# Hidden curriculum: students' reflections and observations

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***Abstract*—This is a research work-in progress paper. The hidden curriculum is the invisible norms, ideals, and values in engineering education that are not part of the formal curriculum. At the University of Calgary, a first-year program in mental wellbeing aims to counteract some of the hidden curriculum narratives by providing students with humanizing support and reflections throughout their curriculum. As part of this, the program delivered a module on hidden curriculum, where students were required to answer three reflective open-ended questions. This paper provides a preliminary qualitative content analysis of the student responses to a specific question: *what are some of these hidden lessons taught about engineering?* The results found three main themes: engineering is difficult, engineering requires teamwork and collaboration, and engineering should be independent. These early results provide a unique insight into the student perspective on the hidden curriculum of engineering.**

***Keywords—hidden curriculum, student reflections, qualitative content analysis, mental wellbeing***

## I. Introduction

Engineering culture can be exclusionary to minoritized groups, often due to messaging they receive through the *hidden curriculum*. Hidden curricula are the "particular assumptions, beliefs, values, or attitudes manifest themselves implicitly and inadvertently in schooling, learning, and professional environments" [1] For example, in engineering we often reinforce the idea that not everyone can be an engineer, that engineering education is unreasonably demanding because it's a safety concern, or that technical aspects of design are more important than social aspects of design [2]. These hidden messages are often received differently by students with different identities. As the hidden curriculum reproduces the dominant culture, underrepresented identities in the classroom may feel at odds and disconnected from their education due to the underlying dominant gender, social, and racial messaging [3].

Scholarly work using hidden curriculum as a framework for investigating engineering education has grown over the last few years. Villanueva and colleagues' [1,4] have a significant repertoire of work aiming at conceptualizing the structural frameworks and pathways in which hidden curriculum is received and responded to. There are a few scholars who are using hidden curriculum as a framework to better understand ethics in engineering [5-6]. Additionally, Nudelman [7] has looked at how hidden curriculum impacts employability, Pehlivanli-Kadayifci's [8] has investigated how jokes contribute to the hidden curriculum messaging, and Polmear, Clegorne, and Summons [9] have looked at the hidden curriculum within engineering leadership education. All these works show the importance of further research to investigate and understand the impact of hidden curriculum in our engineering classrooms. The research in this work in progress paper aims to better understand students' perspectives on the hidden curricula of engineering.

To address the hidden biases within engineering classrooms, at the University of Calgary we introduced first and second-year students to the concept of hidden curriculum. After introducing the topic, we asked students reflective questions to consider their own education and if there was hidden messaging that they had encountered. This paper will provide a preliminary analysis of the student reflective responses using qualitative content analysis [10].

The significance of these results provides insight into students' perspectives on the hidden curriculum. As we aim to deconstruct the hidden messaging in engineering to create more inclusive environments, it is essential that we understand the perspective of the students. The results presented here provide a preliminary understanding of hidden curriculum that will be applicable to the larger research study, which aims to model the impact of hidden curriculum on the classroom using agent based modeling simulations.

## II. Hidden Curriculum in Engineering

*Hidden curriculum* is the theory that "particular assumptions, beliefs, values, or attitudes manifest themselves implicitly and inadvertently in schooling, learning, and professional environments" [1]. Early scholars described the hidden curriculum as "what schooling does to people" [11], where there was a growing understanding that the school systems did more than teach the formal curriculum [12]. Young students from kindergarten are taught hidden lessons about how to conform to institutional structures, such as being quiet, waiting patiently, neatness, and listening to directions without critique. Although these are not part of the formal goals of the curriculum and are often not traditionally "tested" in classrooms, they are required skills to be successful in school [3].

In engineering education research, scholars have begun using the theory of hidden curriculum to better understand the culture of engineering and how it impacts students differently. Idalis Villanueva and her team developed a survey to better

understanding hidden curriculum [4], they have explored the concept of professionalism as a hidden curriculum and faculty members level of awareness [1], and looked at how diverse women cope with the hidden curriculum in engineering [13] Some other examples they found of hidden curriculum in engineering include: "Engineering instructors care more about the technical concepts and equations rather than the individual student's success" and "The ultimate goal of an engineering degree is to get a well-paying job" [2].

