

Hidden Curriculum and Emotions: Do Active or Passive Perceptions of the Hidden Curriculum Affect Students' Emotions

Dr. R. Jamaal Downey, University of Florida

Dr. Downey has been a postdoctoral research associate in the Department of Engineering Education at the University of Florida since 2021. His current research is focused on determining how engineering students respond to hidden curriculum as well as how Latinx contingent faculty experience workplace inequities in engineering. He received his Ph.D. in Language, Literacy, and Culture in Education from the University of Massachusetts-Amherst. Dr. Downey focuses on critical qualitative inquiry with a discerning eye toward humanizing and culturally sustaining pedagogies.

Dr. Idalis Villanueva Alarcón, University of Florida

Dr. Villanueva Alarcon is an Associate Professor in the Engineering Education Department at the University of Florida. Her multiple roles as an engineer, engineering educator, engineering educational researcher, and professional development mentor for underrepres

“Once again no emotional response was experienced, anyone who belittles or inflates someone else status due to ethnicity isn't thinking like an engineer”: Passive or active HC and emotions in Engineering

By: Drs. R. Jamaal Downey and Idalis Villanueva Alarcón,

Introduction

The hidden curriculum (HC) has been traditionally viewed as the unwritten, unofficial, and often unintended messages (e.g., assumptions, lessons, values, beliefs, attitudes, and perspectives) that are not openly acknowledged in each environment [1] [2]. More specifically related to engineering/education, HC is hidden under the veil of norms, professionalism, and standards which prioritizes the current status quo of dominant identities in engineering (e.g., white, male, meritocratic) [1].

The presence of hidden curriculum (HC) in our educational institutions is unquestioned. Hidden curriculum can be perceived as both helpful or hurtful depending on the messages being transmitted, the identities of the individual, and/or institutions that give the HC, as well as the identities of the individuals that receive HC. After implementing a large survey ($n=984$) from a validated instrument (UPHEME), one preliminary finding was the identification of HC as either active (a product of an individual espousing their personal belief and/or biases) or passive (simply the culture and byproduct of institutional schooling). From this data, a previous study found that, while the giver of HC can be identified as either active or passive, the receiver also can also interpret HC as either active or passive also. Given that we do not have data to suggest any inferences between the identity and intent of the givers of HC, we can interpret that way that different individuals *receive* HC. The previous study found that a majority of white participants identified HC as active (26%) while 40% people of color identified HC as active. What was not investigated at that time was the emotional state of the participants when identifying HC as active or passive, especially those self-reported negative discrete emotions that may influence their views of belonging in engineering. Due to these findings, the authors felt it important to dive deeper into this subgroup.

This proposed paper focuses on the emotional state of participants, specifically self-reported negative discrete emotions, when they were asked to rate statements of assumptions regarding who should and shouldn't be engineers in order to see if there are any correlations between those that viewed HC as active or passive, positive or negative. With these patterns and themes, the authors seek to better understand how HC might be utilized to elicit more positive emotions and mitigate the negative emotions that participants are communicating.

Lit review

Villanueva et al., [2] has conceived hidden curriculum in relation to engineering and conceptualized it as a structural framework that has many interconnected and varying parts. These interconnected and moving parts help perpetuate the status quo to protect the norms, customs, cultures, values and traditions in engineering. This conceptualized framework includes four factors that are vital in initiating a disruption to HC: (a) hidden curriculum awareness (HCA); (b) emotions (EM); (c) self-efficacy (SE); and (d) self-advocacy (SA). HCA is a factor in which communication of information is perceived and recognized. For their part, emotions serve as the lens by which HC is received and recognized. Emotions are considered a vital mediator to

processes like decision-making [2]. These two are the main factors that are relevant for this paper.

Research suggests that emotions profoundly impact the way that both teachers and students engage, their personal development, and their academic outcomes [3]. There is a reciprocal relationship between the emotional state of the teachers and students whereby teachers' emotions are mirrored by the students—if a teacher shows excitement and enthusiasm, then students tend to reflect those emotions. Not surprising, if teachers show contempt or a lack of interest in a particular problem or body of research, students' emotions of boredom, irritation, or anxiety surface [4]. If “both knowledge and emotion are inescapably matters of concern in education is one which has been reached by generations of teachers, parents, and educationists from the time of Plato to the present day,” [5, p.229] why are discussing the importance of emotions within the engineering classroom (and field in general) is still seen as taboo?

Theoretical/conceptual framework

Symbolic Interactionism

To better understand the focal group for this study, we must explain the framework of symbolic interactionism that was originally conceived by Mead [6-8] in the 1930s but expanded on and coined by Blumer in the 1960s [7]. While the inception of these concepts was some time ago and there has been much debate about the total tenants of symbolic interactionism, the sections of this theoretical framework that were used for our analysis solely focused on the categorization of HCA and its transmissions, from the lens of the receiver to identify passive and active HC.

