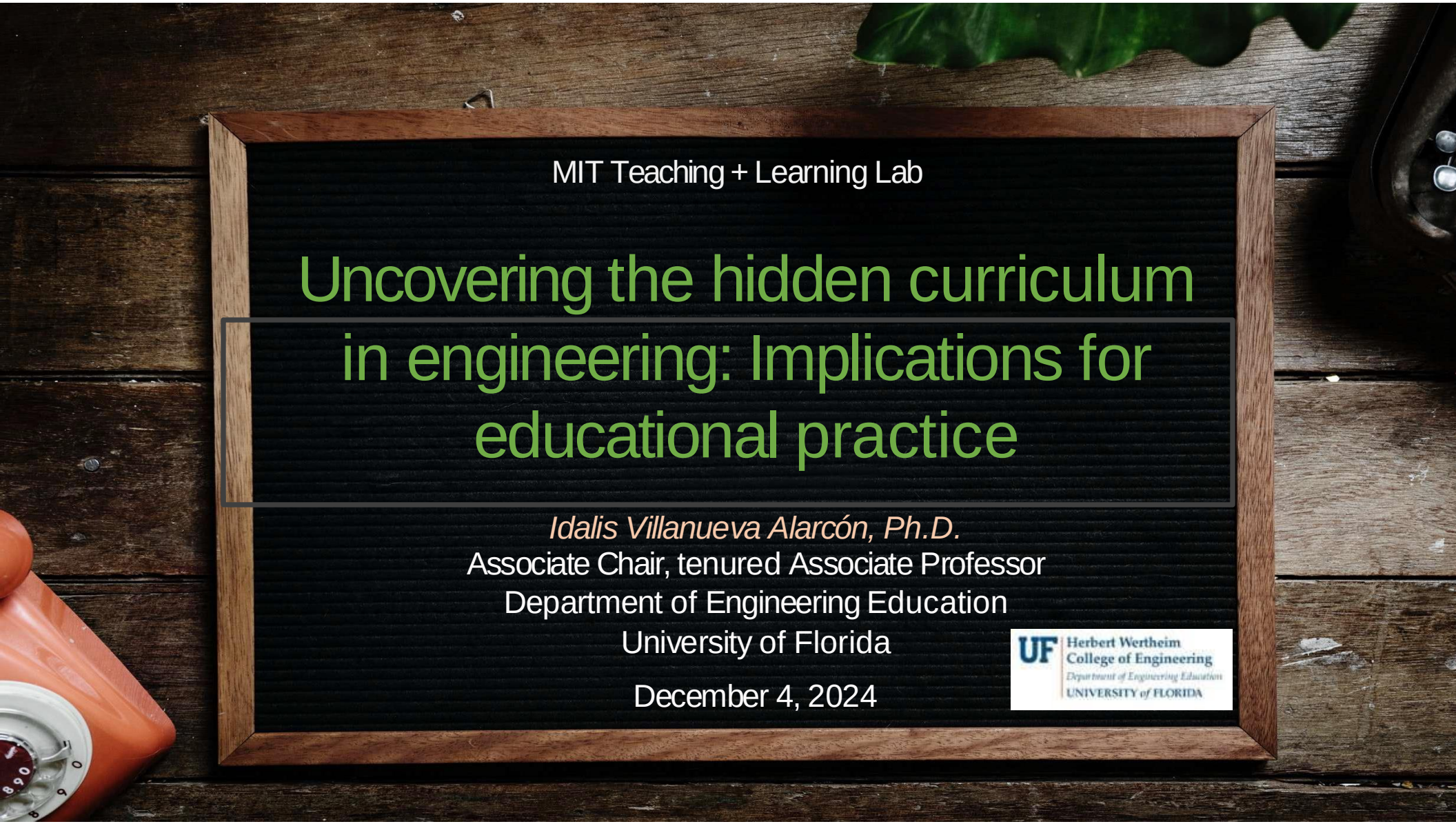
MIT Teaching + Learning Lab
Uncovering the hidden curriculum in engineering: Implications for educational practice
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December 4, 2024
UF
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Agenda

LEARNING OBJECTIVES

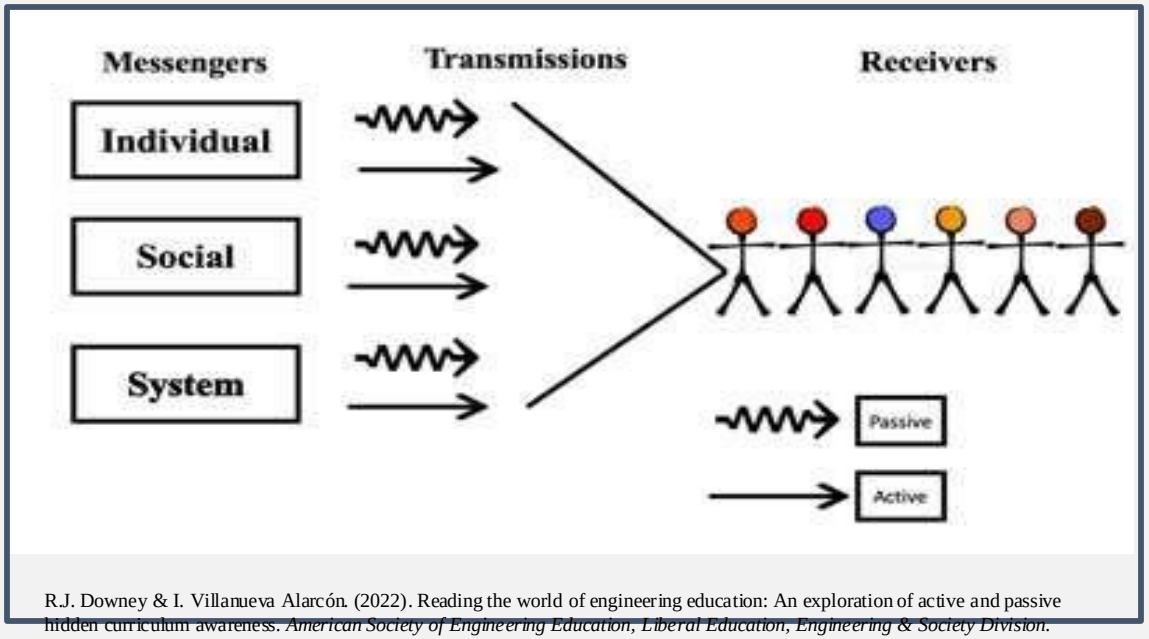
- 1. To understand what is hidden curriculum and its application to the engineering classroom
- 2. To present simple, practical tips and strategies in engineering education practice

AGENDA

- 2:00pm to 2:15pm: Defining Hidden Curriculum in Engineering Classrooms
- 2:15pm am to 2:30pm: Study # 1-3
- 2:30pm to 2:35pm: Q&A (Study)
- 2:35pm to 2:45pm: Tips and Strategies
- 2:50 pm – 3:00pm: Q&A (Tips and Strategies)

What is hidden curriculum (HC)?

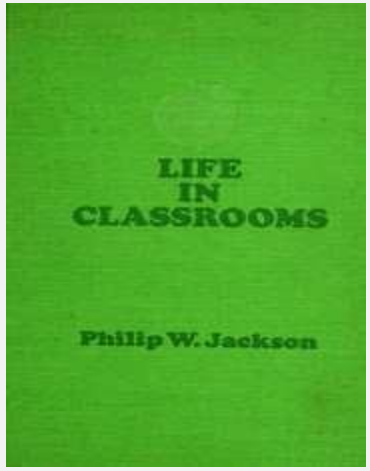
- Hidden Curriculum is believed to have originated from John Dewey in the 1920s. However, there was no recognition of HC until sociologist Philip W. Jackson coined the term in 1968 in his book, *Life in Classrooms*. Jackson argued for the need to understand **education** as a **socialization** process.



