

## **AC 2007-1277: GEEKS ARE CHIC: CULTURAL IDENTITY AND ENGINEERING STUDENTS' PATHWAYS TO THE PROFESSION**

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# **Geeks Are Chic: Cultural Identity and Engineering Students' Pathways to the Profession**

## **Abstract**

This paper reports findings from a longitudinal study of undergraduate engineering students on their embracing of a campus and disciplinary culture, that of a “geek.” In analysis of data from the students’ first and second years, researchers examine the development of pre-professional engineering identity within the pseudonymous Mountain Technology Institute (MT or Mountain Tech). Authors speculate that despite widespread enjoyment in the first year of finding others—“geeks”—who share their interests, in the second year, some of MT’s undergraduates chafe at the narrowness of their engineering and technology education. Further, the authors postulate that the students who become reluctant to remain geeks throughout their undergraduate careers may be reluctant to remain in the engineering field.

## **Background and Motivation**

Nationwide, need for U.S. engineering talent continues to grow, yet enrollment in and graduation from engineering institutions continues to decline. If engineering educators better understand how students come to engage with their studies and chosen institutions as well as develop an identity with the profession, engineering colleges can adjust institutional climates to encourage more students to enroll in engineering studies and persist to completion.

## **Methods and Participants**

The Center for the Advancement of Engineering Education (CAEE) is a study funded by the National Science Foundation exploring the experience of undergraduate engineering students with the intended outcome of improving engineering education.<sup>1,2,3</sup> The Academic Pathways Study (APS) is an element of CAEE; the research conducted and described in this paper is an outcome of the APS.

To better capture the common experiences as well as the institutional differences in engineering education, data has been collected at four engineering colleges. Identified by pseudonym, these institutions are Mountain Technical Institute (MT), a small public university specializing in teaching engineering and technology; Oliver University, a private, historically black mid-Atlantic institution; University of West State, a large public university in the Northwest; and University of Coleman, a medium-sized private university on the West Coast. All data for this paper were collected at MT, a small, public STEM institution, located in the Rocky Mountain West.

As part of a longitudinal, multiple-methods study, these data come from semi-structured ethnographic interviews. Interview questions focus on engineering students’ decision-making processes, activities, and objectives. This paper investigates the emergence of engineering identity among first- and second-year students, addressing this APS research question: What personal and institutional factors influence students’ decisions whether to persist in completing a major in engineering?

Using a socio-cultural context from anthropology,<sup>4,5</sup> in other work emerging from the CAEE, Steven, O’Connor, and Garrison (2005)<sup>6</sup> discuss identity as being “double-sided.” Individuals

can self identify in a particular way, “I’m a chemical engineer,” and/or individuals can be identified by others as either belonging or not belonging to a particular group, in this case, engineers in training. The attributes of an institution—an engineering college—and profession—engineering—have bearing on who gravitates toward them. Other people associated with the institution and profession also have bearing on who chooses to enter or not, persist to completion, and practice after graduation. A draft of these findings describing analysis of the first year of the study was presented at the April 2006 American Educational Research Association annual conference.<sup>7</sup>

For this paper, we discuss

- ❑ how students identify themselves and others as engineers-in-training through their descriptions of their student experiences;
- ❑ how students learn to navigate MT, particularly how competition with intellectual peers bolsters or threatens personal identity;
- ❑ how students relate their personal identity to growing disciplinary knowledge
- ❑ what this cultural identity could mean to persistence in engineering.

Data were collected by digitally audio taping interviews ranging from one and one-half to three hours in March or April of 2004 and 2005, when the participants were first- and second-year students. We conducted sixteen interviews each year and have considered analysis of each of those interviews in this paper. Because of attrition and replacement, the total number of interview participants for years one and two is seventeen; the total number of transcripts is thirty-two. Audio files were transcribed into text, and the Microsoft Word files were formatted for coding in ATLAS.ti 5.0, a software program frequently used in qualitative research. Concurrently, researchers at MT and Coleman worked on developing a codebook to use in analysis of transcripts; then, with collaboration of researchers at Oliver University, the codes were compared, refined, and merged into one analytical tool. Development of codes was a time-consuming process; transcripts range in length from about thirty pages to about 100 pages and require from four to eight hours each to read and code.

