Exploring how engineering faculty, graduates, and undergraduates evaluate hidden curriculum via emotions and self-efficacy

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Introduction

Hidden curriculum (HC) consist of the particular assumptions that are held by individuals about schooling that are manifested in practice (Smith, 2014). These assumptions can be recognized through socio-cultural interactions, experiences with their physical surroundings, or exposure to virtual environments (The Glossary of Education Reform, 2017; Killick, 2016; Margolis, 2001; Smith, 2014). HC has been explored widely in fields such as education, psychology, business, and medicine (Baird, Bracken, & Grierson, 2016; Borges, Ferreira, Borges de Oliveria, Macini, Caldana, 2017; Cotton, Winter, & Bailey, 2013; Joughin, 2010; Margolis, 2001; Rabah, 2012; Smith, 2014) but is relatively unaddressed in engineering (Erickson, 2007; Villanueva et al., 2018) and more specifically neither the positive or negative implications of HC in engineering have been explored.

This study sought to use a mixed-method approach to understand the mechanisms behind HC recognition (via emotions and self-efficacy) for engineering students and faculty nationwide.

Frameworks

Emotions (EM)

In the classroom, relationships are integral to the learning and socialization process (Michael, 2015) of students and their instructors. These interpersonal interactions in the classroom are not devoid from *emotion*. Hargreaves posits that when a classroom environment becomes hyper-rational, data driven, and testing and tracking become target areas, factors such as "health, wellness, and physical activities are pushed to the sidelines"(Hargreaves, 2003, p. 2) leading to stress, burn-out, and dropout. Engineering is traditionally known as a rational and cognitively focused field (Matusovich, Streveler, & Miller, 2013; Hilpert, Husman, & Carrion, 2014). While attaining an emotional understanding of the phenomenon of hidden curriculum may not be linear or intuitive, sub-conscious expressions, gestures, visible signs of interest, concentration, and self-identification and evaluation of their emotions and self-efficacies that can cue to them the supportive nature of their surroundings.

Self-Efficacy (SE)

In academia and other settings, an individual must possess *self-efficacy* (SE) (Bandura, 1993; 2006) or an individual's belief in their ability to succeed in specific situations or accomplish a task. Individuals with high self-efficacy are more capable of executing control over their own motivation, behavior, and social environment (Bandura, 2006). SE is an important regulatory tool for the management of challenges and setbacks (Bandura, 1993; 2006). Prevailing negative forms of HC in engineering could serve to block mechanisms of self-efficacy and deter an individual from executing control over their engineering education experience.

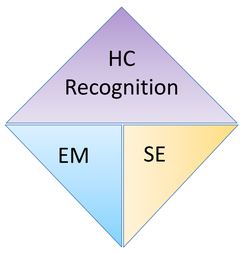

Figure 1. Proposed mechanisms by which HC is recognized in engineering

Research Questions and Design

The underlying research questions for this study were:

1. In what ways are emotions self-reported by engineering faculty, graduates, and undergraduates when evaluating hidden curriculum?
2. In what ways are self-efficacy self-reported by engineering faculty, graduates, and undergraduates when evaluating hidden curriculum?

Participants

As part of a larger study (Villanueva, Gelles, Di Stefano, Smith, Tull, Lord, Benson, Hunt, & Riley, 2018; Villanueva, Campbell, Raikes, Jones, & Putney, 2018), two hundred and forty-eight engineering participants (55 faculty, 54 graduate students and 139 undergraduates) were recruited electronically via email and through social media to complete a custom-created survey around hidden curriculum, emotions, and self-efficacy. All procedures were compliant with Institutional Review Board policies.

Data Collection

Participants were asked to view a video vignette (Table 1) representing what the engineering education literature suggests are common issues of hidden curriculum, particularly around issues of social equity and inclusion (Margolis, 2001; Erickson, 2007; Tonso, 2006; 2014). Soon after, they were presented with a definition of hidden curriculum (The Glossary of Education Reform, 2017; Killick, 2016; Margolis, 2001; Smith, 2014) and some example statements (Table 2) of hidden curriculum identified in the higher education literature (Margolis, 2001; Smith, 2014).

Table 1. Video Vignette description

Summary of the Video Vignette
A White male full professor in engineering and a Latina assistant professor in engineering prepare for the same undergraduate engineering course. Both co-teach the same course. The male professor is the lead instructor to the course and the assistant professor is a new faculty teaching the course.

Table 2. Hidden Curriculum assumption statements used for engineering faculty, graduates, and undergraduates

Number	Hidden Curriculum Assumption Statements
1	Senior faculty in engineering (e.g., tenured professor) deserve higher status, voice, and have more influence than engineering junior faculty.
2	The ultimate goal of an engineering degree is to get a well-paying job.
3	Engineering education is harder, more time-consuming, and expensive because it has a direct impact on safety.
4	Not everyone can be an engineer.
5	To belong to the engineering community, your personality must fit in with everyone else (e.g., technically-driven, efficient, and assertive).
6	Engineering instructors care more about the technical concepts and equations rather than the individual student's success.

Data Analysis

The qualitative questions were collected and holistic and thematic analysis of the responses were conducted. To compare group responses, magnitude coding was also conducted to consider the instances where emotions and self-efficacy were self-reported; additionally, negative and positive emotions were tabulated among the participants.

