

Reimagining Introductory Biology Pilot Study: Preliminary Findings

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Background - Traditional Curriculum at IMSA

- Four semester-long science courses as sophomores
 - Scientific Inquiries in Physics (SI-Physics), Scientific Inquiries in Chemistry (SI-Chemistry), Scientific Inquiries in Biology (SI-Biology), & Methods in Scientific Inquiry
- Electives in junior and senior years
 - Approximately 1/3 of students do not take an elective in Biology
- SI-Biology meets twice a week for 100 minutes per class
 - Significant stressor for some students

Background – Shift in Focus

- State of Illinois Science Standards
 - Based on Next Generation Science Standards (NGSS) → Emphasis on performance and application
- IMSA Priority Outcome in 2017-2018 – Strengthen identity as a learning laboratory
 - Current theme: UN Sustainable Development Goals (UN SDGs)
- Founding legislation → Act as catalyst for educational change in the State



SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD



<http://www.un.org/sustainabledevelopment/sustainable-development-goals/>

Proposed Curriculum: Advanced Biological Systems (ABS)

- Introductory Biology course moved to junior year
- Expanded to two semesters
- Contextualized learning
 - UN Sustainable Development Goals (SDGs)
 - Klosterman and Sadler (2010): Evidence supporting the efficacy of socioscientific issues-based instruction in science education.



• Content:

- Stem cell biology and cellular differentiation
- Molecular controls, cell cycle and gene expression
- Communicable and physiological disease
- Ecosystems as metabolic processes
- Evolutionary change

• Issues for context:

- Reliably feeding the masses, sustainability
- Disrupted ecosystem, human impact
- Managing waste: health and contagion

Purpose of the Pilot Study

- To compare and contrast the effectiveness of the ABS course to the SI-Biology course
- To identify whether the ABS course leads to:
 - Better teaching and learning of complex biological concepts
 - Better student outcomes

Research Questions

- Do students who complete the ABS course have an increased level of content knowledge and enhanced critical thinking, model-building, and ability to make connections to real world issues?
 - Are they more likely to get higher grades and less likely to fail the course?
 - Do they report higher levels of engagement with the course material?
- Do students who complete ABS course have better course performance in subsequent science courses?
 - How is their subsequent performance in other courses?
- Do students who complete the ABS course have a different electives-taking pattern?

Research Design, Methods, and Procedures

Stratified, random assignment of students

- Class of 2020 and Class of 2021 randomly assigned to take ABS or SI-Biology (50/50)
 - Grouped based on race/ethnicity and gender
 - Randomly assigned within groups

Research Design, Methods, and Procedures

Measures of Students' Skill Levels, Outcomes, and Engagement:

- Admissions portfolio (**SAT scores, GPA, Admissions score**)
- Biology content knowledge
 - Pre-study and post-study test
 - **Pre-course and post-course test**
- **Biology Motivation Questionnaire II**
- **Course grades in biology & subsequent science classes**
- **CWRA+ (College Work & Readiness Assessment)**
- Elective-taking patterns across the sciences
- Retention rate

Study Timeline

YEAR 1 (2017-2018)

- Assignment of 2020 cohort
- Half of 2020 cohort took SI-Bio
- Data collection, analysis, and dissemination

YEAR 2 (2018-2019)

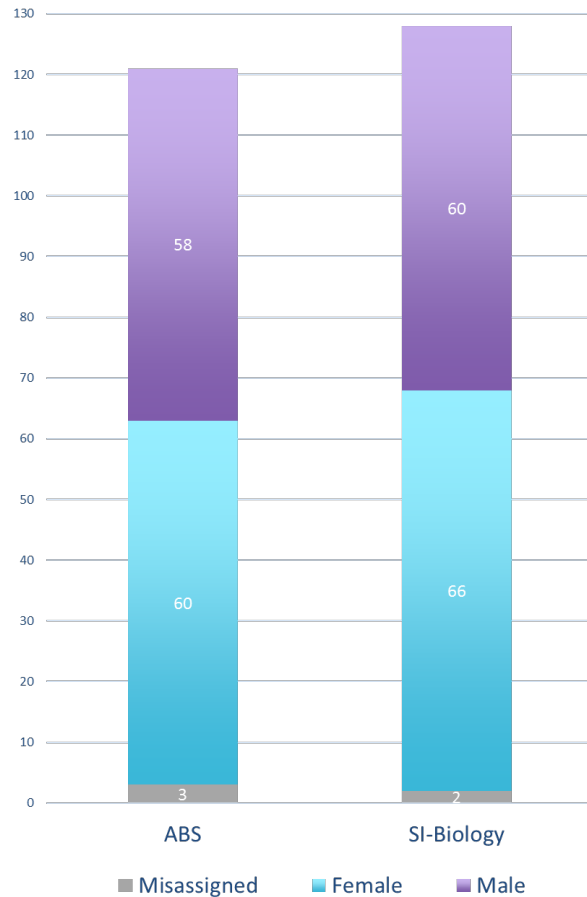
- Assignment of 2021 cohort
- Half of 2020 cohort took ABS/Half of 2021 took SI-Bio
- Data collection, analysis, and dissemination

