

Integrating Literacy and Science Instruction in High School Biology:

Impact on Teacher Practice, Student
Engagement, and Student Achievement

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Agenda for Today's Talk

Study Overview

The Reading Apprenticeship Framework and
Professional Development Intervention

Research Design

Study Results

Implications

Study Overview

- Intervention (Reading Apprenticeship PD) to integrate literacy instruction into biology through collaborative, metacognitive inquiry
- Attempted to build and measure science teachers' implementation integrating literacy and content
- Targeted schools serving African American, Latino, English Learner, and Low SES students
- Investigated the effects on student learning in both literacy and content

Science teaching is at its best when it is most like an apprenticeship.

J. Robert Oppenheimer, 1947

All Literacies are Situated, Sociocultural Practices

- Literacy is a social, cultural, and cognitive activity shaped by situation and context of use (e.g. Scribner & Cole, 1983)
- Diversity is the norm; interpretive practices vary across communities and disciplines (e.g. Heath, 1983; Lee, 1995; Lee & Spratley, 2009; Moje, 2009; Osborne, 2002)

Literacy Apprenticeships Shape Student Literacy Practices

- Students develop theories about literacy practices and purposes based on experiences (e.g. Hull & Rose, 1989; Schoenbach & Greenleaf, 2009)
- Cognitive apprenticeship makes thinking visible and helps students develop needed tools (e.g. Lee, 1995; Rogoff, 1989, Taylor, Peterson, Pearson & Rodriguez, 2002)

Social Processes Mediate Engagement, Learning and Identity

- Advanced psychological processes are acquired through socially and culturally mediated activity (Vygotsky, 1978)
- Adolescents need collaborative, social support to develop dispositions for approaching and engaging in challenging tasks (Dweck & Molden, 2005; Yore, 2004)
- Literacy development involves helping students form new identities as capable readers and learners (Gee, 1996; Mahiri & Godley, 1998).

Academic Apprenticeship: A Project of Bringing Outsiders In...

. . . think about the student who is having difficulty in a certain subject area not as one who is dumb or lacking in aptitude, but rather as someone standing outside of the conventions, rituals, and expectations of discourse in that field—all of which are second nature to the specialist but to a newcomer can be undecipherable.

Tobias, Sheila. (Winter, 1988). Insiders and outsiders. *Academic Connections*. New York, Office of Academic Affairs, The College Board, pp. 275-279.

The Reading Apprenticeship Framework

Metacognitive Conversation draws on what science teachers know and do as experienced readers of science, and on adolescents' underestimated strengths as learners

SOCIAL DIMENSION

- Creating safety to support collaborative problem solving in science & reading
- Investigating relationships between literacy, science learning and power
- Sharing science-related book talk
- Sharing science reading processes, problems, and solutions
- Noticing and appropriating others' ways of reading in science

PERSONAL DIMENSION

- Developing science reader identity
- Developing metacognition in science reading
- Developing fluency and stamina for science reading
- Developing confidence with a range of written science materials
- Assessing science reading performance and setting goals

COGNITIVE DIMENSION

- Getting the big picture
- Breaking down science reading
- Monitoring comprehension with written science materials
- Using science-specific problem-solving strategies to assist and restore comprehension
- Setting science-specific reading purposes and adjusting reading processes

KNOWLEDGE-BUILDING DIMENSION

- Mobilizing and building on prior science knowledge structures
- Developing science knowledge
- Developing knowledge of science vocabulary
- Developing knowledge and use of the text structures of science curriculum materials
- Developing scientific discourse
- Developing scientific reasoning

The Reading Apprenticeship Framework

Metacognitive routines make normally invisible science reasoning processes visible and available for assessment, modeling, and coaching during science reading, problem solving, and science investigations

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Reading Apprenticeship Professional Development in Biology - Intervention

