Module: The Use of GRE Scores

Read the information in this document and work through the sample activities with a group of 3-5 people

Learning Objectives

You will be able to:
- Describe the content and grading process of the Quant, Verbal, and Physics GREs
- Explain how the ETS intends for GRE scores to be used
- Discuss problematic issues with using GRE cutoff scores in admissions
- Examine correlations between GRE scores and other academic measures

Activity: GRE Preconceptions

In your opinion, what should be the lowest Quantitative GRE percentile that is still "acceptable" for an applicant to your program?

In your opinion, what should be the lowest Verbal GRE percentile that is still "acceptable" for an applicant to your program?

In your opinion, what should be the lowest Physics GRE percentile that is still "acceptable" for an applicant to your program?

Assume that you have to decide between these two prospective applicants, which would you admit to your program? Why?

Student A	**Student B**
GRE-Quant: 160	**GRE-Quant: 165**
GRE – Verbal: 150	**GRE – Verbal 155**
GRE – Physics: 790	**GRE – Physics 880**

Overview of the Graduate Record Exams

The General GRE…

- Can be administered either as computer-based test (most common) or a pencil/paper test
- Contains one Analytical Writing Section
    - One Analyze and Issue Task lasting 30 minutes

- One Analyze and Argument Task lasting 30 minutes
  - Is scored from 0-6 in half point increments
- Contains two Verbal Reasoning Sections
  - 20 multiple choice (5-option) questions
  - Is an adaptive test (previous question performance determines future question difficulty)
  - Each section lasts for 30 minutes
  - Is scored from 130-170 in 1-point increments
  - Covers the following content areas
    - Reading Comprehension
    - Text Completion
    - Sentence Equivalence
- Contains two Quantitative Reasoning Sections
  - 20 multiple choice (5-option) questions
  - Is an adaptive test (previous question performance determines future question difficulty)
  - Each section lasts for 35 minutes
  - Is scored from 130-170 in 1-point increments
  - Covers the following content areas
    - Arithmetic
    - Algebra
    - Geometry
    - Data Analysis
- Contains one Unscored/Research Section
  - Can be either verbal or quantitative reasoning
  - Students are not informed which section is the research section
- Allows for a 1 minute break between sections and an optional 10 minute break at after the third section (the half way mark).

GRE Score Interpretations*			
Verbal Reasoning		Quantitative Reasoning	
Scaled Score	Percentile	Scaled Score	Percentile
170	99	170	96
158	80	158	68
153	61	153	50
145	27	145	20
133	2	133	1

The Physics GRE…

- Contains 100 multiple choice (5-option) questions
- Lasts for 2 hours and 50 minutes with no break
- Is a pencil and paper based test where no calculator can be used
- Scores range from 250-990 in 10-point increments
- Covers the following content areas
  - Classical Mechanics   20 questions

- o Electromagnetism 18 questions
- o Quantum Mechanics 12 questions
- o Statistical Mechanics 10 questions
- o Atomic Physics 10 questions
- o Optics and Waves 9 questions
- o Special Topics 9 questions
- o Special Relativity 6 questions
- o Laboratory Methods 6 questions

Physics GRE Score Interpretations*		
Total Correct	Scaled Score	Percentile
84-100	990	99
75	900	83
45	760	61
50	600	27
25	440	2

*Based on GRE Physics Practice Test Form GR1777

Why Do Graduate Programs Use The GRE?

The purpose of this first section is to determine why graduate programs make use of the GRE in their admissions process. This list of reasons have been extracted from multiple research interviews with faculty and will serve as a roadmap outlining future sections of this module.

Commonly cited reasons for using the GRE include:

- efficiently filtering a large number of applications down to a short list
- measuring general intelligence
- objectively comparing students from a variety of backgrounds
- predicting graduate school success
- providing validation of GPA

In a research study focusing on the admissions process of several disciplines, some faculty commented on the fact that the graduate admissions cycle is a time-consuming process, and cited the efficiency of the GRE.

> *"To enhance efficiency, the admissions chair conducted the initial screen of the applicant pool. In a humanities program with 200 applicants, for example, the chair […] relied predominately on GRE and TOEFL scores to cut the pool – still hundreds strong – in half."* Posselt (2016).

> *"We receive so many applications, and we are always in a crunch with time – always. And I have impressions that some of my faculty were simply looking at the GRE. They have a threshold such as, 'If it's not over 700, I won't read anything.' And that cuts usually two-thirds of the applicants."* Participant quote; Posselt (2016).