Symbolic interaction is “the language and gestures a person uses in anticipation to the way others will respond. The verbal and nonverbal responses that a listener then provides are likewise crafted in expectation of how the original speaker will react” [9, p.54]. As humans, when we communicate, we anticipate how the receiver will respond, which then effects the way we initially engage. That is, we think of how we want the respondent to reply—our intended outcome— and we try to engage in communication patterns that will serve our end goal. The way the respondent reacts will then shift how the original speaker continues to engage.

Blumer [7] believed in three core principles to symbolic interactionism: meaning, language, and thinking. The pivotal principle for this paper is language. Blumer states that language happens when “meaning arises out of the social interaction that people have with each other” [9, p.56]. Social interactions have a bevy of varying factors: each person's differing and intersecting identities, past experiences, current contexts, and perceived future outcomes. With that, and in relation to whether one identifies HC as active or passive, People of Color (POC) and marginalized identities have operated in a world that is curtailed to and normalized/s the experience of whiteness. Because of this, a POC woman might feel a HC that perpetuates and normalizes the status quo of cisgender-heterosexual white male engineers as active whereas a white male might identify a professor including nontraditional engineers of color into their curriculum as active. HC can be identified as active or passive for different reasons based on different identities.

Through the lens of sociology and symbolic interactionism theory, passive is defined as individuals who “receive society in a pre-established form and are relatively powerless to shape their own futures [...] they are passive in receipt of the constraints that structure places upon them” [10, p.274]. Within the same framework, active is defined as “the individual” as an “active rather than re-active or done-to. Such an idea of the person rests on the belief that people are

constructive in forging their own destinies, given the constraints placed upon them” [10, p. 274]. Embedded within the definition of active is the agency to create a lived reality rather be at the whims of a society that has pre-determined your lived reality for you.

Who one is and what experiences they’ve had has an impact on how they might identify HC. However, the authors must say that the above definition of passive infers a sense of hopelessness for individuals—that they are powerless. We suggest that no individual is truly and totally powerless. Instead, majority hierarchical identities have systematically and structurally communicated in ways that sustain and maintain that those with less power succumb to the idea they have no power. Pertaining to HC, we believe that all messengers (e.g., teachers, employers) can create their own reality to their receivers (e.g., students, employees).

Emotions

The other theoretical lens for this paper, and the data analyzed through, is that of emotions in engineering. Linnenbrink-Garcia et al. defines emotions as “intense, short-lived episodes, which distinguishes them from moods, which are longer lasting and have a lower level of intensity of affective states [11, p.2]. These same authors also suggest that emotions are psychological processes that “include affective, cognitive, motivational, expressive, and peripheral components” [11, p.2]. Conversely, feelings can be described as private, mental experiences of emotions [12]. Linnenbrink-Garcia et al. also define valence as the differentiation of positive states of emotions such as happiness and joy from negative states like frustration and anger [11]. Moving forward, the authors subscribe to these nuanced differences between emotions, moods, and feelings.

“Engineers often identify their work as rational, beyond emotion, and engineering is often characterized as purely scientific, involving technical solutions to real world problems” [11]. However, research suggests that emotions are integral to the way people teach and learn— “the emotional states of the student and teacher are relevant whether we are considering the aims or the content of education, its effects, the conditions under which learning can take place” [5, p. 223]. A study by Kinnunen [13] of teachers’ observations of students’ emotional responses in engineering education suggests that students’ end of the course grades was either positively or negatively affected based on their respective emotions. The correlations between positive emotions/positive learning outcomes and negative emotions/negative outcomes were also seen in educational psychology [14]. The authors are not suggesting that the only thing that matters in engineering education is emotions. In an oversimplified and simply not achievable attempt to remain objective, engineers subscribe to the traditional view of emotions—that being in emotional states was thought to sway people from their “rational purposes and objectives viewpoints by blind emotions” [5, p. 224]. But to ignore emotions’ real-world implications on both the teaching and learning spectrum would be neglecting our duty as critical and reflexive scholars and practitioners.

Research has shown us the importance of emotions in education and how they affect learning outcomes. A more nuanced and layered understanding of the ways that emotions affect marginalized identities in engineering education might help explain the lack of diversity in the engineering profession as a whole—and ways to better retain the few POC while in their engineering education. This ensures that we are seeing diverse students in engineering programs from a holistic understanding of both the way teachers teach, and students learn [15].

