

Reading the World of Engineering Education: An Exploration of Active and Passive Hidden Curriculum Awareness

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Abstract

This paper seeks to better understand the distinct, and sometimes intersectional ways that particular identities receive the hidden curriculum (HC) (unacknowledged and often, unintentional systemic messages that are structurally supported and sustained) in engineering [1]. From the validated instrument (UPHEME; [2]), 120 participants communicated, in written form, that the HC they received was either active (intentionally and explicitly transmitted) or passive (unintentionally and implicitly transmitted). Using a theoretical, sociological framework of symbolic interactionism in which thematic, content, and magnitude coding was conducted, we found that most White participants identified the HC as *passive* (74%) while People of Color (POC) defined the HC as being *active* (40%). Additionally, when participants identified the HC as *passive*, there was an observed difference of 14% between White participants (74%) and POC (60%). Furthermore, women of color (WOC) experienced the most passive and active HC out of all the groups. The findings provide a more nuanced look into the ways that the HC transmissions are received differently by individuals in engineering education.

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 a given environment [1], [2]. In other words, the HC often consists of positive (inclusive) or negative (exclusionary) systemic messages that are structurally supported and sustained (e.g., [1], [2]). By not identifying the HC and how these messages are acquired by a receiver, individuals can interpret and internalize these messages differently, which can dramatically impact the trajectory of the individual [2].

While the conventional understanding of the HC has been viewed negatively as being harmful to both POC (by means of internalizing negative messages) and majority identities (by not being fully aware of how different ideologies are minoritized and marginalized) [2], uncovering how the HC is activated and operates, can ‘flip the switch’ to positively democratize knowledge and power [2]. Thus, the HC is ripe for possibilities to disrupt the *status quo* dominating engineering today (e.g., White, male, meritocratic) [3].

Acting as the counternarrative [4] to traditional views of the HC, we argue that individuals can activate the HC to imbue more equity and diversity in educational and working environments. Thus, we do not make the argument that any active agent of the HC is negative or harmful. Instead, by attempting to parse out the different ways that individuals communicate or receive the HC, interventions can be crafted towards a more positive outcome for all. Better understanding of how the HC is received by different identities lays the groundwork towards activating the HC to promote diversity and equity in engineering education. In the process of teasing out these HC messages, we contend that we must not disconnect from the contextual, situational, and intersectional realities of individuals that receive the HC.

This paper seeks to qualitatively explore the ways in which individuals at the intersection of race and gender, communicates their receipt of the HC as either active (intentional and explicit transmission) or passive (unintentional and implicit transmission). It is important to note that the

authors acknowledge that intersectionality is not limited to race and gender but rather should include social, historical, cultural, and systemic factors [5], which will be captured in future work. For this paper, the former will serve as a starting point to this nuanced exploration using the lens of hidden curriculum awareness (HCA), the first factor of the structural framework proposed by Villanueva and colleagues [2], [6].

Background

Hidden Curriculum Awareness in Engineering

While originally used to convey the behaviors that children learned in schools such as manners, making an effort, waiting quietly for your turn, and being punctual [7], [8], the study of hidden curriculum has evolved over time to include perspectives that transcend traditional and functional views of education [6]. Traditional perspectives of hidden curriculum situate the need for transaction, a sort of correspondence approach where lessons, communications, and cues are transferred from a messenger to a receiver [6]. Over time, these types of correspondences have evolved to consider what happens outside the four walls of a classroom. Contemporary perspectives of hidden curriculum ('liberal/critical' perspectives) focus on how systemic structures transmit norms, values, and beliefs to individuals and how these forms of messaging serve to sustain the *status quo*, reinforcing privilege and authority over others [6].

In the context of engineering, Villanueva et al., [2], [6], [9]-[16], has re-introduced the study of the hidden curriculum and conceptualized HC as a structural framework that contains several interconnected, moving parts. These moving parts include norms, customs, cultures, values, and traditions that are structurally supported and sustained through individuals, social groups, or systems to maintain a *status quo*. In the conceptualization of the structural framework, four factors were identified as being important at initiating a disruption of the *status quo* [2]: (a) hidden curriculum awareness-HCA; (b) emotions- EM; (c) self-efficacy-SE; and (d) self-advocacy- SA. HCA is a factor by which information being communicated is discerned [6]. Emotions manifest how the HC is received and recognized and is considered an important mediator to processes like decision-making [2]. SE is another mediator and serves as an igniter towards behaviors and actions to counter the HC [2]. SA is considered an outcome of the framework where an action (negative, positive, or none) is taken [2]. Out of these, HCA is considered the most important factor, in that without its initiating role, no messages or information transmitted by a system, structure, or individual(s) can be intercepted or uncovered. We argue that the "task of enabling people to understand what motivates such interference is perhaps even more important" [17, p. 177] than identifying the interference itself.