The hidden curriculum ideologies can be difficult to critically discussed due to some of the underlying beliefs about education that exist in our society. For example, the idea that schools are objective, neutral, and depoliticized runs deep in postsecondary educational institutions. Although our society likes to believe education is neutral, in reality the types of knowledges we teach are based on decisions made by powerful people. Schools and education systems act as "powerful agents in the economic and cultural reproduction of class relations" [14] where the underlying ideologies that we teach about our society, economy, and culture are designed to benefit the powerful and oppress the marginalized [3]. These powerful forces that maintain the hidden curriculum in education are also what make it difficult and resistant to change. The larger body of work of this research aims to further explore these concepts, however this work-in-progress paper will focus on initial findings from student reflections.

## III. Methods

### A. Context – Hidden Curriculm Module

At the University of Calgary, a mental wellness program has been integrated across all first-year classes where students are presented with a variety of topics on a weekly basis [15-17]. In the year 2020-2021, one of those topics was hidden curriculum, where students were given a 10-minute presentation on hidden curriculum, and then asked to answer three reflective questions.

The module started with an overview of emotions and learning, describing how interconnected emotions are to the learning process [18]. Secondly, a definition of hidden curriculum was provided with a few examples of hidden curriculum in engineering education. See figure 1 below for a sample of a slide presented to students.

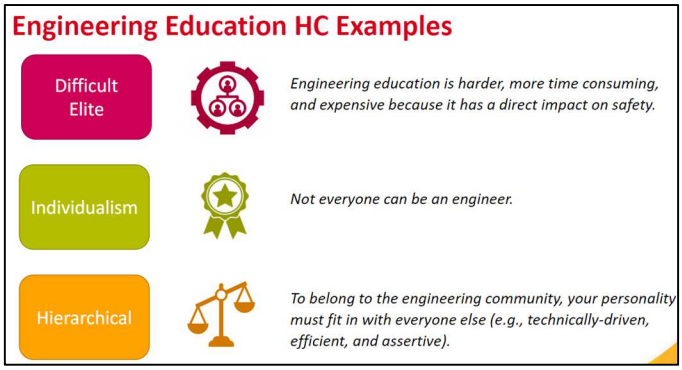


Fig. 1. Sample slide from Hidden Curriculum (HC) module. Content integrated and modified from Gelles et al [2]

Within one-week after the module was presented, students were required to answer three reflective questions on how they manage their emotions when studying, on the hidden lessons taught in engineering, and topics that are missing from engineering education. This work-in-progress paper focuses on the second question about hidden lessons which specifically asked:

> *Q2. As discussed in class (slides 8-10), hidden curriculum is the unwritten, unofficial, and often unintended assumptions, beliefs, and values that we learn as part of our academic experience. Based on your experience so far, what are some of these hidden lessons taught about engineering? Summarize in 2-3 sentences.*

The reflective assignment was graded for completion, where responses were 'spot-checked' by a teaching assistant. Responses were not critically reviewed. Student responses were always kept anonymous, however each week, high level themes from the previous week were presented. This helped students to know we were reading their answers weekly to encourage thoughtful responses, even though we were not critically grading their reflections.

### B. Data Collection

As part of the larger mental wellness project, we have approval for our research ethics board to at the end of the year request student consent to collect their reflective responses (anonymously) to the research team for analysis. Of the approximately 800 students in first-year engineering, 130 students both answered Q2 about hidden curriculum, and consented to provide their responses for research. These 130 responses are analyzed in this paper.

Stereotype threat has been clearly identified in literature, where by simply asking students demographic questions their performance on standardized tests immediately afterwards will decrease [19]. This impact has led to scholars advocating for placing demographic questions at the end of surveys, however stereotype threat will continue to impact students on their next activity. Further work needs to be done to better understand how to manage stereotype, however to avoid causing unnecessary harm, our research team chose to not ask demographic questions during the 2020-2021 survey. Alternatively, to provide some context to the population of students at the Schulich School of Engineering, we will summarize the approximate demographic of students who consented to the survey in the previous year. Although these are not the precise demographics from the year the data was collected, these estimates from the 2019-2020 survey are given to provide contextual information on the general demographics of first-year engineering students who consent to research studies at our university.

Although only about 25% of our students are women, in 2019-2020 just under half of the responses were women. In the previous year, about one-third of participants were white, one quarter Asian, a bit more than 10% south Asian, a bit less than 10% Middle Eastern, a few percent African, and a few percent South American. Additionally, in 2019-2020 about 90% of students were between the ages of 17-20 years old. We estimate that these demographics would be similar in 2020-2021.