The code book has eighteen major level and sixty-four sub-field codes. Table One contains codes for how participants discuss their identities and their relationship to engineering school, the engineering profession, and their peers.

**Table 1: APS Codebook Entry for Identity**

Main Category	Sub Categories	General Definition	Definition Notes/Guidelines
<b>Identity (ID)</b>		<b><i>Any instance where there is a reference to an identity (stereotype/characterization).</i></b>	
	ID.peers	Any instance when the informant talks about peer group identity (in general).	
	ID.professional	Any instance when the informant identifies specific characteristics of a profession or of a person practicing a particular profession.	<b>If engineering specific, also double-code as engineering definition [ED] (general or practice)</b>

ID.self	Any instance when the informant reflects upon his or her intellectual dispositions, personality, habits of mind.
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The main category describes a feature of the participants' speech that aligns with an APS research question; the sub-categories identify finer levels of detail within the main category. The general definition indicates instances for when the code should be used, and the notes/guidelines provide clarity for researchers, particularly for instances in which there is overlap between main-category entries. A segment of speech can be multiply coded. Several APS researchers trial-coded sample segments of transcripts and then refined both codes and data-interpretation practices to develop reliability between coders. Then, the transcripts were coded in ATLAS.ti. Coders do not need perfect agreement on codes, and we have not developed reliability scales due to the qualitative nature of this research methodology; informative analysis emerges from discussion of differing perspectives.

Using ATLAS.ti, researchers can generate reports on specific codes, isolating, for example, discussion of identity from one particular participant, each female participant, all participants who are mechanical engineering students, and/or all interviews conducted in a particular year; ATLAS.ti can also search for a recurrent word or phrase. With a set of codes isolated from the larger transcript, researchers read, make comparisons, and begin to follow emerging themes, such as the recurrent discussion of geeks among engineering students at MT.

This paper uses quotations from eleven of the seventeen students interviewed. The names and specific identifying characteristics of all participants have been changed to protect their confidentiality. We chose the title for this paper based on the prevalence among APS participants for self and/or peer identification as geeks. MT students use the terms "geek" and "nerd" interchangeably, and we have followed their example.

### **Conflicted Professional Identity**

Geeks and engineers share many traits in common, according to MT lore, and verified by APS participants and *Wikipedia*, the online encyclopedia. "Geek" describes a person who is good at math and science, possesses highly specialized knowledge in certain fields, and pursues personal practices such as role-playing games, computer games, and reading science fiction. The term often has had a pejorative quality, used to describe a person who is highly intelligent but quirky, odd, and perhaps socially inept. *Wikipedia* even asserts that lack of interest in personal hygiene can be an attribute of geeks.<sup>8</sup> Computers and the Internet are close companions for many geeks, who eagerly await latest releases of software and compare advantages and disadvantages of different generations of programs, or write their own codes if disdain for the original gets the best of them.

Geeks have been marginalized from American culture at large,<sup>8</sup> although jokes about geeks would suggest that they do not mind—or perhaps even notice—their role at the edge of social norms. Strikingly, the infiltration of computers, the Internet, cell-phones, iPods and other forms of high technology into the United States has recently mainstreamed geeks. The specialized knowledge required to design, operate, maintain, and upgrade these tools has made the technically proficient critical to daily life for many Americans. A January 29, 2007, CBS 60

*Minutes* segment entitled “Get Me the Geeks! How Tricky Technology Is Giving Rise to the Geeks” profiled this rise to prominence and included a description of a technology service company known as the “Geek Squad,” which rescues consumers from their high-technology woes.<sup>9</sup> The business model for the “Geek Squad” takes the best of geeks—technological proficiency, specialized knowledge, and intelligence—adopts some of the kitschy familiar—a corporate uniform of white shirts, white socks, and black, clip-on neckties, borrowed straight from NASA—and corrects the worst—employees must observe personal hygiene and be unfailingly civil in dealing with customers who are lost somewhere in cyberspace. Business is good and growing; in 2002 Geek Squad was sold to Best Buy to support its high-tech sales.