An early study was conducted by Villanueva et al., [6] to explore the perspectives of over 200 undergraduate students, graduate students, and faculty when asked about their engineering experiences; from their perspectives, their HCA levels were tabulated. Their HCA were categorized by forms of transmission (found at the intersection of implicit or explicit and unintentional or intentional) [6]. Implicit HC include those elements that remain in the cognitive processes of receivers but that cannot be extracted (e.g., thoughts, personal beliefs, values). Explicit HC involve carefully designed, tested, and communicated messages or content that can be extracted, studied, and addressed (e.g., policies, rules, laws). Intentionality or unintentionality represents the directionality of transmission of a message where intentional has a higher degree of focused communication compared to unintentional. In that early study [6], the authors found

that engineering faculty and students differed in how they perceived the HC around them. Engineering faculty were split between traditional and more critical perspectives of the HC while students struggled the most to make sense of the HC around them [6]. The authors also found from the “analysis of the participants’ responses, that engineering conveys very intentional messages, which may implicitly or explicitly cue to students their belonging or fit to the field” [6, p. 6]. Moreover, as recent work from the same research group suggests [1], [18], HC and the awareness of such is contextual, situational, and intersectional for marginalized and minoritized groups in engineering.

The purpose of this study was to understand how HCA and its transmission is received by different individuals. More specifically, we focused on engineering undergraduate students, graduate students, and faculty whom communicated, in written form, their views about HC in engineering after seeing a written definition and video vignette of HC [2]. More details on this design and its rationale will be explained in the Methods section.

Symbolic Interactionism to Situate Transmissions of HC in Engineering

To situate HCA and its transmission as contextual, situational, and/or intersectional, it is important to first understand its symbolisms and interactions. To this end, the authors derived conceptualizations of symbolic interactionism [17] to inform their approach to this work. Symbolic interactionism tenets originated in the 1930s [19]-[22] by Mead [22] although the term itself was coined by Blumer [21] in the 1960s. While there have been several critiques since the original conceptualization of this theory, the sections of this theoretical framework that were used for our analysis solely focused on categorization of HCA and its transmissions, from the lens of the receiver.

Briefly explained, symbolic interactionism 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” [20, p.54]. Blumer [21] believed in three core principles to symbolic interactionism: meaning, language, and thinking. 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” [23, p. 276, italics added]. This would indicate that the HC is an everyday and accepted form of institutionalized education that we, as a society, have largely come to accept. We cosign this understanding of institutionalized education by continuing to send our children and/or participate ourselves into said systems of education. It also may signify inequitable power structures that would carry repercussions if a person chose to act upon the received message. Conversely, and within the same sociological and symbolic interactionism theory lens, 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” [23, p. 276; italics added]. This definition provides the individual with agency to self-define and re-create their lived reality on their own terms rather than passively letting reality happen. From our HC work, this is referred to as a ‘changing of self’ strategy [12]. Both passive and active, from Blumer’s definitions, present the individual as powerless and/or limited in their power to enact change.

The most important core principle of symbolic interactionism used for the scope of this paper is language. According to Blumer, language happens when “meaning arises out of the

social interaction that people have with each other” [20, p.56]. This is important because context, experiences, and identities matter. The experiences that POC have operating in a world that is curtailed to and normalizes the experience of Whiteness, dramatically affect the ways in which individuals read the world [24] and subsequently identify and understand its HC.

Related to the HC, we counter some of the aforementioned definitions from Blumer [20] and instead posit that no individual is truly powerless but rather, are systemically and structurally communicated to in that way to ensure that majority hierarchies are stabilized and sustained in societies. Thus, all messengers (e.g., teachers, employers) can forge the destinies of their receivers (e.g., students, employees) and vice versa. In this forging process, it is important to recognize that receipt of the HC cannot be disconnected from the existing intersectional [5], [25] forces behind them. In ascribing to an intersectional lens and from a HC standpoint, we can account for the multiple and contextual layers that situate interconnectedness and interdependencies of receivers. Taken together, we propose a revision of the terms ‘active’ and ‘passive’ from Blumer [21] and position them in the context of HCA and its transmission: (a) *active HCA* are re-defined as the ways that a receiver perceives a communication as being intentionally and explicitly directed at them and/or their identities; and (b) *passive HCA* are re-defined as the ways that a receiver perceives a communication as being unintentionally and implicitly directed at them. It is important to mention that communication of active and passive HCA may align with or occur in opposite ways as suggested in Figure 1.