YEAR 3 (2019-2020)

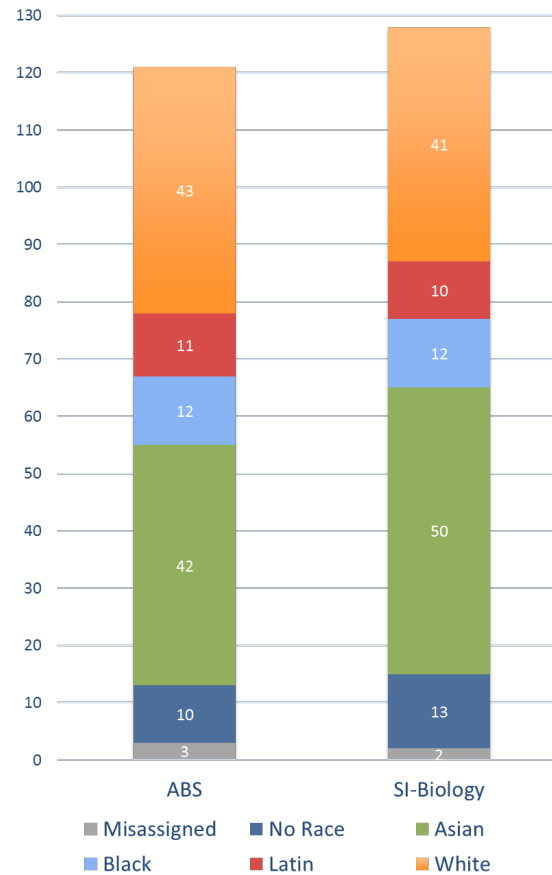
- Half of 2021 cohort takes ABS
- Data collection, analysis, and dissemination

Group Assignment – Class of 2020 (N = 249)