However, it is critical to consider the cost of that efficiency. Throughout this document, you will explore the merit of many of these claims through a critical examination of data from the Educational Testing Service (ETS), the American Physical Society (APS), and other relevant literature.

Using GRE Cut-Off Scores in Graduate Admissions

In light of the convenience and efficiency discussed in the first section, many departments use a minimum GRE score as their filter for applications. Even departments which claim to not have a minimum require still have an idea of a lower limit. Interviews revealed that even if the department did not advertise a cutoff, some faculty had an idea of what minimum GRE scores should be.

> *"No fixed cutoff, but GRE quantitative should be about 90 [sic] percentile or higher."* Participant quote; Posselt (2016).

> *"No hard cutoff, but used as a first cut in going through applications and GRE scores trump GPA scores in assessing students."* Participant quote; Posselt (2016).

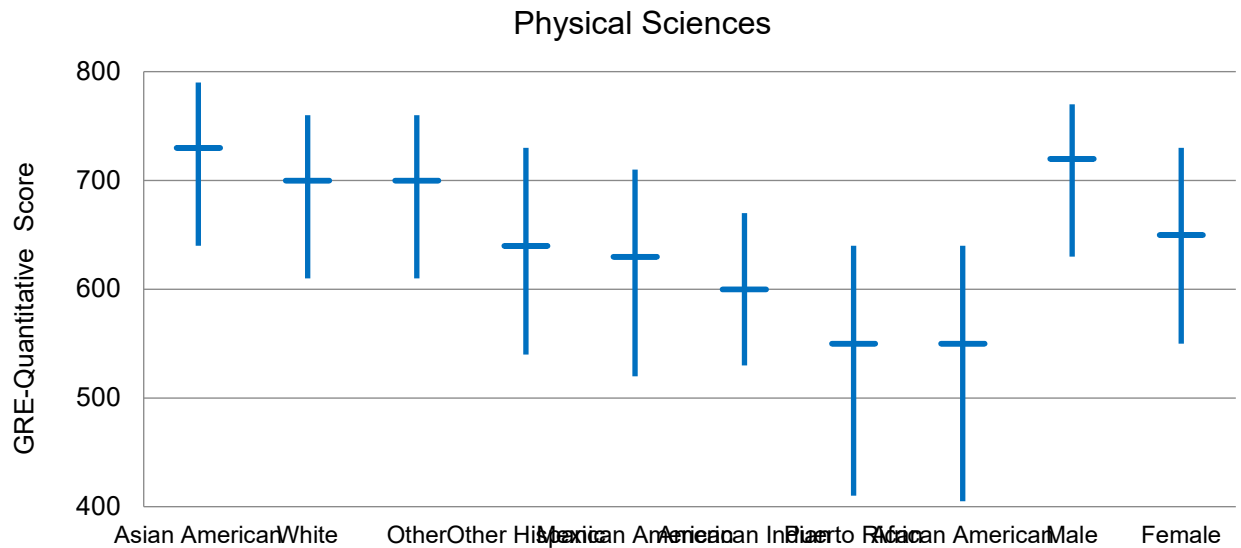However, according to the ETS' Guide to the use of GRE Scores (full document found [here](#)):

> *"[The GRE] is an inexact measure, only score differences that exceed the standard error of measurement of a given score can serve as a reliable indication of real differences in applicants' academic knowledge and developed abilities."*

The ETS published a table of reliability estimates and standard errors of measurement. The following table is based on their publication of this data in 2017.

Standard Error of Measurement for the General GRE		
Assessment	Standard Error	Standard Error of Score Differences
GRE-Verbal	2.4	3.4
GRE-Quantitative	2.1	3.0

Be careful not to confuse standard error with standard deviation. Standard deviation measures the amount of variability of a data set from the mean. Standard error measures how far the mean of the dataset is likely to be from the true population mean. In other words, standard error is the variation in scores that is expected due to errors in the measurement instrument. The standard error of score differences is used to determine whether the difference between two scores is statistically meaningful. In other words, the same student taking the GRE-Quant one day could score a 165 and the next day could score 168.

  To see the effect of using a cutoff score for the Quantitative GRE across many of the underrepresented groups in the physical sciences, see the table below.