### C. Qualitative Content Analaysis

The analysis was conducted using qualitative content analysis [10]. This process allows for systematic method of

describing a qualitative dataset. The aim "is to attain condensed and broad description of the phenomenon" [10]. There are three main phases: preparation, organizing, and reporting. Following the inductive approach, we used an open coding process to categorize and abstract the data [10]. As this is a work-in-progress, just preliminary high-level findings from the organizing phase of the qualitative process are reported, as we have not yet finalized the conceptual model of the data.

## IV. Preliminary Results

Through the initial preparation and organization phases, a few common themes have emerged. These preliminary results will be summarized here.

### A. Engineering is Difficult

By far the most common category that emerged from the data was the idea that engineering is difficult. Students commented on how engineering is "incredibly hard" and the "workload is a lot". Much of the comments compare engineering to other majors saying, "the workload for engineering is much more than other majors," that engineering is "more time-consuming than other subjects," and that it is "harder than any other science degree."

It is evident through some of the student responses that there is a belief that because of how hard engineering is, this also means that it is *better* than other programs. One student said, "engineering is assumed to be a difficult subject and is something that not everyone can do". Another student agreed with the idea that engineering is supposed to "weed out the weak ones". Others talked about how their family always says that "engineering is very tough and a much better program than other majors." These comments show the hidden ideal of elitism that is engrained within engineering.

Students used a variety of rationalizations for the difficulty of engineering. A few students mentioned the importance of safety within the field of engineering, "it's challenging […] due to the safety concerns that it has," and others talked about how "we are being trained to become professional Engineers." One student even rationalized the high workload because all engineering schools do it, comparing ourselves to our neighbouring engineering school and that our institution needs to be equally difficult to uphold this standard.

### B. Engineering requires teamwork and collaboration

The second most common category that emerged from the data was how teamwork and collaboration are emphasized within engineering. Many students talked about the groupwork required in their different courses however students understood that it was more than just groupwork and was important for their engineering career. They said that groupwork "is to practice working and effectively communicating with new and different people," that it's "to prepare us for the future," that "no individual can really work alone in this profession," and that this is important because "engineering is not a one-person job, it is a team effort from all different types of major backgrounds."

Although most students talked about teamwork in the context of learning skills for their future career, some students also talked about the importance of teamwork and peer support to get through engineering education. One student talked about how "the people in my classes have helped me understand certain concepts and I have helped them in return, which is so powerful, schooling is not a one person thing." Another student said that "making friends and surrounding yourself with hard working individuals makes life a lot easier." These comments show that teamwork is also about building a community of supportive peers to work together on challenging tasks.

### C. Engineers should be independent

In contrast to the teamwork and collaboration comments, many students emphasized how much they had to learn on their own. One student said that engineering gives "us the basics and expects us to figure out the rest or learn something on our own." Another student said that engineering is "figure out a lot of topics/concepts by yourself" because "if you don't understand something in class, the teacher may miss your comment and you will have to teach yourself." One student specifically mentioned how engineering emphasizes the "ability to figure out a way on your own without reaching for help." These comments emphasize the hidden ideals of individualism and avoiding showing vulnerability that exist in engineering classrooms.

It is important to mention that the data is from 2020-2021, which at our university was entirely virtual due to the COVID-19 pandemic. It is hard to know if these comments on independent learning are influenced by the virtual learning environment.

## V. Conclusions and Future Work

This research work in progress paper presents initial results on an open-ended question asking students to reflect on the hidden curriculum they have observed in our engineering classrooms. The findings show that the three main themes of categories (engineering is difficult; engineering requires teamwork and collaboration; and engineers should be independent) all have hidden ideals associated with them. As this research continues and develops, it is important through the qualitative content analysis process to further analyze the data and understand these hidden ideals. For example, the concepts of *elitism, learning communities* and *individualism* that emerged as secondary concepts within the primary themes will be further investigated to understand how student comments conceptualize these.

Additionally, the context in which the student reflections were collected was through a first-year mental wellness program that has been developed in part to deconstruct some of the harmful hidden curriculum ideals of engineering [20]. In future research studies, we will do further analysis of student responses across the mental wellness program to better conceptualize how the program is supporting students in critiquing and challenging these ideals.

