Sparking Action: How Emotions Fuel or Inhibit Advocacy around Hidden Curriculum in Engineering

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ABSTRACT

Emotions are not typically addressed or valued in engineering. However, emotions may play a pivotal role as individuals within the field navigate the complexities of the hidden curriculum (HC) or the unofficial guidelines and rules that characterize a learning or working environments. These emotions may be especially relevant for underrepresent students and faculty who may feel isolated, alienated or overwhelmed by negative and unacknowledged HC. As part of the larger mixed methods study, 174 undergraduates, graduate students, faculty and administration in engineering programs across the U.S. were asked to reflect on the role of emotions in advocating for themselves or others to reveal HC in engineering programs. Participant responses were analyzed using a combination of thematic, process, pattern, and co-occurrence coding.

Findings revealed that HC advocacy requires: (1) awareness of the issue; (2) ignition (i.e., emotion); and (3) a sustaining force (e.g., confidence). The most prevalent emotions to fuel advocacy were anger, frustration, and passion; hope was present only after an ignition occurred. On the other hand, inhibited advocacy was a result of one of three factors: (1) disbelief; (2) lack of value; and (3) perpetuating the status quo. Apathy and contentment were associated with participants who thought that action was unnecessary (i.e., disbelief, lack of value) while fear, exhaustion, and hopelessness corresponded to participants who felt prevented from taking action (i.e., perpetuating status quo). Findings from this work highlight how emotions are critical in advocating for issues of inequity in engineering.

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INTRODUCTION

The motivation for this study is to explore in more detail the role that emotions plays in an individual's willingness to advocate for hidden curriculum (HC) in engineering. Understanding hidden curriculum allow for the success of engineering students, particularly for minoritized groups. The intent of this exploratory study is to heighten awareness about how existing engineering education environments, explored through participants' responses around emotions and self-advocacy, influence the roles and expectations of students and faculty in this field. The information will help institutions of higher education to consider alternate ways to promote diversity and inclusion in engineering.

1.1 Hidden curriculum in engineering

Hidden curriculum (HC) is one of four primary forms of curriculum that focuses on the messages or lessons learned that individuals experience in a learning or working environment [1]. HC represents a medium (a key source of messages) by which attitudes, values, beliefs, and behaviors are transmitted.

HC may compliment other forms of curriculum (e.g., formal, null, informal; [1]) in a schooling system to engender positive messages about a profession or education. On the other hand, when a conflict arises between different types of curriculum, there is a strong likelihood that HC is present in that situation. For example, admission into engineering honor societies requires high GPA suggesting that academic performance is indicative of engineering success. In this case, the admissions criteria (medium) conveys a subtle yet negative message that grades are prioritized for success in engineering. (transmission of message); together, they form a HC. HC becomes dangerous when the transmitted messages to learners are negative (e.g., stereotypes, implicit bias; [2]). These negative messages become pervasive over time, resulting in an established and 'invisible' norm where injustices based on meritocracy, hegemony, apathy, exclusion are unseen and unquestioned by the majority [1].

HC has been used to explore unexamined issues in fields like education [3], medicine [4], sociology [5] and more recently, engineering [1,6,7]. In particular, for engineering, Villanueva and colleagues [6,7,10] have begun to uncover the mechanisms that inhibit or limit individuals from advocating for issues of diversity in engineering as this field is known for its male-dominated [8], militant [8] and oftentimes chilly climates for underrepresented populations [9]. In the authors' studies, they have found that four steps or stages have to occur in order for individuals to advocate in engineering: awareness (a sub-component of consciousness by which an individual internalizes an experience; [10]), emotions (the form by which individuals evaluate an environment; [10]), self-efficacy (an individual's confidence in their ability to have control over one's own environment; [10]), and self-advocacy (an individual's willingness to become an agent of their own actions; [10]). The focus of this work will be on the emotions step.

1.2 The role of emotions in processing hidden curriculum in engineering

Emotions are fundamentally important to how we learn, perceive, decide, respond, and problem-solve [11]. Pekrun and colleagues [11] postulate that emotions, at least in academic settings, consist of coordinated psychological subsystems that intertwine affective, cognitive, motivational, and expressive and peripheral physiological processes expressed in two forms: valence (positive/negative) and activation (activating/deactivating). For instance, positive activating emotions, such as enjoyment, may increase reflective processes like metacognition [11], while positive deactivating emotions such as pride may result in low levels of cognitive processing [11]. Likewise, negative activating emotions such as anger and anxiety may spark engagement [11] whereas negative deactivating emotions such as hopelessness may dampen motivation [11]. Other emotions (e.g., frustration) have been reported by underrepresented populations in engineering [12]. This work focuses primarily on the emotion present and its valence but not its activation.

