Paper ID #19136

The Hidden Person within the Frustrated Student: An Interpretative Phenomenological Analysis of a Student's Experience in a Programming Course

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Abstract:

This research paper presents the findings of an interpretative phenomenological analysis (IPA) of a student's experience of frustration in the context of an introductory programming course. We contend that the embodied experience of frustration is ubiquitous yet underexplored within the context of engineering and science education. After interviewing the participant, we analyzed the interview transcript using IPA, a qualitative research method that provides the researcher with a tool to generate coherent insight on complex psychological experiences. In this paper, we present seven themes that demonstrate how the student's frustration experience was connected to his identity formation, experience in shame, and maladaptive help-seeking behaviors.

Introduction:

> I was frustrated particularly with the fact that I guess some of the stuff was ambiguous to me, and probably because I wasn't paying the most attention in class. Um, but, it was frustrating because, um, it was hard to find the guy's [instructor's] number, it was hard to email the teacher sometimes, normally he would—he would, when I did email him, he would respond. And he's been really good at responding, but sometimes teachers don't necessarily or don't always follow through with that, and um, it's frustrating when that happens, um, just because you need the material, and you don't know how to go about getting that (David [pseudonym], a sophomore software development student).

David discusses one reason for his experience of *frustration* in the context of an introductory programming course – an emotional state that we contend is an underexplored yet ubiquitous phenomenon that occurs in the context of engineering education. At a first glance, the above quote may not seem particularly remarkable. In fact, the reader might even feel a sense of annoyance (or empathy) with David's statement, which resembles a mild diatribe that one might expect to overhear among an arbitrary group of science or engineering students.

As defined by Graesser and colleagues, *frustration* is "a feeling of making vain or ineffectual all efforts however vigorous; a deep chronic sense or state of insecurity and dissatisfaction arising from unresolved problems or unfulfilled needs" (pp. 304-305)[1]. In the above quote, David highlights these elements of frustration. He indicates his unfulfilled needs ("I guess some of the stuff was ambiguous to me"). He represents a perceived dissatisfaction by simultaneously assigning responsibility for his situation on the instructor (". . . it was hard to find that guy's number"), on teachers more generally ("sometimes teachers . . . don't always follow through") and on himself (". . . I wasn't paying the most attention in class"). And he characterizes his experience with a felt lack of control over improving his situation via any efforts (". . . you need the material, and you don't know how to go about getting that").

In this paper, we critically examine David's experience of frustration in an introductory programming course. As we have found no existing research on frustration in engineering education, we use this particular case to establish a textured image of how this emotional phenomenon is likely to be experienced in engineering education. We do not claim that David's case is universal. On the contrary, we establish his personal experience as idiosyncratic to him

and his specific context. However, based on the findings, we suggest a link between the emotional experience of frustration and the psychological constructs of identity formation, shame, and help-seeking behaviors.

Background: Frustration in Education Contexts

Frustration, as it is investigated in educational psychology, is portrayed as an emotion that is associated with a particular task. The definition given above comes from work done by Graesser, D'Mello, and colleagues, which particularly examines how frustration, along with other emotions (e.g., boredom, eureka), affect individuals learning during specific instruction via a tutoring software.[1-3] Not surprisingly, they found that learners who experienced frustration in the experiment tended to provide negative feedback about the tutorial software.

Pekrun and colleagues, who developed the well-cited Achievement Emotions Questionnaire (AEQ) do not specifically provide a definition for *frustration*, but they do investigate the emotion, along with several others (e.g., shame, boredom, confusion), as it relates to achievement in particular tasks. [4,5] In particular, they have found that frustration is associated with a perceived lack of control over a certain task. Further, they found that frustration did not correlate positively or negatively to learning gains.[4]

This emerging research from educational psychology does provide some important boundaries on how we understand frustration in the context of our investigation. We understand that frustration is a negative emotional state that is associated with a felt loss of control over a situation. We also concur with Graesser's definition that was stated earlier, which focuses on how frustration arises from "insecurity and dissatisfaction arising from unresolved problems or unfulfilled needs" (pp. 304-305).[1]

