

TEACHING AND LEARNING IN STEM

PURSUING INCLUSIVITY AND EXCELLENCE WITH A SCIENTIFIC APPROACH

UTSA[®]

The University of Texas at San Antonio[™]

Juan B. Gutiérrez, Ph.D.

Professor, Chair of Mathematics, UTSA

October 29, 2024

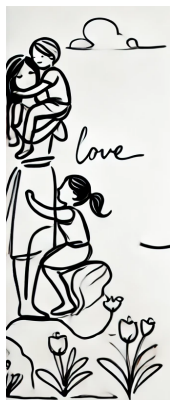


“I AM AN IMMIGRANT...”

You have heard this before...

I will tell you what it means to me.

The power of higher education lifts communities



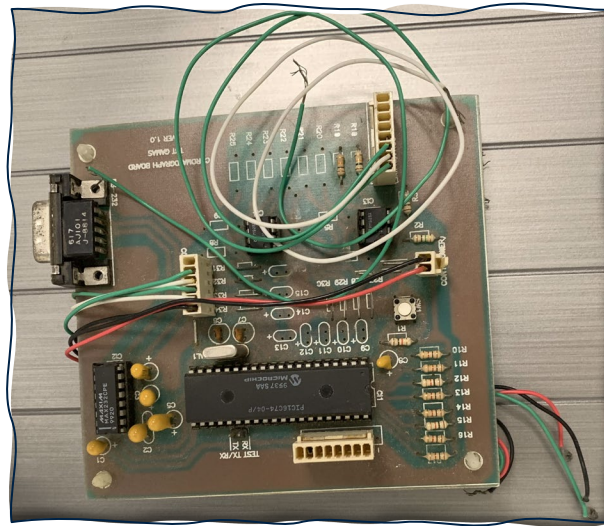
1974



1977



1983



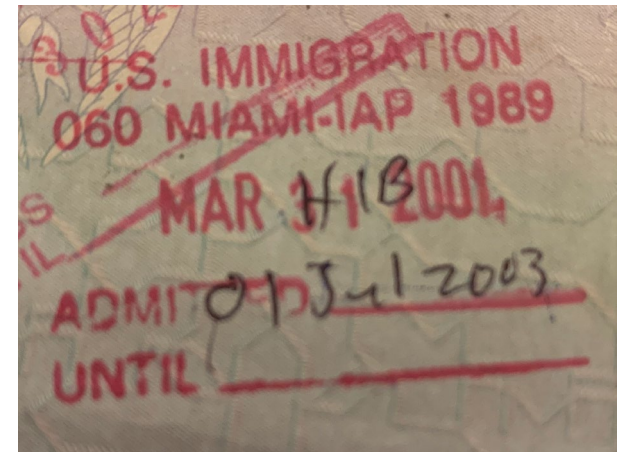
Journey through Equinoctial America 1875-1876 by Edward Francois Andre. Le Tour du Monde 1879



Leftist rebels of the Revolutionary Armed Forces of Colombia (FARC) patrol a roadway near to San Vicente de Caguan, January 1999. REUTERS/Jose Gomez

<https://www.reuters.com/news/picture/idUSRTX2HS9H/>

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The power of higher education changes lives



The Florida State University
Tallahassee, Florida 32306-2400

Office of Admissions

April 10, 2002

Mr. Juan B. Gutierrez
2055 Thomasville Rd #E205
Tallahassee FL 32308-0798

Dear Mr. Gutierrez:

The Admissions Committee for the graduate program in Creative Writing has carefully reviewed your application for graduate admission to Florida State University for the Fall Term, 2002. We regret to inform you that the Committee did not approve your application for the Fall Term, 2002.

- There are no available spaces for new graduate students on a competitive basis.

We appreciate your interest in Florida State University and wish you success in your educational endeavors.

Sincerely,

John Barnhill, Jr.
Director of Admissions

JB:aa

MFA in Creative Writing



Office of Admissions

May 6, 2002

Mr. Juan B. Gutierrez
2055 Thomasville Rd #E205
Tallahassee FL 32308-0798

Dear Mr. Gutierrez:

On behalf of the Admissions Committee for the graduate program in Applied and Computational Mathematics, it is my pleasure to welcome you to our community of scholars for the Fall Term, 2002. Your acceptance to graduate study at Florida State University is just the beginning of a challenging and enriching experience.

Please read the enclosed information regarding your admission to the University. Your academic department will contact you concerning your graduate program and registration.

All of us at Florida State University will make every effort to provide you a challenging educational program based on a firm foundation of tradition and excellence.

Sincerely,

John Barnhill, Jr.
Director of Admissions

JB:ag:aa

PhD in Math

I was a ***truly*** exceptional graduate student...

... every semester, an exception had to be made to keep me in the program.

Thank you Dr. Case!!!



Bettye Anne Case

Graduate Associate Chair & Olga Larson Professor of Mathematics

Department of Mathematics, Florida State University, (2000s)