2 METHODS AND RESEARCH DESIGN

2.1 Positionality

The authors in this exploratory study represent underrepresented racial and gender minorities in engineering whose own experiences in hidden curriculum have shaped the lens used to interpret the data. We recognize that we all have biases and assumptions and as such, we engaged in lengthy discussions and intercoder agreements of the data to minimize any potential misrepresentations on our part.

2.2 Research Design and Questions

This research design is part of a larger complex, mixed-method experimental intervention design [13] where qualitative and quantitative data collection (used to validate a survey instrument we developed [10]) was analyzed first separately and whose findings will be converged at a later time. For this particular study, we are representing the data collected from earlier validation stages of this instrument. To describe briefly, the iteration of the instrument used for this work was as follows: demographics, expectations in engineering education, video exemplar, character identification and resources, hidden curriculum awareness, self-efficacy, emotions, and self-advocacy [10]; all items included a definition of the terms as needed. Additional information about the specific content of these items are provided elsewhere [7]. For this work, we focused on the participants' qualitative responses to the following three questions, which further explored issues of access, equity of resources, and emotions pertaining to advocacy of HC in engineering:

a) How do you think your emotions relates to your ability to advocate to unveil the hidden curriculum in engineering at your university?

b) How do you think your awareness of campus resources can equip you to advocate to unveil the hidden curriculum in engineering at your university?

c) How do you think your confidence (self-efficacy) relates to your ability to advocate for unveiling aspects of hidden curriculum in engineering at your university?

These questions were used to inform the overall research question of this study:

(1) How do engineering students and faculty self-report the influence that their emotions have in their ability to advocate for HC in engineering?

2.3 Participants

Participants represented 174 individuals who responded to this iteration of the instrument. The participants were 48% undergraduate students, 29% graduate students, and 23% faculty. We opted to not break down demographic groups by age, race, gender, ethnicity, or other variables as our primary goal was to understand conceptually and mechanistically how emotions, in general, can fuel or inhibit advocacy around HC in engineering. Other work connected to this data has been broken down by participant demographics and are described elsewhere [7,14]. As part of a larger mixed-methods study, we explore participants' written qualitative responses regarding the role of emotions related to self-advocacy in engineering.

2.3 Methods for Qualitative Data Analysis

We employed a multi-stage qualitative coding strategy for the 174 participants' responses to the three qualitative questions using conceptual mapping and thematic analysis. The first stage consisted of in vivo and versus coding, where participants' own words and potential conflicts and dichotomies were used to explore the data. This was followed by preliminary conceptual mapping and code landscaping to organize the data into categories. These categories informed the creation of a codebook. We conducted an intercoder agreement session to validate codebook codes and refine the conceptual map. We reached 97% consensus of the codes using random selection of 25% of the data after several iterations. The ICA session informed selection of the second cycle of coding: emotions and process coding which allowed us to explore how participants take action and what emotions they experience. Next, we conducted pattern coding followed by co-occurrence modelling of all categories and codes to compare the frequency of themes and topics conveyed by the participants. From this, the concept map was refined, discussed at length by the research team, and finalized.

As an additional check, we used participants' quantitative data from the larger mixed-methods survey to provide context when participants qualitatively expressed feeling 'positive' or 'negative' emotions. Participants indicated what emotions they felt and whether they considered this positive or negative. All coding phases were conducted using MAXQDA 2018, a mixed-method analysis software.

From the coding, stages of stepping back or stepping up were identified. The order of these stages were determined by the degree of action which an individuals described throughout the three qualitative answers. Emotions indicated in these answers were associated with the level of action described.