Yet, the limited existing research on frustration tends to construe the emotion as associated with particular learning tasks, and in our investigation, we envision frustration as a more global emotional phenomenon. In other words, we see the emotional construct of frustration as one that is related to ways of being an engineer (i.e., identity, inclusion)—not merely connected to academic performance. Our working conceptual framework for frustration is informed by existing engineering education research. While such literature does not examine the experience of frustration directly, extant scholarship in engineering education does suggest vivid emotional facets of the holistic formation of engineering students, including topics such as identity formation,[6-11] motivation,[12-13] belonging,[14] and marginalization.[15-18] We contend that understanding how frustration is experienced in engineering and science students can improve the capacity of engineering programs in their efforts to provide more inclusive environments. Additionally, we maintain that through investigating emotional phenomena such as frustration, programs might foster, and indeed acknowledge, healthy emotional regulation in their students.

Research Question and Methodology

In order to fill the gap of understanding related to frustration in science and engineering education, we sought to investigate the overarching research question, "How do students experience frustration in the context of postsecondary science and engineering courses?"

This overarching research question defined our study to closely investigate the internal experiences of students within these courses. Therefore, we approached this study using interpretative phenomenological analysis (IPA) to carefully examine the contextual and embodied phenomenon of frustration. IPA is a qualitative research method that closely examines

personal experience of certain phenomena and articulates contextually sensitive yet theoretically coherent themes.[19] IPA has been used most recently in engineering education research to investigate motivation[21] and identity.[10,22] In the context of our investigation, using IPA enabled us to both closely examine the lived experiences of frustration in students and generate in-depth psychological themes.

The case that we examine within this paper is taken from a slightly larger study to generate insight into frustration. We used IPA to study our research question in 5 students, each of whom was majoring in a science or engineering field and was enrolled in a freshman- or sophomore-level science or engineering class. In the sub-sections that follow, we describe the position of the authors in relation to this study, the procedures for data collection and analysis, and the rationale for selecting the case for this conference paper. This study was approved by Harding University's IRB (#2015-077).

Position of authors in relation to study

In IPA research, the researcher carefully manages his or her stance in relation to the phenomenon under investigation. The researcher approaches the participant as if he or she were walking alongside them, carefully questioning features of their lived experience. Thus, the researcher neither approaches the study with a mindset of suspicion or criticality regarding the participant's perspective nor does she or he approach the study with a trusting or empathetic view. Rather, the researcher is intentionally open to the perspective of the participants while carefully bringing in theory-informed questioning into the analysis process.[19] Consequently, much of the interpretation is guided by the researcher that is conducting the analysis.

In this paper, then, we explicitly make known the role and position of each author in relation to this investigation. H. Ronald Clements (this paper's second author) was the primary researcher of this particular study under the mentoring and supervision of Dr. James Huff (the paper's first author), an experienced IPA researcher. It is worth noting that Mr. Clements was an undergraduate biomedical engineering major who experienced frustration within his own courses before leaving to pursue a degree in cognitive neuroscience. This provided a challenge and opportunity with this investigation. Mr. Clements had much interest in the topic but also had to overcome natural propensity to bring his own frustration experiences into the scope of the investigation. Much of the mentoring dialogue of this investigation involved iterations of analysis, as Dr. Huff coached Mr. Clements to enable the participants' experiences to speak for themselves. Additionally, the findings documented here are the result of the careful and thorough analysis of Mr. Clements. The role of Dr. Huff in generating these findings was to serve as a critical friend to ensuring that Mr. Clements maintained the philosophical commitments of IPA throughout the process.

Data collection

After conducting pilot interviews to refine his process of semi-structured interviewing, Mr. Clements recruited participants by word of mouth who identified as feeling frustrated in at least one science or engineering course. He then interviewed the participants following a semi-structured interview protocol. The interview began by eliciting the general context of the participant and openly asking about their experiences in their coursework. If the participant described an incident of frustration without being prompted, Mr. Clements would then probe this experience and elicit a thorough description of how the participant experienced frustration. Gradually, toward the end of the interview, Mr. Clements became more explicit in prompting the

participant to recount frustrating experiences in their science or engineering courses. In sum, he conducted five interviews with science or engineering majors. The participant whose case we describe in this paper, David, was the final participant to be interviewed. David's interview session lasted for forty-three minutes.