Ph.D., University of Alabama, USA, 1970



**MORAL
IMPERATIVE**

Have the face
of success
match the
face of the
nation

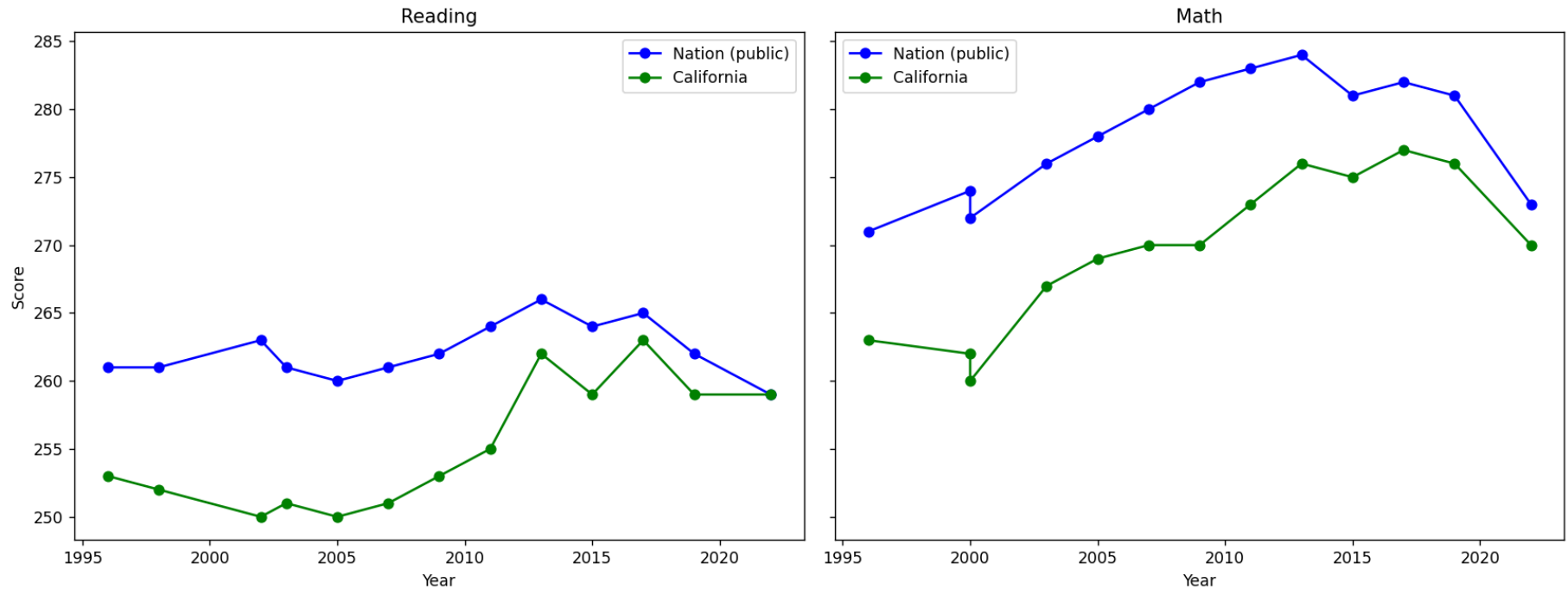
Juan B. Gutiérrez, Ph.D.
Chair of Mathematics
University of Texas at San Antonio

FROM K THROUGH 20+

Since 2013, there has been a national decline in math proficiency.
Reading is holding up.

«English is important, but math is importanter»

Yearly Data: 8th Grade Reading and Math (Nation vs. California)



Source: The Nation's Report Card. National Assessment of Educational Progress (NAEP).

<https://www.nationsreportcard.gov/mathematics/states/scores/?grade=8>

<https://www.nationsreportcard.gov/reading/nation/scores/?grade=8>

Accessed on 10/15/2024.

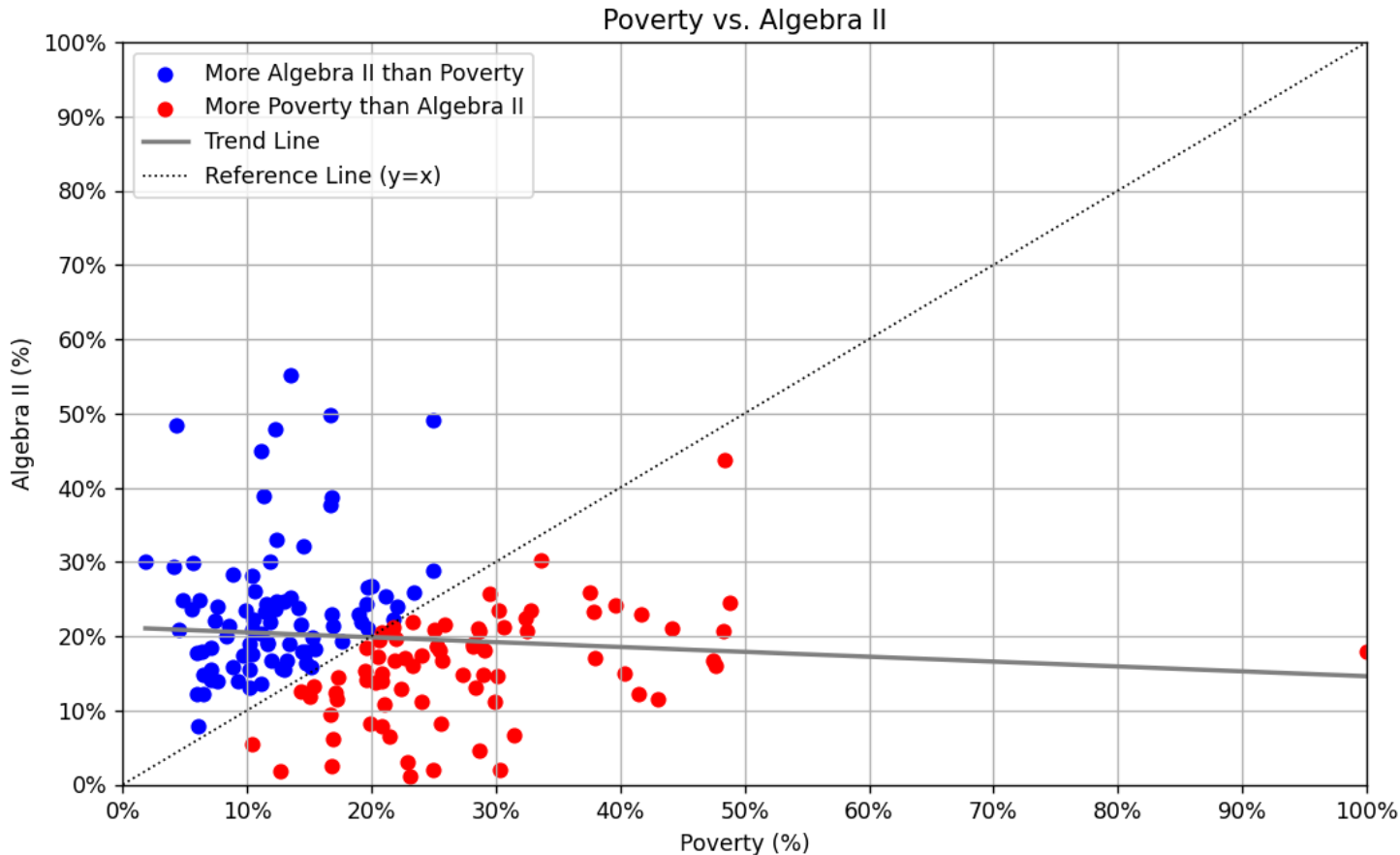


KEY POINT:

