

# Toward a More Equitable and Effective Physics Graduate Admissions Process

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**Georgia Physics and Astronomy  
Education Research**

*Franklin College of Arts and Sciences*

**UNIVERSITY OF GEORGIA**

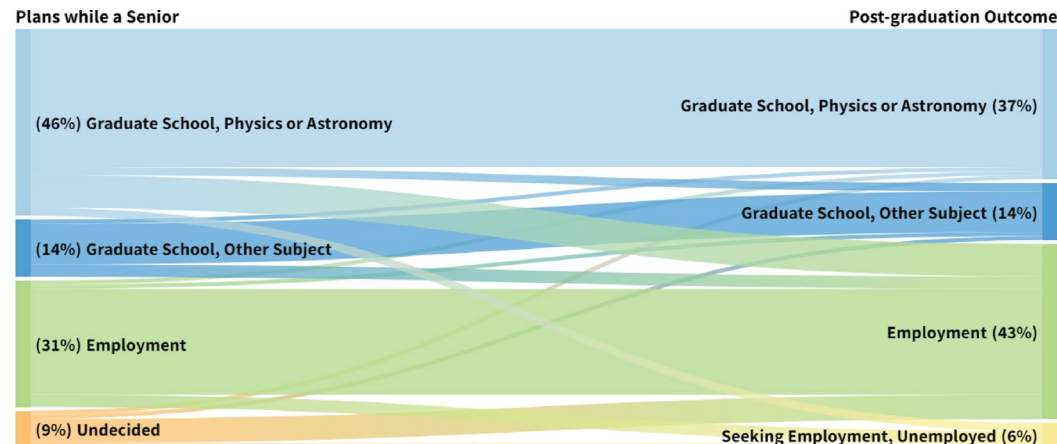
*Research supported by the Michigan State University College of Natural Sciences, Lappan-Phillips Foundation, and the University of Michigan's Center for Academic Innovation.*

*A special thanks to Kirsten Tollefson, Remco Zegers, Scott Pratt, Nicole Verboncoeur, Dao Chi Lam, and Tabitha Hudson for their contributions to this project.*



# Graduate school is a popular choice for physics majors

Post-Graduation Plans versus Actual Outcomes for Physics and Astronomy Seniors, Class of 2021



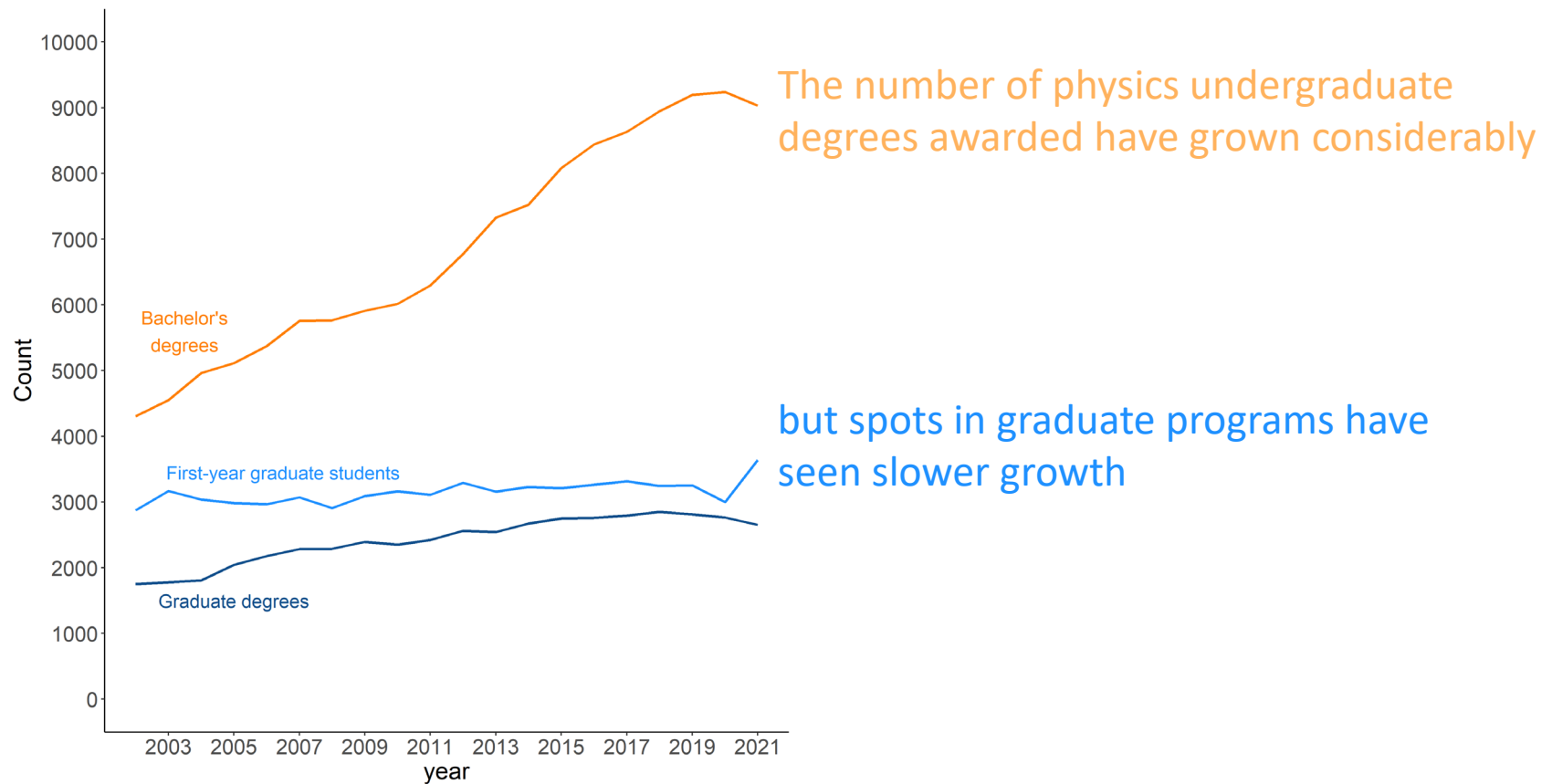
The figure includes only physics and astronomy seniors who graduated in the class of 2021.