Data analysis

After all the interviews were conducted, the five audio files were transcribed by Mr. Clements and by a professional transcriber into Word documents. While he did not directly transcribe all the participant's files, Mr. Clements, under the coaching of Dr. Huff, identified David as a participant that could be analyzed as a single case, for reasons we discuss in the following sub-section. Therefore, Mr. Clements began his analysis efforts with directly transcribing David's interview. He then completed a second iteration of transcribing the audio file to ensure that the authenticity of the interview event was well-represented in the transcript. Mr. Clements then completed a thorough annotation of the transcript, noting descriptive, linguistic, and conceptual comments throughout the transcript. Following this, he annotated what Smith and his colleagues refer to as *emerging themes*.[19] These are statements that capture the psychological picture of particular excerpts within the interview transcript. In order to strengthen the credibility of the analytic process, Mr. Clements completed eight passes through the transcript, under the guidance of Dr. Huff, thereby completing each of the four annotations listed above in two iterations. This analytical process is documented more thoroughly in a separate engineering education IPA study.[23]

Mr. Clements identified nearly 80 emerging themes and then organized them on a thematic map in order to find the substantially grounded yet theoretically coherent psychological themes from David's experience of frustration. Mr. Clements identified 14 themes that he classified in three super-ordinate categories. Several of these themes were more related to David's identity as a computer science student rather than his specific experiences of frustration. Thus, due to the page limitations of the conference paper, we are reporting on seven themes that fully describe David's lived experience of frustration in an introductory programming course.

Background of David

Before describing the findings of the study, we provide the reader with some basic context about David himself. David, a White male, was a traditional freshman software development major at Harding University at the time of the interview. He was selected to participate in the study based on his identified feelings of frustration regarding an introductory programming course. David had come into his major motivated by previous life and school experiences. He perceived that he was gifted at concepts of computer due to a previous experience in a high school course, and he had worked "on computers" with his father throughout his life. David held a strong commitment toward his identity as a student in computer science.

Rationale for sampling David as an IPA case study

We purposefully sampled David's experience of frustration in an introductory programming course as a critical case. According to Flyvbjerg, *critical cases* are sampled in order "to achieve information that permits logical deductions of the type, 'If that is (not) valid for this case, then it applies to all (no) cases'" (p. 230).[24] David's account highlights that frustration may indeed occur in students that we least expect—students who identify strongly with a particular major and students who, through at least their race and gender, seem to naturally identify with the

dominant White, male social norms that pervade engineering and science cultures.[25,26] By critically examining his quiet yet robust case, we might then consider how vividly the experience of frustration resides in students with tenuous relationships to engineering or science cultures.

We further chose to report on David as a single case in order to authentically report the important contextual information associated with an individual case. We contend that although frustration has often been investigated as an emotion that is connected to learning tasks, as discussed in the background section, the emotional state cannot fully be separated from more global and contextually nuanced features of an individual and his or her particular situation. The findings below provide a clear picture of the interwoven contextual features of David's experience in frustration.

Findings

We employ seven psychological themes that are listed in Table 1 in order to present how David experienced frustration. All of these themes are interconnected and meant to be understood as a whole rather than seven individual components. Yet by naming them as themes, we might better understand the complex, and at times contradictory, nature of how frustration is experienced in individuals.

Theme 1: Felt confident in his disciplinary skill due to previous experiences and courses

David had previously taken a basic computer science course in high school, and according to him, much of what was taught in the first portion of the semester were concepts he had previously learned. Due to having prior knowledge, David felt very confident about his ability to perform well in the course:

> Whereas in the beginning of the semester, all he was talking about was things that I had already nailed down. Um, solid. And it was easy for me to complete assignments, um, just because of the past experience that I've had.