The US is facing a learning cliff

The COVID-19 pandemic and other social dynamics have created a loss of learning that has not stopped. This will percolate to higher education for years to come.

Poverty is a strong predictor of absence of algebra II in high school.
Algebra II is strongly correlated with success in college.



Each dot is a school district in California. School districts below the dotted line have more kids in poverty than kids taking Algebra II.

In California, postal code is destiny.

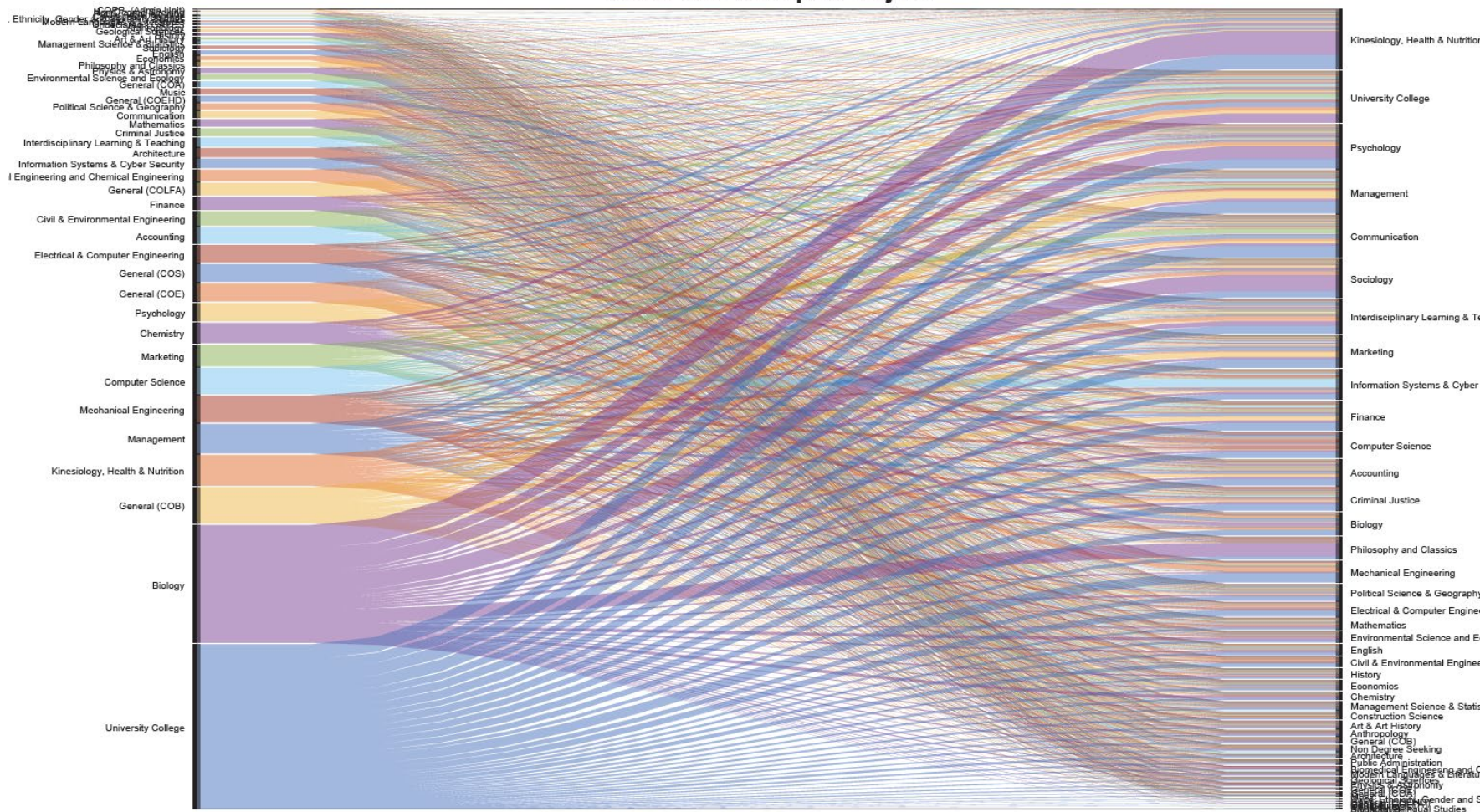
K-12

College

Ph.D.