[aip.org/statistics](http://aip.org/statistics)

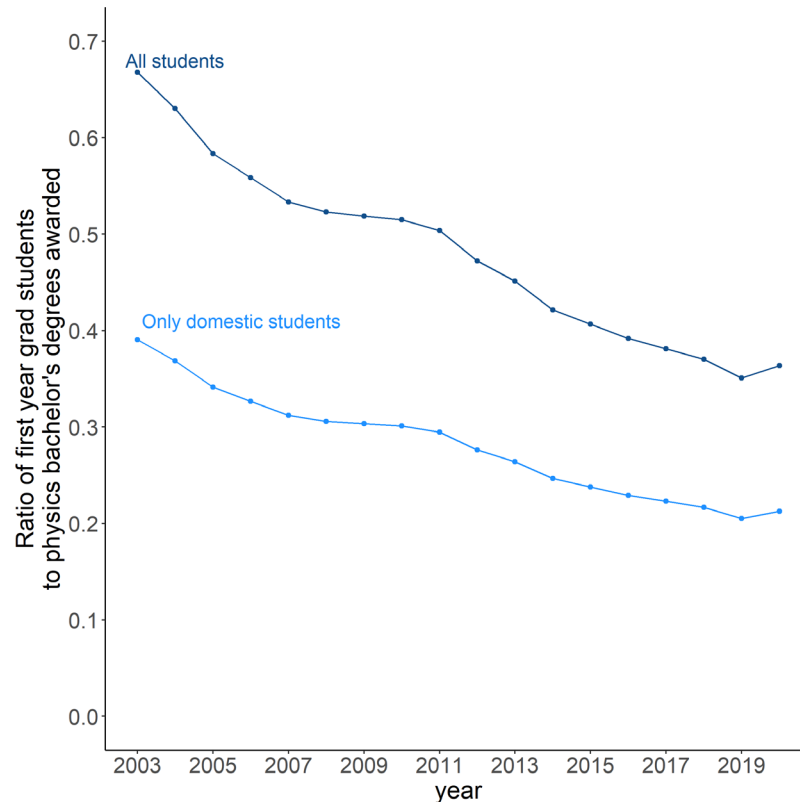


# Larger admissions context



AIP Statistics; Young, Hayward, and Bell (2023)

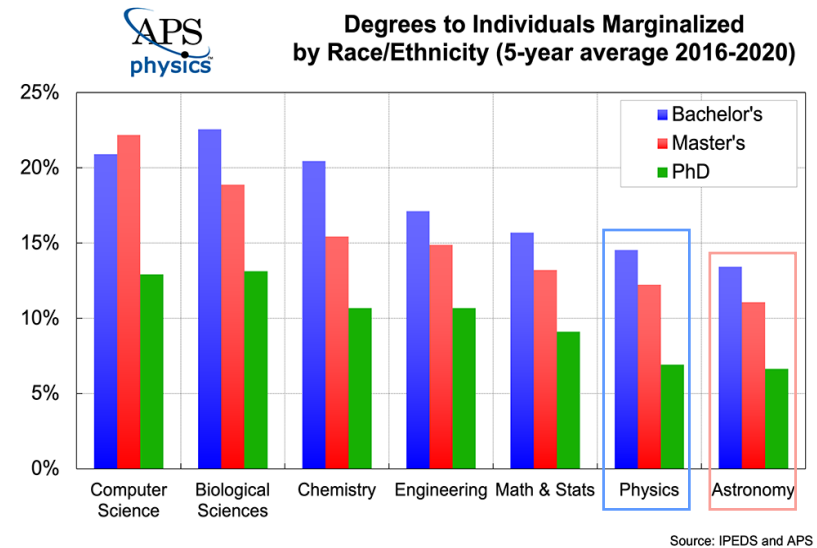
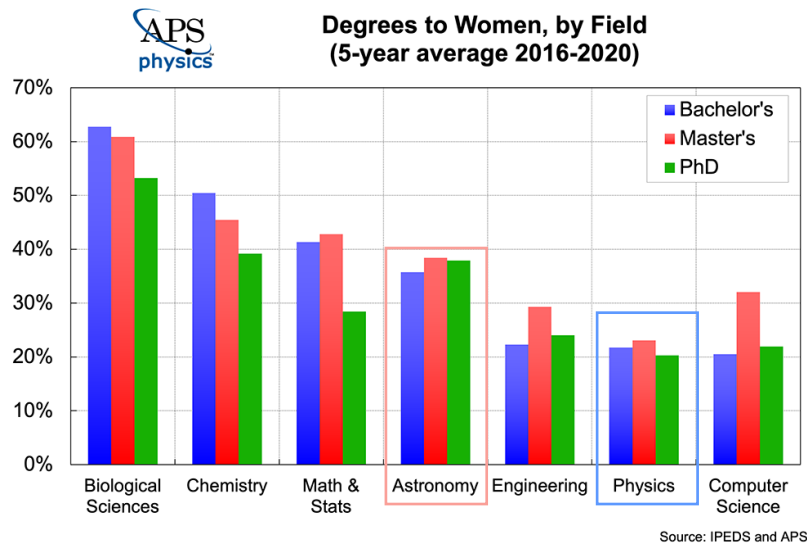
# Larger admissions context



