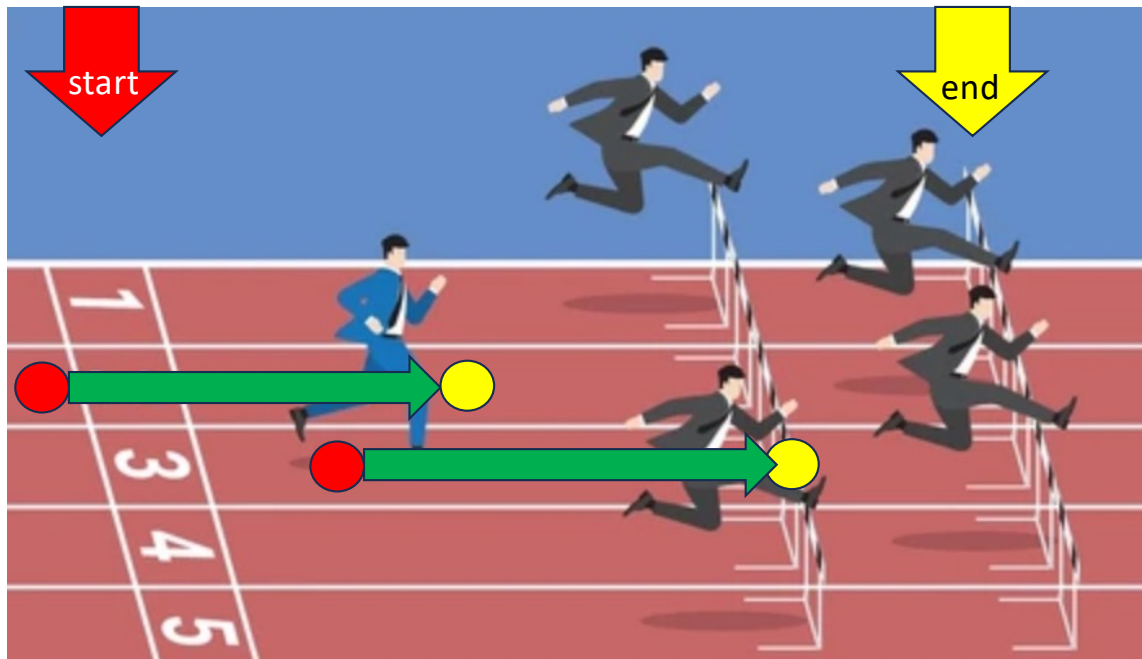


Caring about students = loving data

Ross Nehm, Professor, Ecology and Evolution, AMS

- **Biology:** one of the largest majors
- **Evolution:** a core course and program LO for biology
- **Assessment:** key to improving learning outcomes for evolution
- **Demographics:** factors that can interact positively or negatively with learning

Learning:
Where you **start**,
Where you **end**,
How far you **traveled**

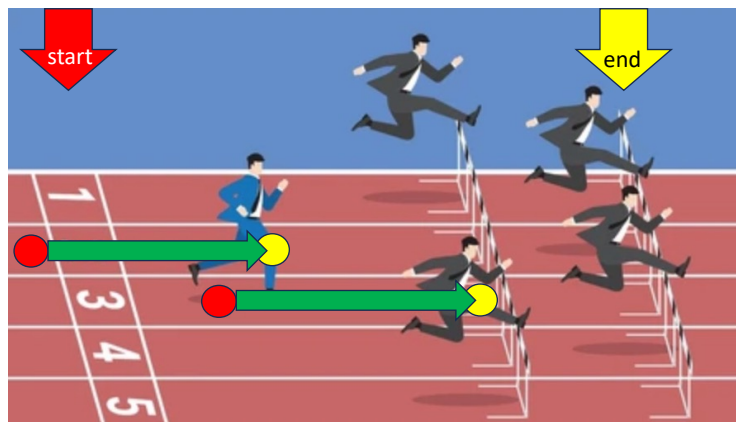


Learning Objectives:

Where you **start**,

Where you **end**,

How far you **traveled**



Research on learning in undergraduate settings:

In a study of multiple introductory biology classes (molecular biology LO), URM, FG, F **start behind, travel less, end up further behind** (Nissen et al. 2024).

