

Work-in-Progress: Emotion and Intuition in Engineering Students' Ethical Decision Making and Implications for Engineering Ethics Education

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Abstract

Recent research in moral psychology suggests that people often rely on emotion and intuition to make moral judgments, rather than reasoning, which engineering ethics education has mainly focused on. In parallel with such findings, studies in the scholarship of engineering ethics have emphasized the importance of emotional capacities of engineers and considered how to incorporate emotional factors into the ethics education of engineering students. Despite growing interest in the importance of emotional aspects of engineering ethics education, however, there has been lack of empirical research addressing the relationship between ethics and emotion. In particular, it is not known how emotion and intuition actually influence ethical decision-making of engineering students.

In this work-in-progress paper, we present preliminary results of our exploratory investigation about how emotion and intuition permeate engineering students' experiences with ethics. We analyzed 11 interview transcripts, which had been collected as part of a larger longitudinal, mixed-method research project with engineering students. We conducted an inductive thematic analysis and found that students experienced a wide range of moral emotions from positive to negative depending on the situation. We also found evidence of students' use of intuition when they made ethical decisions. We anticipate the findings of this study will help engineering educators and researchers design better engineering ethics courses by considering the emotions and intuitions of engineering students, which have previously been ignored but may influence ethical decision-making.

Introduction

Engineering ethics education has typically focused on teaching ethical reasoning skills to engineering students by providing them with knowledge (e.g., codes of ethics, moral theories) and opportunities to practice reasoning (e.g., case study). Engineering codes of ethics, since their explicit formulation from the initial third of twentieth-century [1], have provided a guidance of behavior for engineers. For instance, in their codes of ethics, professional organizations such as National Society of Professional Engineers (NSPE) and Institute of Electrical and Electronics Engineers (IEEE) have emphasized that engineering practice shall "hold paramount the safety, health, and welfare of the public" [2], [3]. A code of ethics tells engineers what they can reasonably expect of others in the profession to do and what they can expect other members in the profession to help them do, as a kind of convention [4]. Therefore, teaching code of ethics in engineering ethics classroom acts as setting "the rules of the game" [4, p. 155] for students to prepare for careers as engineers.

However, such codes have been criticized for their ambiguity and their lack of guidance for novices [5]. Therefore, moral theories – utilitarianism, deontology, virtue ethics, care ethics, etc. – are often used to supplement the codes of ethics approach, namely by providing additional

frameworks helpful as guides for ethical reasoning [6]. In general, codes of ethics of professional organizations and moral theories are introduced to students by instructors as knowledge, as necessary information for ethical conduct.

In ethics education, beyond merely learning knowledge (codes of ethics, moral theories), engineering students also practice ethical reasoning. One of the most common approaches to teaching engineering ethics is through the use of case studies [7]. From disasters which ended up with mass casualties (e.g., the Hyatt Regency Hotel disaster in Kansas City in 1981, the space shuttle Challenger disaster in 1986) to more mundane dilemmas such as conflict of interest and gift giving situations, cases provide students with descriptions of situations in various forms (documentation, video, etc.). Students are typically asked to analyze cases and make judgments based on their reasoning.

Teaching codes of ethics and moral theories with cases represents a reasoning-focused approach to ethics education that is situated in early work in moral psychology. In 1969, Kohlberg introduced a theory of moral development which consists of six stages with three levels [8]. This theory assumes that moral development has “a cognitive core” [9, p. 43], which he distinguished from affective aspects of mental events. In other words, Kohlberg emphasized cognition as a starting point. Cognition became a dominant approach in moral psychology: for example, the most commonly used measurement tools for moral development such as the Defining Issues Test 1 and 2 (DIT1 and DIT2) were rooted in the cognitive approach [10], [11]. Engineering ethics education has also developed in parallel with this stream. For example, engineering ethics researchers have used DIT and developed instruments such as ESIT (Engineering and Science Issues Test), which are both based on Kohlberg’s theory, to assess engineering students’ moral development [12], [13].