There was an intentional decision to not focus on positive emotions and to base most of our analysis on the frequency of negative emotions. This might seem shortsighted, but the

reasoning was clear and evident for the authors. We, the authors, have embarked on the endeavor of better understanding HC to diversify engineering/education. We wanted to see how HC *is* negatively affecting marginalized identities in engineering from either entering or staying in engineering by exploring their self-identified perspective and discrete emotions to a topic.

There is a sentiment that HC is always seen as negative because as it stands, HC is used to maintain the status quo of engineering being exclusionary and serving mostly dominant identities (white males). Not often is HC used to employ more diversity in engineering which the authors would suggest using HC to inject differing identities that break the norm a good thing. However, in the two video vignettes provided to the participants, one had the traditional conception of HC depicted in which a white male professor uses it to exclude identities and solely focus on perpetuating the traditional conceptions of HC. In this case, our research shows that participants with marginalized identities view this type of HC as active because it is actively ignoring people that look like them. We found that more dominant identities identify this type of HC as passive and simply being a byproduct of schooling.

The second video vignette dichotomizing the previous vignette in that a Latina is showcased who brought in different engineers than the traditional pioneers that are regularly being trotted out. More dominant identities defined HC as active in this instance—actively injecting diversity into engineering rather than only covering the engineering classics. In these instances, HC is being defined as active or passive based on three things: the identity of the participants, the identity of the professor, the content being taught.

This paper seeks to tap into these nuanced differences with the limited data we have based on the methods of data collection that was implemented. More specifically, we wanted to focus on self-reported frequency of negative emotions, so that we can isolate those that feel they do or do not want engineering to be more accessible and diverse. The only representation of positive emotions for this paper will be for those participants that felt joy that certain identities were excluded in engineering, those that were happy only a selected few can become engineers, and that engineering should be limited to those that have access, etc.

Methods

Positionality

The authors of this paper are both first generation college graduates. The lead author is a cisgender, heterosexual biracial man. Dr. Downey's doctoral degree is in Language, Literacy, and Culture in Education, and he focuses on critical qualitative inquiry with a discerning eye towards humanizing and culturally sustaining pedagogies. The coauthor is a cisgender, heterosexual Latina woman whose doctoral degree is in chemical and biological engineering. Dr. Idalias Villanueva Alarcón brings expertise in science and engineering, professional formation, workplace dynamics, and STEM education research. Both authors bring different perspectives to this work, which affords them the ability to see trends that might not be obvious to those coming from simply a STEM background. The authors have transformative worldviews, which "holds that research inquiry needs to be intertwined with politics and a political change agenda to confront social oppression at whatever levels it occurs" [16, p. 9]. The authors acknowledge the potential detrimental effects that oppressive forms of communication can have on the subsequent decisions and actions of marginalized and minoritized students in disciplines like, but not limited to, engineering.

Research Question:

The research question that drove this study is: *What are the emotions expressed by students about who should and shouldn't become and belong in engineering and how are they connecting these to active or passive HC experiences?*

Research Design and Instrument:

Between 2018 and 2019, a mixed-method survey that was validated and tested for reliability (UPHEME), which explored the perceptions of 984 engineering undergraduate, graduate, and faculty about HC, how it was defined, received, and responded to was disseminated. This validated survey was instrumental in highlighting the ways that HC has in the formation of values—both institutional and personal [1]. The survey included questions on their prior knowledge of HC, how they would define it, and then the participants were shown two video vignettes, which depicted HC in action. Several short answer questions followed. There was an intentional order in the order of quantitative and qualitative questions, its factors, and the video vignettes. These choices were made to minimize the mental shortcuts that participants might take to grapple with a new concept or phenomenon [1].

To understand if the participants had gained any HCA, participants were asked to define HC. Based on these answers, some identified HC as the actions of individual actors (active) or as a byproduct of schooling institutions (passive). As for the deeper understanding of the participants' emotional states surrounding HC, they were asked: *Can you think about an example of hidden curriculum you experienced in engineering? Briefly explain the situation and the emotions you had in that situation.*

Data Collection and Analysis

The authors previously produced two manuscripts from this larger dataset that has informed this study. In one study, they coded the *n*984 answers looking to see whether the participants identified HC as active or passive [2]. An initial round of thematic analysis permitted the authors to identify those who attributed HC as the product of individual(s) and/or educational institutions. This was followed by content analysis to identify the individual words used to define HC which was a pivotal round to determine the levels by which participants identified HCA and the way it was transmitted as either active or passive. Lastly, the participants' demographics were layered on to the data and used magnitude coding to determine frequency themes and trends among the intersections of gender and race within the group. The authors felt that the connection between who defined HC as active and passive coupled with who belongs in engineering was important to unpack when viewed through the lens of emotions.