5 Day Professional Development Institute

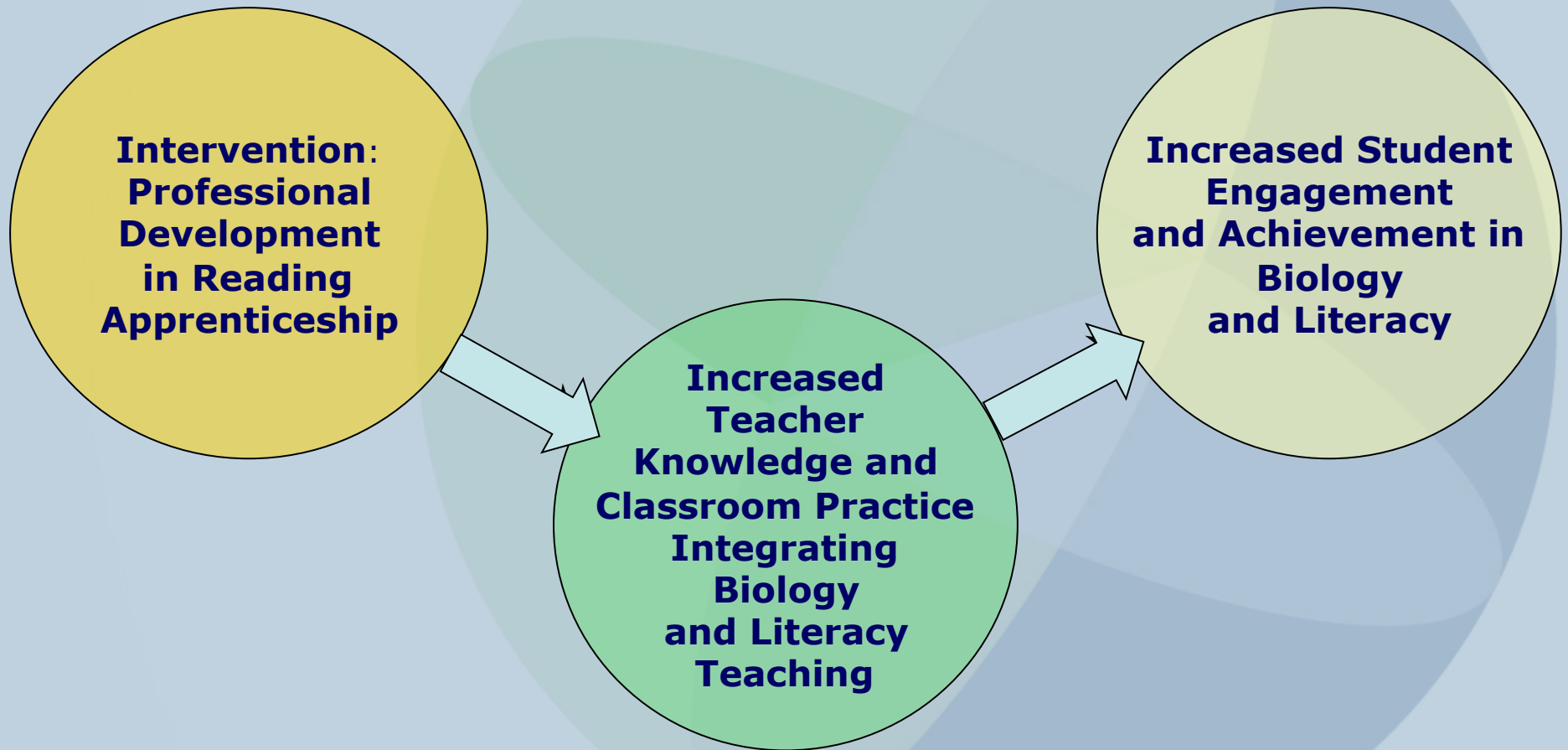
Integrating Literacy Routines into Biology Content

- Rich biology text sets
- Science investigations
- Cell biology, evolution and genetics
- Metacognitive Routines
- Comprehension Strategies
- Classroom Videos
- Student Case Studies

Ongoing Support

- 5 Additional institute days
 - *2 in February, 2006*
 - *3 in August, 2006*
- Curriculum embedded reading assessment
- Classroom libraries linked to biology curriculum
- List serve with professional community and ongoing mentoring from RA coach

Hypotheses



Research Design

Cluster-randomized experimental design

- 105 Biology teachers in 51 districts and 83 schools in California recruited.
- Schools randomly assigned to experimental and control groups.
- Professional development integrating literacy and biology for experimental group, wait-listed control.