Poor performance in a 1st year math course is strongly correlated with abandoning STEM

Donor and Acceptor Majors



Initial major declaration on the left. Destination major on the right.
 The largest correlation is poor performance in math. $p\text{-value} \ll 1E\text{-}5$
 UTSA data, 2012-2019. 86k students, 5.5M credit hours



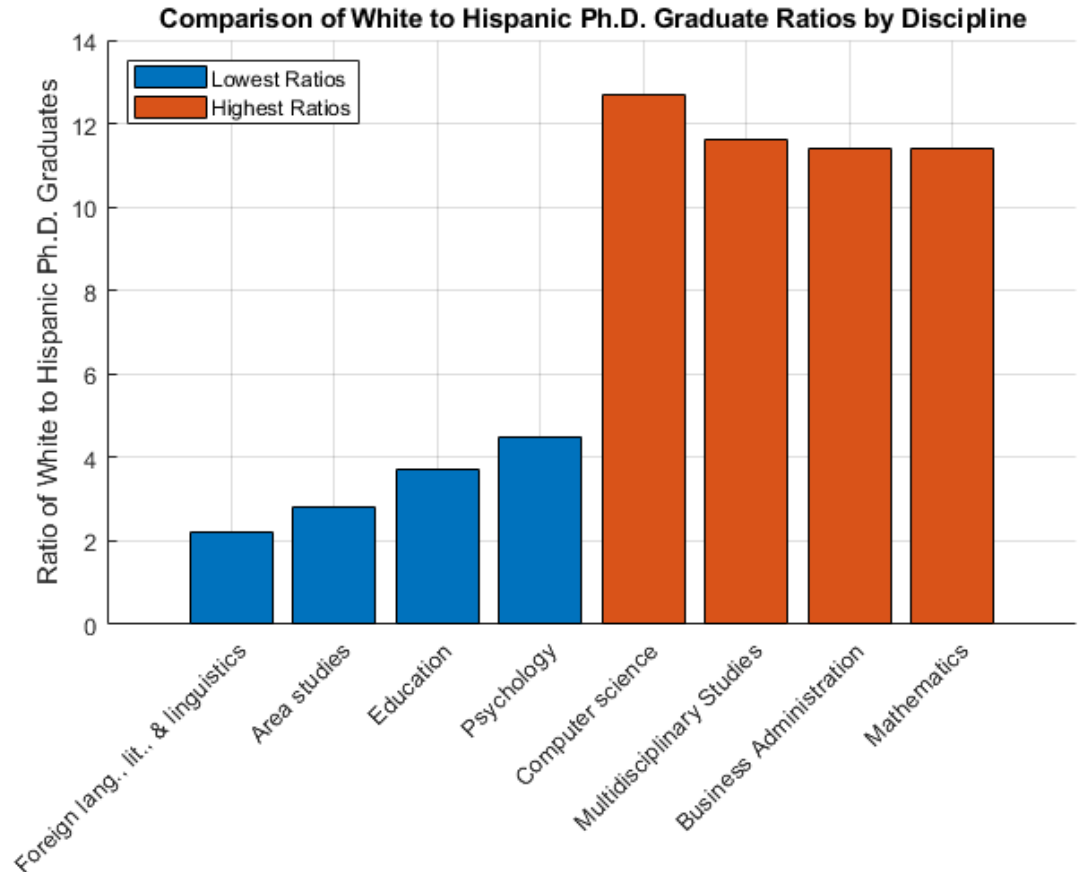
Doctoral Degrees in the US: Biases in Domain Expertise by Race/Ethnicity

Smallest ratios White/Hispanic Ph.D.

1. Foreign languages, literatures, and linguistics (2.2)
2. Area, ethnic, cultural, gender, and group studies (2.8)
3. Education (3.7)
4. Psychology (4.5)

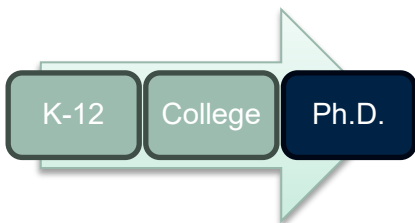
Highest ratios White/Hispanic

1. Computer science (12.7)
2. Multidisciplinary Studies (11.6)
3. Business Administration (11.4)
4. Mathematics (11.4)

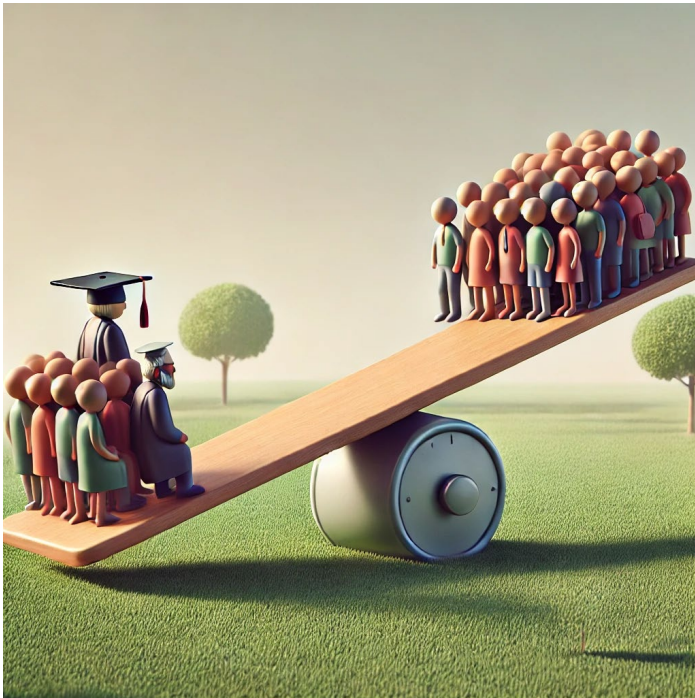


Data Source: *U.S. citizen and permanent resident research doctorate recipients, by major field of doctorate, ethnicity, and race: 2022*

Survey of Earned Doctorates. National Science Foundation. [nsf24300-tab003-004](https://www.nsf.gov/statistics/2022-tab003-004)



KEY POINTS: Who gets to be a Scientist?



Politics is simply applied ethics with a budget.

Scientists have a disproportionate influence in society for they influence valuation of societal investments.

Groups excluded from this realm do not get to exert this influence.

KEY POINTS: Closing the Door to Education is the Shortest Path for Exclusion

In a world of racism without racists, centuries-old processes generate exclusionary dynamics that elevate the top at the expense of the socioeconomic base.