The initial study (*n*984) was coded down to 120 written responses where the participants identified HC as active or passive. The second round of coding allowed the authors to more closely examine the words and phrases shared among the participants such as: "hidden agenda by [the] professor" (#315), "unspoken lessons [in the school]" (#363), "subconscious ideas students pick up" (#450), and "unintentional lessons" (#458). What the authors found was that most individuals described HC as being passive and part of the lessons while engaging within educational institutions by three-fold (69% passive compared to 31% active). However, there were different stories once the data was analyzed through varying identities such as gender, race, and their intersections. White individuals identified HC as active at a rate of 26% while their POC counterparts only identified HC as active 40%. White women identified HC as active 19% whereas Women of Color (WOC) received HC as active at 47%. These stark differences told us that different identities view and receive the transmission of HC differently and that

marginalized intersecting identities have an impact on whether you feel HC is done to you by individuals or simply a byproduct of educational institutions (see Figure 1). Due to these findings and given that this subset of participants was invested in the survey enough to answer most of the short-answer questions, the authors felt it important to better understand this subset of participants [2].

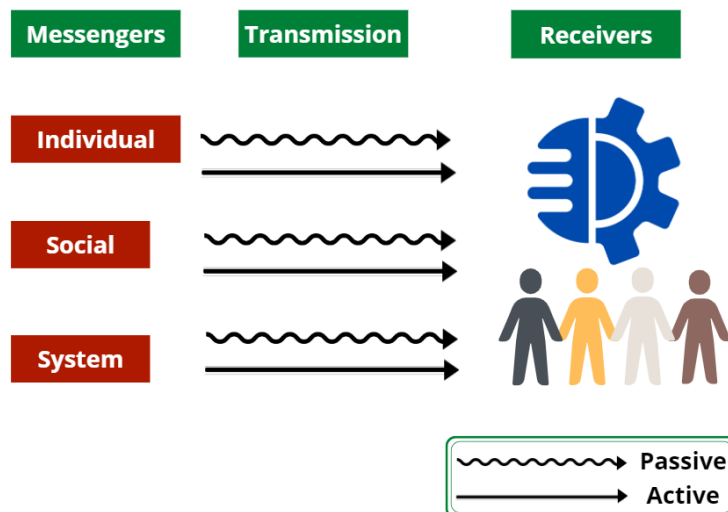


Figure 1. Proposed terms for active and passive HCA and its transmission and adapted from R.J. Downey & I.Villanueva Alarcón (2022).

This secondary analysis inspired us to explore more deeply these active and passive HC and identify how intersectional identities (e.g., first-generation-FG, POC, and marginalized) connected to an expression of experiencing more negative or positive emotions.

For this, we re-visited the original 984 participants and identified those participants that responded to a drop-down menu of 14 discrete emotions connected to the HC they have experienced. Also, participants was asked if the emotion selected was positive or negative to them. From this, we found that $n=341$ participants answered the emotion question on the survey. One hundred and twenty participants answered the survey question with either a negative emotion or lacking any memory of HC experiences—which could indicate a blindness to the presence of HC despite research that suggests HC is always present.

Since the authors were only looking for the effects of expressed negative emotions, the numbers that follow are relative ratios of those that answered either negative or an absence of experience with HC. This is because we wanted to see how HC negatively impacted different intersectional participants. The results from this manuscript suggest that 65% ($n=102$) of the self-identified FG participants identified negative emotions while 35% ($n=55$) did not recall any experience with HC. However, the authors identified that the isolation of FG status did not have the impact on negative emotions that they initially hypothesized since the total number of non-FG participants had a similar rate of negative emotions (63% compared to 65%). The identities that had a larger impact on the frequency of negative emotions were gender, race, and the intersections of these marginalized identities. One reason could be is that FG identity can be hidden whereas gender and race are typically considered visible, although we recognize its social construction.

Given that we wanted to understand this subset of participants and their emotions, the authors started with the sum of the first study’s participants ($n=120$) and then layered on their answers on the emotions’ questions of who does and doesn’t belong in engineering. Given that five participants did not answer both scales, our dataset moving forward is $n=115$. These emotional questions included the short answer along with a Likert scale and participants self-identified their emotional state. The Likert scale asked the emotional state of participants to specific statements such as: “the assumption that not everyone has the same level of access to resources to become an engineer,” and “the assumption that women in engineering are an exception and not the norm,” of which they answered with a number that symbolized specific emotions (see table 1). This scale served as the start point data to analyze for the purposes of this paper to find themes and trends when looking at different variables such as gender, race, and the intersections of these identities.