David described the course as being "easy" because he felt as though he already knew what was being taught. He stated that due to the course being easy, he felt confident enough to not pay attention during the class lectures. According to David, he would regularly "zone out" during the course instruction, as he felt as though he already understood what was being taught at the time. David continued by explaining that he would even communicate to the instructor that he knew the information on a "deeper level" and would continue doing his own work during class time: "It was easy for me to kind of zone out and work, and acknowledge to him that I already knew what he was telling me and knowing at a deeper level, even what he was talking about."

David recalled disengaging his attention from the lecture during one particular class session near the beginning of the semester when the introductory portions of C++ were being taught. David felt as though he did not need to pay attention during this portion of the course because he had learned Java in his introductory high school course. He described the material that was being taught at the time as "the boring stuff" and that it was very similar to what he was taught in his previous course. Due to the course that he had taken, he was initially achieving high marks on his assessments without putting forward much effort within the course. However, according to David, his idea of having the prior knowledge to succeed in the early portions of this course would limit his ability to absorb new knowledge later in the semester.

Table 1: Table of themes for David's experience of frustration

Theme	Example Quotes
1. Felt confident in his disciplinary skill due to previous experiences and courses	Line 312 – 316: "In the beginning of the semester all he was talking about was things that I had already nailed down. Um, solid. And it was easy for me to complete assignments, um, just because of the past experience that I've had."
2. Felt shame in the disconnection between perceived skill and academic performance	Line 350 – 352: "I thought I could handle it easily, um, and I thought it was easy to do [introductory programming course] and I'm cocky and 'I'm so good at this' and it turns out I'm not."
3. Experienced frustration when confidence in disciplinary skill is challenged	Line 253 – 257: "[In high school,] I made decent grades without [studying], and I come here . . . and it's frustrating, because so much of the material is . . . not even taught in class." Line 440 – 442: "Um, I feel like I should've emailed the teacher more, but I was frustrated particularly with the fact that I guess some of the stuff was ambiguous to me, and probably because I wasn't paying the most attention in class."
4. Sought help as a last resort – Help-seeking as a maladaptive form of coping	Line 356 – 359: "I didn't finish, because I didn't know how to do it, and I was struggling, um, I think I texted a classmate, and he tried to help me, I just couldn't get it done" Line 442 – 446: "Um, but, it was frustrating because . . . it was hard to email the teacher sometimes, normally he would—he would, when I did email him, he would respond."
5. Felt warmth toward and support from instructor	Line 398 – 399: "For one, the teacher's just super nice. Um, we—I mean I loved the teacher that we had he was an awesome teacher, he would engage with us on a personal level" Line 444 – 447: "It was hard to email the teacher sometimes, normally he would—he would, when I did email him, he would respond. And he's been really good at responding"
6. Hid from negative perception – Avoided help-seeking to control how he was perceived	Line 455 – 462: Interviewer: "Do you feel like there is maybe a specific reason why you didn't [email the professor for help]? . . ." David: "I don't, I don't really—maybe because I didn't want to admit to him that I didn't listen to him (laughs) when he was talking." Line 440 - 442: "Um, I feel like I should've emailed the teacher more, but I was frustrated particularly with the fact that I guess some of the stuff was ambiguous to me, and probably because I wasn't paying the most attention in class."
7. Externalized responsibility for not seeking help – Felt trapped and abandoned by instructor	Line 521 – 533: "I just can remember feeling like, a little hurt because I came up to the, his office one day, and I really needed help on my project, um, and he had emailed us . . . the wrong time that he wasn't going to be in class, and when I went up there—that was the time that he wasn't in class . . . I feel like he just kind of threw that on us, and ditched us with that specific project, or, um, whatever it was—the homework, I don't remember"

Theme 2: Felt shame in the disconnection between perceived skill and academic performance

While David felt confident about his abilities during the beginning portions of the semester, he stated that, eventually, his carefree nature caused him trouble as the semester transpired. Originally, he disengaged from course lectures due to his felt prior knowledge on the subjects. However, according to David, that pattern created habitual indifference to what was being taught during lectures, and mutated into what he would claim to be a "personality issue." The switch

from understanding the course work on a "deeper level," to being confused and missing course information was not a quick turnaround, as David mentioned:

> Um, and it was easy for me to make the grade and so, um, but my grade has steadily fallen. Um, not at a dramatic rate, but steadily fallen just because of that nature so, I think at the beginning of the course, um, it helped, but now I see it as more of a personality issue that, um, I don't really need to pay attention, I already know this stuff, and—I really need to pay attention, um, and because I don't know this stuff.