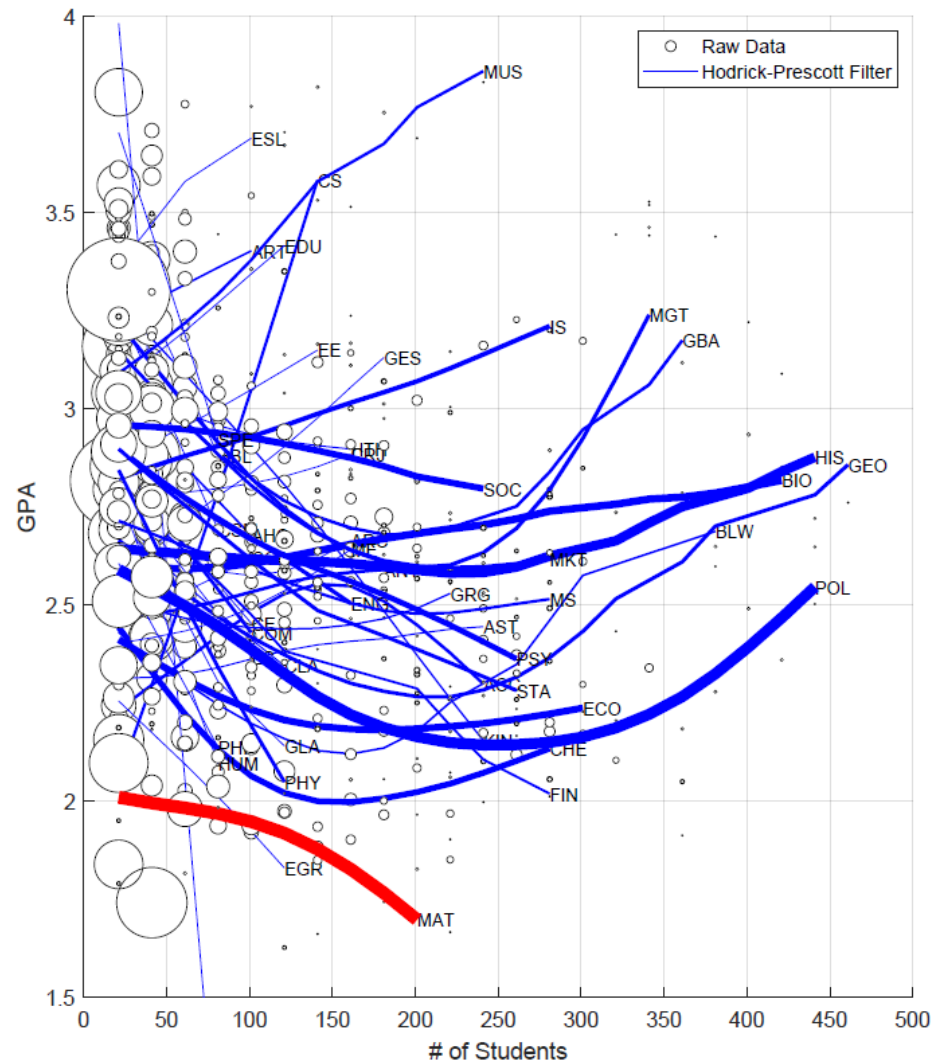
METHODS TO QUANTIFY EQUITY

Class size has a variable influence on outcomes

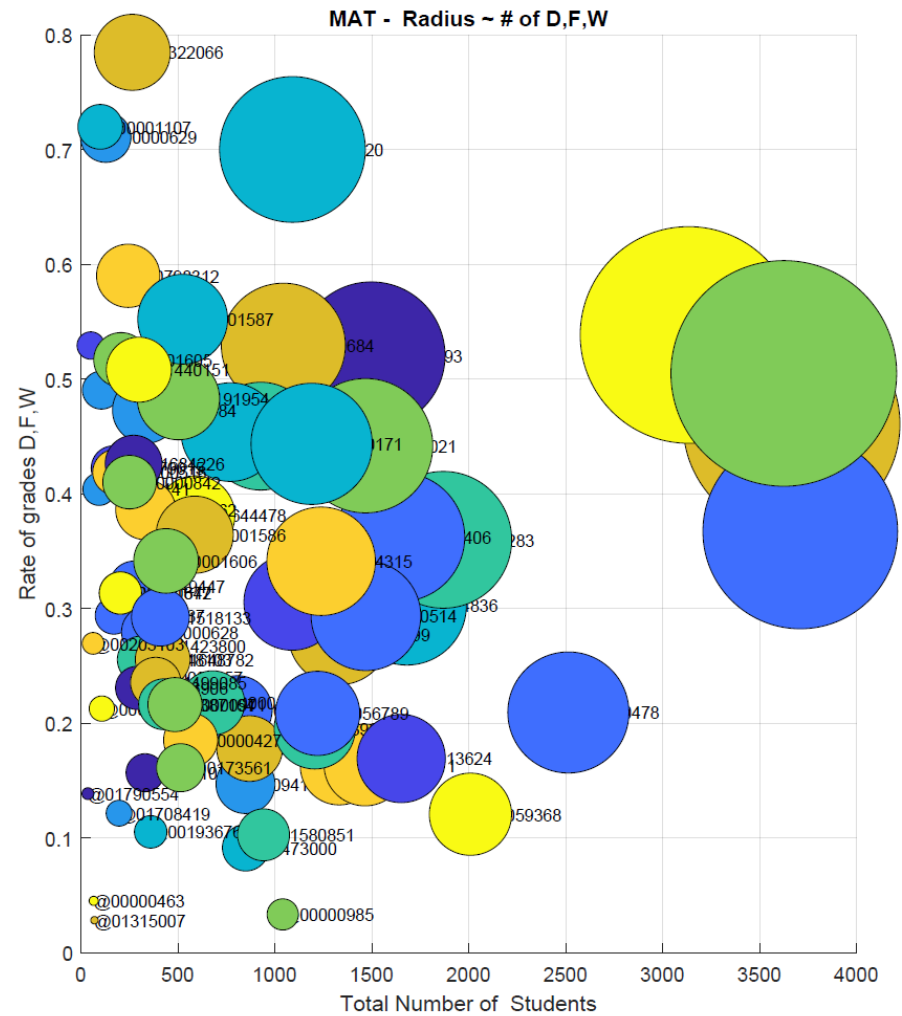
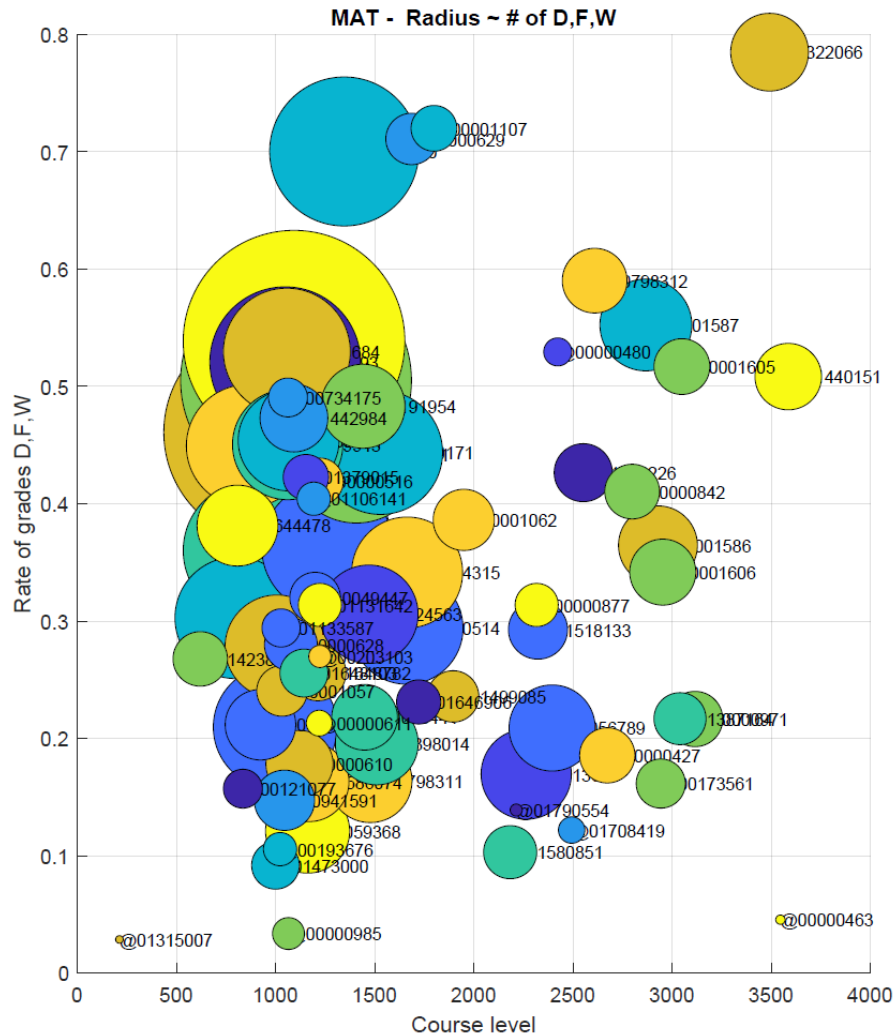
MAT is the subject most affected by class size at UTSA.