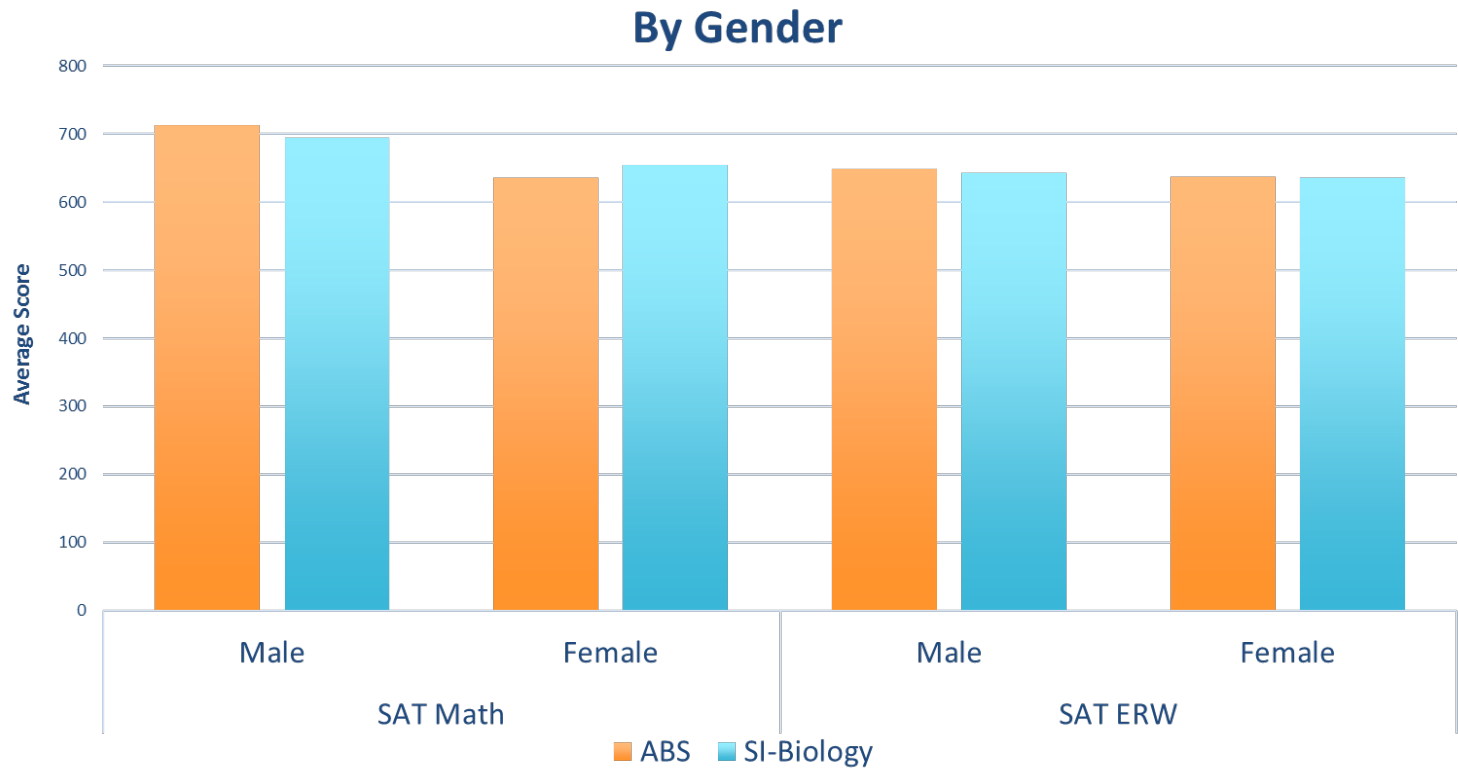
By Gender



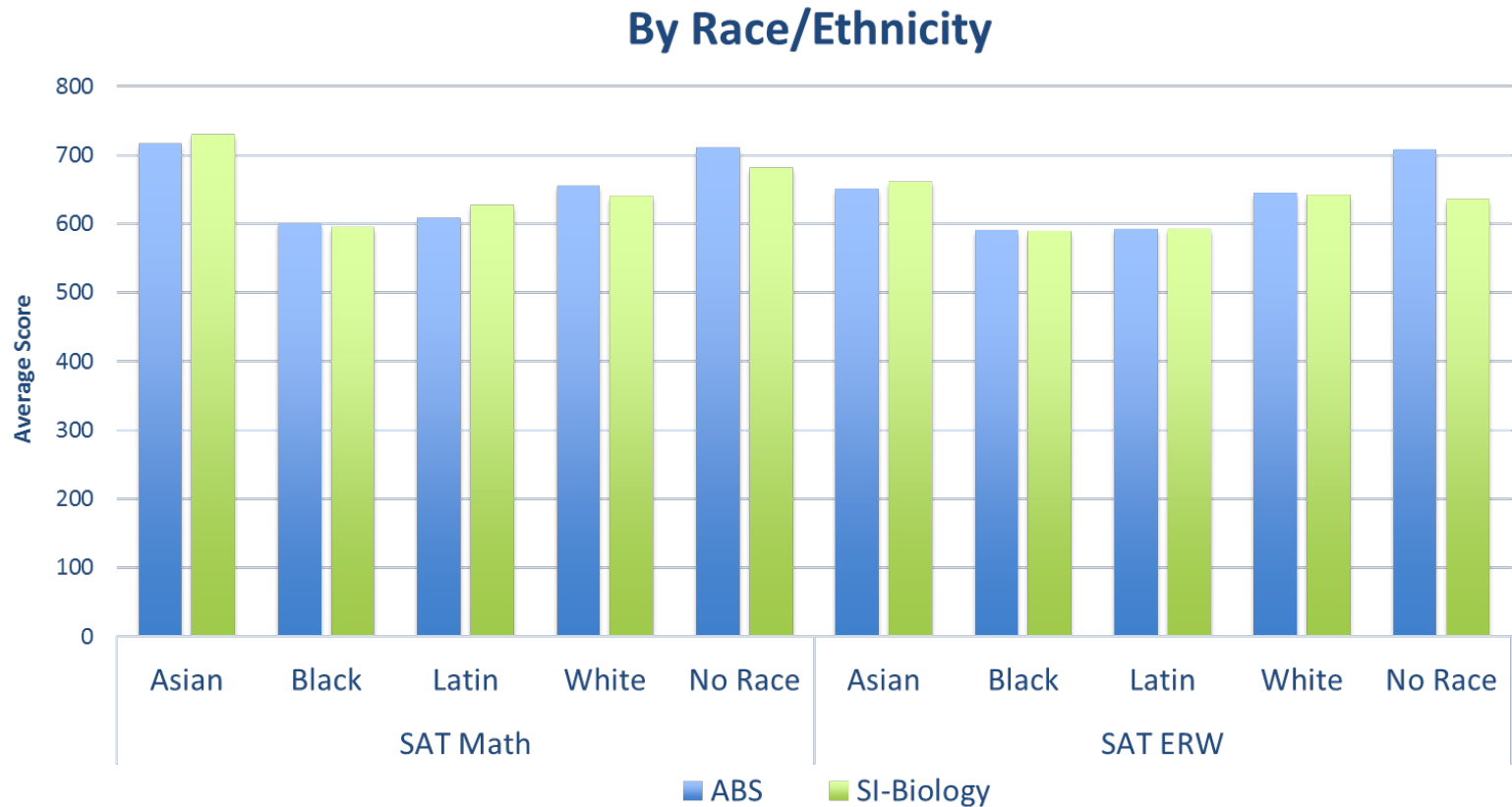
By Race/Ethnicity



No significant differences in incoming skill levels – SAT & GPA



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Preliminary Findings

- Course Grades
- Biology Motivation Questionnaire II
- Pre-Post Course Exam
- CWRA+ Exam

Study Advantages & Challenges

- Doing research with colleagues in one's own workplace with real world implications
- Student participation
- Extensive time required for:
 - Data collection, entry, cleansing, and analysis
 - Additional grading
- Reliability/validity of measures

Questions

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