David stated that he viewed his inability to pay attention in class as tied to his personality and that his grade dropped as a result. According to David, his steady decline in academic performance came as a surprise. In fact, David was so confident in his ability as a computer science student that he would only study briefly for test and do well on them. However, when it came to certain projects and assignments, David began to slowly realize that he did not have the knowledge he needed to succeed in the course, directly pushing against his original thought of having previously learned everything he needed to succeed in the course. He described himself as "cocky" and over confident. Further, he discussed how he assumed the course would be easy, but as the semester went on, it became harder for him to succeed while not paying attention in class:

> . . . I thought I could handle it easily, um, and I thought it was easy to do [intro programming course] and I'm cocky and 'I'm so good at this' and it turns out I'm not. And I didn't know what he was talking about, and um, he was trying to show us how to [class example] and I wasn't paying attention when he said those things. And when I sat down to do the homework, I didn't finish, because I didn't know how to do it, and I was struggling, um, I think I texted a classmate, and he tried to help me, I just couldn't get it done because of the material that I didn't catch in class.

Here David highlighted disconnection between his confidence in his abilities and his struggling academic performance. As we see in later themes, this disconnection between his confidence and his performance formed the basis for his experience of frustration and a perceived lack of control within the course.

Theme 3: Experienced frustration when confidence in disciplinary skill is challenged

After being confronted by his inability to complete coursework, David began to experience confusion, which led him to become frustrated about the situation. David described his attempts to do assigned work as trying to complete a picture with missing portions, and that it became increasingly frustrating when he realized he couldn't complete the work:

> . . . and it [completing homework] would never work out for me, and I wouldn't understand because I didn't even know that I was missing some information. And [I did not know] that he told me [the information]. I didn't even know that there was some more to the picture, and I was trying to complete it without it.

Not only did David experience frustration from his felt inability to synthesize course content, but he also experienced frustration stemming from his perceived inability to change his previous study habits. David stated that during high school he was able to simply go to class and absorb

all the information that way, without having to study outside of class. He stated that after attending Harding University, he was no longer able to continue with that form of learning:

> I came from a high school that I never had to study for anything, and the grade was there. And not saying that the grades were handed to me, but it was just material that was based more solely on classroom learning . . . You would really defeat the purpose of studying, really. Um, and I managed through, and I made decent grades without doing it, and I come here to [Harding], and it's frustrating because so much of the material is even, it's not even taught in class. It's required to study.

David felt as though he should be able to know and comprehend the course content, but he began to feel increasingly lost in the course. Rather than improve the situation by seeking help, he continued to exercise a pattern of disengagement from the course. This disengagement led to further losses in his academic performance, which then caused him to feel a troubling sense of shame from not meeting his own expectations. Trapped in a continually reinforced feeling of shame, David felt a noticeable lack of control over his performance within the course.

Theme 4: Sought help as a last resort – Help-seeking as a maladaptive form of coping

When David was asked to elaborate on certain situations where he had experienced confusion in the course as a direct result of his lack of attention in the course, he was unable to provide a precise assignment or activity. However, he did recount about a certain experience that he had attempting to do a homework assignment: "I didn't finish because I didn't know how to do it. And I was struggling, um, I think I texted a classmate, and he tried to help me. I just couldn't get it done"

When David realized that he did not know what he needed to complete the coursework, he reached out to one of his classmates in order to cope with the situation. Even though he did reach out, the other student was unable to give him the guidance that he needed to be able to complete the assignment, and therefore, he "just couldn't get it [the assignment] done." He had become so accustomed to inherently knowing the course material, that when he was confronted with something he did not know, he was felt limited in his ability to adapt to the situation in a constructive way. Later within the interview, David stated that he felt as though he should have sought help from the instructor more than he had:

> Um, I feel like I should've emailed the teacher more, but I was frustrated particularly with the fact that I guess some of the stuff was ambiguous to me, and probably because I wasn't paying the most attention in class. Um, but, it was frustrating because, um, it was hard to find the guy's number, it was hard to email the teacher sometimes, normally he would—he would, when I did email him, he would respond. And he's been really good at responding.