Line width proportional to number of students.

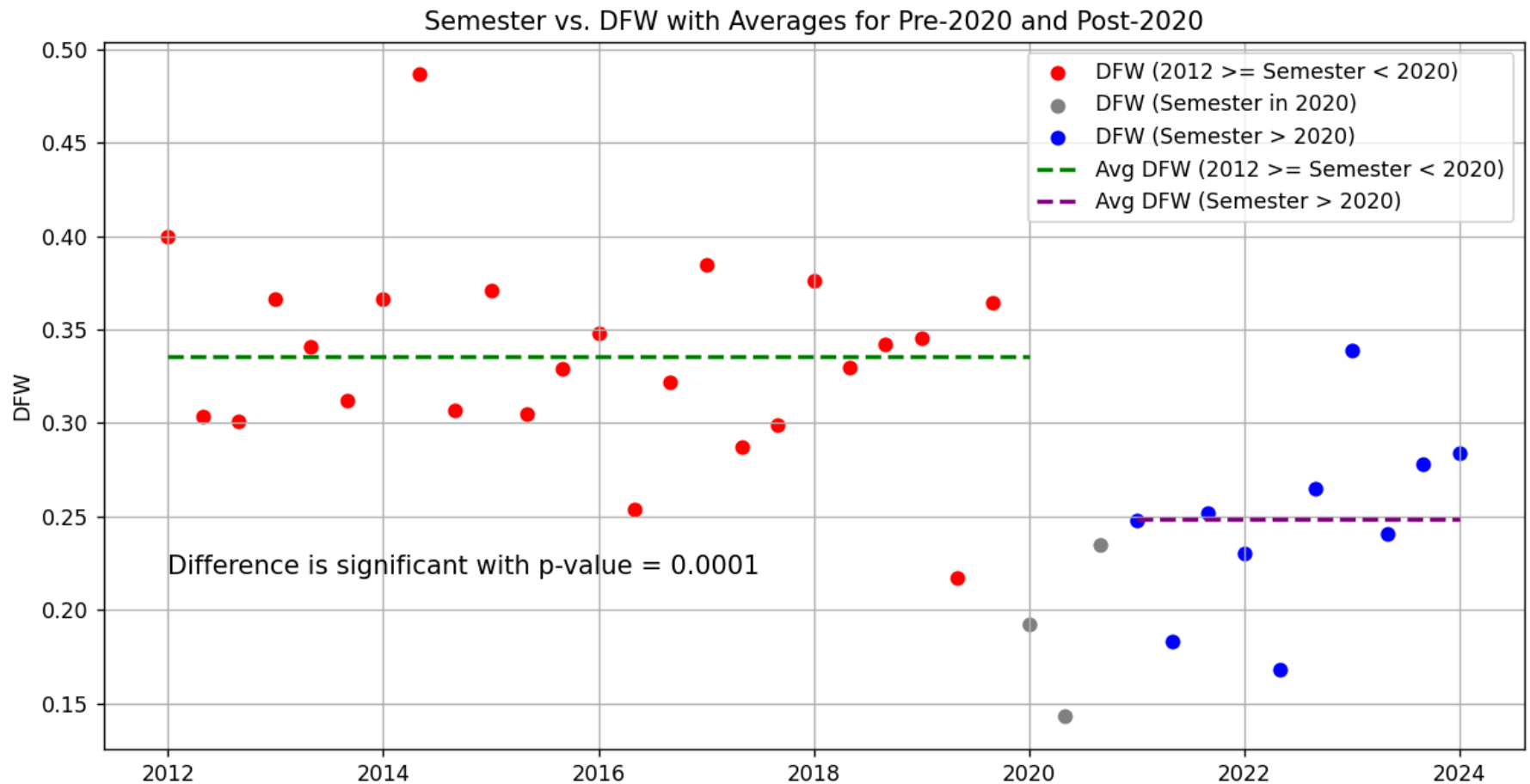
Allocation of limited instructional resources , i.e. TAs, peer-tutors, etc. can be done optimally. Get the largest impact for every dollar spent.



