
Promoting Equity and Justice in Mathematics Classrooms

Will Tidwell, PhD | [he/him/his](https://www.linkedin.com/in/willtidwell/)

Mathematics Department | Morehead State University

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$$F = G \frac{m_1 m_2}{r^2}$$

$$F - E + V = 2$$

$$i\hbar \frac{\partial}{\partial t} \psi = \hat{H} \psi$$

$$\phi(x) = \frac{1}{\sqrt{2\pi\sigma}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

$$E = mc^2$$

$$ds \geq 0$$

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$$

$$\frac{df}{dt} = \lim_{h \rightarrow 0} \frac{f(t+h) - f(t)}{h}$$



Positionality Statement

White, cis-gendered, heterosexual male from the middle class

Education in Alabama and in Utah

Employed by Morehead State University in a Tenure-Track line



Outline for Discussion

- Positionality
 - Definitions
 - Mathematical Modeling
 - Examples
 - Relations to Culturally Relevant Pedagogy and Anti-Racist Teaching
 - Results
-

Equality



Equity

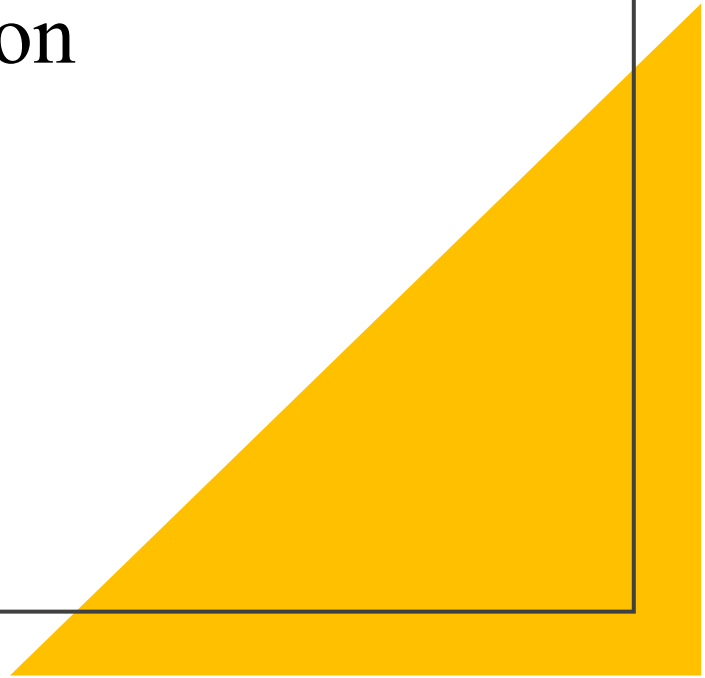


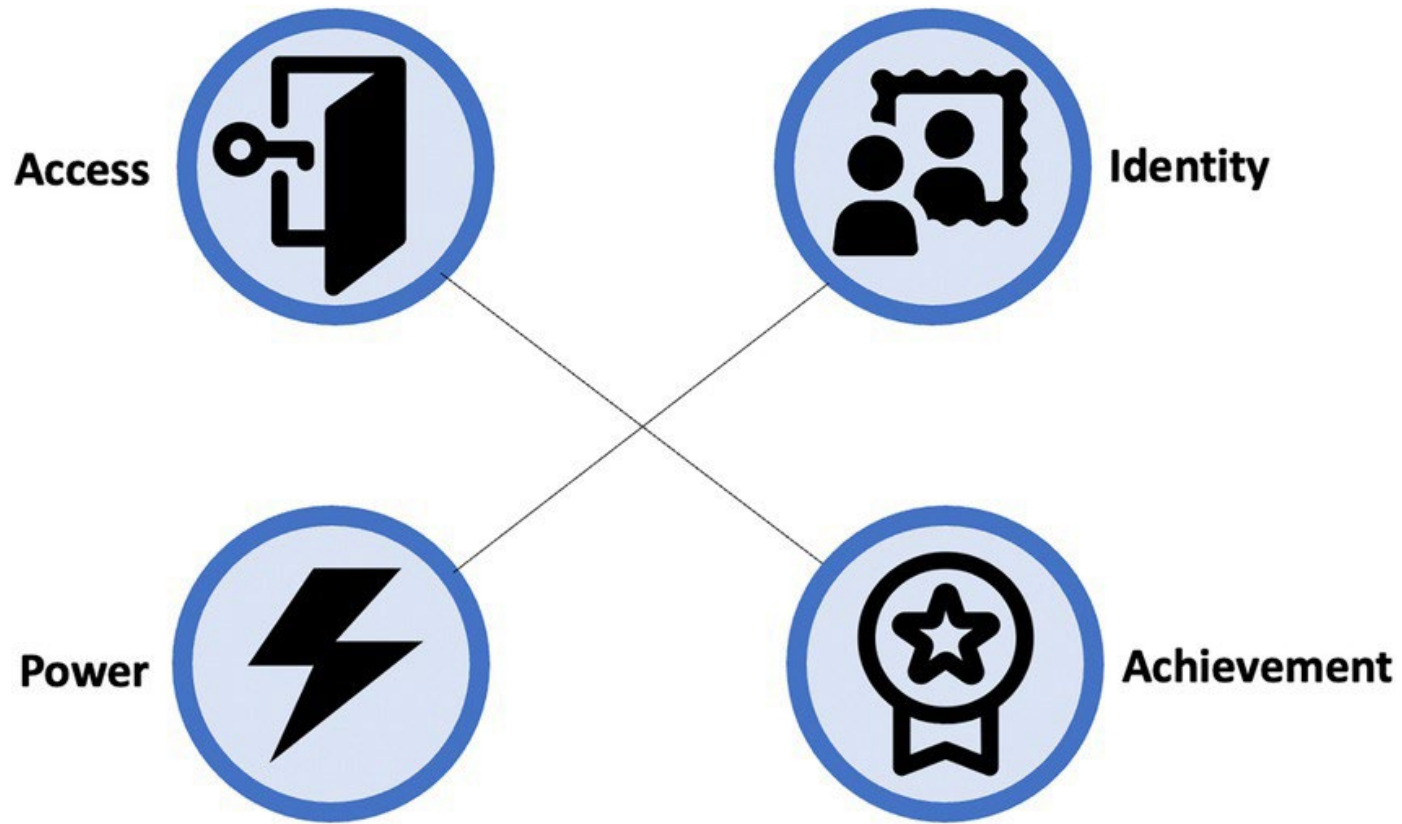
Justice



Equity

The inability to predict mathematics achievement and participation based solely on student characteristics such as race, class, gender, beliefs, or language proficiency (Gutiérrez, 2007).





Dimensions
of Equity
(Gutiérrez,
2007)

Dominant Axis (Gutiérrez, 2012)



Access

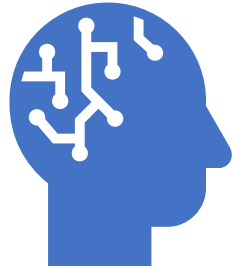
Physical, tangible resources made available to students



Achievement

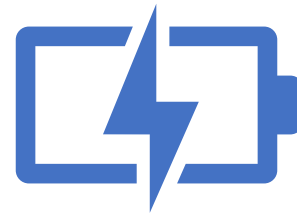
Student outcomes particularly with measurable results

Critical Axis (Gutiérrez, 2012)



Identity

Students' ability to see the world through mathematics AND find themselves in the mathematics



Power

Social transformations in the classroom

Equitable Teaching Practices (Aguirre et al., 2013)