In this excerpt, which was used to open this paper, David described the instructor of the course as being openly accessible to the students and normally responding to any inquiries that they had. But he then described the process of contacting the professor as difficult, as though some external force was keeping him from doing so. Indeed, in the above excerpt, he portrays his frustration as a barrier to seeking help rather than, as one might expect, a motivator to improve his situation. In his interview, David exhibited a pattern of only seeking help on a sporadic basis, even if he felt as though he should have done it more often. David's sense of confidence in his

abilities not only led him to miss information during class lectures, but also created a situation where he internally felt resistance to asking students or the instructor for help, because it went against the confident feeling that he had at the beginning of the course. We elaborate on this internal opposition to seek help in Themes 5-7.

Theme 5: Felt warmth toward and support from instructor

Regardless of David's internal experience of frustration, and even though he partially felt as though he could not ask the instructor for help, he did appreciate the instructor's availability and form of teaching. Several times throughout the interview he mentioned how personable the instructor was, and he described a generally positive interpersonal relationship between him and the instructor:

> I mean I loved the teacher that we had. He was an awesome teacher. He would engage with us on a personal level. I mean, not extremely personal, but more of—he would break into the world that we know. Um, so that we could translate the material that he was teaching us into understandable experience[s], like our phones, or the computers that we have or laptops. Just, or just even everyday examples. . . Just—examples like that would help me, um, cope with like, with the things that I actually didn't know, and was trying to learn from him.

David felt warmth toward the instructor, and he described how this instructor taught in a way that made the course topics easy to understand, and relatable to the student's lives. He also felt as though this specific classroom setting was more of a socially amiable experience than other courses, due to it being relatively small. David also described the course as "fun" and spoke about how he thought the classroom was "laid-back" and not as strict as what he expected for a college-level course. He then continued to talk about having a good-natured feeling about the class and the instructor.

Yet, as discussed earlier, David found it difficult for him to communicate with the instructor. Although he readily expressed a feeling that the instructor was supportive and accessible to students, he also seemed to feel that he could not email the professor freely whenever he had an issue with the course work:

> . . . but sometimes teachers don't necessarily or don't always follow through with that, and um, it's frustrating when that happens, um, just because you need the material, and you don't know how to go about getting that (clears throat).

In this excerpt, David does not specifically mention the instructor of the class, but instead groups "teachers" together as a whole. This statement raises the question of whether or not David was inadvertently speaking about the experience he was currently having in the introductory programming class or if previous experiences that had caused him to feel a general sense of disconnection between instructors and students. Regardless, in spite of his overall experience of frustration in the programming course, he held positive attitude toward his professor.

Theme 6: Hid from negative perception – Avoided help-seeking to control how he was perceived

As mentioned earlier, David's perception of the classroom setting and his relationship with his instructor was what he described as "good-natured" and "personal." Even so, David felt as though he did not ask the professor to help him through his struggle in the course as much as he felt he needed to. According to David, part of why he didn't want to ask for more help was

because he felt as though asking for help would inadvertently be admitting to the professor that he wasn't paying attention in the course: "I don't, I don't really—maybe because I didn't want to admit to him that I didn't listen to him (laughs) when he was talking. Or, maybe the fact that I felt like he was busy."

From David's perspective, this admission would injure the relationship he had with the professor, and cause a strain to be placed on the "easy going" nature of the classroom he was experiencing. David even went as far as to mention that the instructor most likely was aware of the fact that he wasn't paying attention, but to David, "admitting" or seeking more help from the professor would somehow harm the relationship that the two had:

> I just didn't—I didn't want to ruin, I guess the good-natured feeling that I had, and so I just assumed that it would just be the best to not—to not admit to him that I didn't—that I wasn't really listening.to him, even though he probably already knew that because I wasn't looking at him, or it was obvious that I wasn't listening.