Grade & faculty analysis inform optimal points of control.



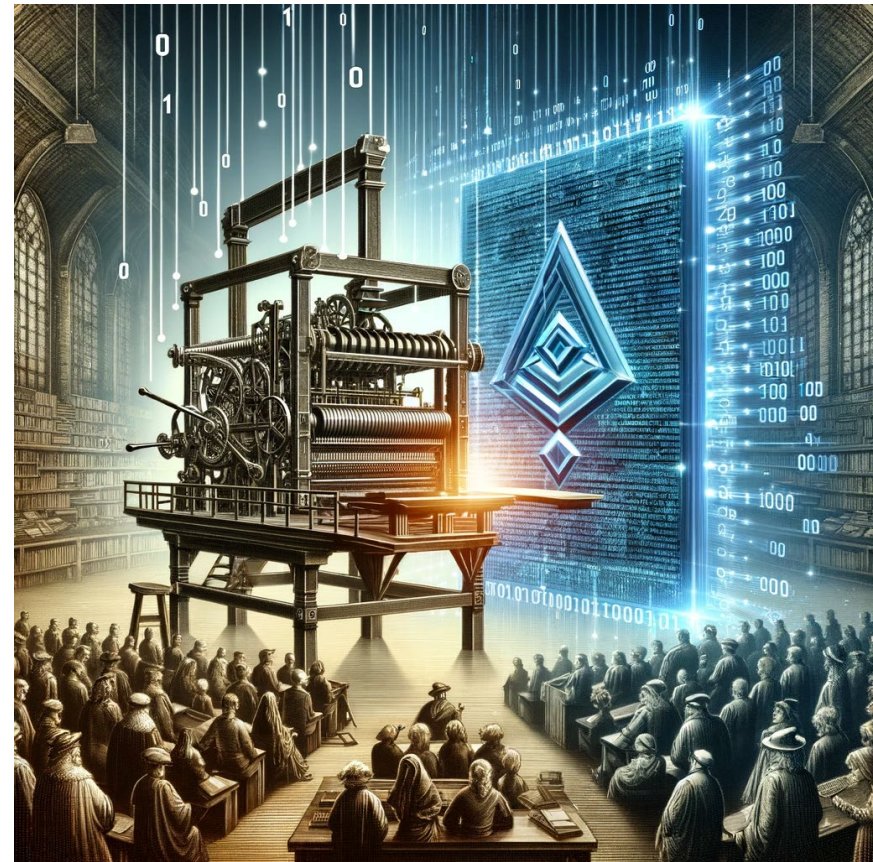
Course coordination and vertical & horizontal alignment of curricula resulted in significant improvements in student performance. Data for math.



HOW TO MOVE FORWARD TODAY... WITH A.I.

We are living through a
Guttenberg moment.

2023 will be taught to our
grandchildren as the year
when generative A.I. went
mainstream.



A.I. has changed instruction overnight

- Students are using AI. When they are not trained in AI use, they delegate reasoning instead of enhancing it.
- Past assessment methods are ineffective.
- A.I. offers an opportunity to improve learning and assess students and classrooms in real time.

Adaptive Learning + A.I.

UTSA A.L.I.C.E.