R.J. Downey & I. Villanueva Alarcón. (2022). Reading the world of engineering education: An exploration of active and passive hidden curriculum awareness. *American Society of Engineering Education, Liberal Education, Engineering & Society Division.*

1968

Philip W. Jackson



HC propagates systemically and structurally through social networks and relationships, where information about dominant norms, values, and beliefs are transferred to a recipient (e.g., students, faculty members).

1. **Explicit (or Formal): Set of written requirements, rules, policies, and practices that serve as the official guidelines for how to engage with individuals and evaluate their quality of work.**
   - *Example*: Syllabus, program of study, student contracts, and written expectations

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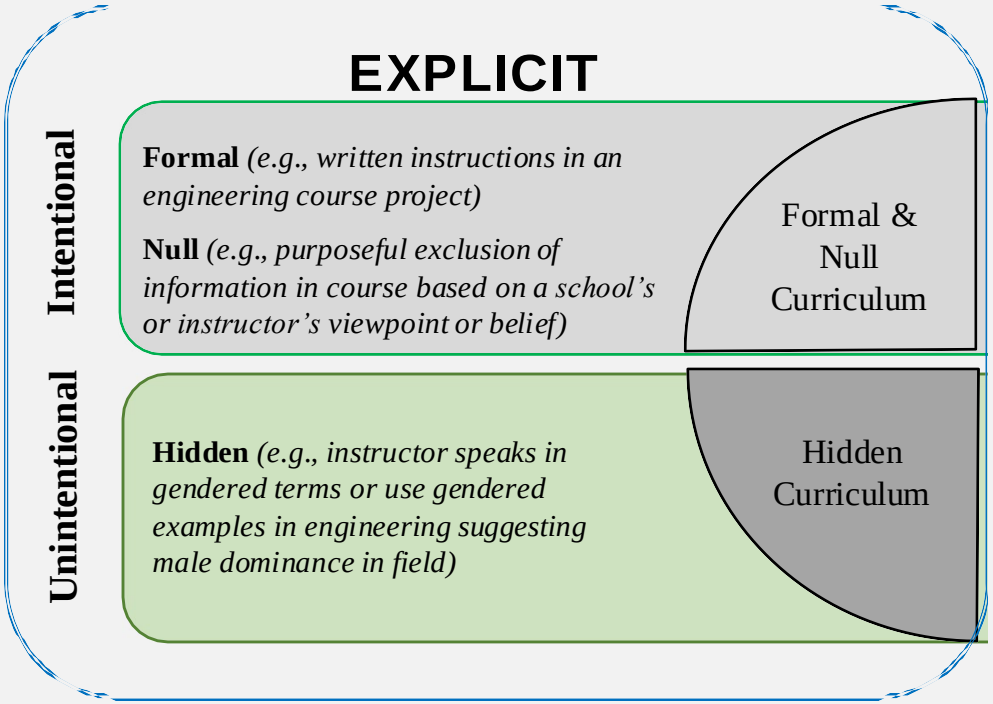
   - *Example*: Teachers opting to not cover political topics in a class.

4. **Hidden: Represents how particular assumptions about how schooling manifest in practice.**
   - *Example:* If an instructor decides to not emphasize a topic in class, a student may learn that this concept is not important.

Hidden Curriculum (HC): Originally derived from social support theory and social capital theory, it signifies the unwritten, unofficial, and oftentimes unintended assumptions, lessons, values, beliefs, attitudes, and perspectives that are not openly acknowledged in an environment.



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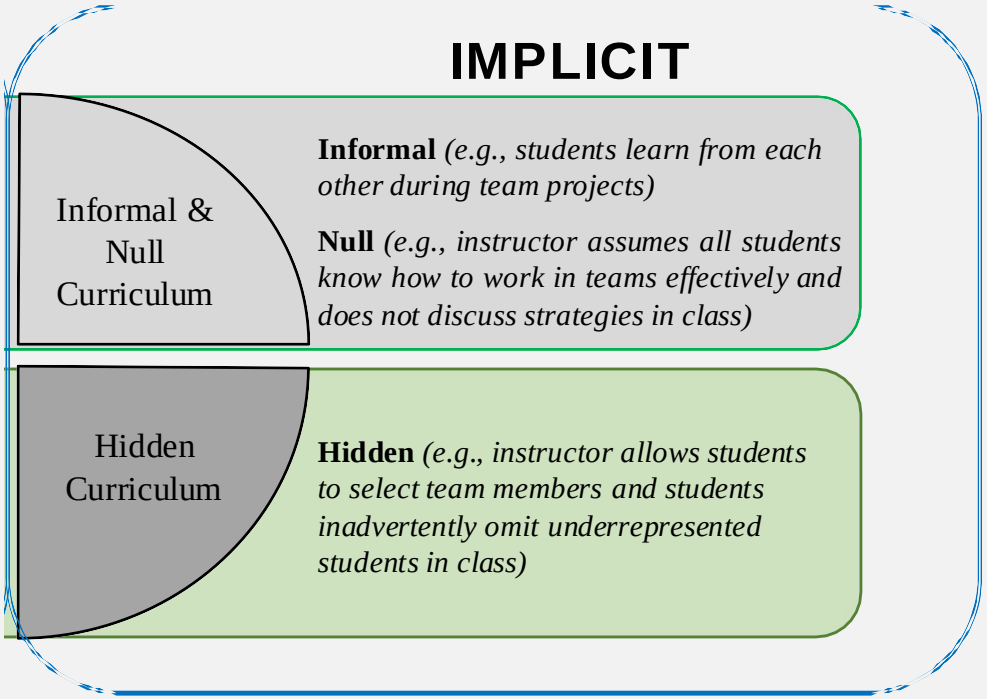