In chemistry, it depends. Some classes reduce the gap, other perpetuate the gap.

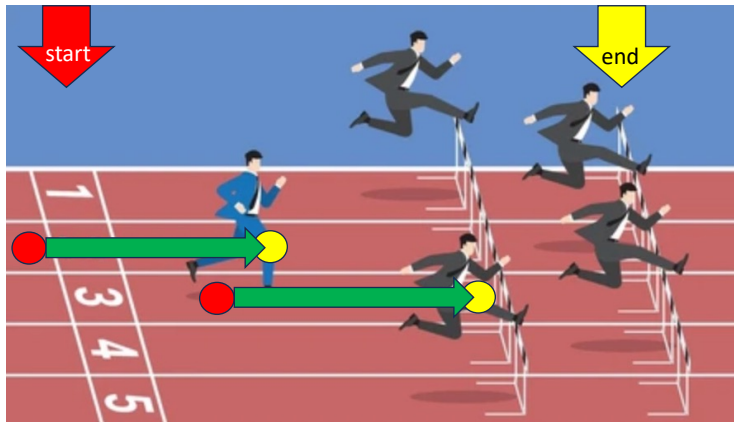
In physics, it depends. Some classes reduce the gap, other perpetuate the gap.

Learning Objectives:

Where you **start**,

Where you **end**,

How far you **traveled**



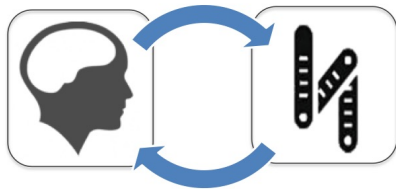
What happens at Stony Brook?

Problem: assessment is focused on end point LO proficiency.

We therefore do not know the impact of courses in terms of whether they: make gaps larger, make gaps smaller, make gaps the same.

We do not assess starting points, making it hard to know not only what's happening to gaps, but how much learning occurs.

Three high-quality, validated and published instruments to measure core LO



CINS



CANS



ACORNS



	CINS	CANS	ACORNS
# of semesters	7	6	11
Sample size	2618	2613	3092
Gender	42.8% male	42.4% male	42.9% male
Race/ethnicity	6.6% Black/African American, 9.2% Hispanic, 45.6% Asian, 38.6% White	6.7% Black/African American, 11.1% Hispanic, 48.6% Asian, 33.6% White	7% Black/African American, 9.9% Hispanic, 47.9% Asian, 35.3% White
PELL status	35.9% PELL eligible	41.1% PELL eligible	39.3% PELL eligible
Prior Bio	32% no prior bio	32.5% no prior bio	32.8% no prior bio

Framework

Evolution, 2024, XXXXX, 1–12
<https://doi.org/10.1093/evolut/qaad026>
 Advance access publication 1 March 2024
 Perspective



Building conceptual and methodological bridges between SSE's diversity, equity, and inclusion statement and educational actions in evolutionary biology

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Abstract

The field of evolutionary biology must bridge the gap between its diversity, equity, and inclusion (DEI) commitments and data-driven educational actions in the nation's undergraduate classrooms and degree programs. In this article, we discuss the urgent need for the adoption of equity frameworks and why they are centrally important to data-driven DEI efforts in evolutionary biology. We describe why equity indicators (e.g., measures) must be endorsed in and aligned with equity frameworks. We introduce a specific equity framework for learning (the enhanced educational debt framework) and illustrate how it may be leveraged to document, interpret, and improve outcomes in evolutionary biology. We apply the equity framework and associated indicators to >3,500 students' first college-level experience with evolutionary biology at a public, 4-year institution in the Northeastern United States to demonstrate how these conceptual tools and empirical perspectives may be used by faculty, departments, and degree programs to better understand their roles in mitigating or perpetuating inequities. We end by discussing how this framework may be applied to a range of evolution concepts and courses in the educational hierarchy and used to help evolutionary biologists better understand the extent to which a core aspect of SSE's diversity statement is being realized.