The number of available spots per bachelor's recipient is decreasing.

AIP Statistics; Young, Hayward, and Bell (2023)

# Larger context: Physics lags behind other STEM fields in terms of representation





What's inequitable with the way we've  
always done it?



# The typical admissions package

GRE scores

GPA

Personal statement

Research statement

Letters of

recommendation



# The typical admissions package

GRE scores  
GPA  
Personal statement  
Research statement  
Letters of  
recommendation





Research Goal: Determine which application components are most predictive of an applicant being admitted to a physics graduate program.

Young and Caballero (2019); Young et al. (2023)

# Data

GRE scores

GPA

Undergrad school

N=512 domestic  
applications

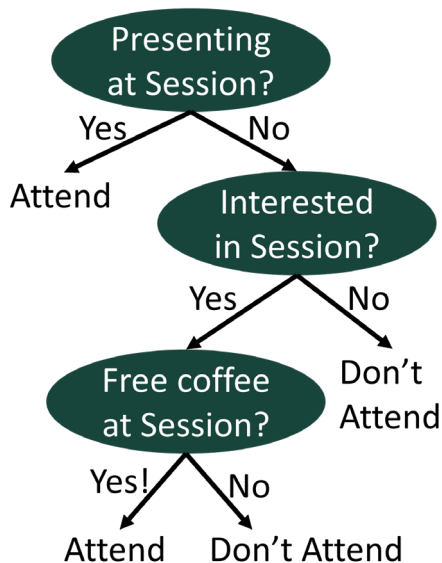


Michigan State University  
2014-2017



# Machine Learning

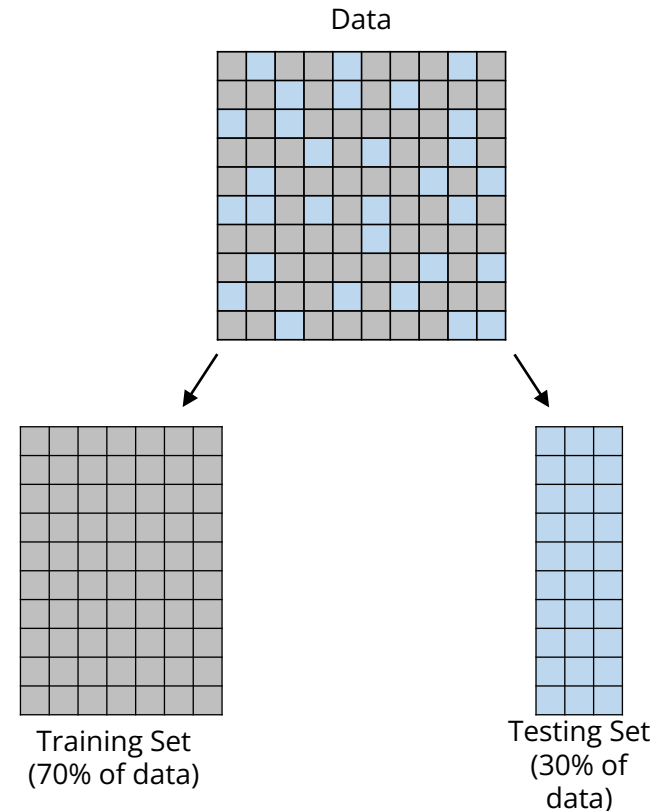
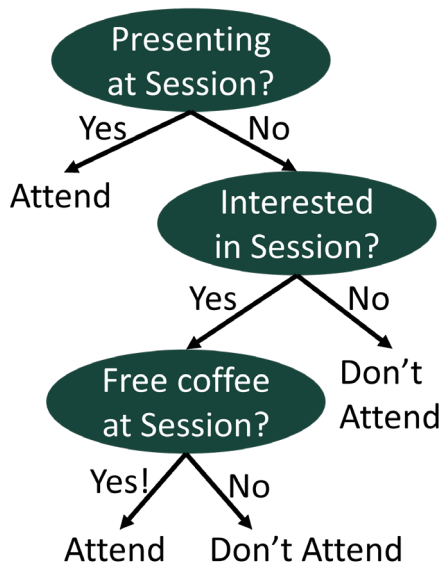
Hypothetical Example: Do you attend an 8am conference session?