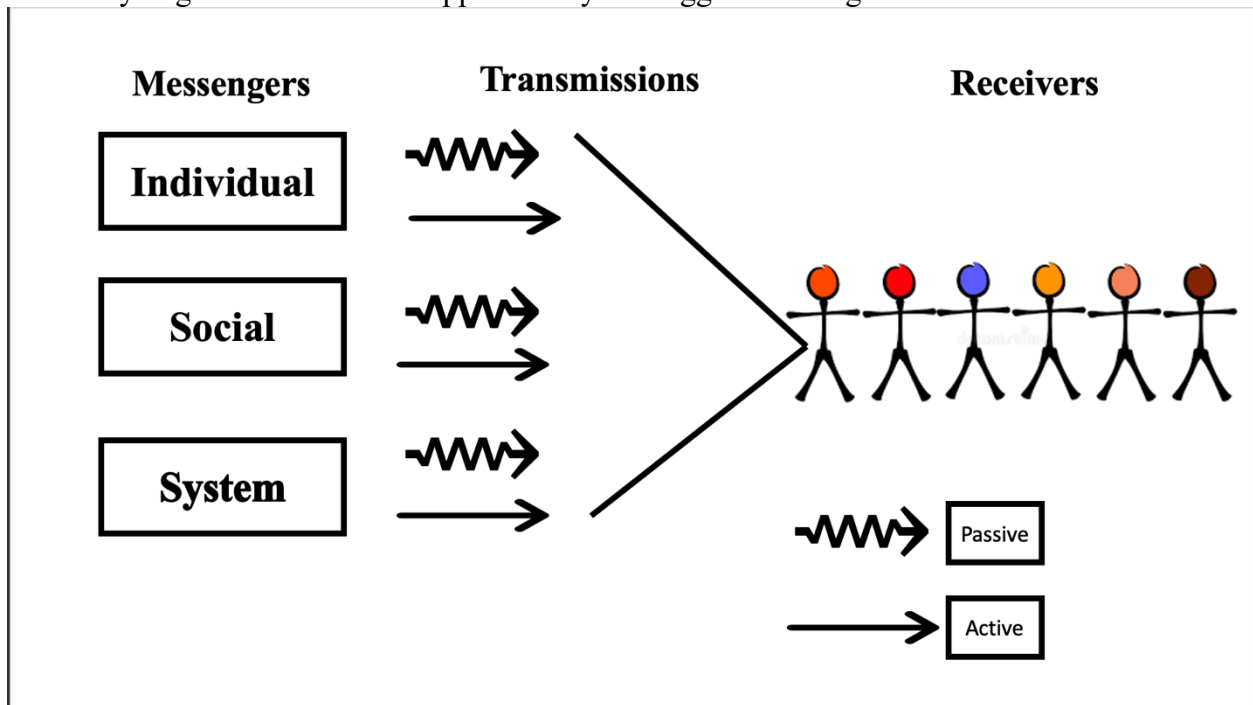


Figure 1. Proposed terms for active and passive HCA and its transmission

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. Villanueva 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” [26, 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 Design and Instrument

A mixed-method survey instrument was validated and tested for reliability (UPHEME; [2]) between 2018 to 2019 to explore the perceptions of engineering undergraduate students, graduate students and faculty about HC, how it is defined, received and responded to. As explained in prior work [2], there was an intentional order in the placement of quantitative and qualitative questions in the instrument, its factors, and a video vignette prompt. The choice was done to minimize the mental shortcuts that participants might take to “make sense of a new concept or phenomenon” [2, p. 1555]. For the context of HCA (the first factor of UPHEME); [2]), the order was as follows: (1) two multiple-selection questions on individuals’ perceptions of the central focus and players in engineering; (2) a definition of the HC along with 6 representative assumption statements on a 5-point Likert scale; (3) a video vignette prompt where the 6 statements were enacted by actors; and (4) two qualitative questions, one asking participants to define hidden curriculum in their own words and the other to describe the HC they identified in the video (meant to identify what participants situated as important or identifiable by them). This study will focus on the latter qualitative question: *After viewing this video vignette, did you identify any hidden curriculum? Yes, an example of HC I identified is...; No, because....; or Not sure, because...*

Research Question

- In what ways do race, gender, and the intersections of these identities in engineering differ in gaining awareness of the HC they identify?