The authors decided to split the dataset into two categories. Given that the participants had seven assumptive statements to label with their emotions, they had eight options: choose between zero and seven which is eight options. The logical choice was zero to three as the bottom negative frequency, and four to seven as the top negative frequency. In this manner, the split line is not arbitrary but rather an attempt to see the top and bottom halves.

Table 1. List of discrete emotions participants can select from

Entry	Emotions Option
1	Anger
2	Anxiety
3	Boredom
4	Enjoyment
5	Frustration
6	Happiness
7	Hope
8	Hopelessness
9	Interest
10	Pleased
11	Pride
12	Relief
13	Shame
14	Other/Not Listed

Findings

Forty-nine percent ($n=56$) of participants had a frequency of three or less negative emotions about who does and doesn’t belong in engineering. This might seem good. However, the smaller number of negative responses means that this group of people are pleased, happy, and have hope and pride about women being the exception in engineering, and that it’s good not everyone has equitable access to becoming an engineer.

Pertaining to race, there was 75% white participants ($n=42$), 12% Hispanic ¹($n=7$), 7% Black ($n=4$), 4% Asian ($n=2$), and 2% American Indian ($n=1$). Pertaining to gender, there was 29% self-identified women ($n=16$) and 71% self-identified men ($n=40$). Within the intersections of gender and race, there were 54% ($n= 30$) white men, 21% ($n=12$) white women, seven percent ($n=4$) Latinos men, five percent ($n=3$) Latinas, five percent ($n=3$) Black men, two percent ($n=1$) Black woman, four percent ($n=2$) male Asians, and two percent ($n=1$) male American Indian.

A composition profile from someone in this group means they are happy that not everyone should have the same resources to become an engineer, that the central focus of engineering should be technical specifications and not socio-cultural considerations, pride that women in engineering are the exception and not the norm, and those that do poorly in an undergraduate engineering course should change to a non-engineering major. This composition profile also believes that a selected few should become engineers, and those that have higher levels of access to resources should become engineers.

¹ This moniker was used at the time of the study, but the authors recognize that this term is problematic [17].