Data Sample

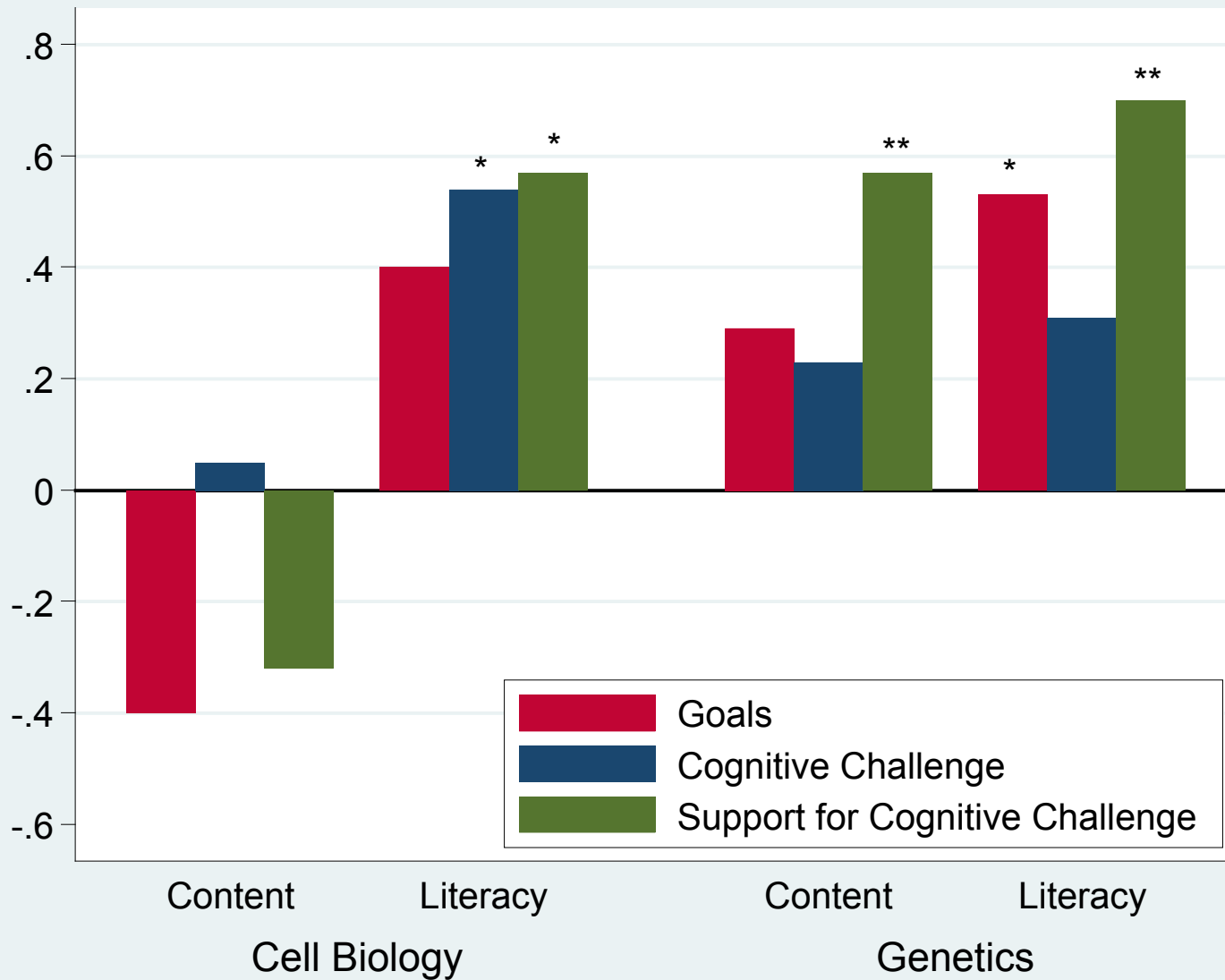
ELA CST	Longitudinal Data Sample			Cross Sectional Data Sample		
	Treatment	Control	Total	Treatment	Control	Total
Schools	23	22	45	27	22	49
Teachers	31	23	54	36	25	61
Students	832	404	1236	3162	2274	5436

More representative and balanced sample obtained in the cross-sectional sample; the cross sectional data provides the best estimate of impact of the intervention.