Breiman 2001 Strobl et al. 2007 Janitza et al. 2013

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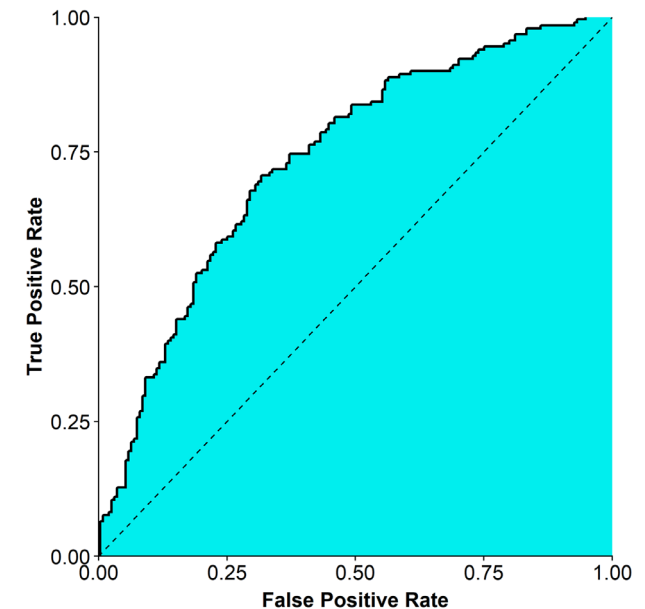
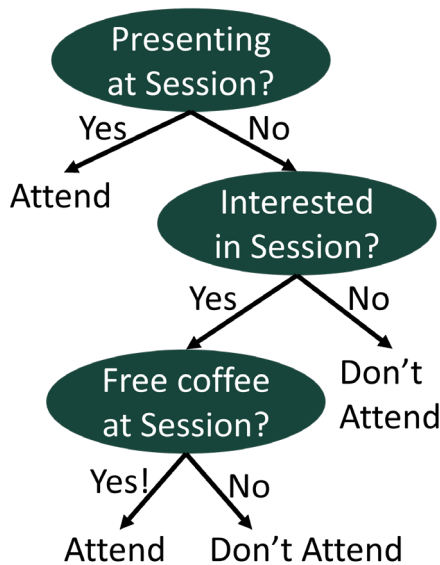
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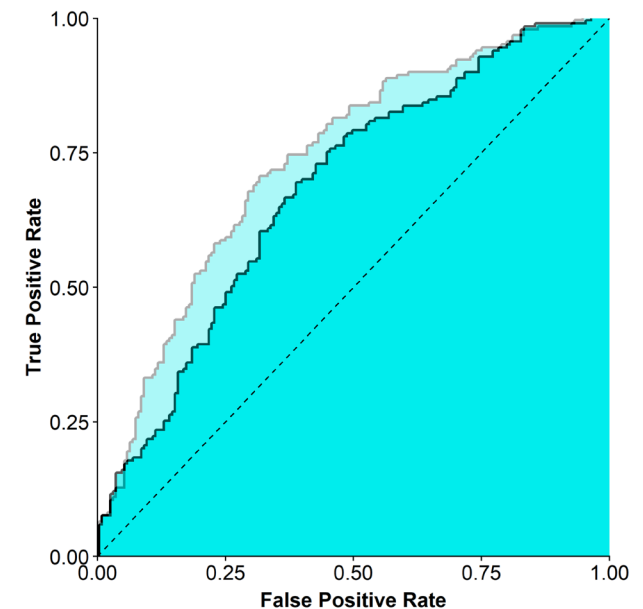
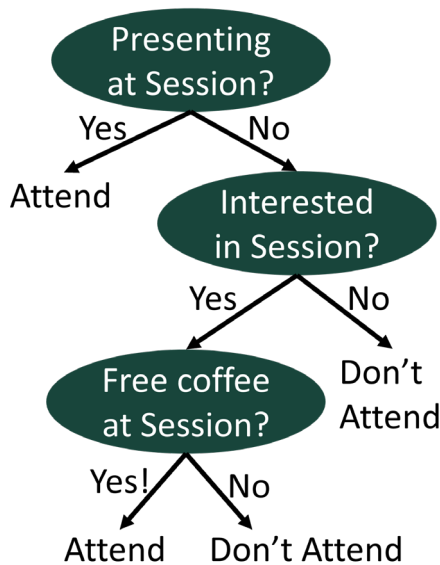
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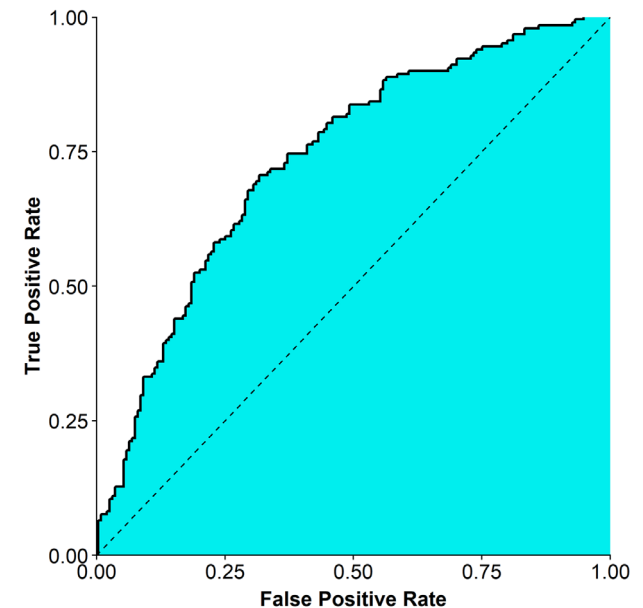
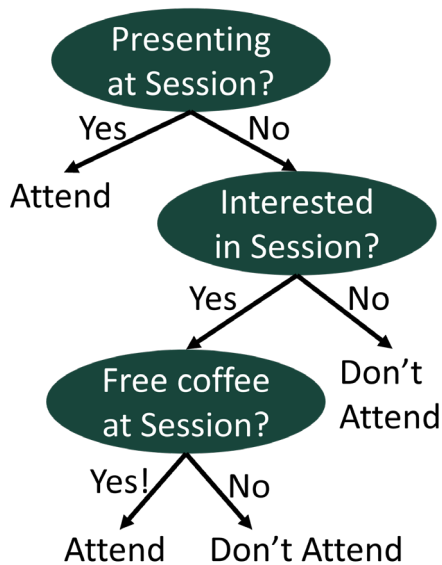
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# Machine Learning