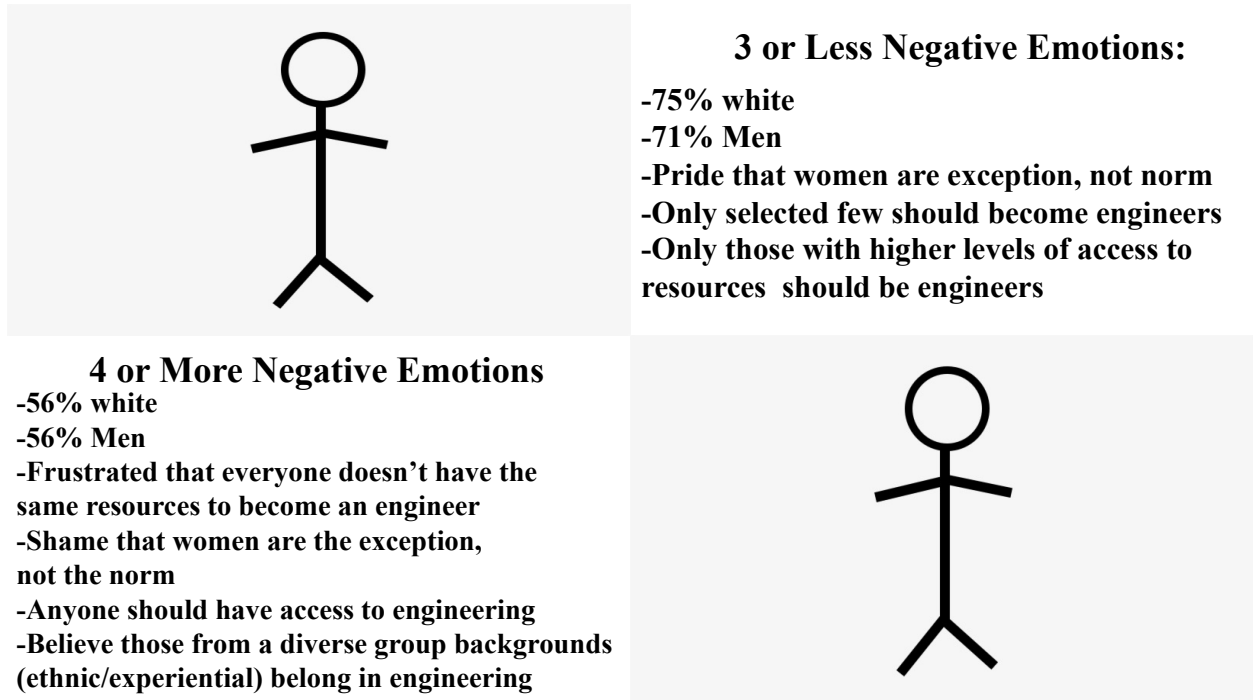


Figure 2: Picture Representation of Findings

The remaining 51% participants ($n=59$) had a negative emotional reply frequency of four negative words or more. This indicates that more than half of the original participants ($n=115$) were frustrated, felt shame, anger, and had anxiety that not everyone has the same access to resources to become an engineer, or that women were the exception, not the norm. When thinking about ways to diversify engineering and make it a place that not only welcomes marginalized identities, but makes them feel like they belong, these participants might be the changemakers that allow this evolution in engineering to take place and sustain over time.

This group ($n=59$) comprised of 56% self-identified men ($n=33$) and 44% self-identified women ($n=26$). There was 56% white participants ($n=33$), 22% Latinos ($n=13$), seven percent Black ($n=4$), 12% Asian ($n=7$), and three percent American Indian ($n=2$). There was 32% ($n=19$) white men, 24% ($n=14$) white women, 12% ($n=7$) Latinos, 10% ($n=6$) Latinas, seven percent ($n=4$) Black men, three percent ($n=2$) Asian men, eight percent ($n=5$) Asian women, two percent ($n=1$) American Indian man and two percent ($n=1$) American Indian woman.

A composite profile from someone in this group is frustrated that not everyone has the same access to resources to become an engineer, anger that students who do poorly in an undergraduate engineering course usually change to a non-engineering major, and shame that women are the exception in engineering, not the norm. This composite profile believes anyone, regardless of grades and skills should have access to engineering while also believing those that come from a diverse group of ethnic and experiential backgrounds belong in engineering.

Table 2. Results

Results	4 or more Frequency	3 or less Frequency
	%	%
Total	51	49
Gender		
Women	44	29
Men	56	71
Race		
White	56	75
POC	44	25
Race/Gender Intersection		
White Women	24	21
White Men	32	54
POC Women	20	7
POC Men	24	18

Active/Passive findings

When sorting the participants by active and passive to see if there are any potential connections, some stark findings appeared. As a reminder, the determining range of frequency for negative emotions was zero to three and four to seven. We've established that in general, the higher the frequency of negative emotions to the assumptive statements infers that the participant feels more access to diversity for engineering is needed ($n=59$). The less frequency of negative emotions to said statements means one was ok with the perpetuation of norms and standards in engineering that negatively affects those with marginalized identities ($n=56$). Our recent study suggests [2] that more marginalized identities one holds, the more said person is likely to see HC as active. The less targeted identities one has, the more this person feels HC is simply a byproduct of schooling (passive). The authors have included an adapted chart from their previous study that shows which types of identities identified HC as active or passive.

Table 3: Previous study results identifying active/passive HC

Results	Active	Passive
	%	%
Total (n120)	31	69
Gender		
Women (n43)	30	70
Men (n77)	31	69
Race		
White (n78)	26	74
POC (n42)	40	60
Race/Gender Intersection		
White Women (n26)	19	81
White Men (n52)	29	71
POC Women (n17)	47	53

POC Men (n25)	36	64
----------------------	----	----

This chart confirms that the more marginalized identity one holds, the higher likelihood that they feel HC is active and more of something done to them rather than the natural product of institutionalized schooling. What is interesting is that there are some anomalies. Overall, men are one percent more likely to identify HC as active compared to women (31 vs 30 respectively). While white women fall far behind POC women (19 vs to 47 respectively), white women are 10% less likely to identify HC as active compared to white men (19 vs to 29 respectively). POC are 14% more likely to identify HC as active compared to their white counterparts (40 vs to 26 respectively). The identity of race seems to be more salient than that of gender. While the authors could postulate that these anomalies could be explained through the theory of critical whiteness studies, that line of inquiry is outside the scope of this project.

Looking forward, it would seem that the more marginalized identities one holds, the more likely that person would deem HC to be active, and the higher likelihood that person would want others that look like them in engineering, be it by gender, race, or their intersection. If someone identifies HC as passive, there might be a higher chance that they are satisfied with what they see in engineering landscape. These predictions are solely based on the connection between participants that identify HC as active vs passive, and how said participants view who should and shouldn't be engineers.

Passive HC Findings

This round of coding showed us that there were 53% ($n=31$) of four negative emotions or more identified HC as passive. Self-identified men made up 68% ($n=32$) of three or less; women were 32%. Seventy-two percent ($n=34$) of the passive three or less were white which parallels both the total percent of white participants with three or less (75%) and the total percent of those that identified HC as passive (74%).