Some popular culture watchers maintain that geeky interests have developed broader appeal, citing the widespread popularity of geeky cinematic favorites such as *Lord of the Rings* and *The Matrix*, or a television show *The O.C.* which features a comic-book loving nerd as a main character.<sup>10, 11</sup> However, *Wikipedia* questions whether the embrace of geeky attributes—particularly style elements of clunky glasses frames and hair styles—is but a passing fad within mainstream culture.<sup>8</sup> While geeks might be appreciated for their ability to unravel the mysteries of the latest Windows platform or the new BlackBerry one received as a birthday gift, geeks often remain the butt of popular humor or viewed as in need of sprucing up. An Amazon.com search on “geek chic” in March 2007, yielded 174 books using the term, ranging from novels to quizzes to self-identify as an authentic geek to self-help books for assisting geeks to more socially proficient lives, suggesting that, despite its current cache, authentic geekiness remains marginalized.

Because individuals develop identity in context, if a student enrolls into an institution perceived as having a particular identity, s/he must engage with that identity and ultimately choose whether to accept or reject it as personally relevant and desirable or tolerable. Engineering students, particularly at a STEM-intensive institution, must engage with the broader cultural perception that engineers are geeks; at MT, students often refer to themselves and their peers as “engi-nerds,” so closely is the identity of an engineer tied to being geeky or nerdy. APS data indicate that this process of identification is emergent; first-year students react differently than second-year students to the connection between geeks and engineers. The shift among MT students is to distance themselves from being geeks and possibly from becoming engineers.

## **Results**

In APS, we have learned that many of these undergraduates describe having chosen MT because they are “good at math and science.” Most were in the top ten percent of their high school classes and identify strongly with high GPA’s and past academic success. Recognition that everyone else at MT carries that pedigree is one of the first identity shifts MT matriculants must make. A certain pleasure that they are in the company of other smart people with similar pursuits is a common response. Anxiety is another common response when students recognize that they are no longer at the top of the heap.

Perhaps by choice or circumstance, many MT students were absent from the center of their high-school social networks and may have been isolated to greater or lesser degrees because of their math and science interests or hands-on hobbies, like building trebuchets or robots. Some MT students unwind listening to distinctly offbeat musicians. Some describe choosing to study over

partying, socializing, or relaxing. Gaining knowledge and learning what to do with that information is empowering; being able to apply their knowledge to their interests is a thread through a number of the participants' interviews. A segment of MT students engage in role-playing games like *Dungeons and Dragons*, playing hours of computer games, reading comic books, and watching reruns of each generation of the television program *Star Trek*. Painful shyness and/or introversion are characteristics recurrently described about MT students, and some APS participants describe their peers' questionable personal habits regarding hygiene and attire.

By their own definition and perhaps satisfaction, many of these students are geeks and first-year interviews reveal that students take some pleasure in being surrounded by fellow travelers. Telling certain types of jokes and applying specific disciplinary knowledge to daily life are two ways students self-identify as geeks and/or nerds. Furthermore, at Mountain Tech in the first year of study, it's chic to be a geek. However, the cultural cache of geekiness at MT is not a trend or fashion. Rather, it is the recognition that peers at MT have similar areas of curiosity and engagement, as well as the satisfaction of being enrolled in a public institution with extremely demanding entrance requirements. Discovering that others share their intelligence, interests, abilities, and passions pleases many of MT's first-year students, creating a community that helps define how students engage with the character of the institution and how they identify with or reject the of engineer.