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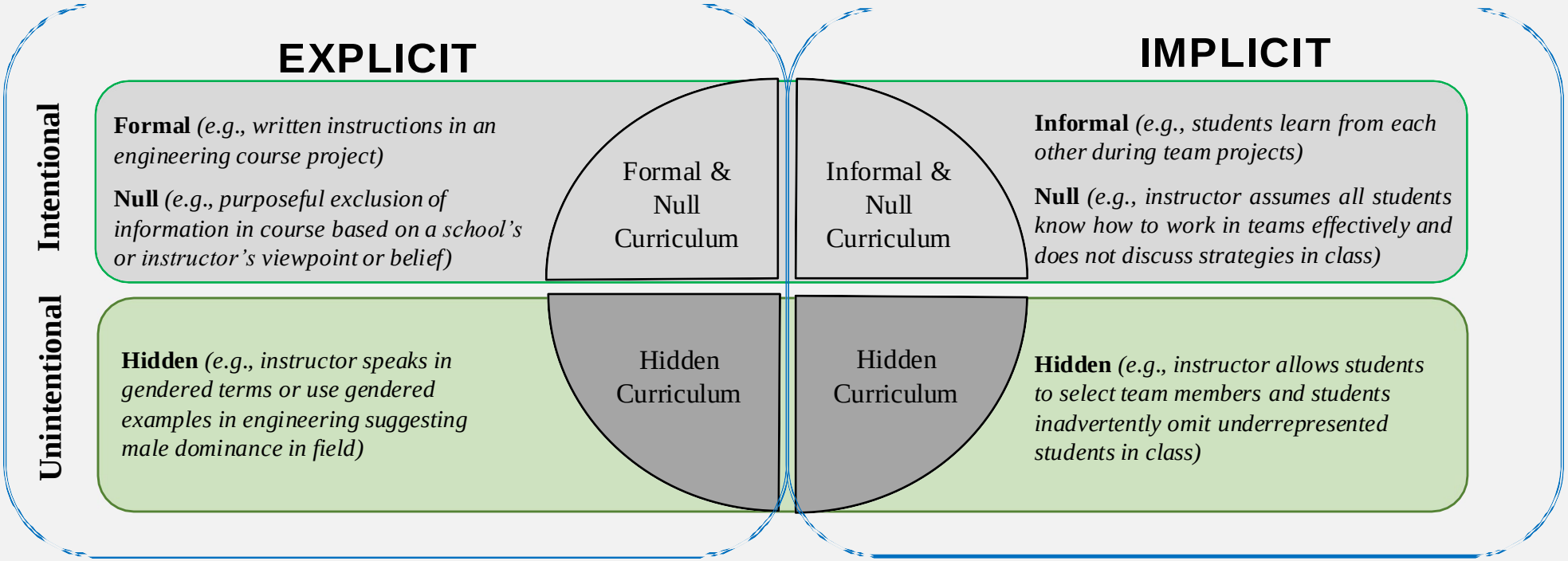
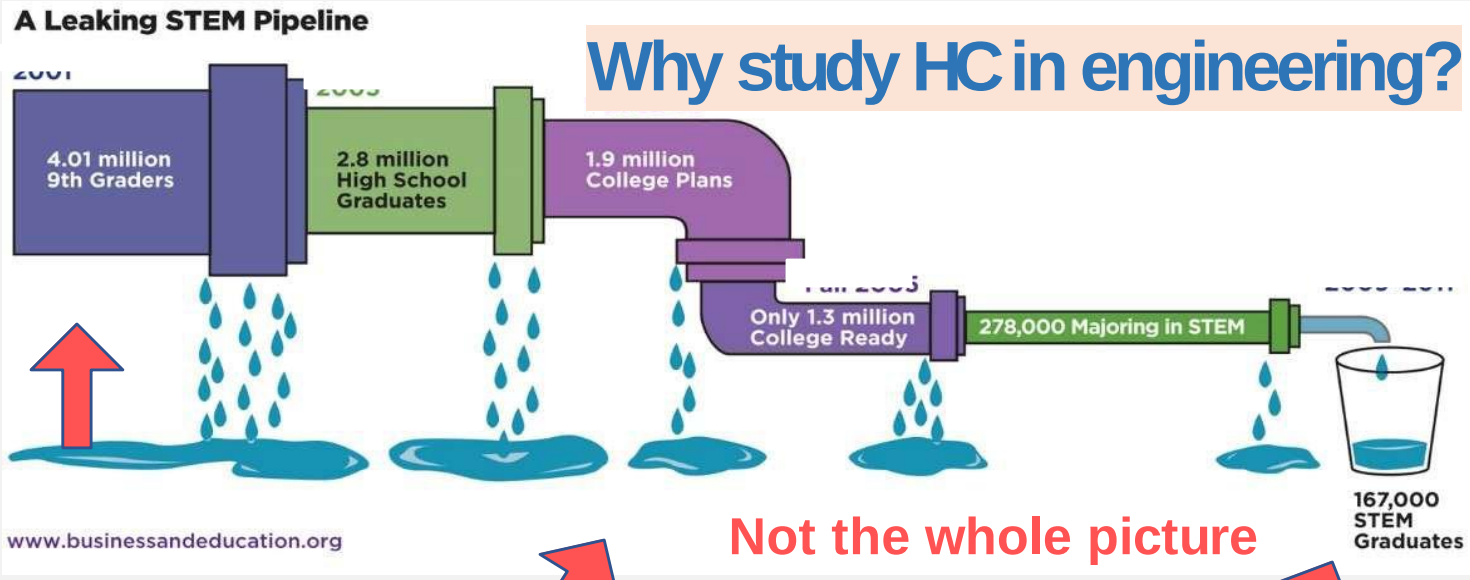


Not all hidden curriculum is negative:

- When we clearly communicate our expectations and the rationale behind our actions and choices through HC, it helps debunk assumptions that ultimately guides individuals' decisions and actions.
- **Hidden Curriculum is an idea that is so simple that it is oftentimes overlooked and unexamined.**

Understanding hidden curriculum can allow working and learning environments to equivalently communicate information for the benefits of all its members. If the communication is inclusive, then positive outcomes (e.g., retention) can surface.

Why study HC in engineering?



Not the whole picture

- Closed system
  - No consideration of re-entry into 'pipeline'
- Implies different pathways as waste
- Location of 'leaks' determines focus of interventions
  - High school
- Implies there is only one pathway and point of entry
- No consideration of non-traditional students
- No consideration of how to be successful after you exit the pipeline

- Even the way this graphic is designed has implications

Q=v*A

Smaller pipe (less area= less space for underrepresented students) "weed-out classes"

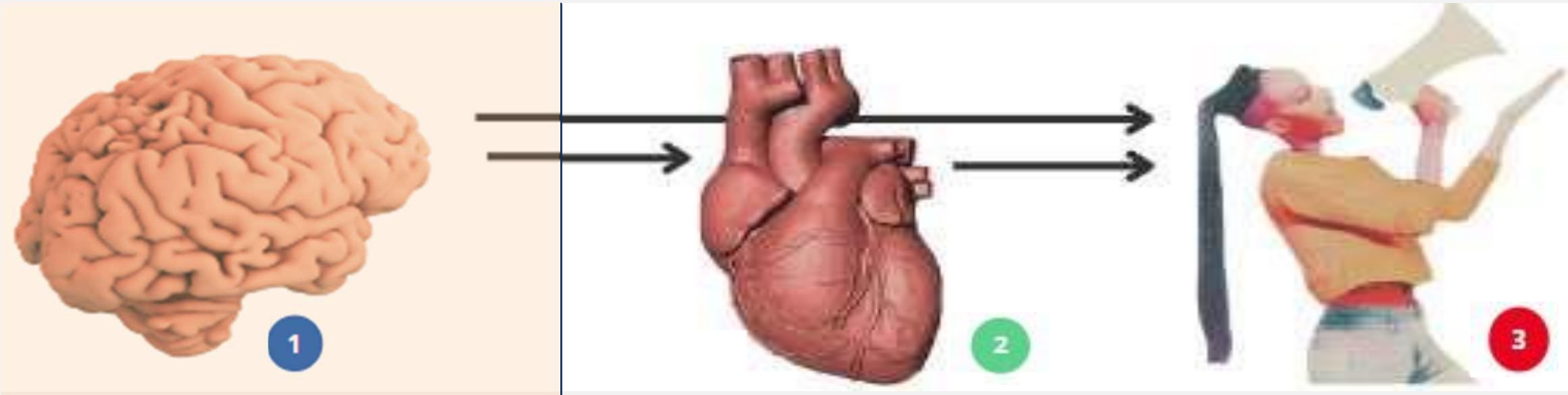
- Implies all graduates will easily find jobs in their field
- Perpetuates focus on the problem of a shortage of engineers and not issues of access of equity within engineering

Takeaways:

1. Are we making the right assumptions?
2. Are our assumptions limiting our understanding of key issues in the education of all engineers?