Self-identified men made up 55% ($n=17$) of the passive four or more; women were 45% ($n=14$). Sixty-eight percent ($n=21$) of the passive four or more were white which is 12% higher than the total percent of white participants with four or more (56%) and 6% lower than the total percent of those that identified HC as passive (74%).

Table 4. Identify HC as passive

Results	4 or more Frequency	3 or less Frequency
	%	%
Total	53	84
Gender		
Women	45	32
Men	55	68
Race		
White	68	72
POC	32	28

Active HC Findings

In this round of coding, 16% of the three or less negative frequency participants identified HC as active. Self-identified men made up 89% of the active participants with three or

less; women were 11%. Eighty-nine percent of the active participants with three or less were white which is 14% higher than the total percent of white participants with three or less (75%) and 63% higher than the total percent of those that identified HC as active (26%).

We found that there were 48% of participants with four or more negative frequencies which identified HC as active. Self-identified men made up 57% of the active participants with four or more; self-identified women were 43%. White participants made up 43% of the active participants with four or more which is 13% lower than the total percent of white participants with four or more and 23% higher than the total percent of white participants that identified HC as active (26%).

Table 5. Identify HC as active

Results	4 or more Frequency	3 or less Frequency
	%	%
Total	47	16
Gender		
Women	43	11
Men	57	89
Race		
White	43	89
POC	57	11

Discussion

What is most striking about the findings is the diversity in the second group—those that had a higher frequency of negative emotions of four or greater compared to the group of three or less negative emotions frequency. Out of the $n=56$, there were only 25% POC ($n=14$) in the lower negative frequency opposed to the higher frequency group ($n=59$) which had 44% POC ($n=26$). This could mean that the more marginalized identities you possess, the greater access and sense of belonging to engineering one *should* have, but don't. Conversely, the less diverse your identities are, you might be (sub)consciously perpetuating the hegemonic normalization of cis-gendered white men in engineering. Protecting one's self-interest is nothing new. However, acting as gatekeepers to diversifying engineering limits the number of differing voices in the room when trying to problem-solve and could create a sense of groupthink.

What wasn't explored are ways to normalize difference in engineering. Since more POC feel that HC is active in a negative way that actively harms them by not acting as a window *or* mirror to their experiences, engineering educators could use their classrooms to introduce (and normalize) ways that diverse identities have contributed to engineering. While this continues the belief that HC is active, it would be activated in a manner that produces a counternarrative to the dominant narrative [18]. Solórzano and Yosso define counternarratives as highlighting the stories of those often forgotten or not represented [18]. By activating counternarratives, educators would be able to allow more diverse and often stigmatized identities to be seen as worthy, as productive, and normalize the idea that other identities can (and do) contribute to the evolution of engineering. This will be no easy feat. There are generations of normalizing dominant identities in engineering. However, the gain would be a space that invites marginalized identities and encourages them to stay.

The trends between active/passive and negative frequency confirmed our previous study [2]. Believing that HC is passive and a byproduct of schooling in which everyone is equally affected by, and those same participants having a lower frequency of negative emotions towards assumptive statements on who should and shouldn't be engineers, are mostly white and men. Out of the group of people that feel HC is active and those same participants having a higher negative emotions frequency is a much more diverse and equal identity pool than the previous. The participants that felt HC was active was more diverse than the participants that felt HC was passive. Similarly, those that had a higher frequency to negative emotions about who should be excluded from engineering was more diverse than those that had a lower frequency of negative emotions that felt engineering should be exclusionary. While there is more work to be done to concretize the connection between believing HC to be active/passive and those that feel engineering should be more inclusive of the identities regularly excluded, the authors suggest there is a strong connection between these factors.

Future Implications

In education, specifically children's literature, Dr. Rudine Sims Bishop coined the concept of windows and mirrors and sliding glass doors [19]. She believed that children's literature could act as a window into other cultures, a mirror for our own, and sliding glass doors to enter other people's lives. Pertaining to engineering education, marginalized identities need to see themselves in the work and dominant identities need to value seeing people that don't look like them in their curriculum.

Given the current state of engineering that house a dearth of POC, women, and other marginalized identities, finding ways to recruit, retain, and graduate more of these identities is essential for the success of engineering education. The findings suggest that those with more marginalized identities have more negative emotions about assumptions that diversity does not belong in engineering.

Acknowledgment

This material is based upon work supported by the National Science Foundation (NSF) No. EEC-1653140 and 2123016 given to the second author. Any opinions, findings, and conclusions or recommendations expressed in this material do not necessarily reflect those of the NSF. We want to give a special thanks to the institutional liaisons, Dr. Hector Cruzado, Dr. Sindia Rivera-Jimenez, Dr. Heather Shipley, Dr. Kimberly Cook-Chennault, and Dr. Paul Barr who assisted us with collecting participant data in the first stage of sampling. We also want to thank the participants for sharing their experiences with us and the readers of this work.