## References

[1] I. Villanueva, T. Carothers, M. Di Stefano, and M.T., " "There is never a break": The hidden curriculum of professionalization for engineering Faculty." *Education Sciences*, vol. 8, no. 4, 2018. https://doi.org/10.3390/educsci8040157

[2] L. Gelles, K. Youmans, and I. Villanueva-Perez. “Hidden Curriculum Advocacy and Resources for Graduate Students in Engineering.” *CoNECD Conference*, 2019.

[3] E. Margolis, *The hidden curriculum in higher education,* Psychology Press, 2001.

[4] 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 International Journal of Engineering Education,* vol. 36, no. 5, 2020.

[5] R. Tormey, I. LeDuc, S. Isaac, C. Hardebolle, and I. V. Cardia, “The formal and hidden curricula of ethics in engineering education,” in Proceedings of *43rd annual SEFI conference*, 2015.

[6] C. Rottmann and D. Reeve, “Equity as rebar: Bridging the micro/macro divide in engineering ethics education,” *Canadian Journal of Science, Mathematics and Technology Education*, vol. 20, no. 1, pp. 146-165, 2020.

[7] G. Nudelman, “The hidden curriculum in two employability skills development courses in a South African electrical engineering degree programme,” *Journal of Education and Work*, vol. 33, no. 5-6, pp. 360-374, 2020.

[8] E. Pehlivanli-Kadayifci, “Exploring the hidden curriculum of gender in engineering education: A case of an engineering faculty in Turkey,” *International Journal of Engineering Education*, vol. 35, no. 4, pp. 1194-1205, 2019.

[9] M. Polmear, N. Clegorne, and D. R. Simmons, “Uncovering the Hidden Curriculum of Leadership Education in Civil Engineering,” *International Journal of Engineering Education*, vol. 38, no. 1, pp. 1-13, 2022.

[10] S. Elo and H. Kyngäs, “The qualitative content analysis process,” *Journal of advanced nursing*, vol. 62, no. 1, pp. 107-115, 2008.

[11] E. Vallance, “Hiding the Hidden Curriculum: An Interpretation of the Language of Justification in Nineteenth-Century Educational Reform,” *Curriculum Theory Network*, vol. 1, no. 1, pp. 5, 1973. https://doi.org/10.2307/1179123

[12] F. D. Kentli, “Comparison of hidden curriculum theories,” *European Journal of Educational Studies*, vol. 1, no. 2, 83–88, 2009.

[13] V. Sellers, I. Villanueva Alarcón, “What Strategies do Diverse Women in Engineering Use to Cope with Situational Hidden Curriculum?” In Proceedings of *American Society of Engineering Education Annual Conference,* 2021.

[14] M. W. Apple, *Knowledge, power, and education.* Routledge, 2013.

[15] R. Paul, D. Dedemus, M. Boyce, and K. Johnston, “The “Engineers Have Feelings” Project: Integrating Mental Wellness and Lifelong Learning Skills in First-Year Undergraduate Engineering Courses,” *Proceedings of the Canadian Engineering Education Association (CEEA)*, 2020.

[16] R. Paul, O. Adeyinka, M. Boyce, G. Eldib, K. Gaulin, K. Johnston, L. Kelba, B. Lindsay, and R. Tormon, “Impact of integrating mental wellness and personal learning reflections into first-year undergraduate engineering courses,” *Proceedings of the Canadian Engineering Education Association (CEEA)*, 2021.

[17] M. R. Pandey, R. M. Paul, K. Johnston, A. Dawood, C. Betancourt-Lee, K. Filali, T. Tajwar, B. Lindsay, and M. Boyce, “Learning from Learners: Wellness modules and self-reflections for first-year engineering students to enhance their journey in engineering education,” *Proceedings of the Canadian Engineering Education Association (CEEA)*, 2022.

[18] K. M. Quinlan, *How higher education feels: Commentaries on poems that illuminate emotions in learning and teaching*. Springer, 2016.

[19] C. M. Steele, “A threat in the air: How stereotypes shape intellectual identity and performance,” *American psychologist*, vol. 52, no. 6, pp. 613, 1997.

[20] I. Villanueva, V. Sellers, R. Paul, and B. Smith, “Transforming engineering education: How engineers use social capital in response to hidden curriculum,” in *International Handbook of Engineering Educaiton,* [in review].