### **Getting Geeky: MT in the First Year**

Because of MT's rigorous admission process and the climate of a STEM-centered curriculum, students tend to be academically focused, disciplined, and hardworking; this quality of our student body mirrors findings in Seymour and Hewitt (1997).<sup>12</sup> Furthermore, students identify themselves and their peers according to these attributes.

*Kids who go here are willing to work harder; [those] who go here are in college to work, not to party, and that's so true with this school. I can't really say engineering students versus other students because there's not other students running around here that I see and stuff. I don't know how the engineering students at other state schools are but the kids who go here go to school to work and, the kids I see on the weekend [elsewhere] go to school to party....And then you could say that the kids who go here, their minds are logic based, and other people's aren't, but I don't know. ((laughs)) Max*

Not only is being serious about academic activities one identifier on MT's campus, students tend to identify their seriousness as being "nerdy" or geeky.

*I think we're all for the most part pretty serious about school, and we're pretty sure we want to be engineers.... So I think personality-wise, we're -- we all realize we're kind of nerds and I think that's pretty cool, that we can like joke about it and have fun with it. Christina*

These self-described geeks, nerds, and dorks are proud of their identity as such:

*I was talking to one of my friends about this; like, whenever we have visitors from other schools, like, if our friends come to visit us or something, we tend to talk more about like our classes, like about Physics and stuff than we do regularly and like, he was saying, "I think it's cause we're proud of the fact that we're nerds, and so we kinda like ((laughs)) like talking about that stuff in front of other people." It's so weird.... We enjoy like those kind of things like, what would be considered dorky or nerdy. Leslie*

Forgoing leisure-time activities to study is one common behavior many MT students share.

*And the people are so nice here too, like you have stuff in common with them you know. It's okay that you don't wanna go out on Friday nights cause you have to study, you know, they understand that. Grace*

This dedication can be a downside to life at MT:

*I was doing homework all through spring break, so it wasn't like it was that much fun. Christina*

Students also report studying over Fall and Thanksgiving Breaks. In addition, MT students routinely describe studying until early morning hours and most weekends.

A love of math and science is a common reason participants at MT describe for their pursuit of engineering. Virtually all of the respondents in the first-year interviews report a love of and facility for math and science as principal reasons for choosing engineering as a major and MT as a college destination.

*I always loved math and science, even watching Bill Nye, the Science Guy ((I: Can you tell me a little bit more about him?)) yeah he, he's just, he's excited about science ((I & R laugh)). It, it's just that when you find others who can look into something and have the same passion as you do it just motivates you that much more. Like um, someone who, when you listen to a song it absolutely blows you away, and you're just like, "Oh!" and then you meet someone else that feel the same way it's just that instant bond. ((I: Right. That connection, or bond, yeah.)) Umm, when you said 'bond' I was like "Chemical bond!" Nooo!" ((R & I laugh)). Anna*

When asked what she likes about math and science, a female participant reflected,

*Problem solving, I guess, logic, the fact that when you're doing, I don't know, you're writing a paper and like the only success is when you're done, you know, "Okay, I'm done," but when you're trying to figure something out, it finally comes to you, there's like a little light bulb, and it's so much more rewarding. Jane*

While most respondents say that math and science skills are instrumental to their enrollment in an engineering school, the relationship between math and science knowledge and engineering practice are not always explicit until after matriculation.

*Honestly, no, I had no idea what engineering was, I was just like, "Okay, math and science school, we got it," and then like somehow that just kind of became synonymous with engineering, with that definition. They're like, "Oh you can be an engineer," I'm like, "Okay, I guess so?" And, I only really got a feel for what I'd be doing [after I arrived] up here. Jane*

Humor is a way MT students share their interest in math and science as well as define themselves as being different from students in other majors. MT's students identify their type of humor as related to their interests in math and science. They also characterize their humor as outside the mainstream of their peers.