3 RESULTS

3.1 Primary Themes: Stages to fuel or inhibit HC advocacy in engineering

From our codes, we found that individuals in general, can take one of two actions when discovering HC in engineering: (a) stepping up or (b) stepping back. **Stepping up** represented the different forms that an individual was willing to take action to reveal and address HC in engineering. Stepping up could be summarized in three primary stages: (i) awareness, (ii) ignition, and (iii) conservation. First, an individual's level of ***awareness*** of hidden curriculum and the resources available to address this issue represented a state of knowledge about HC or knowledge about resources to promote success in engineering. Second, ***ignition*** was equated to a 'spark' or impetus to take action once HC is recognized or experienced. This impetus was associated with an emotional reaction where an internal conflict to take action or not arose. While this impetus could be promoted internally within an individual (e.g., through witnessing or feeling), it did not necessarily mean that an action would be taken. Third, ***conservation*** of an action refers to the considerations needed to oppose the status quo, such as perceived and actual negative consequences within the context of engineering education. For example, an individuals' confidence was seen as a bolstering and maintaining force to reveal HC and enact an action in response to it. Together, the findings suggest that being aware is insufficient for an individual to take action. This awareness must be coupled with a corresponding igniting emotion that is tempered through strategies and the confidence needed to support such an action, in the face of opposing forces and challenges.

Stepping back represents an individual's withdrawal or unwillingness to take action, in light of their current and specific university and departmental contexts. Stepping back can be represented in several stages: (i) disbelief, (ii) lack of value, and (iii) perpetuating the status quo. ***Disbelief*** involves either a denial that HC exists in engineering or that it poses a negative influence on underrepresented populations. It also may indicate that an individual has not personally experienced the effects of negative HC and equate their experience to what other populations experience in engineering. ***Lack of value*** represents an individual that is aware of HC or issues of inequity in engineering but are not placing value or express a desire to take any actions to address it. ***Perpetuating the status quo*** includes individuals who would like to take action or help correct inequities but some force prevents them from taking action; it is a self-sustaining force that passively resists change and is a result of organizational structures found in academia and in engineering. These organizational structures are hierarchical and reinforce suppression and silence of individuals who would like to make change.

3.2 Secondary Themes: Emotions used in stages to fuel or inhibit HC advocacy

From our codes, we found secondary themes that related emotions to advocacy around HC in engineering: (a) emotions and promoters of action (stepping up) and (b) emotions and deterrents of action (stepping down). A summary of these emotions are included in Table 1 and 2.

For stepping up (Table 1), the most prevalent fuelling emotion present in awareness was ***comfort***. Participants expressed feeling comfort when they knew about resources that can help them succeed despite a negative HC. Comfort was expressed through awareness of a community who shared similar experiences with HC. For the ignition stage, the most prevalent **fuelling emotion** coded was ***passion*** followed by ***frustration*** and then ***anger***. Being passionate about an issue appeared to be the most productive emotion for advocacy actions such as speaking up and raising awareness. For frustration, participants expressed it as a negative emotion that would be experienced after witnessing a HC that was not beneficial to the individual. This emotion also related to an internal resistance to HC, which did not reflect an externalization of this emotion into an action such as speaking up about an issue. Anger, also present in the ignition stage, was seen as a prompt that individuals can use to raise awareness about HC. For the conservation stage, ***passion*** and ***hope*** were highly coded. These primarily positive emotions, resulted in the most intention by the participants to sustain an action even in light of pushback. Like passion, hope was associated with raising awareness of HC.

Table 1. Associated fuelling emotions to step up stages

Order	"Stepping Up" Stages	Associated Fuelling Emotion	Describing Attributes of Fuelling Emotion in Stepping up Stage
1	Awareness	Comfort	The feeling of being soothed, consoled, or reassured. The individual feels more at ease because of a shared experience or intrinsic motivator (e.g., community, confidence).
2	Ignition	Passion	Passion involves a willingness to make change. It shows a conviction and compelling desire to help others or make long lasting change.
		Frustration	The feeling of being upset or annoyed especially because of their inability to change or achieve something that is affecting them directly.
		Anger	A strong feeling of displeasure and belligerence aroused by a perceived or actual injustice. Anger is often a response to being hurt by something or someone. Anger can result in verbal or physical outbursts by the individual.
3	Conservation	Passion	Passion involves a willingness to make change. It shows a conviction and compelling desire to help others or make long lasting change.
		Hope	Hope is the feeling that what is wanted can be had or the events will turn out for the best despite challenges.

For stepping back (Table 2), the most prevalent **inhibitory emotions** were contentment, apathy, fear, exhaustion, and hopelessness. For the status quo stage, the most prevalent emotion present was ***fear***, particularly amongst the associate professor population. ***Exhaustion*** later followed for this stage and it resulted from individuals that had accumulated stresses associated with a sense of powerlessness to take action. ***Hopelessness*** resulted from a person's lack of confidence that they could personally enact meaningful change. Disbelief, which was the least prevalent of

the three stepping back stages, was mostly associated with the emotions of ***apathy*** and ***contentment***. Apathy showed a lack of desire or willingness to enact an action based upon identified negative HC while contentment involved a sense of satisfaction with the current organizational system.