Keywords: evolution learning, educational debt, equity frameworks, indicators, undergraduate education

Introduction

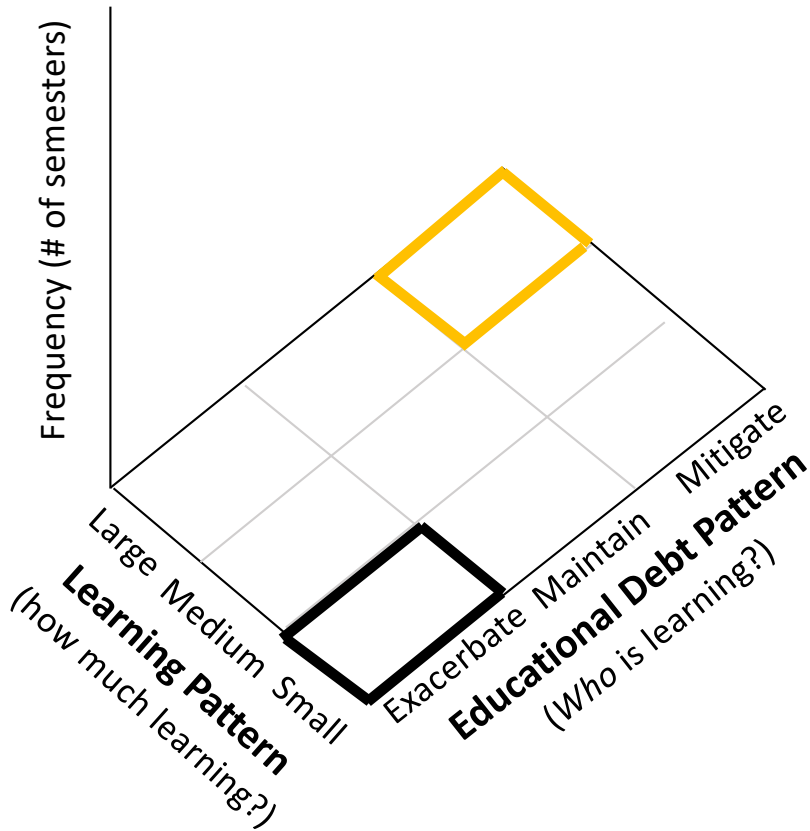
Members of historically excluded communities (HECs), e.g., marginalized racial/ethnic groups, females, first-generation students, low-socioeconomic status, etc.) continue to be severely underrepresented in the field of evolutionary biology (Graves, 2019; Mead et al., 2015; NSF & NCSSES, 2022; O'Brien et al., 2020; Roshworth et al., 2021; Tseng et al., 2020). The Society for the Study of Evolution (SSE), the world's largest organization of evolutionary biologists,¹ has begun to acknowledge, document, and outline strategies for addressing the educational inequities and systemic biases responsible for patterns of disciplinary underrepresentation. SSE's (2017) diversity statement instantiates a dedication to broadening participation of HECs. The diversity, equity, and inclusion (DEI) challenges facing the community are immense, and many goals, topics, and priorities deserve attention. In this article, we focus on one foundational but underexplored facet of DEI in evolutionary biology: disciplinary understanding and learning (cf. National Research Council [NRC], 2019).

SSE's diversity statement commits to “foster[ing] a broader understanding of evolutionary biology” (SSE, 2017), which appropriately identifies disciplinary understanding as a

relevant diversity topic (SSE, 2017) (see Supplementary Section 1). Disciplinary understanding is attained by learning and is a fundamental component of disciplinary interest, degree choice, advancement to upper-division coursework, degree attainment, and career participation. Monitoring learning tells us whether our efforts are moving students forward, whereas more commonly collected static measures such as exam scores and course grades (e.g., Denton et al., 2022) tell us only where students currently are in their educational journey but not how far we have helped them advance. Monitoring learning is essential for instructors and departments to determine whether undergraduate coursework is helping students achieve the knowledge required for disciplinary growth. Therefore, disciplinary learning is a meaningful equity indicator that is core to building both a more diverse and prepared workforce.