Physical Sciences

Chart: GRE-Quantitative Score (y-axis, 400 to 800) for groups: Asian American, White, Other, Other Hispanic, Mexican American, American Indian, Puerto Rican, African American, Male, Female

---

Activity: Reflection for GRE Cut-off Scores

Thinking back to the Two Folder's Activity from the previous section, reflect on how this new information affects your thinking. Did this information surprise you? How will you interpret GRE scores in the future? Write your own thoughts down first and then discuss as a group.

According to the ETS, a cutoff based only on GRE scores should never be used as a sole criterion for denial of admission. Any department considering the use of a cutoff score should compile a rationale justifying the appropriateness of such a score for each measure with evidence that the proposed cutoff score for the measure usefully distinguishes between individuals who are likely to succeed in graduate school and those who are not, and the impact of the proposed cutoff score on the institution's goals related to diversity.

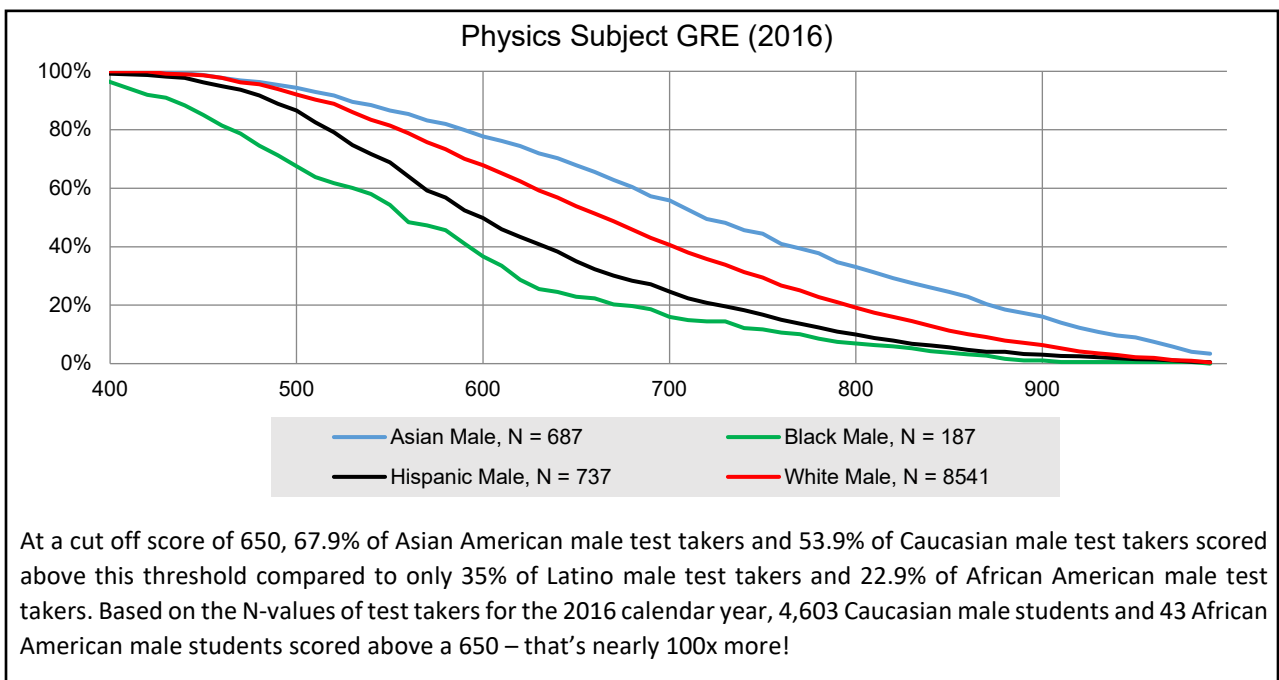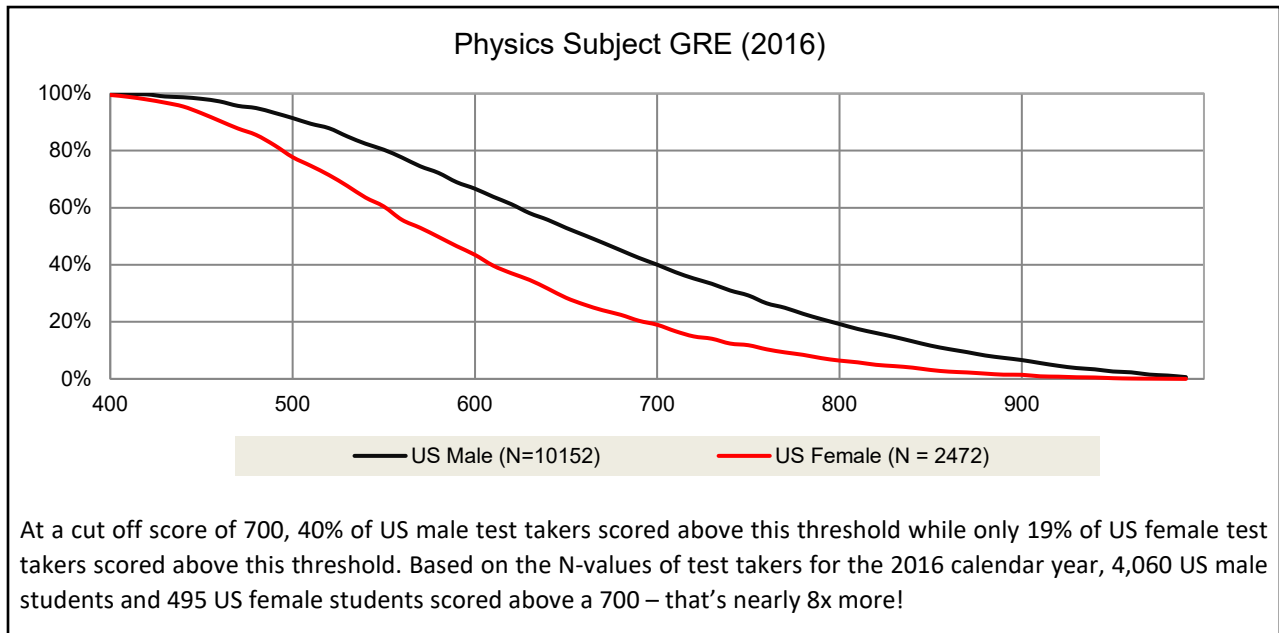**Activity: Prediction for GRE Cut-off Scores**