Hypothetical Example: Do you attend an 8am conference session?



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# Test scores & GPA are most predictive of admission

## All Variables

Average Testing Accuracy:

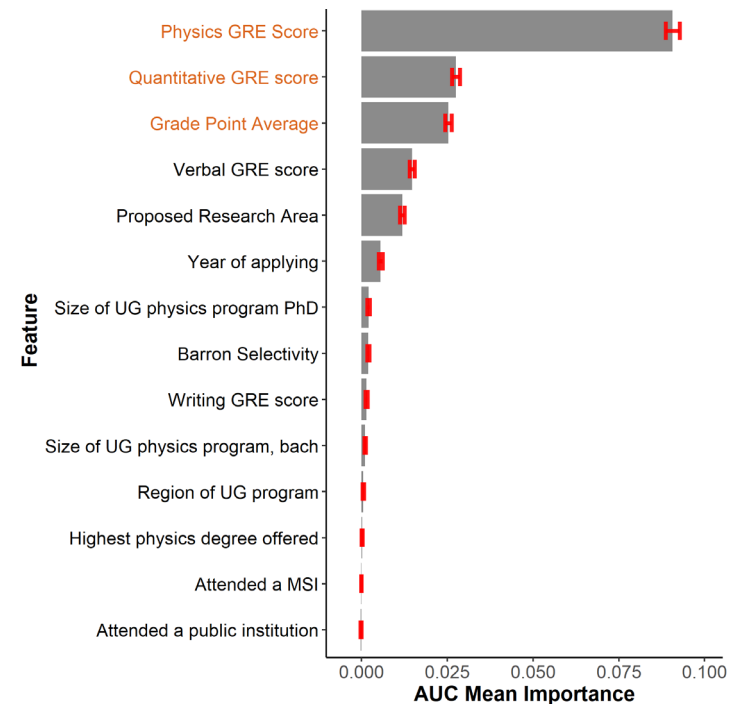
$75.6\% \pm 0.6\%$

Null accuracy: 52.7%

Average Testing

Area Under the Curve (AUC):

$0.756 \pm 0.006$





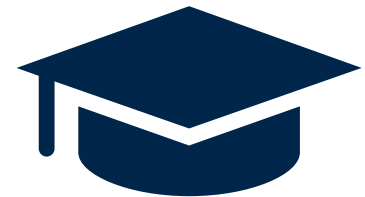
# Why the Physics GRE is inequitable



Cost



Score discrepancies



Limited predictive  
ability

Miller et al. 2019, Owens et al. 2020



# What would it look like to rethink graduate admissions and make it more equitable?

Young et al. 2022



👤 Nicholas Young

# Rubric-based holistic review

Kent and McCarthy 2016; Posselt 2016; Miller & Posselt 2020



# Rubric-based holistic review



[Flickr](#), CC-BY-2.0

Miller 2015; Barceló et al 2021; Woo et al 2022



Academic Preparation (25%)	Physics Coursework
	Math Coursework
	Other Coursework
	Academic honors and/or recognitions