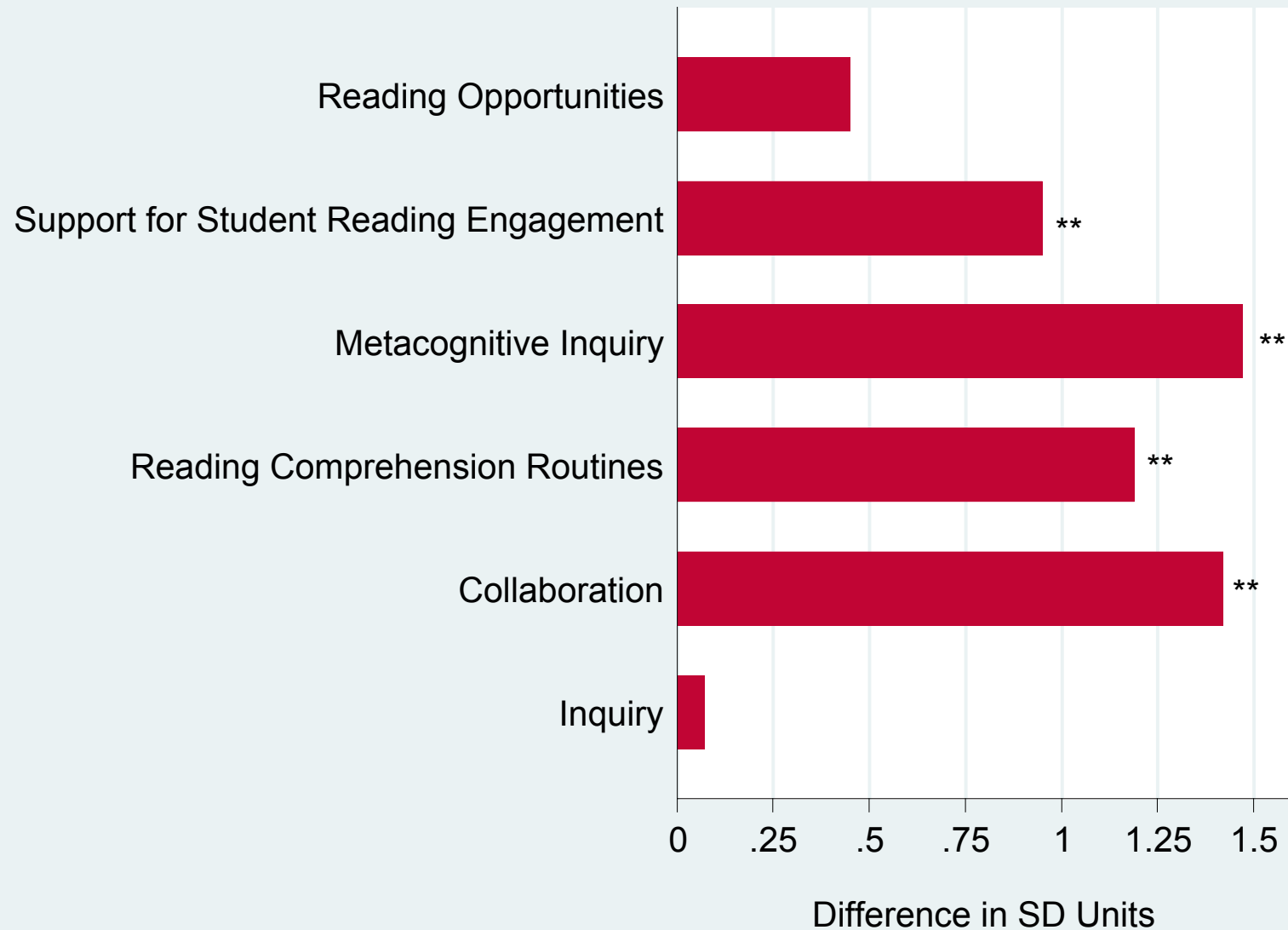
Teacher Survey (Experimental/Control Differences)



