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## Introduction and Need

- Formative Assessments (FAs), such as online homework assignments, allow instructors to gauge student understanding and provide feedback<sup>1</sup> but may create disproportionate challenges for certain students.
- While other work has identified barriers for online courses in general<sup>2</sup>, less is known about specific challenges for engagement with online FAs within traditional course contexts and how barriers impact performance.
- Outside of class, students are likely to use the internet, yet little is known about how students utilize the internet to complete FAs.
- Information seeking behaviors using the internet include how the student understands the question, how they design their search, how the search results page is evaluated, and how they formulate their answer.

## Guiding Questions

- To what extent do students experience various barriers with respect to online FAs?
- How do students' demographics and course performances relate to the presence of identified barriers?
- How do students search the internet to answer biology questions?

## Selected References

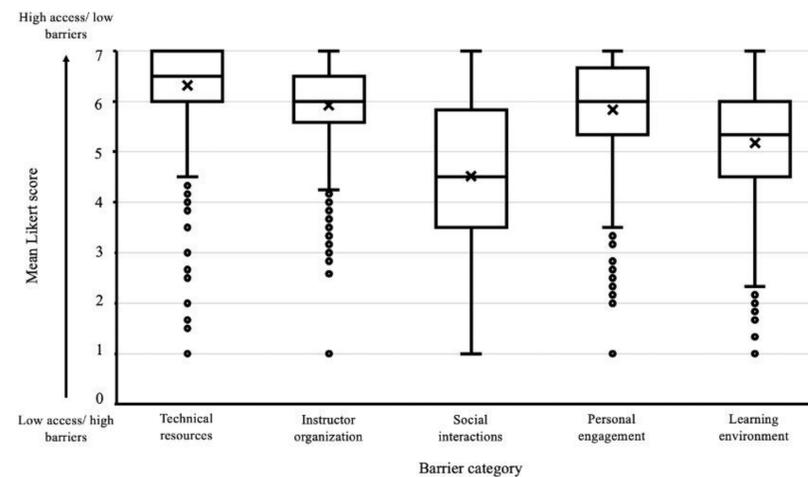
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- Muilenburg, L.Y., & Berge, Z. L. (2005). Student barriers to online learning: A factor analytic study. *Distance Education*, 26(1), 29-48.
- Hinojroza, J.E., Ibieta, A., Labbe, C., Soto, M. (2018). Browsing the internet to solve information problem: A study of students' search actions and behaviors using a 'think aloud' protocol. *Edu. Inf. Technol.*

## Outcomes: Barriers to engagement with online FAs

### Methods to assess barriers:

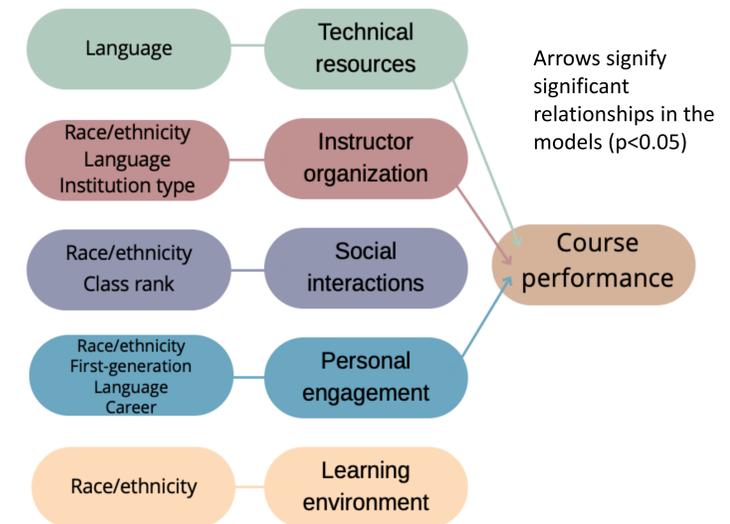
- Developed a survey and implemented in 7 intro. biology courses (n=1250).
- Ran linear mixed models to assess demographic predictors for each barrier category and to test whether barriers impact course performance.

### Prevalence of perceived barriers to online FAs



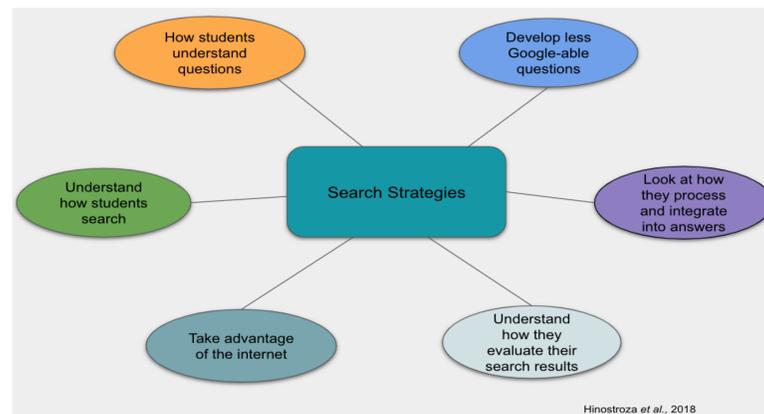
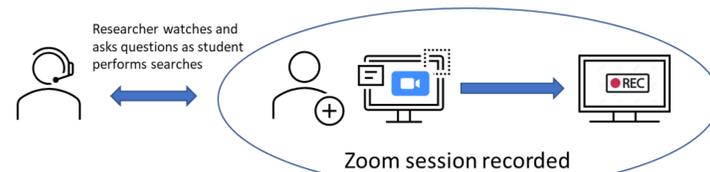
Students reported fewer barriers in *technical resources* and more barriers in *social interactions* categories.

### Connections among demographics, perceived barriers, and course performance



## Outcomes: Student online search strategies

### Novel interview method: students were recorded searching the internet to answer biology questions (n = 25)



Action	Process	Code	Definition
Copies and pastes		Copy/pastes answer	The student's answer is copy and pasted from the website and they do not adjust wording.
		Transcribes from website	The student writes the answer from the website but does not use the copy/paste function.
Developing answer	Writes answer	Rephrases answer	The student uses information from the website(s), paraphrasing the answer.
		Answers with no search	The student formulates their answer without using the internet.
		Incorporates own idea	The student uses the information from the website(s) and also incorporates ideas or information from sources outside of the internet.
Qualifies answer		Uses multiple sources	The student uses multiple websites to develop their answer. This may also occur after the student writes the answer but wants to confirm a statement that they wrote.
		Notes a guess at answer	The student was unable to find a suitable answer on the internet and writes an answer noting that it was a guess.
		Expresses uncertainty about answer	The student answers the question, noting an uncertainty in an understanding of the biology.

Codebook excerpt for how students use the internet to search for biology information. "Developing answer" was one of five action categories in this study. (Adapted from Hinojroza et al. 2018)

## Broader Impacts

- Identifying barriers to online FA engagement is crucial to supporting students and ensuring inclusive learning opportunities.
- Predicting which students are more likely to face certain barriers allows instructors to take a more proactive approach to increase student access.
- Understanding how students use the internet to help answer biology questions can be valuable to FA development and evaluation.
- Outcomes of this work will be used to implement institutional supports, to improve student access and engagement with FAs.