Individually predict how using a Physics Subject GRE Cutoff Score of 700 might impact the gender and racial diversity of application which pass the cut. Will the percentage of male vs female test takers scoring over a 700 be equivalent? If not, how different will those percentages be? Also consider race. Write your individual predictions in the space below.
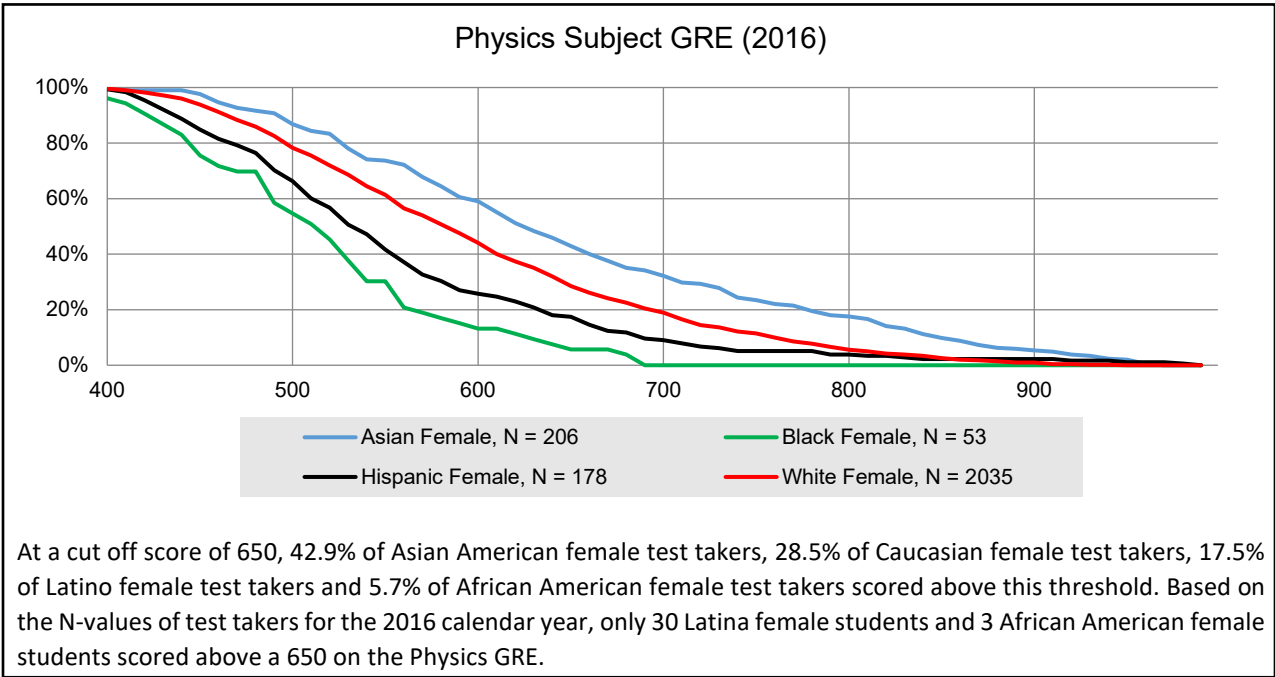
To see how GRE cutoff scores directly impact both gender and ethnic/racial diversity, consider the following data from the Physics Subject GRE. Discuss each table as a group.