Data Collection and Analysis

Coding for this study consisted of an initial round of thematic analysis that allowed the authors to determine who directly identified the HC as the product of individual(s) and/or the larger institutions. A round of content analysis was performed to get a granular understanding of the words being used to define the HC. This pass at the data was crucial to determine the levels by which the participants identified HCA and its transmission as active and/or passive. Finally, the demographics of the participants was layered onto the thematic and content analysis data, using magnitude coding to determine frequency trends amongst the demographic groups at the intersection of gender and race. The latter was predominantly used to present the magnitude of instances an individual communicated active or passive HCA. The authors coded the total responses ($n=984$) prior to data cleaning and narrowed down to 120 written responses where participants identified both active and/or passive HCA. This secondary data analysis allowed the research group to more closely examine phrases shared by participants such as: hidden agenda by

professor (#315), unspoken lessons (#363), subconscious ideas students pick up (#450), and unintentional lessons (#458).

Table 1. Participant Self-Identified Demographics

Demographic	<i>n</i>	%
Gender ¹		
Women	43	36
Men	77	64
Age		
18-29 years of age	80	67
30-39 years of age	14	12
40 years of age or older	26	22
Racial/Ethnic Identity		
American Indian or Alaska Native	3	3
Asian	9	8
Black or African American	8	7
Hispanic, Latina/o, Chicana/o/ or Hispanic, Latina/o, Chicana/o and White	22	18
White	78	65
Race and Gender Intersection		
White men	52	43
White women	26	22
POC men	25	21
POC women	17	14
First-generation undergraduate student ²		
Yes	47	39
No	70	58
Unsure	3	3

Results & Discussion

One hundred twenty participants shared in written form, that they perceived HC as either active or passive (Table 2). In total, out of the 120 participants, most individuals described the HC as being passive by three-fold (69% passive versus 31% active). However, when we teased out the classifications by gender, race, and the intersection of these identities, we found different observations.

For gender, the ratio found from the total participants was about the same between passive and active HCA, where self-identified women and men communicated HC as being passive to them (70% and 69%, respectively), which was three times more frequent than active HCA (30% and 31%, respectively). For race, we found that White individuals identified passive HCA about three times more than active HCA (74% compared to 26%). However, POC identified passive HCA and active HCA (60% and 40%, respectively) differently compared to their White counterparts (74% and 26%, respectively) where active HCA was higher for POC. While both groups appeared to receive both active and passive HCA, it was concerning that POC communicated receiving more active HCA. This is important to point out because the HC has

¹ There were no self-identified transgender and/or non-binary individuals

² First-generation refers to the first person attending college from their immediate family

traditionally been used to perpetuate and normalize Whiteness, under the guise of standards and professionalism [12]. It is no surprise that the majority of White participants feel that the HC perceived has been primarily passive and viewed possibly as by-products and not directed at them. Other studies from our research group have suggested that the HC has been used to convey normality for majority groups in engineering while minoritized and marginalized groups (e.g., POC) may feel deviant, not normalized, and perpetuating a lack of belonging for POC in engineering spaces [25], [27] because the HC is viewed as being directed *to* them. Additionally, there may be a sense of safety that has been created in rules, regulations, and norms that show and define professionalism [12]. Particularly in engineering, professionalism means following prescribed rules, regulations, and norms. These normative views and standards serve to continue the perpetuation and normalization of White supremacy and patriarchy [28]. Because of that, POC could feel threatened by these normative views and standards and is possibly why a larger percent of POC view the HC as active than the White participants (14% difference).

At the intersection of race and gender, we found that 19% of White women received active HCA whereas 47% of Women of Color (WOC) received active HCA. Eighty one percent of White women identified the HC as passive while 53% of WOC identified the HC as passive. Twenty nine percent of White men identified the HC as active. Thirty six percent of men of color (MOC) identify the HC as active. Seventy one percent of White men identified the HC as passive while 64% MOC identified the HC as passive. We found that the HC is perceived as being directed more to intersectional individuals but more predominantly amongst WOC. That is, the layered oppression that WOC feel by their compounding intersectional identities (gender/race) reveals itself in the data and could account for the 28% difference between white women and WOC in defining the HC as active (19% and 47%, respectively). This observation of intersectional identities shaping how the HC is received is also validated by the results that point to the 11% difference of defining the HC as active between MOC and WOC (36% and 47% respectively). Some representative quotes are included below:

Hidden curriculum are some traits that no one wants to admit but are silent killers in schools and work places (*sic*) about heritage (Latino undergrad, man, *passive*)

Hidden curriculum consists of concepts informally and often unintentionally taught in our school system. Social expectations of gender, language, behavior, or morals are examples of this. The results of hidden curricula in schools filter out into society as students grow into adults. (White undergrad, man, *passive*)