Hidden Curriculum Pathways:

HC represents the unacknowledged and oftentimes 'hidden' lessons or messages in a working or learning environment that informs individuals ways to navigate such structures and systems.



AWARENESS

The ability to recognize hidden messages, lessons, or patterns that cues to an individual the climate and/or environment they are in.

INTERNALIZATION AND REGULATION

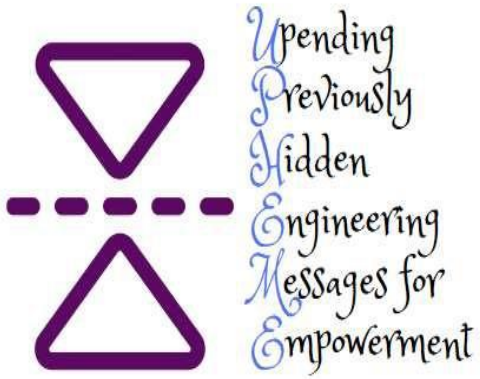
The way that an individual internalizes and regulates the hidden curriculum awareness they have received. These happen in the form of motivational constructs (e.g., self-efficacy) and emotions.

SELF-ADVOCACY

The willingness of an individual to act upon an injustice for themselves and others.

UPHEME (HC Instrument)

- Mixed-methods
- 5-pt Likert scale
- 6 assumption statements
- Factor Loadings ≥ 0.40 for all statements
- Cronbach Alpha ~ 0.77 to 0.89 for factors; Full instrument (0.84)



Statement Number	Description
1	The assumption that *not everyone has the same level of access to resources to become an engineer.*
2	The assumption that *the central focus of engineering is on the technical specifications of the product rather than socio-cultural considerations.*
3	The assumption that *students who do poorly in an undergraduate engineering course usually change to a non-engineering major.*
4	The assumption that *women in engineering are an exception and not the norm.*
5	The assumption that *in engineering "soft skills" (e.g., communication, teamwork) are under-valued.*
6	The assumption that *diversity in engineering is under-valued*

UPHEME Participants

- 964 survey respondents
- 58 institutions of higher education (with colleges of engineering) across the entire United States and Puerto Rico
- Faculty, Graduate Students, and Undergraduates in Engineering
- Collected between 2018-2019 (pre-COVID)
- Data analysis is ongoing (for now, results are mixed-method; requires cohesive integration)

** The percentages exceed 100% because some individuals self-identified in multiple categories **

	%(Percentage)
Men	62%
Women	37%
White	52%
Asian	5%
Black	7%
Multiracial	7%
Other	28%
First-Generation	40%
Undergrad	75%
Graduate	7%
Faculty	18%
Born in United States	66%
Born in Latin America	21%
Born in Other	12%
HSI	35%
PWI	44%
Other (HBCU, CC)	20%

Demographic	Sample Size (%)
Self-identified Gender	
Female	247 (37)
Male	422 (63)
Other	2 (0.3)
Institutional Type	
HSI (public + private)	175 (26)
HSI (public)	56 (8)
HSI (private)	119 (18)
PWI	269 (40)
Other (e.g., community college, HBCU, HEI, etc.)	224 (33)
Race and/or Ethnicity	
Hispanic, Latina/o, Chicana/o (e.g., Mexican, Puerto Rican, etc.) +	179 (27)
White (e.g., German, Irish, Lebanese, etc.)	338 (50)
Other	153 (23)
First-generation (i.e., first one attending college from their immediate family) *	
Yes	260 (39)
No	400 (59)
Non-traditional undergraduate student (i.e., a student who is at least 25 years of age or older and/or has a spouse, committed partner, or dependents) *	
Yes	233 (35)
No	417 (62)

Study 1 (Quantitative):

Institutional Contexts and HC in Engineering

(N=671)

*The table does not include *not sure* responses.

+ The table describes Hispanic as an ethnic identity although we acknowledge the more inclusive terms of Latinx/a/o/é.

Study 1 (Quantitative).

How do undergraduate engineering students differ in their HC awareness compared to non-HSIs?

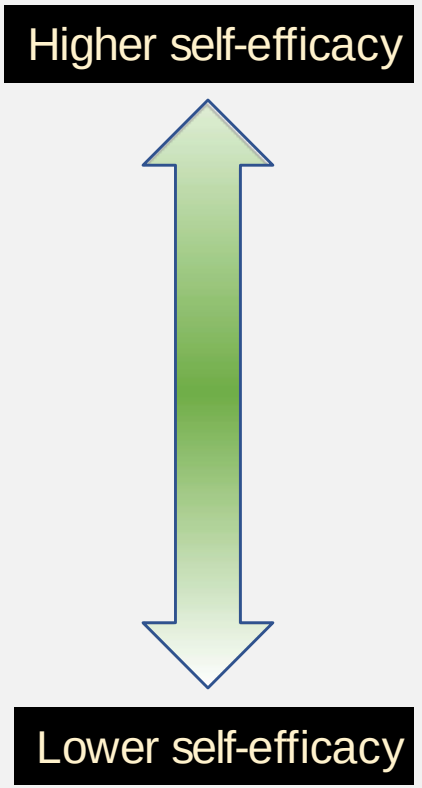
Institution Type	Mean (SD)	
	Female	Male
Overall	3.64 (.89)	3.54 (.83)
HSI (public + private)	3.52 (.92)	3.46 (.82)
HSI (public)	3.27 (.88)	3.61 (.83)
HSI (private)	3.60 (.93)	3.38 (.80)
PWI	3.58 (.85)	3.46 (.82)
Other (e.g., HEIs)	3.75 (.89)	3.76 (.86)

- A two-factorial ANOVA revealed no significant differences between self-identified females and males in their responses.
- However, there was a significant difference between the institution type ($F = 6.25$, $df = 2, 671$, $p = .002$) with a small effect size (partial $\eta^2 = .02$) and an observed power of 0.89.
  - HEIs appeared to have higher estimated means, suggesting higher levels of HCA.
- A posthoc Tukey HSD multiple comparison procedure suggested a significant difference between 'Other' institutions compared to HSIs and PWIs ($p<0.05$).
- No significant difference between HSI public and private for this sample

Study 2 (Mixed).

Which HC strategies and assumptions, if any, did the students recognize the most?

- **Changing environment where norm resides:** Strategies participants used to address the HC directly.
  - ***Example quote:*** "I have learned to be more disagreeable and to speak up. I think as women who enter engineering, we cannot wait for our male counterparts to call on us for the answer or ask us what we think, I've adapted to speak up for myself even in tough situations."