Results

Summary of Results:

- Across the 6 HC statements, undergraduate students self-reported the highest number of emotions the primary ones being "frustration" and "anger"
- Negative emotions were self-reported 2x higher than positive emotions among undergraduates, 3x higher for faculty, and 1.3x higher for graduate students
- Interestingly, high self-efficacy levels were reported mostly by faculty, while mid-levels of self efficacy were reported mainly by undergraduate and graduate students
- Qualitatively, participants from minoritized groups expressed higher levels of hidden curriculum awareness compared to their majority counterparts.
- Themes of inequities of access, resources, and respect for diverse groups in engineering were found among participant responses

Table 3 & 4. Frequency Count of Self-Reported Emotions

Self-Reported Emotions	Statement 1			Statement 2			Statement 3			Statement 4			Statement 5			Statement 6		
	FC	GR	UG	FC	GR	UG	FC	GR	UG	FC	GR	UG	FC	GR	UG	FC	GR	UG
Anger	10	6	12	3	4	6	2	3	3	7	6	23	10	12	23	11	12	23
Anxiety	1	1	3	1	3	7	0	6	25	0	2	13	5	4	7	1	3	7
Boredom	2	3	11	2	4	7	3	5	9	2	1	5	3	3	10	1	3	13
Enjoyment	0	0	3	2	2	5	1	3	6	1	1	4	2	3	6	1	1	3
Frustration	19	13	29	16	7	19	10	4	21	8	5	14	9	13	39	19	11	30
Happiness	1	3	5	1	2	4	0	0	2	0	0	1	1	1	4	0	3	2
Hope	0	5	11	6	12	20	1	3	12	2	4	19	2	5	7	1	3	16
Hopelessness	2	3	6	0	4	1	0	0	4	1	1	10	3	2	4	1	3	11
Interest	4	6	14	3	4	16	10	4	12	3	4	5	2	4	5	2	4	4
Pleased	0	1	6	4	4	5	5	6	5	1	2	1	0	2	6	2	0	2
Pride	1	0	5	1	1	6	11	10	21	5	10	19	2	1	2	1	2	1
Relief	0	1	1	0	1	3	0	3	1	4	1	4	1	0	1	2	0	5
Shame	2	2	7	5	0	16	2	0	2	5	8	6	4	0	7	4	4	8
Other/not listed	9	3	13	6	2	6	3	1	2	9	0	6	5	0	5	4	3	5

Self-Reported Emotional Valence	Statement 1			Statement 2			Statement 3			Statement 4			Statement 5			Statement 6		
	FC	GR	UG	FC	GR	UG	FC	GR	UG	FC	GR	UG	FC	GR	UG	FC	GR	UG
Positive	5	10	32	12	21	46	18	24	44	10	14	32	7	8	23	7	12	17
Negative	31	21	63	25	16	51	15	12	42	20	15	57	32	31	79	33	22	79

Table 5. Frequency Count of Self-Reported Self-Efficacy

Self-Reported Self-Efficacy	Statement 1			Statement 2			Statement 3			Statement 4			Statement 5			Statement 6		
	FC	GR	UG	FC	GR	UG	FC	GR	UG	FC	GR	UG	FC	GR	UG	FC	GR	UG
Low	7	12	22	7	7	16	5	3	10	4	6	16	6	8	21	6	7	13
Low to Mid	10	11	30	5	8	22	7	4	18	10	12	23	8	9	24	7	9	18
Mid	16	12	46	15	18	53	12	17	37	12	15	39	13	21	45	13	18	52
Mid to High	13	13	30	16	6	36	16	16	43	11	13	36	12	7	29	12	8	34
High	9	6	11	12	15	12	15	14	31	18	8	25	16	9	20	17	12	22

Sample Quotes:

- The resources available to the students. Students that come with a high income group have greater access to resources and family members that are able to provide any learning assistance. Undergraduate student -3rd year or greater, Male, Ecuador, American Indian (Quechua)
- Some professors don't really care about culture and such… […] This is hidden because colleges like to boast about how their staff is very open to culture but for the most part, professors care more about the topic they're teaching. In addition, some professors care more about their research than actually teaching because that's not their area of interest. Undergraduate student 1st-2nd year, no gender (prefer not to say), China (Asian)
- As a woman in engineering, I often find that I need to be much more assertive and hardworking than my male peers in order to get the same attention and credit from male professors. Undergraduate student 1st-2nd year, Female. U.S. (Italian + Filipino)
- I see the way the student and other professor talked to Prof. Garcia as very gendered. The student especially was condescending. I see this all the time. In an effort to be professional and polite there are times that I let it slide and regret it later… Associate professor, Female, U.S. (White)

Discussion

Together, the data suggests that amongst engineering faculty, graduates, and undergraduates, there is an overall lack of awareness of hidden curriculum, and more predominantly among the majority populations. One interesting finding was that each group responded differently to the emotions and self-efficacy self-reports to each HC assumption statement. Undergraduates expressed the highest incidences of negative emotions with mid-levels of self-efficacy. Graduate students reported disparate levels of negative and positive emotions with mid-levels of self-efficacy. Faculty expressed the highest instances of negative emotions (e.g., frustration) with the highest levels of self-efficacy across the statements.

For faculty, it is possible that experience and exposure to some of the HC present at their institutions may provide a different lens to how to handle these assumptions. Perhaps, faculty provide responses that are more in tune to the realities at their institutions. Graduate students may be at a transitional point in their careers and may be less certain on how to handle hidden curriculum at their institution. Undergraduates may have a heightened sensitivity to hidden curriculum issues either based on present experiences or newness to this topic. Across all cases, issues of access, resources, and respect for diverse engineering populations was presented as an area of need in engineering. These findings suggests a need to customize hidden curriculum strategies for different engineering groups and based upon considerations of diverse needs.

Significance

This work presents the first attempts to explore the mechanisms behind hidden curriculum in engineering via emotions and self-efficacy. Identification of hidden curriculum is central to an individual's successful navigation of their education and future careers. The findings from this work can inform future mentoring, advising, and advocacy methods that can be used amongst colleges of engineering to ensure equitable success of all individuals at all stages in this field.

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