The hidden curriculum is how the instructor conveys or talks about social or cultural aspects of the overall subject and how important or unimportant those aspects are. (White undergrad, woman, *active*)

...things that are taught not being related to the course material. Such as personal opinion. (White undergrad, man, *active*)

The hidden curriculum is the biases present in our classes from professors. (Asian undergrad, woman, *active*)

Each educator shaping the curriculum to his way of thinking, instilling his opinion at the same time. (Latina undergrad, woman, *active*)

Finally, from the written responses, we observed that all participants agreed that the passive HCA received was a byproduct of schooling (in this case, engineering education)—that the cost of schooling was having to endure a certain level of negative HC. With this understanding, the participants felt the HC was merely present no matter what happens—the water a fish swims in. However, when it came to active HCA, most POC, and in particular WOC, communicated receiving the most active HCA in engineering. These finding parallels work from our group [1] and others that suggest that intersectional women suffer the double-bind oppressions [29] of racism and sexism and might be more primed to be aware of and/or experience these oppressions.

Table 2. Summary of findings connected to active or passive transmissions of HC

Results	Active		Passive	
	%	<i>n</i>	%	<i>n</i>
Total (<i>n</i> 120)	31	37	69	83
Gender				
Women (<i>n</i> 43)	30	13	70	30
Men (<i>n</i> 77)	31	24	69	53
Race				
White (<i>n</i> 78)	26	20	74	58
POC (<i>n</i> 42)	40	17	60	25
Race/Gender Intersection				
White Women (<i>n</i> 26)	19	5	81	21
White Men (<i>n</i> 52)	29	15	71	37
POC Women (<i>n</i> 17)	47	8	53	9
POC Men (<i>n</i> 25)	36	9	64	16

Concluding Thoughts

To disrupt minoritization, oppression, and exclusion of POC in STEM while also changing the structures of higher education, we must reconceptualize the ways that the HC is being perceived and recognized. While “The Masters tools will never dismantle Master’s house” [30], if we do not identify the ways that White normative messages perpetuate and operates over POC bodies or through subconscious ways through the guise of professionalism and standards in the classroom, there will be no sustained change.

This paper explored these subtle but real differences—the ways that the HC can and is being utilized to either passively push the normalization of engineering education, or actively subvert the normalization of Whiteness and patriarchy by individuals. Lest we forget, the powerful will not release their stranglehold on power without conceiving of a way to regain what had been lost [31].

Future Implications

Due to the normalization of dominant ideologies in engineering such as male-dominance, competition, exclusion of both faculty and student people of color (POCs) in engineering [3], more work needs to focus on how faculty and students in engineering understand the concept of the HC and its subsequent perpetuation of normativity on and within the discipline/s. With this

new understanding of the ways POC receive the HC as more active than passive, and the impacts it has on their development in the disciplines of STEM (i.e., engineering) through means such as standards, regulations, and professionalism, school administrators, and educators alike can better comprehend, reflect, and act upon how many of the standards present in their working environments are normalized.

For classrooms, understanding the HC and its potentially negative influence on learners, practitioners can apply asset-based and interdisciplinary pedagogies, such as Culturally Sustaining Pedagogy [32] to better serve those bodies that have been excluded and seen as deviant from the norm. By identifying the HC and whether the institution and/or individual is responsible, knowledge and the transfer of information are democratized, and power dynamics can become more equitable, particularly for underrepresented populations in engineering.

Limitation

The findings from this work occurred in a snapshot in time and may not fully reflect the evolution of ideas and experiences with engineering education and to the HC surrounding them [2]. Because of the fluid nature of our changing racial climate (largely due to the Trayvon Martin, Michael, Eric Garner, George Floyd and Breonna Taylor murders (along with several others) and subsequent protests and trails that followed), we are unable to say that this research is reflective of the current racial environment. The research group was able to conduct a follow-up qualitative study across the five institutions used to recruit the first set of participants between 2020 to 2021 where the HC was presented as part of professional development seminars to allow participants to reflect on and communicate in depth the HC they learned about. However, analysis of these findings is underway and not within the scope of this study.

Due to the nature of the questionnaire, some qualitative scholars would not consider these short answers as true qualitative research. However, the authors agree with Creswell [33] and argue that open-ended short answers are indeed qualitative and serve the purpose capturing a more in-depth snapshot and understanding of previously unknown social phenomenon [34]. While we understand that this method of capturing qualitative data is not as detailed as other forms of qualitative methods (ethnography, participant observation, etc.), the creators of the survey placed a heavy emphasis on capturing a large set of data in order to find themes. This allows the researchers the ability to situate and identify themes found among the large data set rather than rely on a more informed and deeper understanding from lesser numbers.

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