However, some engineering ethics researchers argue that engineering students’ ability to make moral judgments does not necessarily predict their ethical behavior [14], and students’ moral motivation should be promoted [15]. Recent research in moral psychology suggests that moral action covaries more with moral emotion than with moral reasoning [16]. Moreover, Haidt uses his social intuitionist model to argue that moral judgment relies on quick moral intuitions, and moral reasoning is usually “a post hoc construction, generated after a judgment has been reached” [16, p. 814]. Hence, factors such as affect are likely influential in the processing or steps between an individual’s ethical judgment and ultimate behavior, as well as in the judgment stage itself.

Damasio describes how human decision-making is influenced by *somatic markers*, which are feelings connected to predicted future outcomes of certain scenarios and acquired by experiences [17]. In other words, he posits that affect is interwoven with all human decision-making. Immordino-Yang and Damasio [18] describe this large overlap between emotion and cognition as “emotional thought” and consider its educational implication. After observations of brain-damaged patients, they concluded knowledge and reasoning detached from emotional implications are of little use in the real world. Therefore, we believe engineering ethics education should also appreciate importance of emotion.

A few studies have acknowledged the importance of incorporating emotional aspects in ethics education. For example, Kretz advocated student empowerment for morally activated minds and hearts [19] and developing emotional responses such as empathy and sympathy [20]. In engineering ethics education more specifically, Roesser discussed the importance of enhancing emotional and imaginative capacities of future engineers, especially in terms of encouraging emotional reflection in the design process for risky technologies [21]. Moreover, Sunderland reported a novel attempt to engage students' moral emotions in story-telling activity about ethical issues [22].

Despite growing interest in emotions in engineering ethics education, there has been little empirical research about how emotions actually influence engineering students' ethical decision-making. More broadly, it is not known whether, how, and to what degree emotions permeate students' thinking about ethical problems. In this paper, we investigate moral emotions experienced by first-year engineering students. We address the following research questions:

- RQ1) What moral emotions do first-year engineering students experience in various situations related to ethics?
- RQ2) How are first-year engineering students' ethical decisions influenced by their intuition?

In this work-in-progress paper, we report preliminary results of our exploratory investigation.

Background: Moral Emotions

What counts as moral emotions? Haidt suggests that moral emotions are "linked to the interests or welfare either of society as a whole or at least of persons other than the judge or agent" [23, p. 853]. Haidt suggests two components useful for identifying the moral emotions: disinterestedness of elicitors and pro-sociality of action tendency [23].

Regarding the first component, disinterestedness of elicitors, it is worth noting that some emotions appear when the self is directly associated with triggering event of the emotions (e.g., when something good is happen to the self), whereas other emotions appear when self is not directly related to the event (e.g., when watching a picture of suffering children). We can say the latter emotions, whose elicitors (the events triggering the emotions) are less directly related to the interest of self, are better classified as moral emotions.

Regarding the second component, the pro-sociality of elicited action tendency, emotions can increase the possibility of taking an action as a response to their triggering events. Some emotions influence people to act for the benefit of others (e.g., feeling sympathy while observing unrelated others' suffering can lead to an action to help them) or social order (e.g., feeling anger while perceiving injustice of a society can lead to taking action to improve it). In contrast, other emotions elicit behaviors that are not necessarily related to pro-sociality (e.g., feeling happiness for one's own success).

Based on the two components (disinterestedness of elicitors and pro-sociality of action tendency), Haidt created a two-dimensional space in which various emotions are placed (see

Figure 1). The most prototypical moral emotions can be placed in the upper right corner of the space. However, Haidt notes that the placement is highly speculative, and different arrangements might be possible. In other words, no clear distinction between moral emotions and non-moral emotions has been established, and the classification of moral emotions may depend on the context.