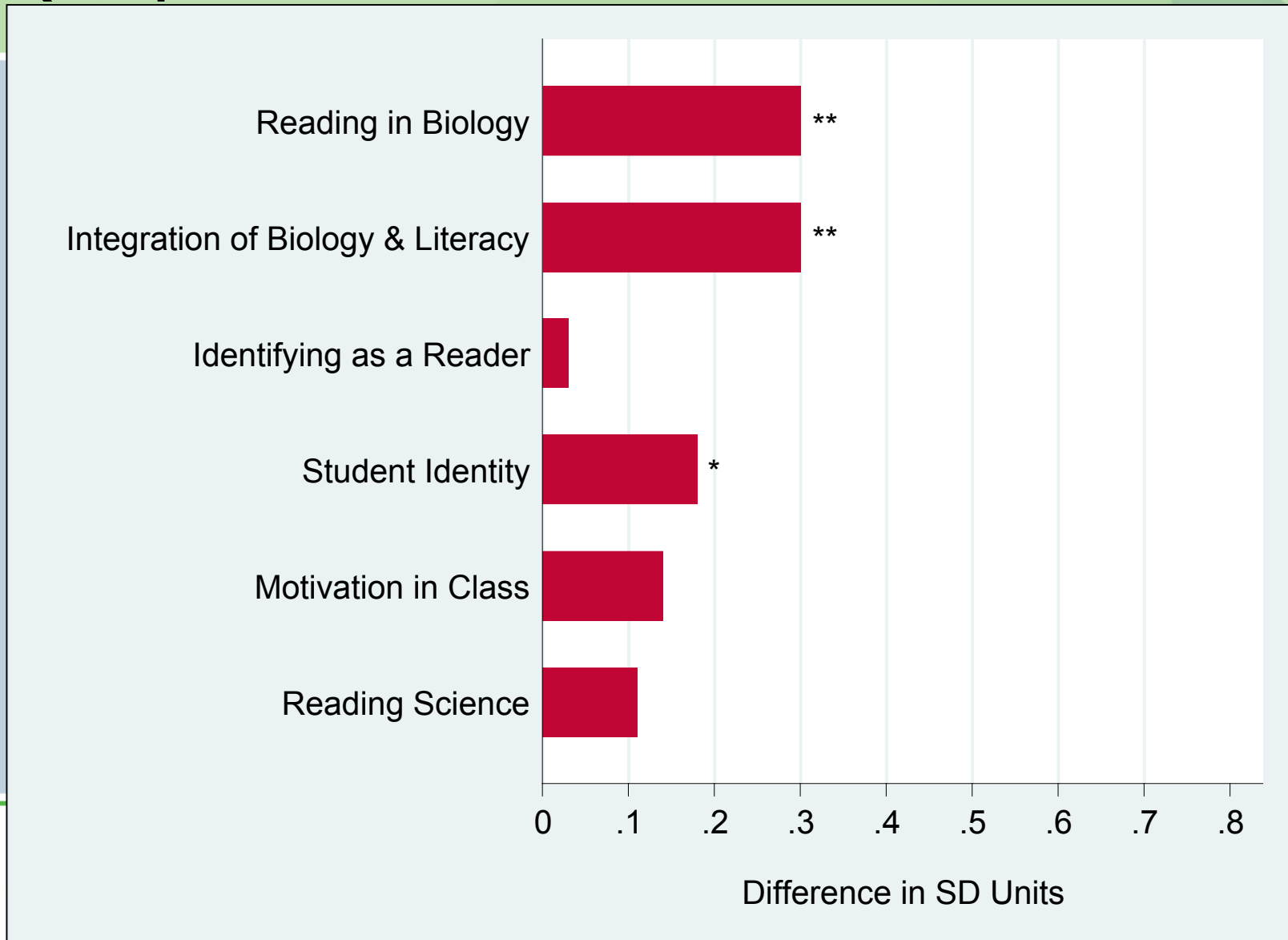
Teaching Assignments (Experimental/Control Differences)