1

Go deep with mathematics

2

Leverage multiple mathematical competencies

3

Affirm mathematics learners' identities

4

Challenge spaces of marginality

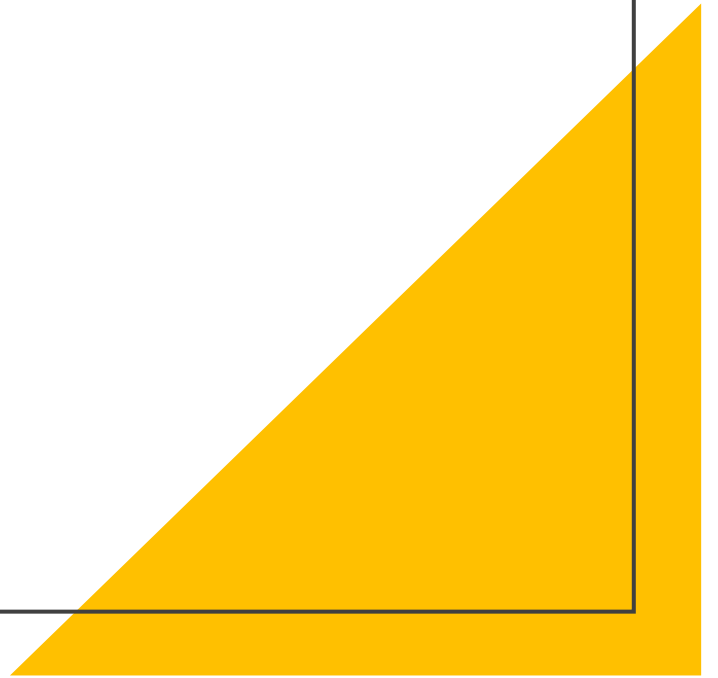
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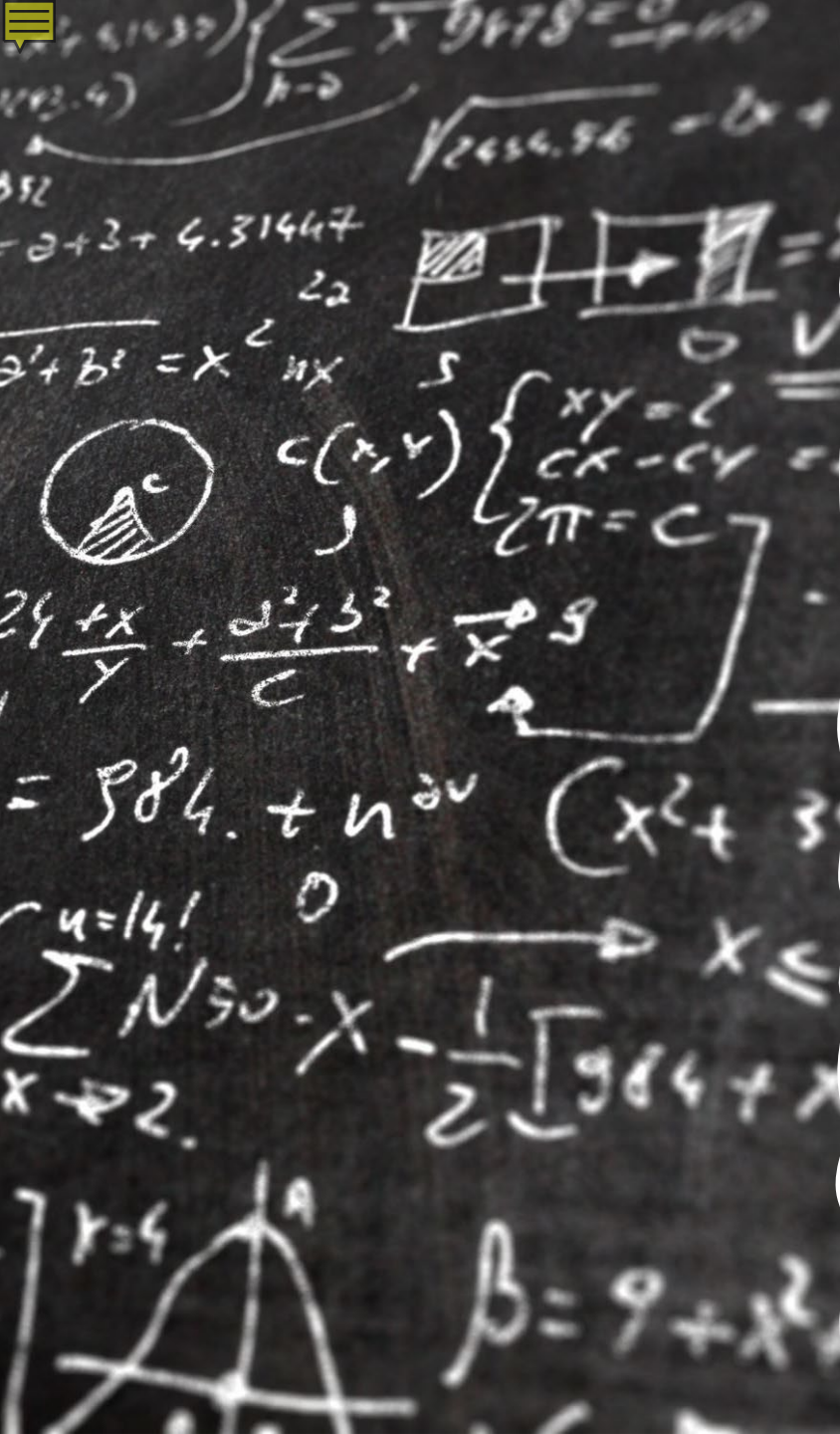
Draw on multiple resources of knowledge

Culturally Relevant Pedagogy

Ladson-Billings' (1995) culturally responsive pedagogy (CRP)

- 1) academic success,
- 2) cultural competence, and
- 3) critical social consciousness





What is mathematical modeling?

- **Mathematical modeling** is the *process* of dealing with an isolated individualized reality to cope with and explain selected facts and phenomena of a given situation in terms of formal mathematics (modified from D'Ambrosio, 2015).

What is Mathematical Modeling?



How is mathematical modeling beneficial?

- It is a litmus test to assess students' capacity to creatively solve complex problems (Kartal et al., 2016)
- Allows for a valuable "new" viewpoint in mathematics.
 - Application: Math \rightarrow Reality
 - Mathematical Modeling: Reality \rightarrow Math (Stillman et al., 2007)
- Supports the development of problem solving (Noble, 1982) and algebraic thinking (Lew, 2004)
- Can be used to develop creativity (Chamberlin & Moon, 2005)

Why should we do mathematical modeling?