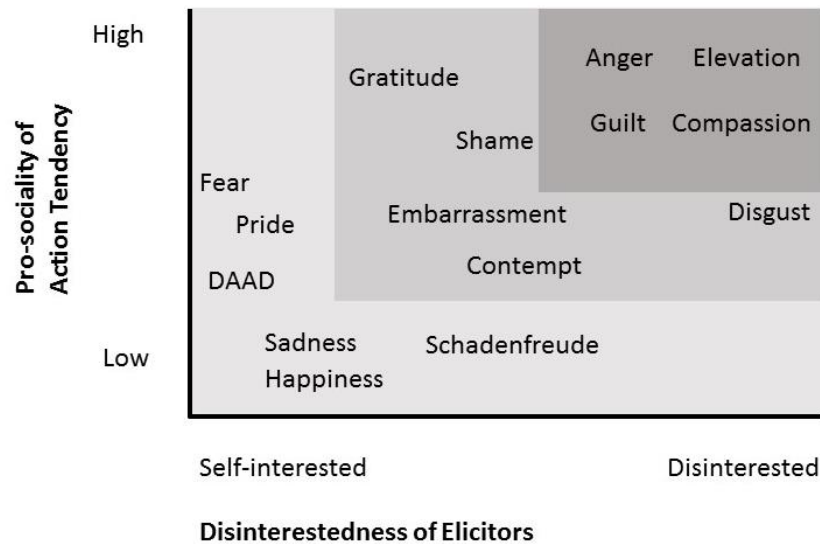


Figure 1. The moral emotions. The placement of each emotion is highly speculative. The most prototypical moral emotions can be placed in the upper right corner of the space (the original figure is from [23]). DAAD = distress at another’s distress.

Although there is no clear distinction between the moral emotions and non-moral emotions, some emotions have been commonly discussed among moral psychologists, including shame, guilt, embarrassment, anger, contempt, disgust, elevation, gratitude, pride, empathy and sympathy [23], [24]. In this paper we will refer to these as traditional moral emotions. Shame, guilt, and embarrassment are negative valence self-conscious emotions, and most of the research on moral emotions conducted so far has focused on shame and guilt [24]. Other-focused, negative valence emotions such as anger, contempt, and disgust have also been commonly discussed as moral emotions. Recently, research in positive valence moral emotions such as elevation, gratitude, and pride is also emerging [23]-[25].

In engineering education, shame has been studied, although not specifically as a moral emotion [26]. In the context of engineering ethics, Davis once mentioned some moral emotions such as embarrassment, shame, and guilt when he explained why engineers should support their profession’s code [27]. However, there has been little empirical research about moral emotions in engineering ethics. In our study, we explore what emotions engineering students exhibit in an interview when they describe their experiences related to ethics in general.

Methods

Data Collection

The data analyzed in this paper were collected as a part of a larger longitudinal, mixed-method study of engineering students in four different institutions [28]. For the longitudinal study, we collected survey data at three different times: during the first year (first-phase survey), fifth semester (mid-point survey), and eighth semester (second-phase survey). We conducted follow-up interviews at two different times: after conducting the first year survey (first-phase interview) and the eighth-semester survey (second-phase interview). Currently, we have completed the first-phase and mid-point surveys, and the follow-up interviews of the first-phase survey (first-phase interview).

During the first phase of the longitudinal study, we interviewed 113 first-year engineering students out of the 757 total survey respondents. The interviews were 30-60 minutes each. The audio-recording of the interviews were transcribed by external transcription services. The interviews were semi-structured, and to some extent probed concepts and constructs aligned with the original survey. Related to the present study, some representative questions from the interviews were: “Can you think of any especially memorable ethical situations that you've encountered?”; “What kinds of experiences have shaped how you think about social and ethical responsibility?”; “Can you tell me about a time when you felt that you or someone you know didn't receive a fair response for something that you or they did?”.

Data Analysis

We selected a small subset ($n = 11$) of the entire collection of transcripts of first-phase interviews ($n = 113$) for preliminary analysis. Table 1 shows demographic information of the selected students and their pseudonyms. Since the data was collected from four different institutions, we randomly selected two or three transcripts from each institution. Then we added some students who showed outlier responses in the survey for wider coverage of different cases. For example, Connor and Barney in Table 1 were selected because they responded negatively (e.g., “disagree” or “strongly disagree”) to the moral attentiveness questions (e.g., “I often find myself pondering about ethical issues”) of the survey. We chose random selection and broad sample coverage because this was an exploratory study aimed at understanding the range of students' experiences.

We analyzed the interviews to explore the intuitive and emotional parts of the students' experiences. While reading through transcripts, we collected excerpts that included emotional expressions such as words commonly used for representing emotions (e.g., *angry*, *frustrated*) or phrases commonly used for showing an intention to express emotions (e.g., “I felt...”). We extracted each excerpt from the whole transcript with the original question the interviewer asked and kept the context of the interviewee's answer. We then generated initial codes and searched for themes in the collected excerpts in an inductive way, i.e., we conducted inductive thematic analysis within the collected excerpts [29].