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Capstones

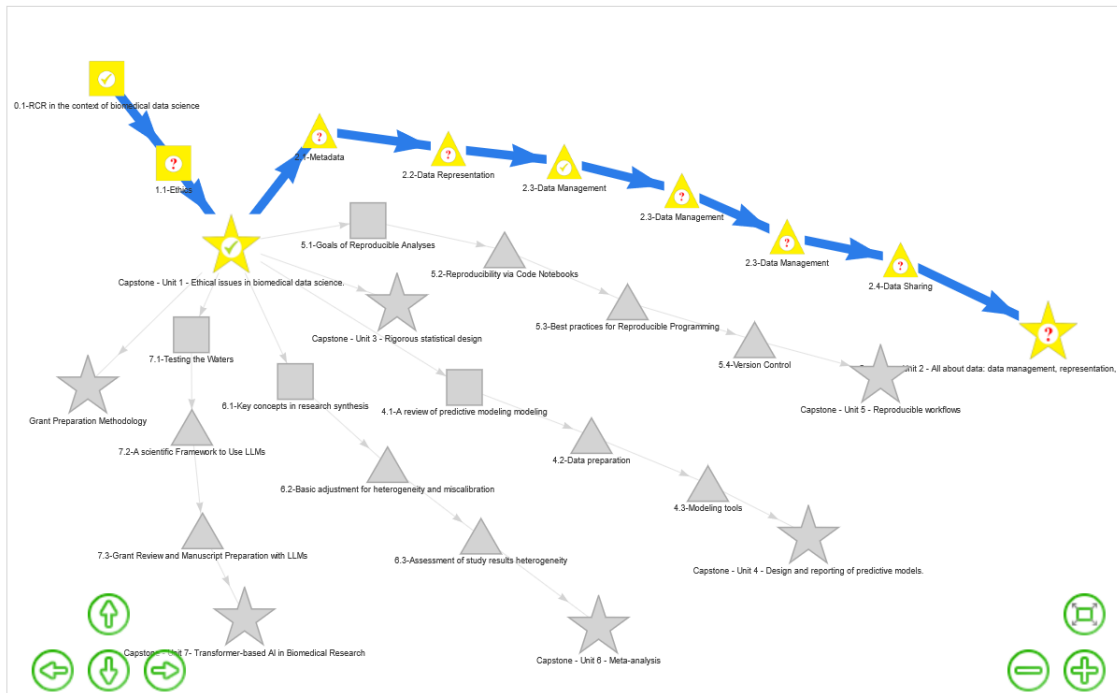
Map

Syllabus

27% Graded | 31% Read | 68% Pending

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Select your area of emphasis:



Adaptive Learning:

It is now possible to create personalized paths that respond to student needs, as opposed to teaching all to everyone at the same pace.

Adaptive Learning + A.I.

UTSA A.L.I.C.E. Search

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Home > Courses > MAT1093: Precalculus > Section 1.1 – Functions and Function Notation

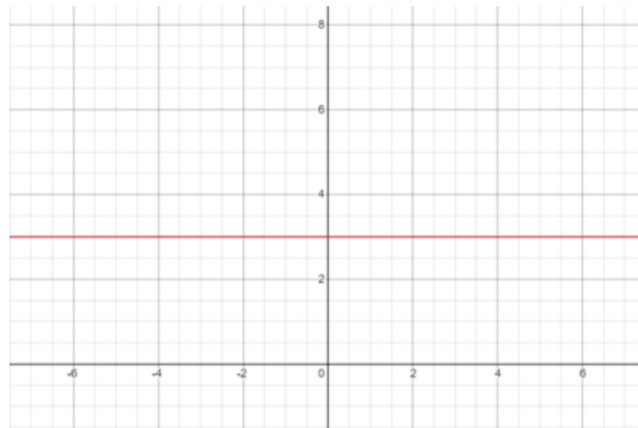
[Intro](#) [PDF](#) [Video](#) [GenAI](#) [Test](#)

0% Graded | 4% Read | 95% Pending

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The next lesson is : 3

Constant Function



For the constant function $f(x) = c$ the domain consists of all real numbers; there are no restrictions on the input. The only output value is the constant c , so the range is the set c that contains this single element. In interval notation, this is written as $[c, c]$, the interval that both begins and ends with c .

Domain: $(-\infty, \infty)$

Adaptive Learning:

By capturing student learning outcomes at the lesson level per student, personalized content can be deployed in real time.

Adaptive Learning + A.I.

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Intro PDF Video **GenAI** Test

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gpt-4o RESET

I do tno understand why for the constant function $f(x)=c$ the domain consists of all real numbers; there are no restrictions on the input. The only output value is the constant cc , so the range is the set cc that contains this single element. In interval notation, this is written as $[c,c]$, the interval that both begins and ends with c . Explain with a simple example

Sure, the concept here is that a constant function doesn't care about what x value you put in, because it's going to always output the same number, c .

Let's take an example of a constant function $f(x) = 3$. This means that no matter what x value you put into the function, the outcome will always be 3.

For example,

$$f(-100) = 3 \quad f(0) = 3 \quad f(45) = 3 \quad f(1000) = 3$$

As you can see, no matter what x value you use (and you really could use any real number), the function

Enter your prompt

Send

A.I.-assisted learning

By capturing student learning outcomes at the lesson level per student, A.I. agents can be personalized per student per lesson... hundreds of thousands of A.I. agents per institution per year

Adaptive Learning + A.I.

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Course List

Inbox DAIR-3 Summer 2024 Cohort 2 (JSU)

STUDENT	OPUS	PAGINA	LABOR
(b) (6)	DAIR-3	5.1-Goals of Reproducible Analyses	1963 hours Jul 28 2024 2:09PM Today reproducibility was referenced, and I raised an issue about legal authorization if I had work that had not gone through the patent process.
(b) (6)	DAIR-3	5.1-Goals of Reproducible Analyses	1963 hours Jul 28 2024 2:10PM # Markdown Tools I never knew about the different tools that you could use to make the reproducible work flows. ## Credit for re-usability You don't get enough credit for creating reusable code.
(b) (6)	DAIR-3	5.1-Goals of Reproducible Analyses	1963 hours Jul 28 2024 2:10PM Explored and discussed reproducibility in-class. Thought about some of the challenges related to reproducibility in my own work. For my own work I usually use

AI-assisted assessment – in real time

Students can obtain immediate A.I.-driven feedback.

Instructors can assess students with respect to the personalized syllabus.

Instructors can assess performance of a class with respect to a lesson and in general.

Discussion

1. Students carry invisible burdens. A helping hand offered to a single student can change the trajectory of communities.
Toward compassionate student success...
2. There are critical subjects central to student success in all areas.
Toward quantitative analysis of student success...
3. Equity in critical subjects could introduce diversity in the successful layer of society.
Toward equity-based interventions...
4. A.I. cannot be ignored. It must be embraced.
Toward a new theory and practice of pedagogy...

Thanks for you attention!

Juan B. Gutiérrez, Ph.D.

juan.gutierrez3@utsa.edu