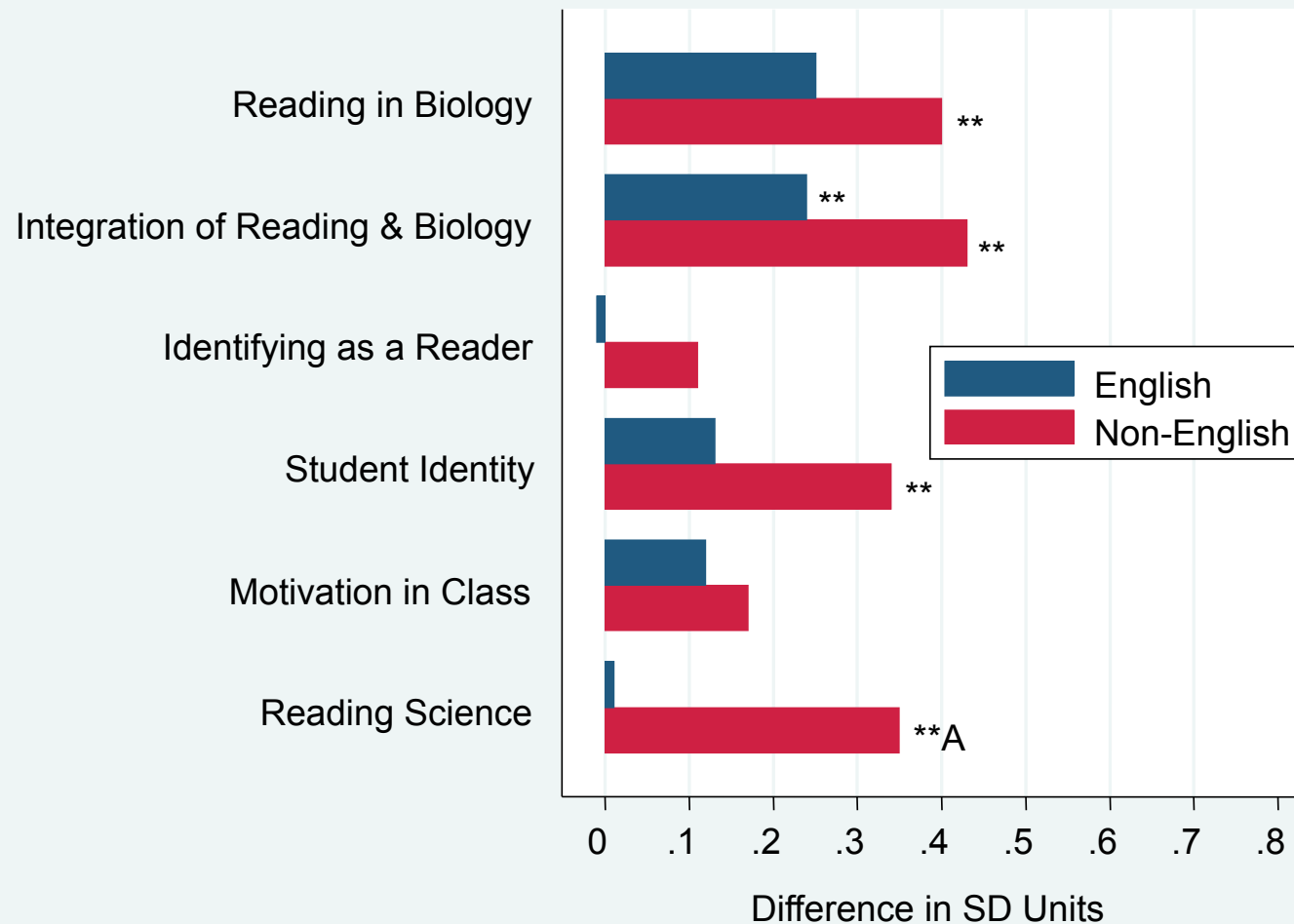
Teacher Interviews (Experimental/ Control Differences)