David felt as though the atmosphere of the classroom, although very cordial and accepting, was a core reason that he did not seek help from the instructor more often. David seemed motivated to hide or escape from the possibility of the instructor having a negative impression of him if he did decide to ask for help. His positive relationship with the instructor did not serve as a platform for approachability. Rather, this relationship seemed to reinforce a fear of harming the relationship by making the choice to seek help on understanding the course content.

Theme 7: Externalized responsibility for not seeking help – Felt trapped and abandoned by instructor

In spite of David's overall positive relationship with the instructor, he also mentioned instances that occurred between the students and the instructor that served to threaten his sense of connection with the instructor. As David described:

> What's certainly another frustrating thing is how short his office hours are. It's that I'm not always able to go into his office and get the actual help that I need, because of you know, [sports team] practice, or other obligations that I have, and I definitely have an issue with that, how short his time was, um, and so that kind of translated into emailing him less, because I didn't really know how to, I guess, engage.

David felt as though the instructor's office hours were not accommodating to his personal schedule, due to other extra-curricular obligations that he had. He mentioned that going into the instructor's office, and meeting with him face-to-face is his only means of getting the "actual help" that he needs. According to David, his inability to meet face-to-face with the professor caused him to also lose the desire to email the professor, due to a relational disconnect that had formed. For David, this disconnect seemed to grow more and more as the semester went on. At one point, David discussed how he felt abandoned by the professor during an assignment:

> Um, I don't have a specific occurrence, I just can remember feeling like, a little hurt because I came up to the, his office one day, and I really needed help on my project, um, and he had emailed us, um, and of course we all make mistakes, but, he emailed us the wrong time that he wasn't going to be in class, and when I went up there—that was the time that he wasn't in class. But the email had a mistake in

> it, so I assumed that he was, or, he was in his office at that time, but he wasn't. And I remembered that being frustrating to me, because, um, I feel like he just kind of threw that on us, and ditched us with that specific project, or, um, whatever it was—the homework, I don't remember.

David used very strong language here, as he felt as though he had been "ditched" by the professor for this specific assignment. According to David, he had come up to the instructor's office when he "really needed help on his project," and came to ask for help. Through the process of help-seeking, which had been implemented as a mechanism of last resort, David appeared to feel vulnerable in seeking help more proactively. David mentioned how he felt "hurt" when this occurred, due to the miscommunication between the instructor and the students. So while David felt as though the instructor may be approachable and personable, he also felt "ditched" during this specific occurrence. While this theme might initially appear contradictory to the previous themes, the strong sense of both connection and disconnection with the instructor lends credulity to the data by providing an authentic tension that composes his experience of frustration.

Discussion

David's particular case of frustration reveals some broader patterns of the emotional experience that may be true for other students as well. This IPA case study is intended to convey the context-laden psychological patterns related to experience frustration in a single case. In no way is it intended to make knowledge claims that may be generalized to a broader audience. Yet by closely examining a single case, we can clearly see the nuanced context surrounding the frustration experience. Namely, in David's situation within the introductory programming course, we can see how the experience of frustration is connected to his sense of career identity, an emotional experience of shame, and maladaptive behavior related to seeking help within the course.

In the first three themes ("Theme 1: Felt confident in his disciplinary skill due to previous experiences and courses"; "Theme 2: Felt shame in the disconnection between perceived skill and academic performance"; and "Theme 3: Experienced frustration when confidence in disciplinary skill is challenged"), David expressed a committed sense of identity as a software development major. His major had been a natural trajectory for him based on his previous experiences with his father and with his performance in a high school computing course. It is possible that he demonstrated what psychologist James Marcia calls a *foreclosed* identity in his academic major, characterized by strong commitment and little exploration or challenging of this sense of career identity.[27, 28] David began to feel a lack of control over his situation in the course when his performance on the homework tasks began to challenge his sense of identity ("'I'm so good at this' and it turns out I'm not," Theme 2). And because this academic performance challenged his sense of self, the academic struggle was characterized by an emotional experience of frustration.