Table 2. Associated inhibitory emotions to step back stages

Order	"Stepping Back" Stages	Associated Inhibitory Emotion	Describing Attributes of Inhibitory Emotion in Stepping Back Stage
1	Disbelief	Apathy	An individual who is apathetic does not show personal interest about revealing HC or issues of access and inequity within engineering. While they may be aware of these issues, they have no desire or willingness to change them.
		Contentment	The feeling of contentment or happiness connotes an individual being happy with the current organizational system. Often, these individuals are benefiting from the system and may be in a position of privilege. Subsequently, they do not have an intrinsic need to be aware of these issues since they do not suffer negative consequences of HC.
2	Lack of Value	Apathy	An individual who is apathetic does not show personal interest about revealing HC or issues of access and inequity within engineering. While they may be aware of these issues, they have no desire or willingness to change them.
3	Perpetuating the Status Quo	Fear	Fear is a distress aroused by a threat (real or imagined). Since taking action can carry with it a personal risk, individuals may experience fear at the thought or possibility to speak out or take action, which inhibits their willingness to act.
		Exhaustion	Emotional exhaustion results from the accumulated stress of being drained or worn-out. It is associated with a sense of powerlessness, which may result in decreased motivation and burnout.
		Hopelessness	An individual who expresses hopelessness believes that the current state of things in their lives will not change. They will likely care about revealing HC or issues of access and inequity in engineering but believe that nothing can be done about it so there is no point in trying. This emotion can result from constantly seeing or experiencing failed attempts to change the status quo in engineering.

3.2 Conceptual Model to Step Up or Step Back in engineering

Taken together, the coded themes and emotions were placed in a conceptual diagram to represent the inhibiting and fuelling emotions for the stepping up and stepping back stages for HC advocacy in engineering. As shown in Fig. 1, each pathway is individual and dependent on a particular emotion. It is important to note that while these stages and related emotions are presented in a continuum, the reality may be that these are either iterative or concurrent depending on the nature of the HC and the influence it may have on a particular individual.

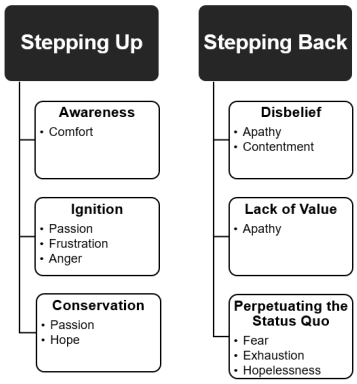

Fig. 1 Emotion-Informed Conceptual Model for HC Advocacy in Engineering

4 DISCUSSION

The data presented here, while not disaggregated by group, provides an overview of the important role that emotions have in fuelling or inhibiting actions related to revealing HC and advocating in turn for issues of access or inequity in engineering. The literature suggests that emotions are an important factor for processes that involve decision-making and cognition [11]. We also found that emotions can either fuel or inhibit action, in part due to an individual's intrinsic beliefs and expectations, as supported in the literature [11].

In this exploratory study, we showed that around stepping up stages, awareness is needed to ignite the emotions necessary to conserve an action. However, it is important to note that these actions have to be strategic as these can vary by an individual's relative role and power within an organizational structure and disciplinary culture of engineering. This finding supports Lewin's theory of organizational change force-field theory [15], which suggests that a variety of forces arise from the way an organization operates: its structure, culture, and control systems that can make it resistant to change and place it in a condition of opposition. However, in order for an organization to change, there has to be an increase in the force for change or a decrease in the resistance to change [15]. This cannot happen without implementation of strategies and resources that will support these modifications.

On the other hand, stepping back stages involves either a lack of knowledge or desire to take action, either because of their personal experiences or their satisfaction with the organization or sub-culture. It is also possible that the risk of stepping up far outweighs the benefits, which may impact a person's extrinsic motivation for an action [16]. It is important to mention that when unquestioned over time, HC, both with its benefits and disadvantages, becomes a norm [1]. Without a mechanism or model that can be developed to help individuals evaluate such a HC, it will continue to lie in the liminal spaces of the unconscious mind and action becomes an afterthought, at most.