Physics Subject GRE (2016)

Legend: US Male (N=10152), US Female (N = 2472)

At a cut off score of 700, 40% of US male test takers scored above this threshold while only 19% of US female test takers scored above this threshold. Based on the N-values of test takers for the 2016 calendar year, 4,060 US male students and 495 US female students scored above a 700 – that's nearly 8x more!

Physics Subject GRE (2016)

Legend: Asian Male, N = 687; Black Male, N = 187; Hispanic Male, N = 737; White Male, N = 8541

At a cut off score of 650, 67.9% of Asian American male test takers and 53.9% of Caucasian male test takers scored above this threshold compared to only 35% of Latino male test takers and 22.9% of African American male test takers. Based on the N-values of test takers for the 2016 calendar year, 4,603 Caucasian male students and 43 African American male students scored above a 650 – that's nearly 100x more!

Physics Subject GRE (2016)

Legend:
- Asian Female, N = 206
- Black Female, N = 53
- Hispanic Female, N = 178
- White Female, N = 2035

At a cut off score of 650, 42.9% of Asian American female test takers, 28.5% of Caucasian female test takers, 17.5% of Latino female test takers and 5.7% of African American female test takers scored above this threshold. Based on the N-values of test takers for the 2016 calendar year, only 30 Latina female students and 3 African American female students scored above a 650 on the Physics GRE.

Activity: Reflection for GRE Cut-off Scores

How do your predicted values compare with the reported data? Do the numbers from the reported data surprise you? Write your thoughts in the space provided.

Activity: Physics GRE Cut Off Scores

As a group, pick another cut-off score (if your program currently requires the Physics GRE, consider using the cut-off you might impose) and discuss the implications for gender and racial/ethnic diversity at that threshold. Use the space below for your calculations. How does this information influence your thinking of using GRE cut off scores?

It's not just the Physics Subject GRE that has shown a discrepancy between test takers of differing genders and racial/ethnic backgrounds. Above is data from the GRE-Quantitative exam from 2006-2007 and includes students whose major was in the physical sciences.

In addition to the diversity implications of requiring or emphasizing a specific GRE cut-off, female graduate students reported in a research focus group that they were less inclined to apply to schools with recommended GRE scores.

Misconception: The GRE Measures General Intelligence

When asked in an interview-based study what GRE scores signal, 50% of the participants mentioned intelligence (e.g., "sheer intellectual horsepower", "native intelligence")[3] In that same study, more than 50% of GRE mentions within the context of admissions committee meetings were classified as "smart talk".

"Someone who does that well on the GRE is unlikely to be lame- brained. They are likely to be smart." (philosophy)
"Freaking genius" (political science)

"I question she has what it takes."
"[He was] from a different planet and we were confident that this person was not going to be one of us. He's not going to be a full member of the scientific community."
(biology)

Activity: Predictive Power

How well do you think the Quantitative GRE, Verbal GRE, and Physics GRE predictions PhD Completion for physics students? Write down your thoughts and then discuss with your group.