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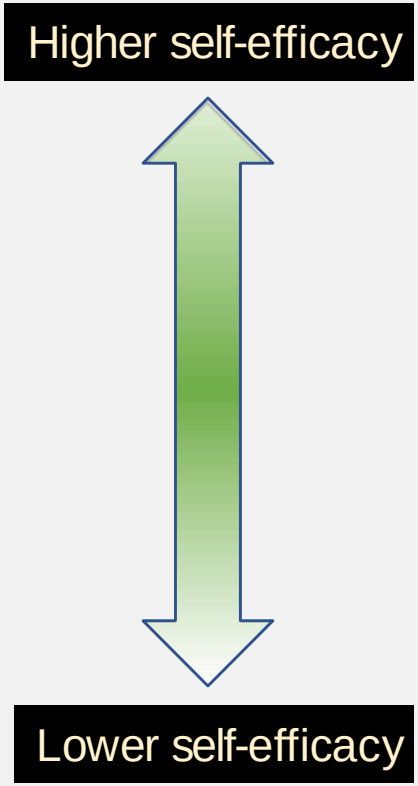
- **Negotiating self within the norm:** Strategies participants used to change themselves that did not address HC directly.
  - ***Example quote:*** "Learning how to have confidence and to ask questions when other people may not be was a struggle for me. I got past this by considering my own self-growth and development was more important to me …"



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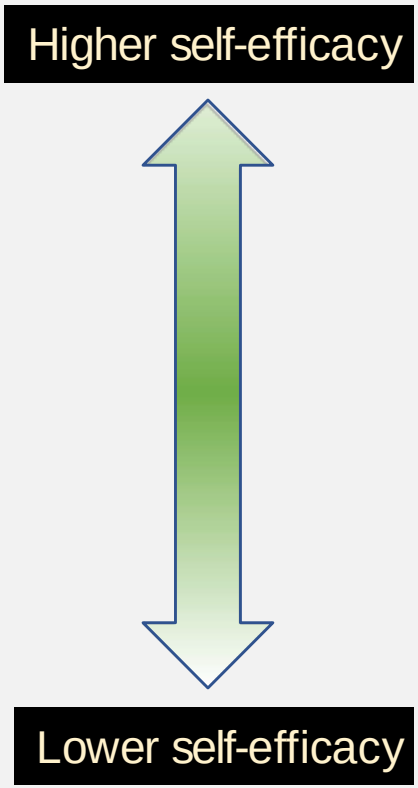
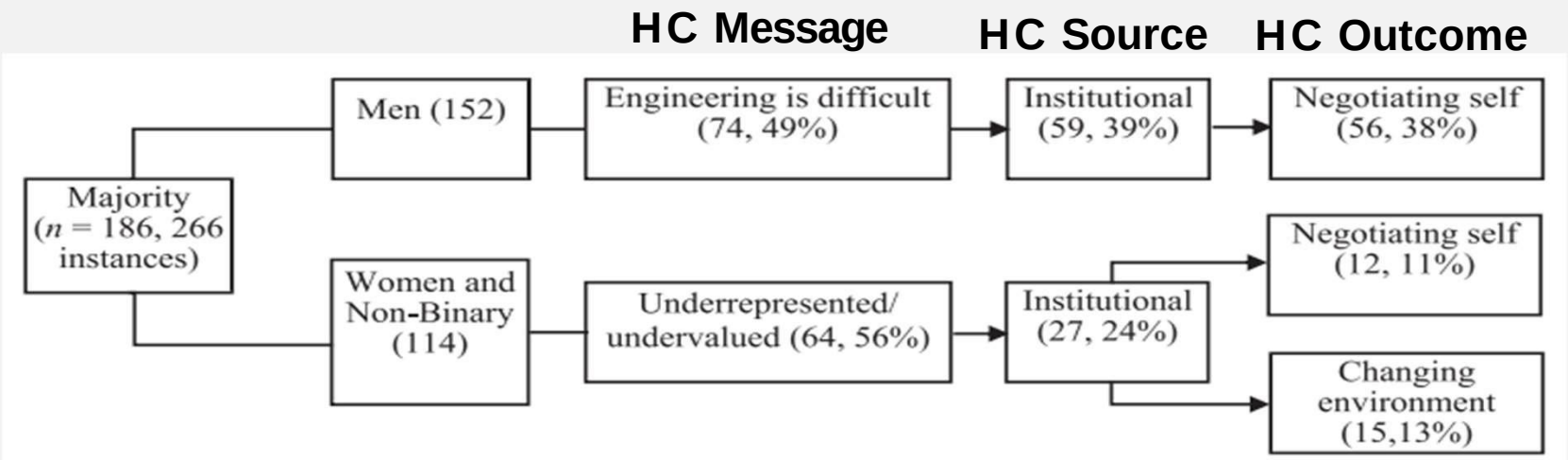
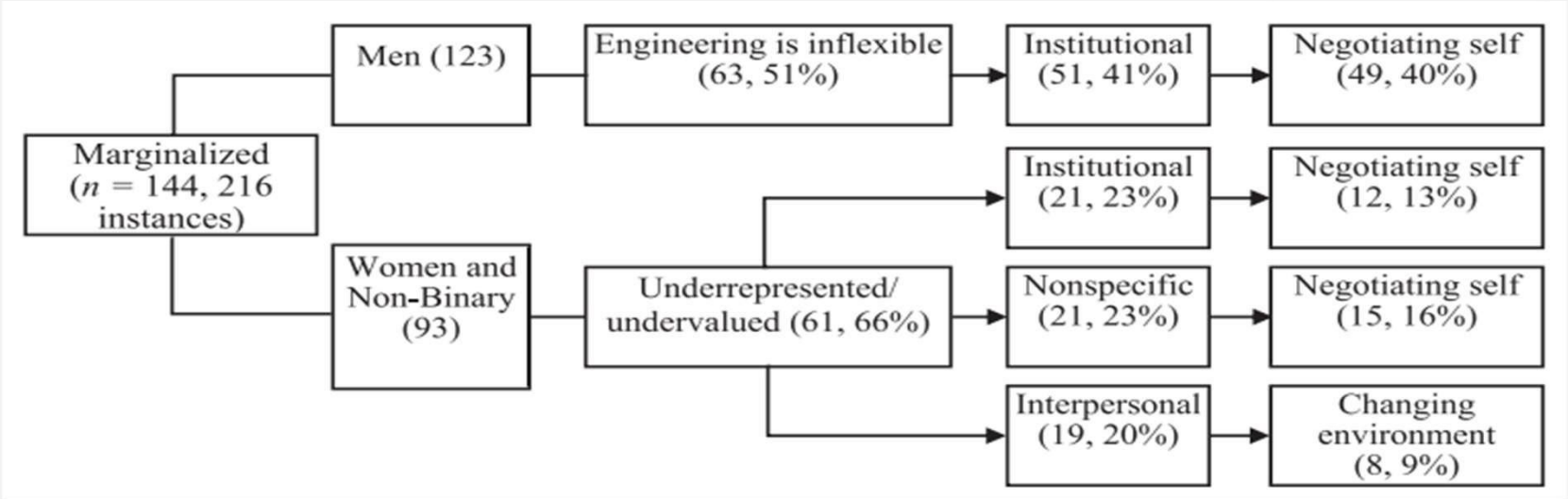
- **No/minimal action within the norm:** Strategies participants used that did not take direct action to address HC.
  - ***Example quote:*** "I have had male group project members ignore me when I assign tasks for everyone to do, despite the fact I was elected Team Leader. These are personal obstacles because there is nothing, I can do about them as a female."