Non-Cognitive Competencies (25%)	Achievement Orientation
	Conscientiousness
	Initiative
	Persistence

Research (25%)	variety/duration
	quality of work
	technical skills
	dispositions

Fit with program (15%)	research
	faculty
	community
	diversity

GRE Scores (10%)	General GRE
	Physics GRE

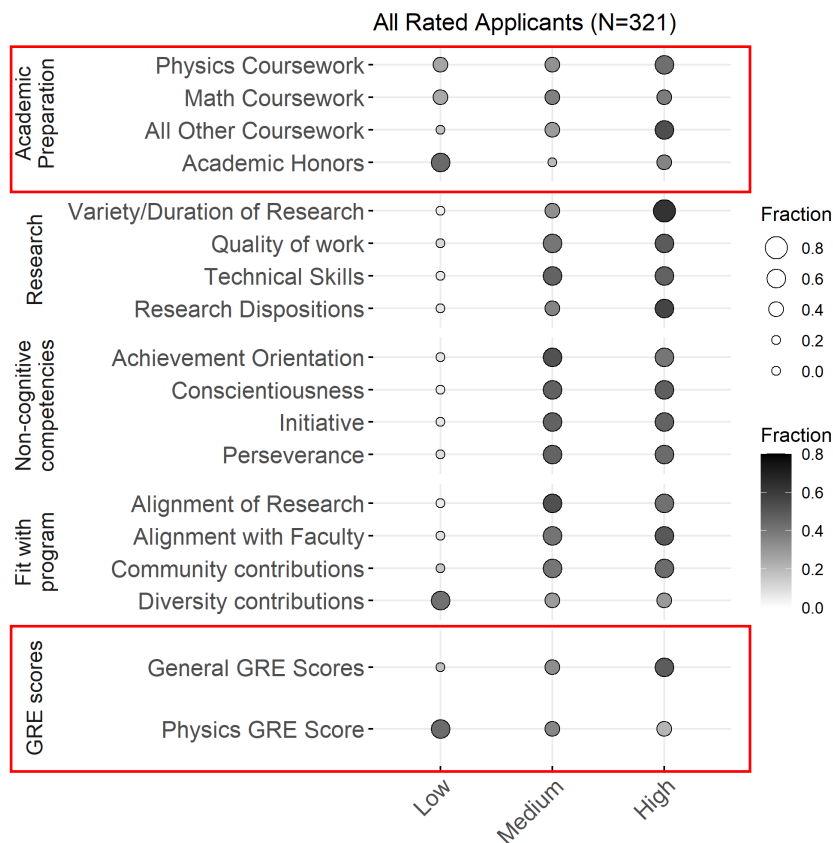
<https://igenetwork.org/>

Academic Preparation (25%)	Physics Coursework	Research (25%)	variety/duration
			quality of work
	Math Coursework		technical skills
	Other Coursework		dispositions
	Academic honors and/or recognitions	Fit with program (15%)	research
Non-Cognitive Competencies (25%)	Achievement Orientation		faculty
	Conscientiousness		community
	Initiative		diversity
	Persistence	GRE Scores (10%)	General GRE
			Physics GRE