- Mathematical modeling when done correctly and with the correct context is an:
 - Equitable Teaching Practice (Tidwell et al., 2022)
 - Culturally Responsive Teaching (Anhalt et al., in press)
 - Anti-Racist Teaching (Anhalt et al., in press)
 - Avenue for mathematics *with, about, and for* social justice (Tidwell & Bennett, in press)



Where would this occur?

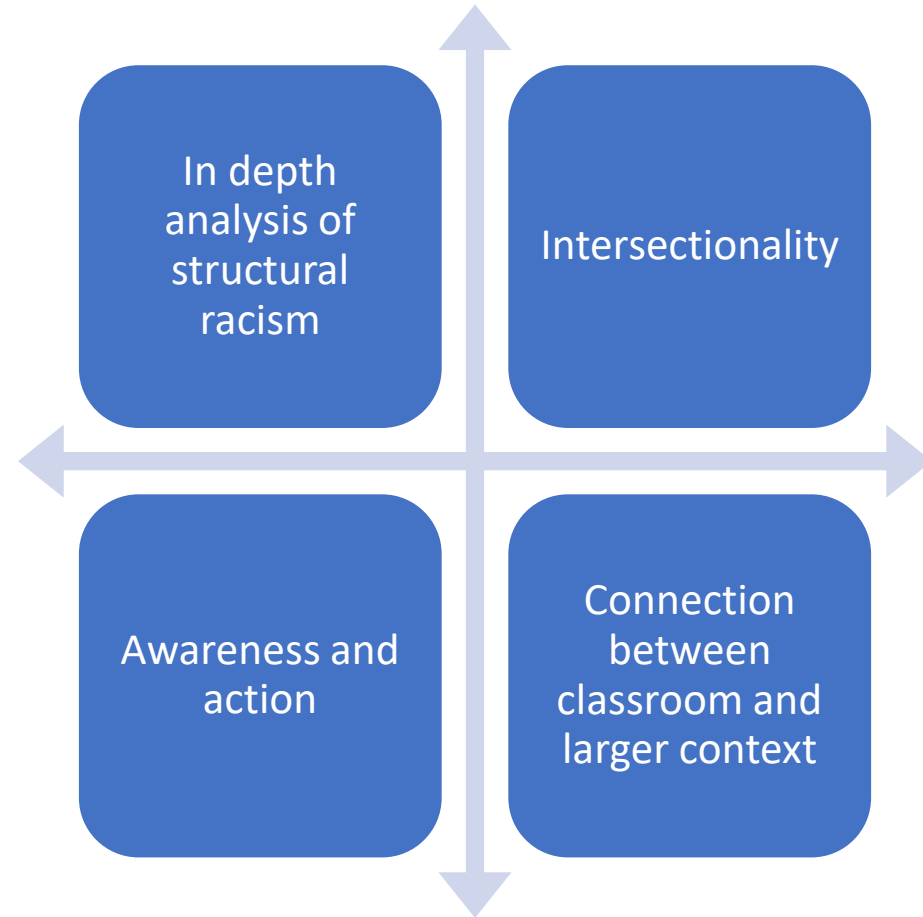
- Mathematical modeling appears internationally in curriculum all around the world.
- In the US, it can be found profoundly in two different locations within the *Common Core State Standards for Mathematics*.
 - Mathematical modeling is a content strand in secondary mathematics
 - Standard of Mathematical Practice 4: Model with mathematics.



Mathematical Modeling Examples


- Elementary Grades
 - How many plastic bags do I need to create a jump rope?
- Middle Grades
 - Is the healthcare system racist?
- High School
 - Investigate the systemic oppression of the Sioux, how much land was taking from them over the course of 25 years and create a model to predict the size of their reservation.
- University Level
 - Create a model that describes the spread of COVID-19.

Anti-Racist Teaching Practices (Kishimoto, 2018)



Culturally Responsive Pedagogy

Modeling supports:

- 1) students' *academic success* in learning mathematical modeling as an approach to solving authentic problems;
 - 2) students' development of *cultural competence*, an ability to understand, appreciate, and empathize with people from cultures other than their own; and
 - 3) students' development of *critical social consciousness* to explore and challenge social inequity.
- 
- A large yellow triangle is positioned in the bottom right corner of the slide, pointing towards the top right.



What does this look like in action?

- Math 315 – Functions and Modeling & Math 442 – Advanced Mathematical Modeling
- Weekly investigations into phenomena complete with problem posing
- At the end of the semester during final projects, more than 40% choose to investigate a social injustice of their own fruition (Tidwell & Bennett, in press)



Questions

w.tidwell@moreheadstate.edu