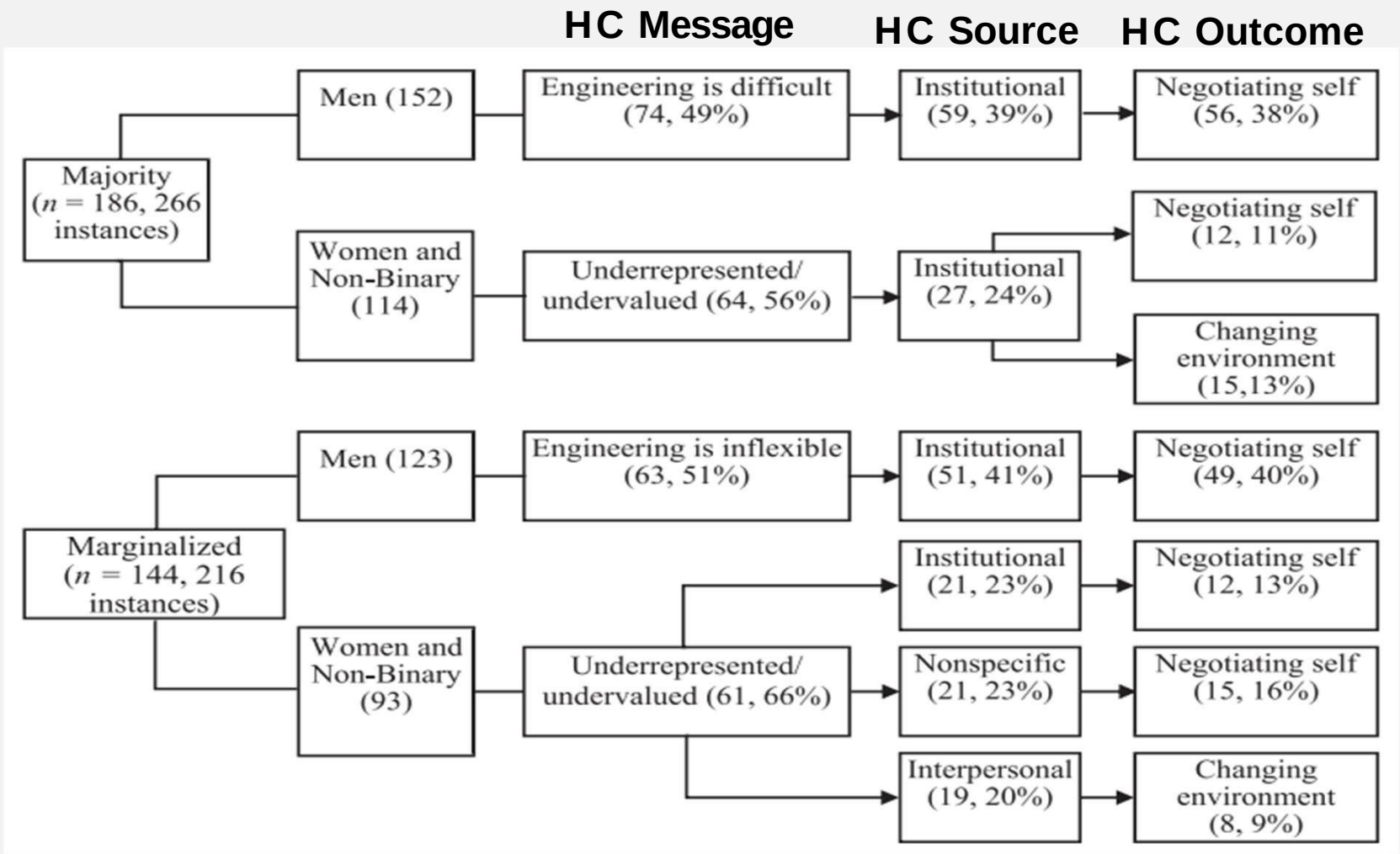
V. Sellers & I. Villanueva. (2021). What strategies do diverse women in engineering use to cope with situational hidden curriculum? *Proceedings of the American Society of Engineering Education Annual Conference & Exposition (virtual), Women in Engineering Division, Long Beach, CA, June 27-30, 2021,* Paper ID #32762, p. 1-16


HC Message
HC Source
HC Outcome
Majority (n = 186, 266 instances)
Men (152)
Women and Non-Binary (114)
Engineering is difficult (74, 49%)
Underrepresented/ undervalued (64, 56%)
Institutional (59, 39%)
Institutional (27, 24%)
Negotiating self (56, 38%)
Negotiating self (12, 11%)
Changing environment (15,13%)
Mid Self Efficacy (SE)
Mid SE
High SE

HC Message **HC Source** **HC Outcome**



Sellers, V., & Villanueva Alarcón, I. (2023). From Message to Strategy: A Pathways Approach to Characterize the Hidden Curriculum in Engineering Education. Studies in Engineering Education, 4(2), 176–200. DOI: https://doi. org/10.21061/see.113



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Study 3: HC Perspective Types

Liberal Perspective

- Focuses on those **taken-for-granted assumptions and practices** of school life which although being created by various 'actors' within the school (for example, teachers and students), **take on an appearance of accepted normality** through their daily production/reproduction.
- ***Learning activities and teacher-student relationships and interactions provide a message to students about what is considered normal or not in society.***

Functionalist Perspective

- Focused on how schools played their part in maintaining **social order and stability**.
- Views schools as vehicles through which students learn the social norms, values, and skills they require to function and contribute to the existing society.
- ***School's purpose is to create the next generation of workers who work for but never question society***

Critical Perspective

- Addresses **how schooling functions to reproduce various inequalities in society.**
- It recognizes that 'official' or formal curriculum statements of a school's support hints to those hidden or unintended consequences that lead to social injustices for many groups.
- ***School curriculum and delivery will not benefit all students equitably***

Participants	Functional	Liberal	Critical
Undergraduates	12%	57%	31%
Graduates	10%	50%	40%
Faculty	50%	0%	50%

N=264

No significant differences between gender on student perspectives ($p>0.05$) but in faculty, the functionalist perspective primarily came from men and critical perspectives from women & non-binary groups.

What does this all mean for educational practice?

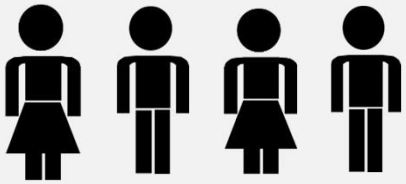
Systems (e.g., higher education)

HC

Structures (e.g., classroom)

Individuals (e.g., teachers)

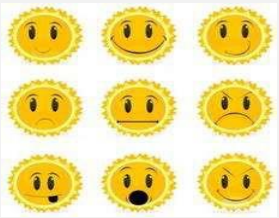
University support of faculty teaching across different colleges and departments



Structures
(departments or colleges)

+

Individual's Decision-Making Space
(persist or desist?)



Behavior/Outcomes
(graduation or drop out)

Adapted from Bronfenbrenner (1979) Ecological Model

Tips and Strategies for HC: Clarifying Expectations

- A 2015 study of Winkelmes (UNLV) and McNair & Finley (AAC&U) conducted a study on 7 minority-serving institutions of a total of 1,180 students, 35 faculty
  - 425 students were first-generation
  - 402 non-White students
  - 479 low-income students
  - 297 multiracial students
- Small Teaching Intervention:
  - 2 assignments were changed in faculties' courses to include clearer expectations and more problem-centered (or relevant in focus)

Three discussed areas before assignment:

1. **Purpose of Assignment**
   - What skills will be learned?
   - What type of knowledge will be gained?
   - How the assignment ties to their long-term goals in the profession?
2. **Task of Assignment**
   - What are students expected to do in the assignment and what are important steps to follow or not follow?
3. **Criteria in Assignment**
   - Is there a checklist or rubric in advance for students to follow?
   - Is there an example of what a good assignment looks like (e.g., instructor provides notes or steps to a similar problem)?