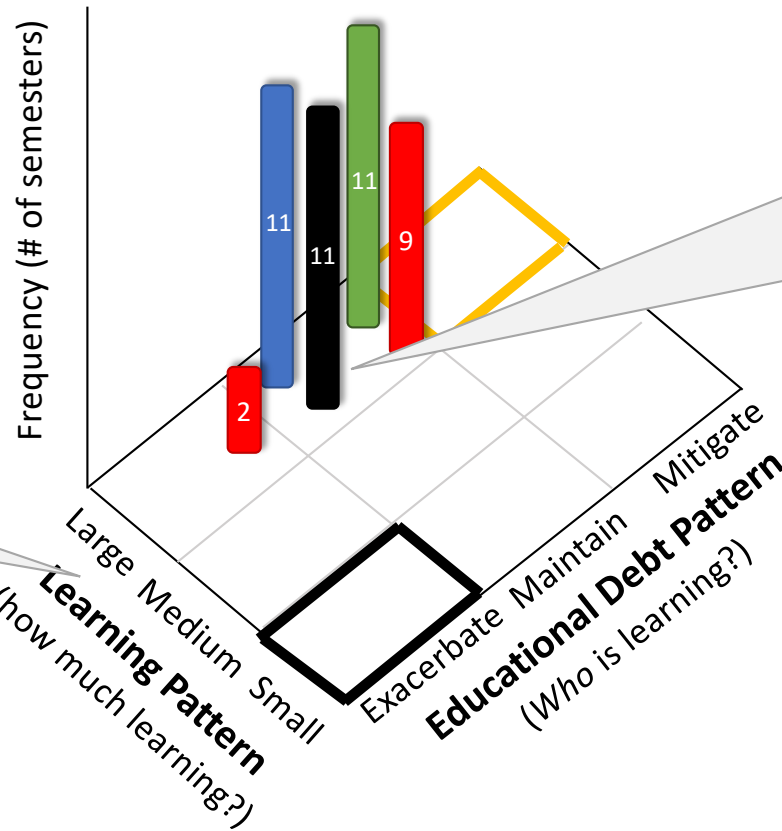
In the approximately 6 years since SSE drafted its diversity statement, little discussion has focused on how to measure, interpret, track, and improve evolution learning in a way that broadens participation in the field of evolutionary biology. For example, empirical work on evolution education has historically understudied HECs (Dank et al., 2019; however, see e.g., Nehm & Schoofeld, 2008), and only a handful of large-scale studies disaggregate evolution learning by demographic variables (e.g., Abraham et al., 2009; Sbeglia & Nehm, 2022). Furthermore, empirical work overwhelmingly focuses on knowledge measures at static time points (e.g., beginning or end-of-course knowledge) instead of adopting a longitudinal

¹According to SSE's communications manager, SSE has 3,416 members as of September 2023, which amounts to more evolutionary biologists than the Society for Integrative and Comparative Biology and the European Society for Evolutionary Biology.



Findings

ACORNS instrument



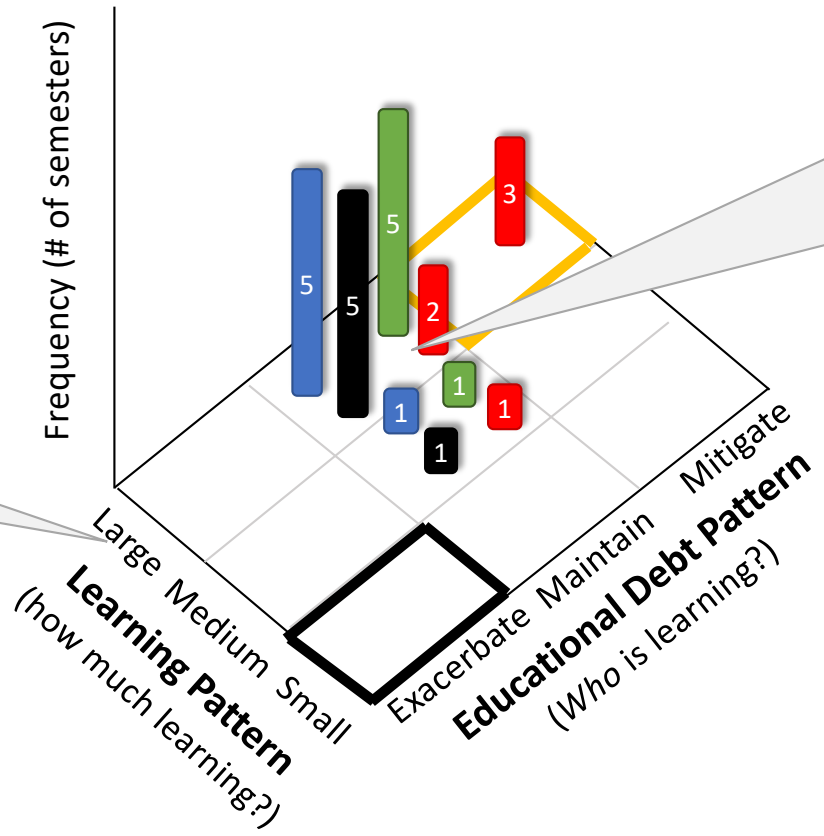
Large magnitudes of learning (**distance traveled**)