References

1. I. Villanueva, M. Di Stefano, L. Gelles, K. Youmans, and A. Hunt. "Development and assessment of a vignette survey instrument to identify responses due to hidden curriculum among engineering students and faculty," *IJEE*, vol. 36, num. 5, pp.1-21, 2020.
2. R. J. Downey, and I. Villanueva. "Reading the World of Engineering Education: An Exploration of Active and Passive Hidden Curriculum Awareness" Paper presented at 2022 ASEE Annual Conference & Exposition, Minneapolis, MN, August, 2022.
<https://peer.asee.org/41113>
3. T. Lonngren, M. Adawi, J. Berge, H. Huff, I. Murzi, R. Direito, Tormey, and U. Sultan. "Emotions in engineering education: Towards a research agenda." *Frontiers in Education Conference (FIE)*, 2020 IEEE, 2022, 1–5.
<https://doi.org/10.1109/FIE44824.2020.9273951>
4. S. Hartikainen, L. Pylväs & P. Nokelainen. "Engineering students' perceptions of teaching: teacher-created atmosphere and teaching procedures as triggers of student emotions." *Euro J Eng Ed.*, vol. 45, num. 5. Pp-814-832, 2022.
5. M. Griffiths, Emotions and Education. *JPE*, vol. 18, num. 2, pp.223-231, 1984.
6. H. Blumer, *Symbolic Interactionism*. California: University of California Press, 1986.
[20] E. M. Griffin, "Symbolic interactionism of george herbert mead," in *A First Look at Communication Theory*, 8th Ed. New York: McGraw-Hill, 2012, 54-66.
7. J. Spurway Marks, "Blumer's symbolic interactionism: Methodological implications", *Electronic Theses and Dissertations*, 1971.
8. G. Mead. *Mind, Self, and Society: The Definitive Edition*. Illinois: University of Chicago Press, 2015.
9. E. M. Griffin, "Symbolic interactionism of george herbert mead," in *A First Look at Communication Theory*, 8th Ed. New York: McGraw-Hill, 2012, pp. 54-66.
10. C. Jenks, "Active/passive," in *Core Sociological Dichotomies*, California: Sage Publications 2012, 261-274.
11. L Linnenbrink-Garcia, E. A. Patall, and R. Pekrun. (2016). Adaptive Motivation and Emotion in Education: Research and Principles for Instructional Design." *Plcy Insgt Behvrl & Brn Sci*. Policy Insights from the Behavioral and Brain Sciences, vol. 3, num. 2, 228–236. <https://doi.org/10.1177/2372732216644450>.
12. A. R. Damasio. (2000). "A second chance for emotion." In R. D. Lane & L. Nadel (Eds.), *Cognitive neuroscience of emotion* (pp. 12–23). Oxford University Press.
13. P. Kinnunen, "Dealing with emotions – Engineering teachers' observations of students' emotional reactions to receiving feedback on their work," *2020 IEEE Frontiers in Education Conference (FIE)*, 2020, pp. 1-5, doi: 10.1109/FIE44824.2020.9274107.
14. S. Hartikainen, L. Pylväs & P. Nokelainen (2022) "Engineering students' perceptions of teaching: teacher-created atmosphere and teaching procedures as triggers of student emotions." *Euro J Eng Ed.*, vol. 45, num. 5. Pp-814-832, 2022. ^[1]_[SEP]
15. A. Hargreaves. *Teaching in the knowledge society: Education in the age of insecurity*. New York, NY: Teachers College Press, 2003.
16. J. Creswell & J Creswell. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 5th Ed. California: Sage Publications, 2017.
17. I. Villanueva Alarcón, J. A. Mejia, J. Mejia, J. and R. Revelo. "Latiné, Latinx, Latina, Latino, or Hispanic: Problematizing terms often used in engineering education. *J Eng Educ*, 111: 735-739, 2022. <https://doi.org/10.1002/jee.20486>

18. D. G. Solórzano, and T. J. Yosso, T. J. (2002). Critical Race Methodology: Counter-Storytelling as an Analytical Framework for Education Research. *Qualitative Inquiry*, vol. 8, num. 1, pp. 23–44, 2002. <https://doi.org/10.1177/107780040200800103>
19. R. Sims Bishop. “Mirrors, windows, and sliding glass doors.” *Perspectives*, vol 1, vol. 3, pp. ix–xi, 1990.