*My friends and I, we tell awful math jokes that everyone else outside the school would groan at, but we think they're really fun. Christina*

*Yeah, it's funny oh like here at MT, the kind of jokes that they have here, like uh, "A day without fusion is like a day without sunshine," ((I laughs)); I know, [but] people [here] understand it. Anna*

*I don't think of [being nerdy] as degrading....I guess (.) oh man, I would have to say, first of all, if you laughed at really dumb jokes; like we have this joke about all these functions like  $x$  squared and  $x$  cubed and  $1$  over  $x$  or whatever, they're all hanging out at a party and they like say  $E$  to the  $X$  in the corner and, like all the other functions walk over to them and they're like, "Why don't you come integrate with us?" And he's like, "What difference does it make?" Like no one understands it unless you took calculus, and we all thought it was funny. I think that's one part of being nerdy is like saying stupid jokes like that, but they're funny. And then, I don't know, I guess probably studying a lot but not really, I, I don't know. Like just, just be like, "Yeah, we proved the speed of light today! It was so cool!" you know stuff like that, I mean, things that normally a lot of people don't find very interesting that are like scientific and mathematical; I think that's pretty nerdy, I think that's a nerd right there ((laughs)). Hilary*

Other attributes students give themselves and their peers include being smart, hardworking, and shy.

*A lot of the kids who are just smart, and understand and they just crank out the problems and get it, um, a lot of 'em are pretty introverted, and um, and but by introverts just being really quiet, didn't talk to anybody, just look down at your feet when you walk by a girl and ((laughs)) you know what I mea, ((I laughs)). The, the boys are pretty bad at this school. But, they'll be nice, they'll talk a little bit, they'll look up and be able to smile and at least nod to you when you walk by on the sidewalk.... It's so funny because... some of 'em just, just, just freeze up, you know, they can't even think when you ask them something ((R & I laugh)); they just almost drop their pencil because they can't think of what to say, 'cause they're so scared. Grace*

Within an institution whose members broadly describe themselves as geeks, participants allude to levels of hierarchical differentiation within MT. Some geeks are extreme, even among their

peers. The interviewer asked a follow-up question about other fraternities' perceptions of the participant's fraternity's no-alcohol or tobacco policy:

*I know that [other fraternities] don't like or agree with what we do, with our dry policies and our no tobacco policy and stuff like that. But that's what we do and we get cheaper insurance and it attracts a lot of people. [For fun,] we have foosball tournaments. We get a bunch of people together; this past semester we had sixteen teams, so that's two persons per team, so that's thirty-two people. And then we had a foosball tournament. Gigantic: we took the whole entire day of Saturday, and we blasted rock music, just, just music, and we played foosball, had a tournament all day. Mark*

To deal with stress, MT students describe recreational activities almost quintessentially geeky: listening to music that could never make the Top 40, playing fantasy games, and relishing various generations of *Star Trek*.

*My escape is coffee. When I'm stressed or feeling bummed I'll go to Starbucks and just get a nice coffee, just sit there for a couple hours, enjoying my coffee. And that, that, that's, that's my escape. Well, I guess music could be. I'm a big fan of Weird Al ((laughs)). Nobody else is like him and so it's, he's a very different and very talented guy and nobody really sees that but he really is. Mark*

*I'm drawn most towards uh, to fantasy, science fiction, and uh some action movies, there's some really nice action movies out there. Um I can easily tell you why I like science fiction, Star Trek, Star Wars. [I: Are you a Trekkie? What do you like about that, about Star Trek and that whole series?] Because every episode, if you throw up a flar-, part where um, in the Next Generation, where they always resort to [inaudible] they always have to do something different, they can't use what the books tell them to. Like sometimes they can, but there's always experiences out there where you have to use your own discretion. And I've always thought, "That's really cool. They have a set procedure for most things and then there's a lot of leniency around that." Um, plus there's a lot of technology and it's one big puzzle every time. I like puzzles. That and Deep Space Nine is just cool, so. [I: What do you like about fantasies, fantasy movies?] Fantasy movies, um, it ties into role playing a lot. I like to role play a lot. I do Dungeons and Dragons, online games; it's a break just to try and be something different and see how like good other people are at making believe. Robert*

Surrounded by students with similar interests, passions, and academic pursuits, MT's students embrace the cultural climate with some pleasure and satisfaction. In this way, being a geek and being surrounded by other geeks seems desirable. However, other aspects of life at MT pose challenges to the students' emerging identities as engineers.