Together, our work supports the notion that emotions are integral in a person's decision-making process to identify the necessary actions and potential strategies needed to navigate HC. Without this knowledge, engineering students may struggle

to successfully navigate their engineering education. Also, it presents a unique model that emphasizes that emotions are pivotal in guiding action or inaction to address hidden curriculum in engineering. This study demonstrates an alternative perspective to addressing change in engineering education related to issues of access and inequity.

5 SUMMARY, LIMITATIONS, AND ACKNOWLEDGMENTS

The data supports a preliminary conceptual model that supports the notion that emotions are pivotal to a person's willingness to step up or step back around issues of HC in engineering [7]. Our finding suggests that some of these emotions can be fuelling for action or inhibitory for advocacy.

Some of the limitations of our study could include the need to disaggregate populations to understand more contextually-specific stages to step up and step back. Also, we acknowledge that this data collection is merely a snapshot in time and that these may change by situation or context.

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REFERENCES

[1] Villanueva, I., Di Stefano, M., Gelles, L., and Youmans, K., (2018), Hidden curriculum awareness: a qualitative comparison of engineering faculty, graduate students, and undergraduates. *World Engineering Education Forum,* Albuquerque, NM, pp. 1-6.

[2] Liberating the Curriculum, (2017), Found in: https://liberatingthecurriculumblog.wordpress.com/2017/09/17/hidden-bias/

[3] Margolis, M., (2001), The Hidden Curriculum in Higher Education, Routledge, New York.

[4] Smith, B., (2014), Mentoring at-risk students through the hidden curriculum of higher education, Plymouth, UK: Lexington Books.

[5] Lipsett, D.R. (2015), Developmental life of the medical student: curriculum considerations. *Academic Psychiatry,* vol. 39, issue 1, pp. 63-69.

[6] Villanueva, I., Carothers, T., Di Stefano, M., and Khan, M.T.H, (2018), 'There is Never a Break': The hidden curriculum of professionalization for engineering faculty. *Education Sciences*, vol. 8**,** issue 57, pp.1-21.

[7] Gelles, L., Youmans, K., Villanueva, I., and Di Stefano, M, (2019), Hidden Curriculum Advocacy and Resources for Graduate Students in Engineering. *CoNECD Conference*, Crystal City, VA, 2019, pp. 1-16.

[8] Riley, D, (2008), Engineering and social justice. *Synthesis Lectures on Engineers, Technology, and Society*, vol. 3, issue 1, pp. 1-152.

[9] Collins, D., Bayer, A.E., and Hirschfeld, D.A., (1996), Engineering education for women: a chilly climate? *Women in Engineering Conference: Capitalizing on Today's Challenges*. 1996 WEPAN Conference, issue 57592, pp.1-6

[10] Villanueva, I., Gelles, L., Di Stefano, M., Smith, B., Tull, R., Lord, S., Benson, L., Hunt, A., Riley, D., and Ryan, G., (2018), What does hidden curriculum look like and how can it be explored? *Proceedings of the American Society of Engineering Education Annual Conference & Expo*, issue 21884, pp. 1-16.

[11] Pekrun, R., and Linnenbrink-Garcia, L. (2014), Emotions in education: Conclusions and future directions. In *International Handbook of Emotions in Education.* First Edition. Taylor Francis: New York, NY, USA.

[12] DeCuir-Gunby, J.T., Long-Mitchell, L.A., & Grant, C, (2009), The emotionality of women professors of color in engineering: a critical race theory and critical race feminism perspective, In *Advances in teacher emotion research*, Springer, Boston, MA. pp. 323-342.

[13] Creswell, J.W., & Plano Clark, V.L., (2018), *Designing and conducting mixed methods research*, 3rd ed., Thousand Oaks, CA.

[14] Villanueva, I., Di Stefano, M., Gelles, L., and Youmans, K, (2018), Exploring how engineering faculty, graduates, and undergraduates evaluate hidden curriculum via emotions and self-efficacy. *Northern Rocky Mountain Educational Research Association Conference*, Salt Lake City, UT.

[15] Pasmore, W.A. and Woodman, R.W., (2007), Research in Organisational Change and Development, vol. 16, Emerald Group Publishing.

[16] Deci, E.L., and Ryan, R.M., (2008), Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology/Psychologie canadienne, vol. 49, issue* 3, pp. 182-185.