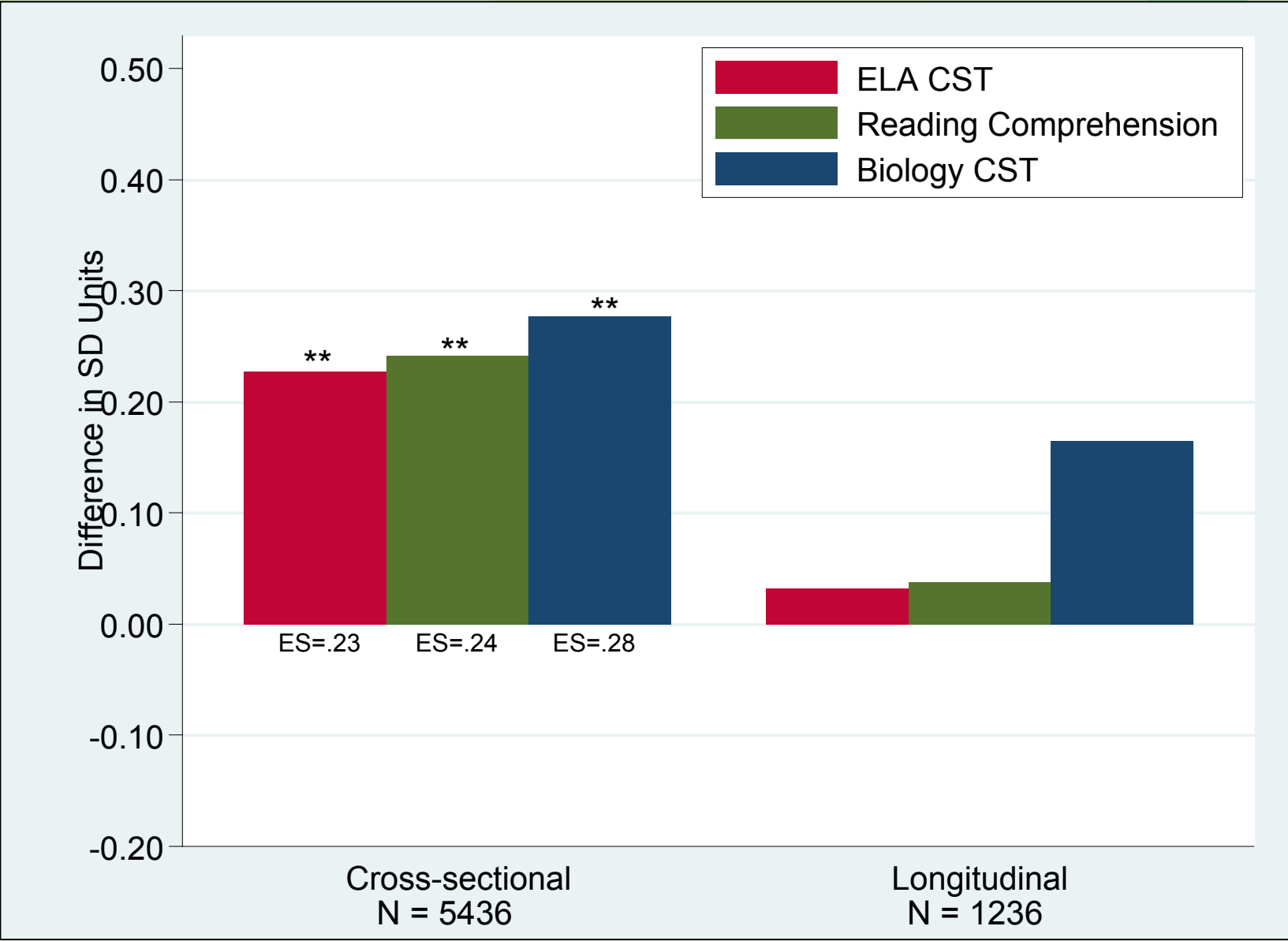
Student Opportunity to Learn Surveys (Experimental/Control Differences)



Student Opportunity to Learn Surveys (Experimental/Control Differences)



Student State Standardized Test Scores (Treatment/Control Differences)



We Can Improve Instructional Quality through Professional Development

- Multiple measures (Teacher Surveys, Teaching Assignments, and Teacher Interviews) indicate:
 - Increased teacher support for reading engagement
 - Less lecture
 - More collaborative group work
 - More discussion of science readings
 - More metacognitive inquiry
 - More modeling and guided practice in comprehension routines and strategies

These Changes Can Result in Improved Student Learning Outcomes

- Student Opportunity to Learn Surveys
 - Increased reading in biology
 - Increased integration of biology and literacy
 - Increased confidence and student identity for language diverse students
- State Standardized Test Scores
 - Increased scores on state standardized measures of ELA, reading comprehension, and biology

For more info..

- See the research tab on the WestEd website:
www.wested.org
- See a video clip of a middle school science classroom implementing Reading Apprenticeship on the Doing What Works Clearinghouse website:
http://dww.ed.gov/practice/?T_ID=23&P_iD=61
- See a video clip of a high school science classroom implementing Reading Apprenticeship at: <http://www.wested.org/readingapprenticeship>