Table 1. Demographic information of the selected students ($n = 11$) for this paper

Pseudonym	Gender	Race/Ethnicity	Institution
Alex	Male	N/A	Univ. A
Benson	Male	White	Univ. B
Brody	Male	White	Univ. B
Cameron	Male	White	Univ. C
Cody	Male	White	Univ. C
Connor	Male	White	Univ. C
Barney	Male	White	Univ. B
Britney	Female	White	Univ. B
Patricia	Female	White	Univ. D
Phineas	Female	White	Univ. D
Alice	Other	Hispanic	Univ. A

Findings

Students exhibited a wide range of moral emotions from negative-valence emotions to positive-valence emotions. Traditional moral emotions discussed in the previous section appeared in our data (e.g., anger, disgust, guilt, pride), but students also used other expressions to describe emotions they experienced. Emotional expressions could be classified into three broad themes: subsequent negative emotions, anticipatory negative emotions, and positive emotions. This categorization was influenced by Pekrun [30]’s classification of achievement emotions. Pekrun classified achievement emotions in academic settings into activity emotions and outcome emotions and divided the outcome emotions into prospective/anticipatory emotions and retrospective emotions based on the time at which the emotions are experienced. Some evidence of the use of intuition in ethical decision making will also be reported in this section.

Subsequent Negative Emotions

When negative valence emotions appeared after a student made a decision or after an event occurred, we classified those emotions as *subsequent negative emotions*. In this section, we report evidence of traditional moral emotions *anger* and *disgust*, as well as some non-traditional (i.e., less discussed) subsequent moral emotions we found in our data.

Anger. As a traditional negative moral emotion, *anger* was often reported. For example, Cody shared his experience of observing a behavior of his friends’ parents, who he thought were unfair. He said, “Oh, I was just really *angry* about it... There's no reason that she shouldn't have been able to stay at her parents’ house... And they should be responsible for her until she's at least 18.” Also, Alice shared a similar emotional experience, although they used word *upset* rather than *angry*. As they said, “*It makes me a little upset* because I feel like in order for the school to be working toward that great purpose, you can't distinguish the ideas, like okay these sound like they can happen, because sometimes that just means we don't really innovate, we just kind of stick with the same old ideas.”

During the interviews, multiple students used expressions like “I felt like it was unfair.” There can be different interpretations of what emotion students exactly felt, such as disappointment or helplessness. However, we could interpret students experienced emotions like *anger* when they thought they were unfairly treated, as previous studies on *anger* illustrated its association with “moral concerns about being betrayed, insulted, or treated unfairly” [23, p. 856].

As an example, Barney said, “*I felt like I was treated very unfairly there* because I felt like they didn't do a satisfactory job of telling me, of informing me how to turn the assignment in. I feel like especially since I completed it before the due date, I just didn't turn it in, that I deserve full credit for it,” when he recounted a situation when he would be able to earn a B+ grade at most because of his late submission caused by an instructor's mistake.

Also, Alice used similar expression when they described their uncle's unfair treatment of their cousins by saying: “There was that a lot, and *I felt like that was very unjust*. Especially because you could see that it was unjust on both parts, because it was also affecting how my youngest cousin was growing up, because he was spoiled in that sense.” We interpreted this statement to indicate that Alice also experienced the negative emotion *anger* based on the situation they described and their attitude toward the situation, although they did not use the specific word *anger*.

Generally, students reported their own emotions. However, for *anger*, some students reported observing someone else's emotion and how it influenced their own future behavior. When we asked students to recall any memorable situations related to ethics, some students mentioned their misconduct followed by negative feedback (*anger*). For example, Cody said, “I cheated for a while on some of the really early math stuff, like, first learning multiplication and that kinda thing. And *my parents found out and they were really, really, really angry*. And *I've never done it since then*, pretty much... And it's just, when your parents are really disappointed and angry at you-... It's just kind of bad as well.”