However, frustration might not entirely capture David's emotional experience when he felt that his sense of self was challenged. It seems that alongside the frustration that he felt in relation to his academic performance within the course, he also felt a strong sense of *shame*. As described by psychologist Helen Block Lewis, shame is a strikingly painful, self-conscious emotion that involves a global devaluation of the self. Yet, through her grounded theory investigation on how adults experience shame, Van Vliet offers a definition that might be more relevant to David's

experience. She describes shame "as an assault on the self, where the individual's self-concept, social connection, and *sense of power and control* come under attack" (p. 233, *emphasis* ours).[30]

Themes 2 and 3 highlight the painful nature of how David experienced shame and frustration in the course. The experience in the programming course not only challenged his identity as a software development major, but it also threatened his self-concept. Furthermore, the Theme 3 and Theme 4 ("Sought help as a last resort – Help-seeking as a maladaptive form of coping") accentuates how his sense of control in the situation was in disarray. We contend that, based on the findings, we can better understand David's experience in frustration with the course if we also can see the sense of shame that he felt in relation to his identity.

The last four themes (Themes 4 – 7) provide a textured view of David's behaviors that only served to deepen his cycle in frustration and shame rather than ameliorate his situation. While David did seem to realize that seeking help from the instructor would improve his situation, he was motivated to hide both his struggling performance and his emotional states of frustration and shame from the instructor. In a contrast from what might be expected, his perception of the instructor as an approachable person (Theme 5: Felt warmth toward and support from instructor) only seemed to magnify his desire to hide his painful experience from the instructor and mitigate any threat to the social bond between them (Theme 6: Hid from negative perception).[31]

Moreover, David simultaneously seemed to both internalize his responsibility for his frustrating experience in the course and externalize the responsibility to the instructor (Theme 7: Externalized responsibility for not seeking help). To make sense of these seemingly contradictory patterns, we may again look to motivational features of shame. As put by Tangney and Dearing, a person who is feeling shame typically feels motivated to act in ways that hide from the emotional state, avoid it altogether, or externalize responsibility to others.[32] While David's amplified sense of internal responsibility may be an indicator of how painfully he lived the experience of shame and frustration, his placing responsibility on the instructor for his situation might have been a way to cope with the painful emotions through avoidance.

Future Work

As we continue analysis on the remaining four participants of this investigation, we seek to understand how patterns of frustration might generally relate to features of engineering or science education. While the analysis of David's case provides a detailed picture of how frustration was experienced in a science/engineering education context, the findings of this case are limited in providing commentary on how institutional cultures of science or engineering education may contribute to maladaptive forms of processing the emotion.

Conclusion: Implications for Practice

As we conclude this paper, we ask what we might learn from this particular case of a single student in a single course. Substantial attention has been given to identity and other facets of professional identity formation in engineering education.[6-18] Often, such identity research is conducted in the interest of creating more inclusive atmospheres within engineering. This study highlights through ample contextual data that powerful emotional experiences, such as frustration, accompany identity formation. As we continue to rightfully investigate the professional formation of engineers, we can better understand issues around inclusion and exclusion within engineering programs by probing these emotional experiences.

Finally, by acknowledging that emotional experiences do occur in poignant ways within science and engineering programs, we might better conceptualize and practice ways of healthy emotional regulation in the context of professional formation. In this investigation, we do not intend to convey the message that engineering programs should seek to mitigate the lived phenomena of frustration among their students. Rather, we want to encourage programs to equip students with healthy ways of working through frustration, such as enacting reparative help-seeking behavior,[33] when the experiences do occur.

Acknowledgements

We would like to express our gratitude to the McNair Scholars Program at Harding University. This work was made possible by their support. Any opinions, findings, and conclusions or recommendations expressed in the material are those of the authors and do not necessarily reflect the views of the McNair Scholars Program.

Additionally, we would like to thank the insightful comments of the anonymous reviewers of this paper. These points of feedback helped us sharpen the quality of the paper.

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