Tips and Strategies for HC: Reflection for Belonging

- **Experimental:** Participants were asked to write an essay and follow up video connected to a survey. Participants were told, would be shown to future students to help ease their transition to college.
- **Control:** The procedure was the same but the survey addressed topics unrelated to belonging (e.g., change in social-political attitudes)

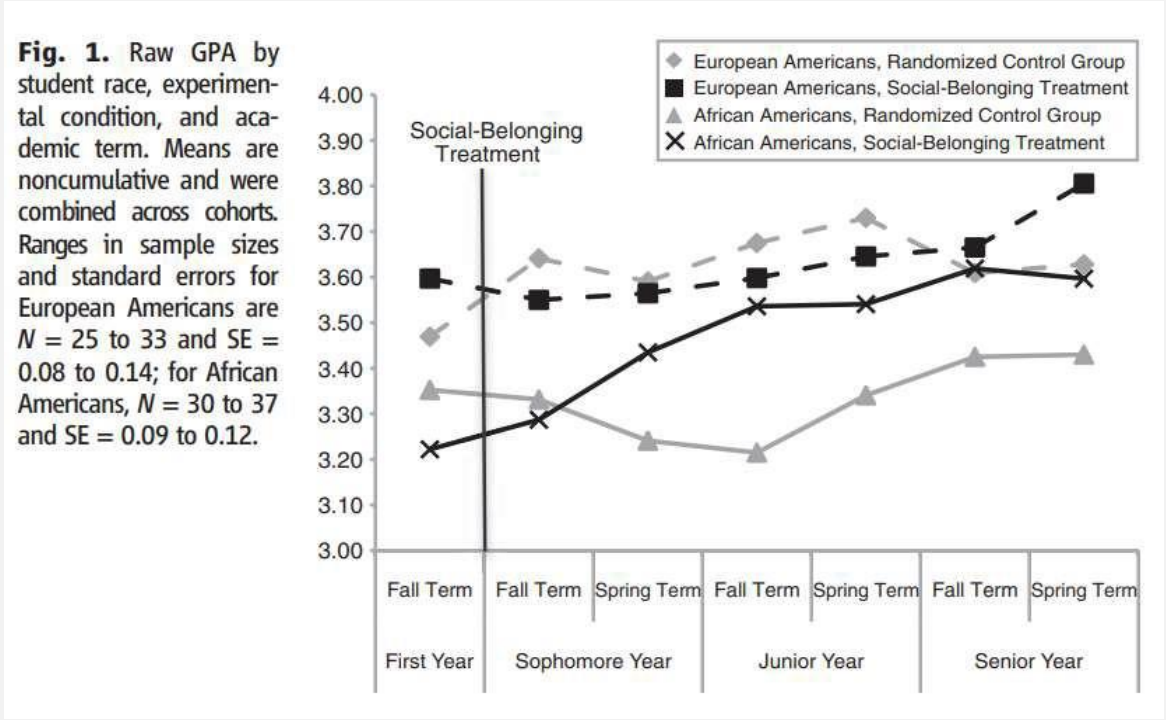


Fig. 1. Raw GPA by student race, experimental condition, and academic term. Means are noncumulative and were combined across cohorts. Ranges in sample sizes and standard errors for European Americans are $N = 25$ to 33 and SE = 0.08 to 0.14; for African Americans, $N = 30$ to 37 and SE = 0.09 to 0.12.

Walton and Cohen (2011). Science Magazine, 331 (6023), 1447-1451

Tips and Strategies for HC: Clarifying Expectations

- When we clearly communicate to students the rationale behind our instructional choices, they are more likely to do what we intend, be more motivated to learn, and be more successful.

- **Hidden Curriculum is an idea that is so simple that it is oftentimes overlooked and unexamined.**

Example: Office Hours

https://youtu.be/yQq1-_ujXrM

Tips and Strategies for HC: Clarifying Expectations

- **Sense of belonging** is key to improve persistence, confidence and success for all students but particularly from underrepresented groups
  - Sense of belonging can be created inside and outside of your classrooms
  - Can be communicated verbally, in written form, or non-verbally

Syllabus Example
(Helping students understand your viewpoint as instructor)

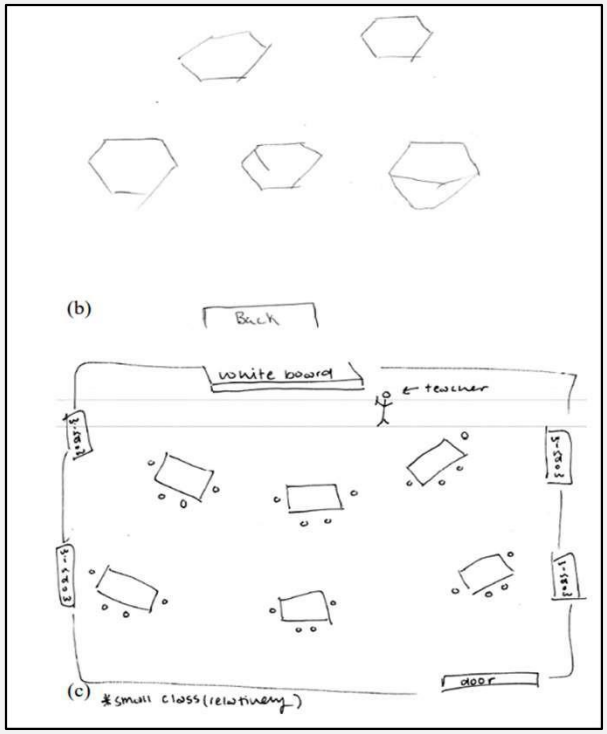
TRADITIONAL

This course will execute a "zero tolerance" policy on cheating and plagiarism.

HC-INFORMED

Re-grading of exams, reports, and assignments is a timely and serious undertaking. As such, I take academic integrity very seriously. You are asked to also take your academic integrity seriously. I understand that learning new concepts can be sometimes challenging and that you may get frustrated. However, before deciding to pursue alternate options (e.g., cheating, plagiarism), please come see me. I will do my best to help you identify resources in compliance with our university's code of conduct and help you achieve success.

Tips and Strategies for HC: Embedding Choice



- Students' choice to adapt the classroom arrangement allowed their individual needs and preferences to be met