Barney also reported his observation of others' anger, by saying: “Honesty is just a really good thing in every situation... That opened my eyes to even though a lie might seem harmless, a lot of times it has bigger effects than we can realize. *My parents were mad at me, my friend was mad at me*. I didn't expect that to happen. I thought that I was just doing something harmless that no one would ever know about.” Both Cody and Barney experienced others' (especially, their parents') anger, which influenced them to change their behavior: Barney said he learned “Honesty is just a really good thing in every situation,” and Cody said he learned “Not to cheat.”

Disgust. The moral emotion *disgust* tends to be provoked when “taking in or standing too close to – metaphorically speaking – an indigestible object or idea” [31, p. 826]. Alice expressed similar emotion, although they did not directly use the word *disgust*. As they said,

Like in high school, some high school programs, they have you do a certain number of volunteer hours. *I always felt like I kind of hated the idea of that*. Especially colleges, they ask you for your volunteer hours, and I'm like, “I don't want to do something

because I'm trying to accumulate volunteer hours. I don't want to do something that's meaningless to me. *Then, I feel like I'm using an organization or a person.*"

We can see Alice felt negatively about the instrumental use of an organization or a person.

Non-traditional subsequent negative emotions. In this section, we report some evidence of negative moral emotions which occurred in ethical situations but were relatively less-discussed: *regret, frustration, bother, and horror.*

An example of the feeling *regret* could be found in an excerpt where Alice described their experience in which they just followed the crowd:

One time, I guess in like middle school, there was a door marked "do not enter", like don't go through this door, and there was a door that told you to go through. It was just a difference of a few seconds, and my friend ran through the door that said do not go through, and so... I didn't want to, but then I was like, "Well, she's going in through that way, so why not rush in behind her." *Then, immediately I regretted it*, because it kind of went against my ideas of don't just follow the crowd. Then I realized what I had just done, and my friend laughed at me for it. It's like, "You just broke the rules." ... *I learned that I should stay true to what I believe*, even if it's a small thing.

We can also see some evidence of *frustration* and *bother* in answers to a question about experiences that shaped students' ethical and social responsibility. As an example, Brody explained his experience of observing tax evasion during his mission trip:

Obviously, I've never done anything in the United States with real estate or taxes or anything like that. As I was there, I had to figure that out. I noticed that the system, there's a lot of people who cheat it. *That was something that really frustrated me at first, realizing that so many people evade taxes.* Coming back to the United States, I realized it's just as easy here if you know the right people or if you know what to do. *That's just something that kind of bothers me* because not everybody lives the same standard that we do here...

In the passage, Brody reported uncomfortable feelings after observing others' unethical behavior of evading taxes. The strong emotional experience of *frustration* and *bother* seemed to help him to keep the lesson seriously. As a similar example, Cameron reported a feeling of *horror* when he saw news reports of disasters:

I guess just general observation, like the same stuff I was talking about with the fires for the chargers and like the water heater with carbon monoxide and bridges collapsing and whatnot, that obviously devastates lots of people and is widespread, sometimes very widespread problems. Of course, you always also see the TV commercials of recalls on stuff, *because horrible things are happening and whatnot*, so I think that type of, just *witnessing all of that kind of stuff happening, you realize*

that there's just something else that has to be going on, and it's not the right thing to be happening. I think that's probably the biggest part of it for me.

Similar to Brody's case, this excerpt also indicates experiences that shaped ethical or social responsibility. Cameron also experienced a kind of negative emotion after witnessing a horrifying event, which made him think that he should prevent such disasters.

Anticipatory Negative Emotions

When negative-valence emotions appeared before a student made a decision and influenced their decision-making, we classified those emotions as anticipatory negative emotions. In this section, we report evidence of traditional negative-valence moral emotion *guilt* and *anger*. In general, *guilt* is regarded as a self-conscious emotion that comes after someone transgresses a moral imperative [31]. But in our data, some students anticipated they would feel guilty if they broke rules. For example, Patricia mentioned why she never cheats on tests:

I think in high school there's a lot of risky situations with academic honesty, because every time [pause] *I never cheated on tests because I felt guilty about it like, "That's not my grade,"* and I just felt like I wasn't living up to my potential but you'd be in class and there would be people very blatantly cheating and you're just like, "All right." ... I think one thing you can learn is, you see how vulnerable people are if they are turning to that and doing that and I just looked at it and said, "I'm not going to do that. I just going to make my way." ... *Because I feel like it wouldn't be true if I was cheating.*