Faculty were asked in an interview what the GRE-Quant tells them about an applicant:

> *"This economics program was not unlike the top 25 in the field for requiring a perfect or near-perfect quantitative GRE score […]. They interpreted the score as signal of competence with skills, and as a signal of how the student would fare in coursework."*

> *"This person has a really high GRE math or something, and so they're more likely to have some technical ability."*

> *"If a person has a really high GRE score, I think that tells something. But if the GRE score is mediocre or something, sometimes it's bad, I don't think that necessarily tells the students is bad."*

These faculty members explain the GRE-Quant serves as some predictor of how an applicant would fair in graduate school. However, the GRE-Verbal, Quantitative, and Physics subject test all fail to reasonably predict graduate school completion.
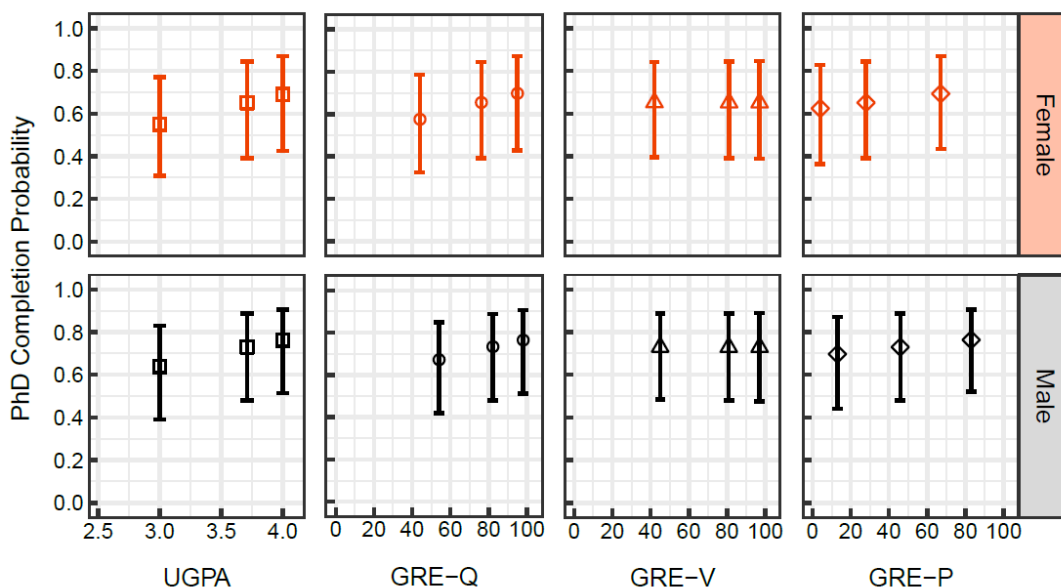
Does the data showing the lack of predictive power of the GRE align with your prediction? If not, were your surprised by the data? Write your thoughts in the space below.

_____

_____

_____

_____

Optional GRE Scores

While some programs have begun eliminating the GRE from their list of admissions requirements, other programs have moved to either reduce the influence of GRE's in their admissions process by making the GRE optional.

However, based on a series of focus groups with graduate students, the term "optional" was a matter of interpretation. Female graduate students in particular felt that they had to submit their GRE scores based on their perception that admissions committees would think that they were hiding a terrible score.

> *"I think [this program's] official position is GRE optional, right?"* - Interviewer
> *"You didn't have to include it. And I almost didn't….but I just felt like it was suspicious not to."* – Student 1
> *"Yeah, I think I was the same."* – Student 2
> *"And so was I."* – Student 3
> *"'You're not including it, does that mean that you've got a score so bad that you just don't want us to see it?' And I was like, 'Well, here it is. That's my awful score.'"* – Student 1
> *"Unless they said, 'Do not send,' I sent them anyway because everyone was like, 'You should send, just so they don't think you got a zero.'"* – Student 4

Activity: Overall Reflection

Discuss this module as a whole with your group. What did you learn? What surprised you the most? What policies in your current admissions practice (if any) could be impacted by the data presented in this module?

\
\
\
\
\
\

References

Potvin, G., Chari, D., & Hodapp, T. (2017). Investigating approaches to diversity in a national survey of physics doctoral degree programs: The graduate admissions landscape. Physical Review Physics Education Research, 13(2), 020142. doi:10.1103/PHYSREVPHYSEDUCRES.13.020142

"Factors that can influence performance on the GRE general test 2006-2007" as cited in Miller, C., & Stassun, K. (2014). A test that fails. *Nature*, *510* (7504), 303-304.

Miller, C. W., Zwickl, B. M., Posselt, J.R., Silvestrini, R. T., Hodapp, T. (2019). Typical physics PhD admissions criteria limit access to underrepresent groups but fail to predict doctoral completion. Science Advances,

Posselt, J. R. (2016). *Inside graduate admissions: Merit, diversity, and faculty gatekeeping*. Cambridge, MA: Harvard University Press.

Owens 2018 - Data