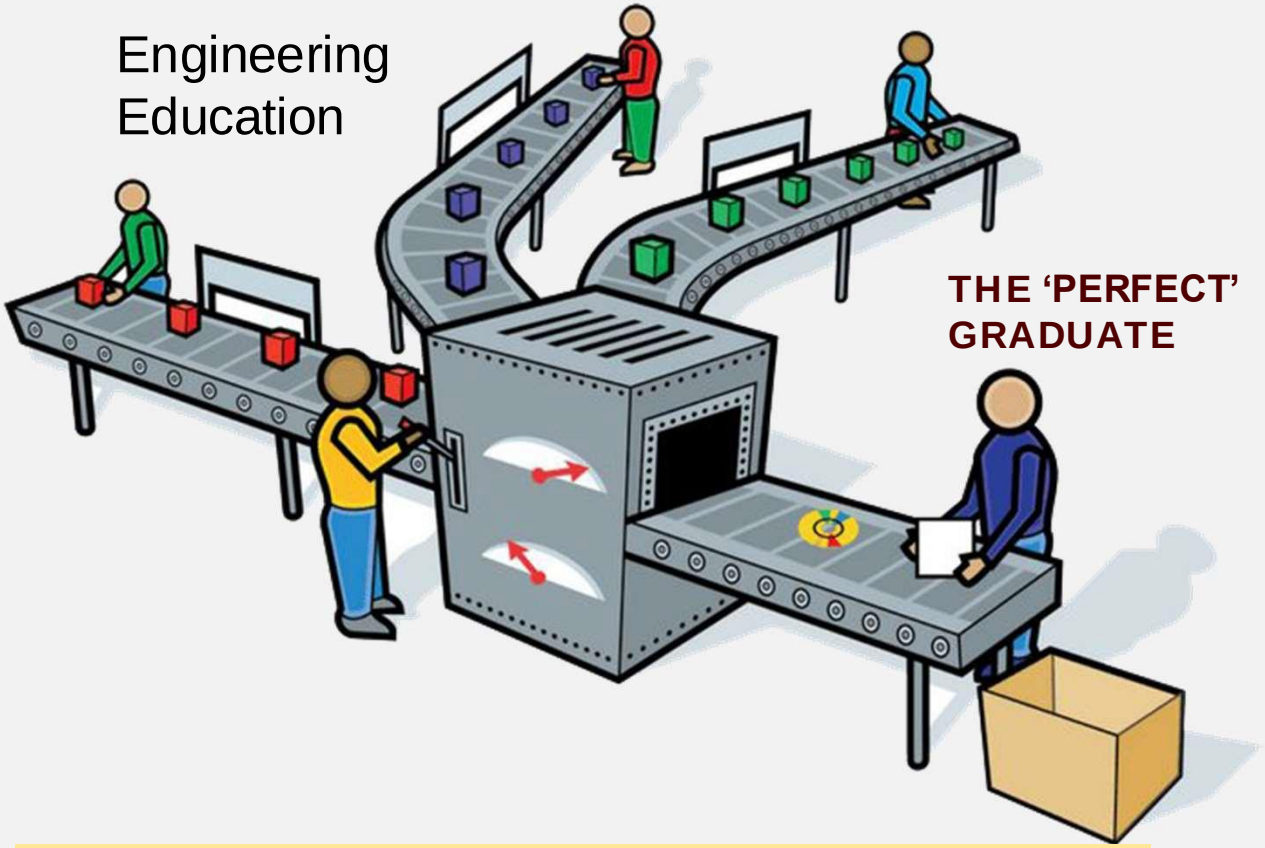
> Embedding choice into the classroom is essential given the diversity of learners, instructors, and instructional modalities, and seating styles in classrooms are easily changeable environmental variables that impact choice, purpose, inclusivity, and functionality. (Harvey & Kenyon, 2013, p. 2)

- The same rationale can be included for selection of course topics, format of assignment delivery, etc,

E. J. Harvey & M. C. Kenyon, "Classroom seating considerations for 21st century students and faculty," J. Learning Spaces, vol. 2(1), 2013.

Christensen, D. & Villanueva, I. & Benson, S. (2018). Understanding First-Year Engineering Students' Perceived Ideal Learning Environments. 1-6. 10.1109/WEEF-GEDC.2018.8629736.

Engineering Education



Why do people leave engineering so quickly?
It may be an unattended hidden curriculum issue

ENTRY:

- WOMEN EARNED 23% OF ENGINEERING DEGREES (ASEE, 2022)
  - HIGHER PERCENTAGES ARE ONLY SEEN IN 3 DISCIPLINES (ENVIRONMENTAL, BIOLOGICAL, BIOMEDICAL)
- BLACK OR AFRICAN AMERICAN, 4.5% (ASEE, 2022)
- LATINÉ, 13.1% (ASEE, 2022)
- OTHER, 4.4% (ASEE, 2022)

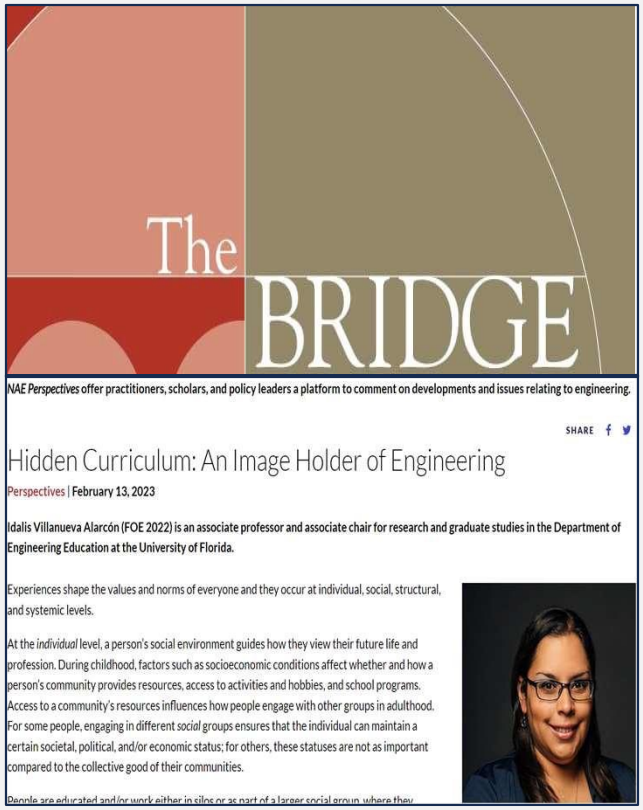
EXIT:

- 14% WOMEN AND 18%URM ENTER ENGINEERING WORKFORCE

20 YEARS LATER:

- ONLY 4% WOMEN AND 13% OF URM REMAIN (ASEE, 2019)

NATIONAL ACADEMY OF ENGINEERING


The BRIDGE

NAE *Perspectives* offer practitioners, scholars, and policy leaders a platform to comment on developments and issues relating to engineering.

SHARE

Hidden Curriculum: An Image Holder of Engineering

Perspectives | February 13, 2023

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Experiences shape the values and norms of everyone and they occur at individual, social, structural, and systemic levels.

At the *individual* level, a person's social environment guides how they view their future life and profession. During childhood, factors such as socioeconomic conditions affect whether and how a person's community provides resources, access to activities and hobbies, and school programs. Access to a community's resources influences how people engage with other groups in adulthood. For some people, engaging in different *social* groups ensures that the individual can maintain a certain societal, political, and/or economic status; for others, these statuses are not as important compared to the collective good of their communities.

People are educated and/or work either in silos or as part of a larger social group, where they

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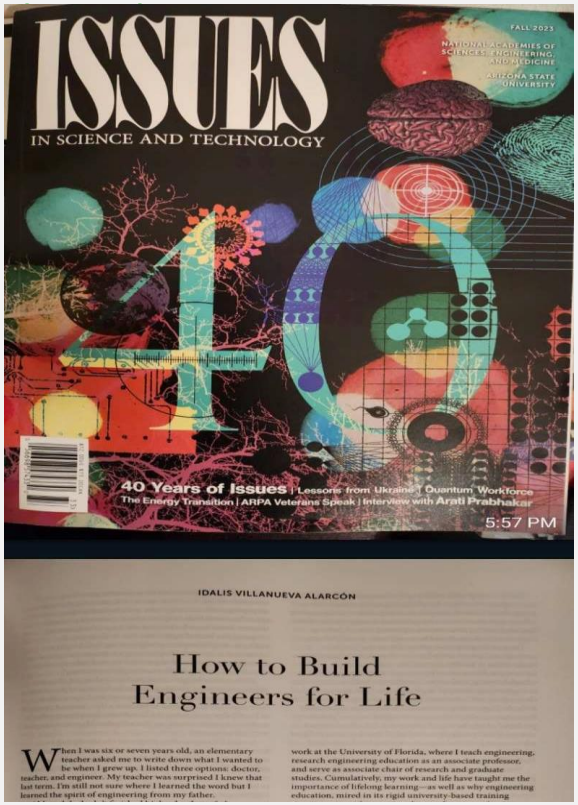

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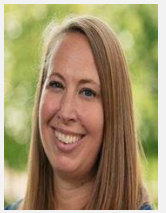
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