We do not know how Patricia learned the emotion *guilt*. She might have learned it from her previous academic misconduct or other rule-violating behavior. What we can infer is that she learned the emotion *guilt* previously and transferred the memory to this case to imagine the emotion she would experience if she would cheat on a test. Such example of emotional imagination could also be found in the other examples, although it was not about *guilt*. To the interview question asking about memorable ethical situations, Phineas answered:

I like my friends now, and I have two people who both don't have roommates. They're in my friend group, and they're both trying to room with me at the same time. I go one place, one asks, and I go the other place, and the other asks me, and I'm just like, "I'm not gonna live with either of you because I don't want to pick that fight." *I think it's just gonna make people mad. I don't want to make people mad.* I'm gonna live with someone random because that's the best way to get along.

We can see another anticipatory emotion *anger* from this excerpt. Phineas anticipated others' anger in advance and reflected the emotion on her decision-making. Throughout Patricia's and Phineas's cases, we observe that a student's own emotion or others' emotional response to the student may influence the student's later decision.

Positive Emotions

In our data, positive-valence moral emotions appeared less often than negative-valence moral emotions. We found evidence of *pride* and *elevation*, but no students used those exact words. For example, when asked how the honor code of his institution influenced students' behavior, Brody answered:

I think it's definitely in the back of their mind. If they are going to do something against the honor code, they're going to do it more blatantly. Whereas, if they're going to obey the honor code, it's generally gone unnoticed. There's not really a compensation for them abiding by it, *besides the warm fuzzy feeling I guess they get.*

Here, *the warm fuzzy feeling* could be interpreted as the positive emotion *elevation*, although the student described it as not that influential factor on his behavior. Some students described the emotion *elevation* more positively. For example, Patricia described a positive feeling she experienced when she did community service:

I went to a Catholic high school, so service is really important to everyone. Top Soccer, which is the program I was telling you about for special needs kids, that's pretty much what got me into it and did other stuff like NHS [National Honor Society] where I just learned to love it I guess. *It made me feel better.*

Also, from Barney's example, we could see his *pride* as a white, male, Christian, the factors that Barney believed as the reasons why he should behave in more responsible way:

I also feel, I don't know, *I feel a responsibility as a white, male, Christian, fulfilling all of the archetypes. I feel a responsibility to make sure that even though I'm not really part of any minority group, I still feel a responsibility to advocate for the minority groups and recognize that, yes, I am privileged by being like I am and it's my responsibility to use that power and that privilege in a way that will help other people.*

Intuition

During the data analysis, we also found evidence of that students used intuition in ethical decision-making. For example, Cameron described his experience in Science Olympiad and how he decided not to cheat, even though it was not a serious competition but a recreational event. As he explained, "There wasn't really a choice for me. It was just like it's something you just don't do. *I guess it's a subconscious choice, you could say.* For me, it wasn't more of a like, 'Should I do this or not?' It was more of a you just don't do this type thing." As this quote suggests, he did not reach his conclusion through reasoning. Rather, he framed it as a *subconscious* choice, which we could interpret as an intuitive decision-making.

Also, answering the question that asked how ethics classes influenced his ethical perspective, Cameron replied,

The ethics class I took, I don't think it shaped my ethic perspective. *I didn't really have many changes of heart*, if you will. What it did do is *we analyzed a lot of ethical theories, and I guess I was able to actually concrete define my ethics better*. I always knew like this is what I feel and believe and whatnot, but I guess that class helped me further define why it was I felt that way, and also like what sort of schools of thought I matched with type thing.

Cameron said the ethics class he took did not change his heart (or his existing ethical perspective) much. Rather, he explained that learning various ethical theories was helpful for supporting his existing ethics. This is a good example of Haidt's argument, which describes moral reasoning as "a post hoc construction, generated after a judgment has been reached" [16, p. 814].

We could find another example, although it was less clear than previous ones, from Barney's statement. He said,

I feel like most of the students are serving each other, or *following these rules not because they're following any kind of ethical framework they have, but just because it's what they've been told and taught to do since they were kids...* I feel like a lot of students here are just doing what the church says is right, or what their parents have taught them in right instead of what they actually believe is right.

