviews

Findings: Main Impact from 3-Level HLM Analysis

	Effect size	*p* value	Change in percentile ranking
Biology			
Unadjusted effect size	0.01	.958	0%
Adjusted effect size	0.01	.892	0%
U.S. History			
Unadjusted effect size	0.33	.214	12%
Adjusted effect size	0.32	**.037**	12%
Biology & U.S. History combined			
Unadjusted effect size	0.14	.516	6%
Adjusted effect size	0.14	**.067**	6%

Low Differential Attrition: No classes were lost to attrition—we obtained outcomes for one or more students present at baseline in the classroom. Student attrition for the combined sample was 3.8% overall, and 2% differential. Low potential for bias.

Sensitivity Analyses: U.S. History and Combined results are robust in terms of their magnitudes; however, for U.S. History, the *p* values fluctuate around significance level .05.

Findings: Moderator Analyses (Combined Sample)

- Positive differential impact of *EU* on achievement, depending on disability status.

- No differential impact of *EU* on achievement, depending on level of teachers' baseline score on the Technological Pedagogical and Content Knowledge (TPAK).

Findings:
Impact *Within* Biology Units

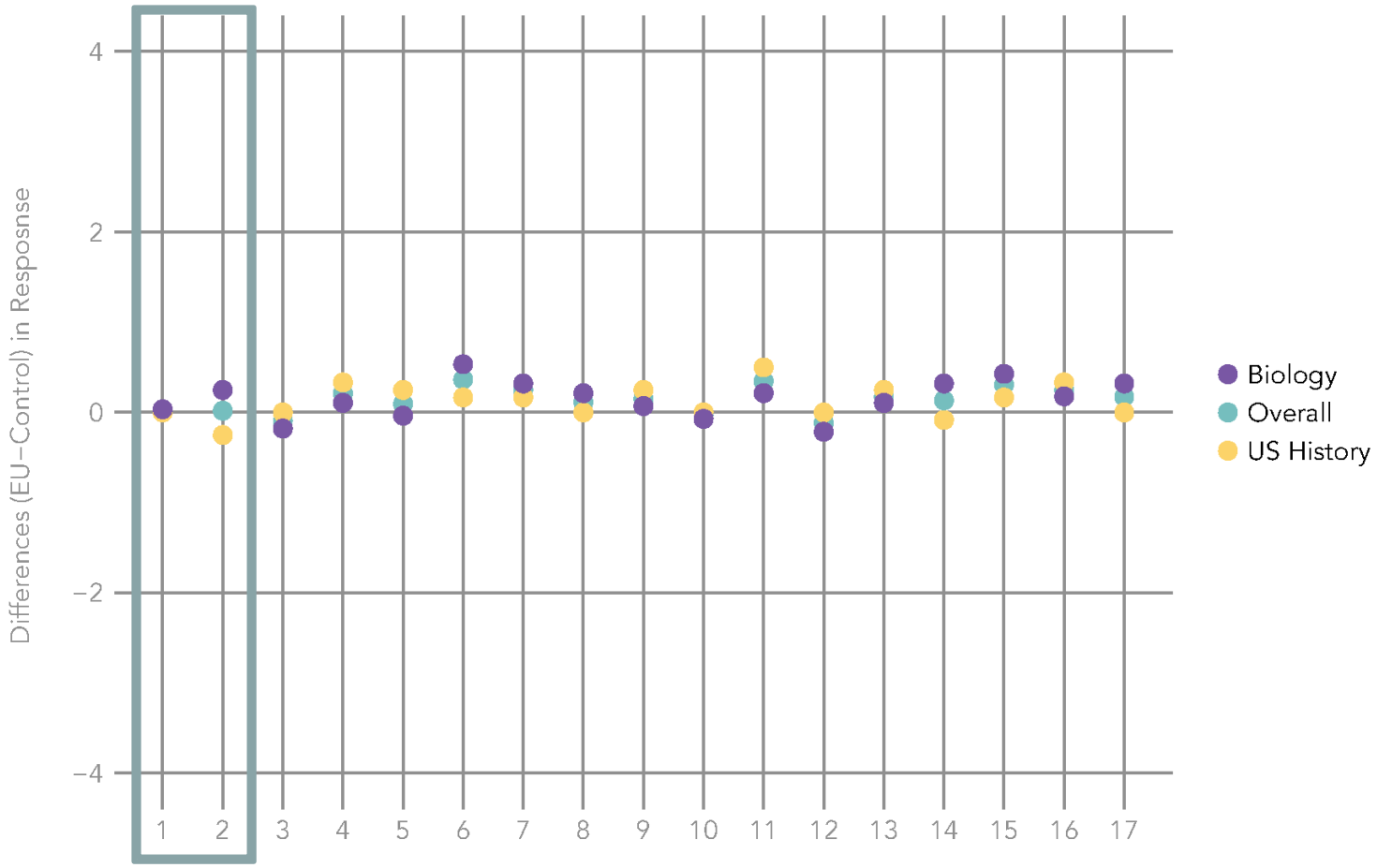
> *…the content of Enhanced Units best support student learning when they focus on a single topic, allow adequate time, and use instructional supports that all relate to the critical topic of the unit and build sequential understanding.*

- Students on average experienced greater impact of *EU* on assessment of Evolution than Ecology.
- These results are considered exploratory.

Findings: Conditions for Impact

- Fidelity of implementation not met system-wide. Indicators included:
  - teacher adherence
  - teacher quality of delivery
  - teacher-perceived usefulness of tools/strategies
  - student self-reported understanding
  - student self-reported collaboration
- Treatment-control contrast was strong based on use of SIM routines. No evidence of contamination.

No Differences in Mediator Impacts



Ex: (1) Explicit instruction, (2) Reteach to a few students

Areas for Improvement

- Provide additional support for less-structured, less-sequential content
- Explore how content enhancement routines can be applied to a greater range of topics
- Adjust for operational challenges of technology tool: visual interface, usability, Google Drive interface
- Improve tools and strategies for students that may struggle with typing or prefer using paper

Follow-on research

- What mediates impact? Flesh out Logic Model, identify better measures of mediators
- Tease out impact for students with disabilities: look at different types of disabilities
- What is/are the best way(s) for teachers to present SIM routines to their students, particularly for students with learning challenges through SIM intervention?
  - Investigate how the routines can be applied to a greater range of topics.
  - Consider how introducing devices to the routines potentially presents steeper learning curves and difficulty with buy-in for teachers and students alike

Contact

Hannah D'Apice, Research Manager
hdapice@empiricaleducation.com

Full EU report available at

https://www.empiricaleducation.com/past_research/

Reference this presentation:

D'Apice, H., Schellinger, A., Zacamy, J., Wei, X., & Jaciw, A. P. (2020). *Supporting Content-Area Learning in Biology and U.S. History: A Randomized Control Trial of Enhanced Units in California and Virginia.* Presentation delivered in a virtual symposium on September 9, 2020 for the annual spring conference of the Society for Research on Educational Effectiveness, Washington, DC. Retrieve from https://www.empiricaleducation.com/past_research/

Empirical Education®

EMPOWERING EDUCATORS THROUGH EVIDENCE AND INSIGHT

empiricaled

empiricaleducation

empirical-education

empiricaleducation

empiricaleducation

Empiricaleducation.com