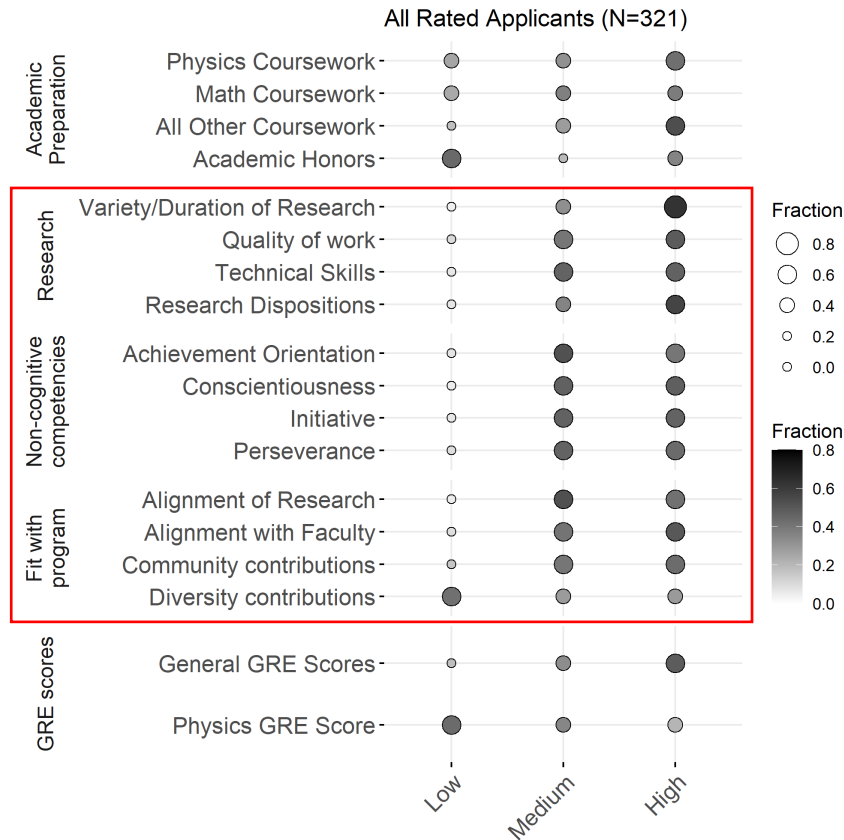
3 years

321 Rated Domestic Applicants

<https://igenetwork.org/>



Applicants spread  
between the rubric  
levels

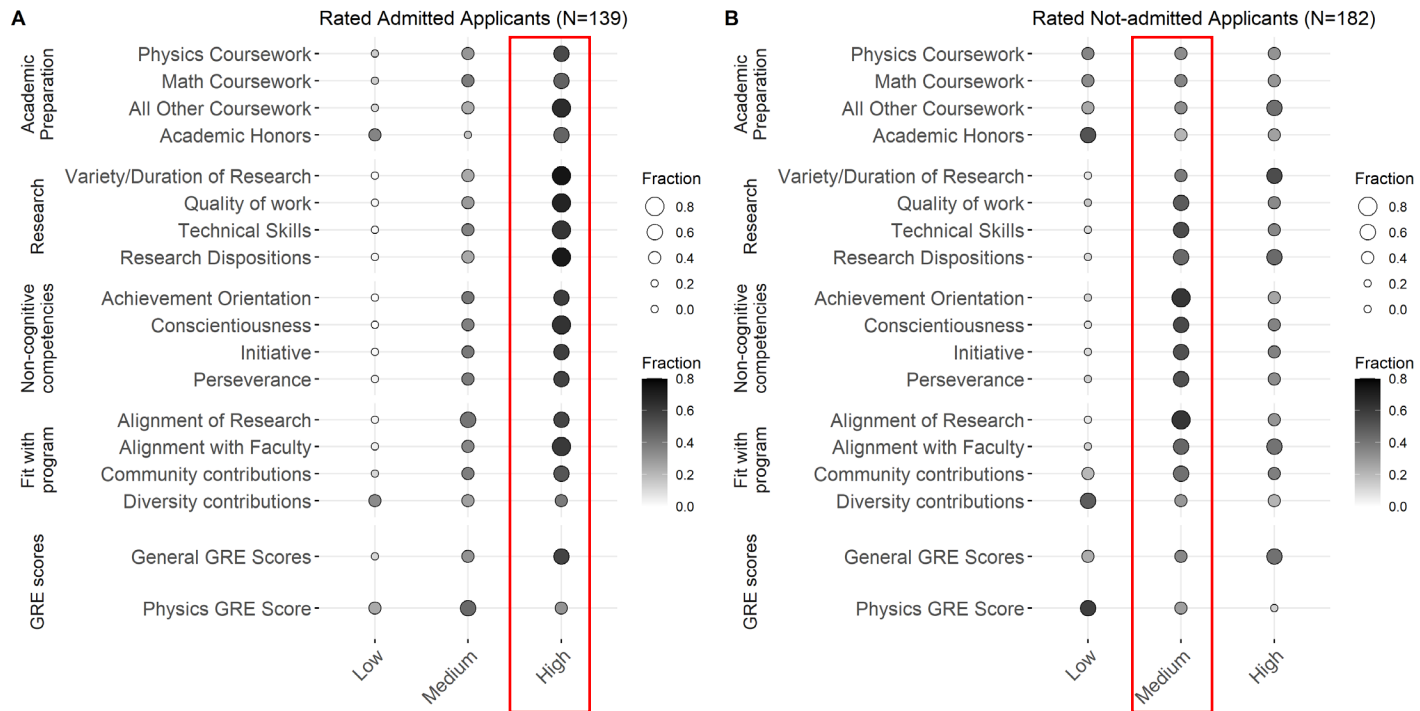


Applicants  
concentrated in the  
“medium” and  
“high” categories



# Admitted applicants tend to score "high"...

## Rejected applicants tend to score "medium"

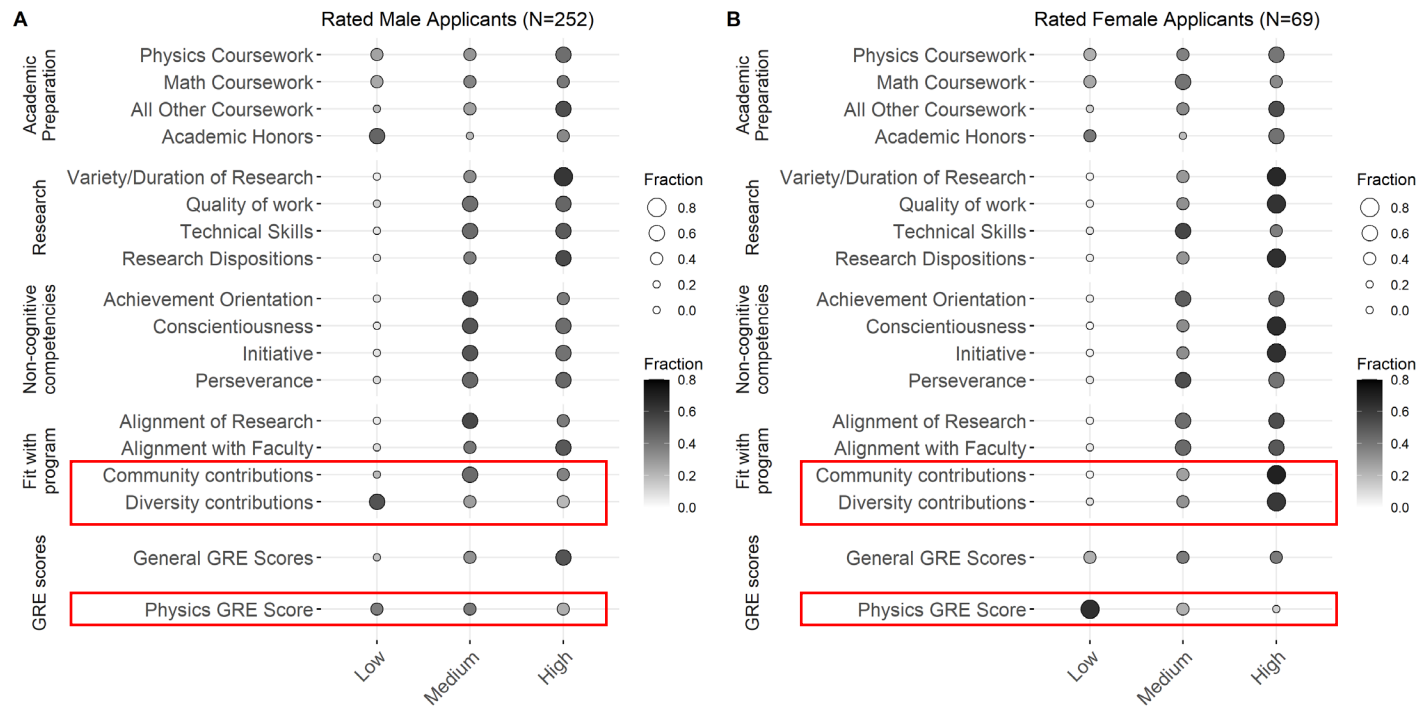




What about equity???

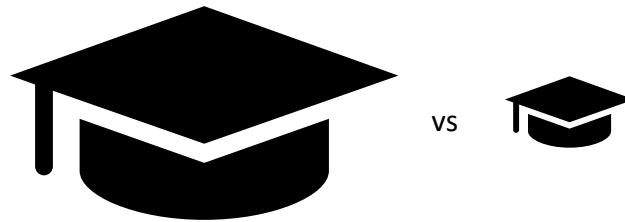


The only differences in ratings between males & females were on physics GRE scores and service/diversity work.



Miller et al. 2019; Guarino & Borden 2017

Test scores are the only consistent difference



Mikkelsen, Young, Caballero 2021

## *Takeaway*

Rubric-based holistic review seems promising for achieving equity in graduate admissions.





But is really a different process?



The evidence suggests that rubric-based holistic admissions is a change from the traditional admissions process...



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but there's still some work to do to be confident in that conclusion.





# Takeaways

- The traditional graduate admissions process in physics is test score and GPA heavy.



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- Test scores and GPA can be inequitable for minoritized applicants
- Rubric-based holistic review seems promising for achieving equity in graduate admissions.




# Recommendations

- Discontinue the use of the physics GRE

Owens et al 2020



 Nicholas Young

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- Discontinue the use of the physics GRE
- Rethink the admissions process in terms of what applicants are evaluated on, how they are evaluated, and who is doing the evaluating

View the Michigan State Rubric:

Rubric-based holistic review: A promising route to equitable graduate admissions in physics  
(Young et al 2022)

# Recommendations

- Discontinue the use of the physics GRE
- Rethink the admissions process in terms of what applicants are evaluated on, how they are evaluated, and who is doing the evaluating
- Engage in self-study and report on what is and is not working

Scherr et al 2017; Rudolph et al 2020

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Questions?

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Slides:

[bit.ly/](https://bit.ly/)

Scherr et al 2017; Rudolph et al 2020

# Recommended reading

- Barthelemy, Ramón, MacKenzie Lenz, Alexis Knaub, Jordan Gerton, and Pearl Sandick. "Graduate Program Reform in One Department of Physics and Astronomy: From Tragedy to More Progressive Policies and an Evolving Culture." *Physical Review Physics Education Research* 19, no. 1 (January 9, 2023): 010102. <https://doi.org/10.1103/PhysRevPhysEducRes.19.010102>.
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