Incoming educational debt was not exacerbated by the course, but rather was generally ***maintained***

- Race/Ethnicity
- Gender
- PELL eligibility
- Prior Bio

Findings

CINS instrument



Large magnitudes of learning (**distance traveled**)

Incoming educational debt was not exacerbated by the course, but rather was generally ***maintained***

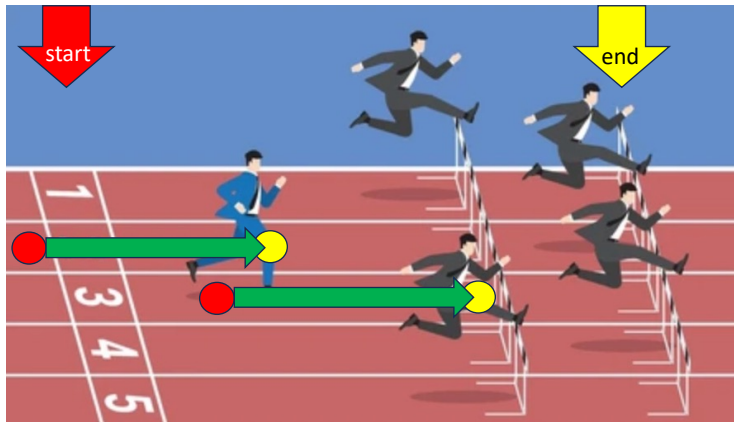
- Race/Ethnicity
- Gender
- PELL eligibility
- Prior Bio

Learning Objectives:

Where you **start**,

Where you **end**,

How far you **traveled**



Research on learning in undergraduate settings:

At SBU, URM, FG, F **start behind**, **travel long distances**, **maintain distance** (Nissen et al. 2024).

This is much better news that the only other work on bio courses.

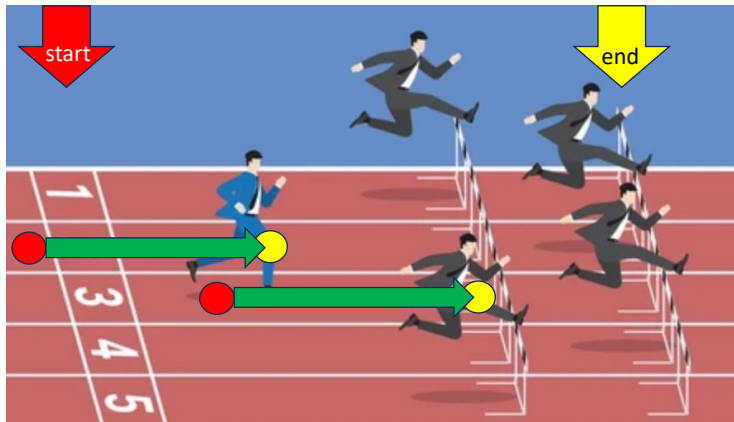
But it helps us identify where in the assessment loop we need to focus our attention.

Learning Objectives:

Where you **start**,

Where you **end**,

How far you **traveled**



Implications for Assessment Policy

Focusing on the end of the race—the current assessment approach advocated by OEE—greatly limits our ability to:

Understand how classes impact students.

Pinpoint where reform is needed.

Address inequities.

Acknowledgements

We thank our graduate and undergraduate researchers, the instructors and students of the gateway course, and our funders.

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