This answer also showed students generally relied more on accumulated experience than ethical reasoning when they behave, at least according to the student's perspective.

Limitations and Future Work

One of the limitations of this study is that we relied on students' self-reports to explore emotions occurring with their past experiences. Generally, emotions appear and change quickly, so they are relatively hard to track. Therefore, it is possible that the self-reported emotions are the results of some distortion and/or re-interpretation of the situation that they were asked to recall.

Also, during the interviews, we did not specifically ask students to identify the feelings that they experienced in situations related to ethics, because the main objective of the larger project was understanding students' general perspectives on ethics/engineering ethics and influences on their perspectives, rather than emotions. Nevertheless, the interviews often produced emotion-related concepts and words. Thus, it is possible that even though students experienced some moral emotions in the past, they just did not report them during the interview. To understand various moral emotions more thoroughly, we can consider asking about students' feelings more directly while conducting interviews.

Moreover, the interview questions could influence the types of emotions the participants expressed. Some questions, such as "Can you tell me about a time when you felt that you or someone you know didn't receive a fair response for something that you or they did?" tended to induce the emotion *anger*. One of the reasons why negative emotions appeared often in our data

so far could be due to the specific questions and probes we used. We should consider the characteristics of the questions we asked to interpret the results.

Another limitation centers on the characteristics of the participants. We analyzed only the first-phase interview data from first-year engineering students, because the second-phase interview data has not yet been collected. Since the first-year engineering students who just entered the university have little experience in real-world engineering and even engineering as a discipline, situations they encountered and reported were usually not directly related to engineering. Therefore, our study results can show some examples of moral emotions that the first-year engineering students experience in general, but we cannot say those are the moral emotions that commonly occur in engineering-related situations more specifically.

In the future, we could conduct a similar analysis with the second-phase interview data, which will be collected with senior engineering students in spring 2019. We anticipate that the students who participate in our second-phase interview will have richer experiences than first-year students, because they have had more exposure to engineering (and hopefully, engineering ethics) during their college years. Also, we can compare our analysis of the students' data with other sources of evidence (e.g., interviews with practicing engineers conducted as part of another study) to see what is similar and different, and determine potential educational implications.

Conclusion

In this paper, we addressed two research questions: RQ1) What moral emotions do first-year engineering students experience in various situations related to ethics? RQ2) How are first-year engineering students' ethical decisions influenced by their intuition? We analyzed 11 transcripts and reported preliminary results of an inductive thematic analysis. From the data, we found that students experienced a wide range of moral emotions from positive to negative, depending on the situation. Students' emotional experiences could be classified into three broad themes: subsequent negative emotions, anticipatory negative emotions, and positive emotions. Subsequent negative emotions included traditional negative moral emotions such as *anger* and *disgust*, as well as non-traditional negative moral emotions such as *regret*, *frustration*, *bother*, and *horror*. As anticipatory negative emotions, some students reported *guilt* and *anger*. We also found positive emotions such as *pride* and *elevation*.

What was especially noteworthy was the anticipatory moral emotions, regardless of their valence. For example, we could see students learned emotions like *guilt* from their previous experience and transferred the memory to other situations. One student imagined the emotion she would experience if she cheated on a test and then decided not to cheat based on the prediction. This type of emotion prediction could be found in other examples, such as expecting others' *anger*. We also found positive anticipatory emotions *elevation* and *pride*. These findings are aligned with recent explanation of emotion in neuroscience: our brain predicts what is going on around us in the world based on past experiences, and emotions are constructed [32]. These results about students' emotions can support Kretz's argument about the role of emotion in teaching *being* ethical [20].

We also found evidence of students' use of intuition when they made decisions. We could not see how their intuitions were shaped in our data, but we could guess that a social persuasion process existed previously, aligning with Haidt's social intuitionist model of moral judgment [16]. By considering our findings about anticipatory emotions, engineering ethics educators and researchers could think about how to shape educational environments in which students can learn appropriate moral emotions for prosocial decision-making and regulate emotions if they hinder their ethical decision-making. Such an endeavor would likely be synergistic with studies of emotion in teaching and learning [33].

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