### **Institutional Navigation**

Unlike APS participants at other institutions, MT students have little choice in their academic pursuits because of the university's exclusive STEM focus. From their first semester, MT students are immersed in a math and science curriculum: first-and second-year students enroll in Calculus I and II, Differential Equations, Physics I and II, Chemistry I and II, Earth and

Environmental Systems, Engineering Design, Statics, Thermodynamics, technical writing, and begin early-level disciplinary courses in the second semester of the sophomore year.

Among their challenges: adapting to the intensity of a pre-engineering curriculum and learning to adjust their expectations of themselves in relation to their peers. Because they have previously identified themselves by their high grade point averages and high class standings among high school peers, a common adjustment MT students must make is recognizing that not everyone can remain at the top of this new environment. Because all students on this campus are high-achieving, sometimes reevaluating their own position in the academic hierarchy is one of the most personally challenging experiences these students have faced; Seymour and Hewitt (1997)<sup>12</sup> report similar findings in other STEM institutions.

*This school's really ridiculously hard and um, and I know I'm not one of the top students.... I really want to be at the top, that'd be really nice, but realistically I'm not.... Accepting the fact that I'm not gonna be the best ((laughs)) or that I'm, I'm basically average here [is my greatest challenge]. Like it bothers me a little that, and, and at the same time like, I don't know, it makes me almost not even want to try sometimes cause I'm just like, "You know, why does it matter, cause I'm just, you know, I'm not ever gonna be better than you or whatever," but I think that's my hardest problem right now is accepting the fact that I, I'm not the best and, and maybe I can be but I don't, realistically, I don't think it's gonna be, uh, happening for me. Christina*

Another participant described the experience of receiving her first "C" on a test and how she had to come to terms with it; her social network achieved through membership on an MT Varsity Women's team was instrumental in learning to reframe her experience.

*I do like to be pushed I think it's made me a lot better student and I think it's gonna make me a better engineer. (I: When you did get that C, how did you do?) It was the first one ever. It's kind of like frustrating and then, and then I went to varsity practice and it was like I told, you know, the girls in the locker room and they're like, "Yes! But you're still not really an MT student until you fail something, girl," so they kind of like put it in perspective. I was pretty distressed when I first got it back, but then I went to practice and they're like, "Don't worry about it, you can still get an A in the class." Hilary*

Another point of adjustment MT students must make is that some material in certain classes is more accessible than other content. Students describe their ambitious study practices, but someone else often sets the curve and seems to do so easily, without effort. The perception that some students "get" the material easily and quickly is widely described among MT's participant cohort.

*I think it's just neat if somebody is just so brilliant and can, is able to just crank out numbers and see this and see that, and understand that, you know. I mean, oh, I wish I could do that. Grace*

*Others pick up on things quicker than I do and, and they're, they're-, maybe it's just um a characteristic of some of the; everybody seems to be able to explain things a lot better*

*than me. Like I just-, uh, I just get the general concept down, I don't get the in depth part very well-, well I do but I just can't convey it to anybody else, I can't explain it to 'em that, "This is how it works." Christina*

The experience of performing lower than personal expectations can be isolating. Furthermore, the competitive environment and the introverted character of the other students can lead to a sense of loneliness in this difficult environment.

*I talk to my dad about it a lot, too, because he's an engineer and he kinda understands like what it's like to be in a college and studying that stuff and he's like, "You know what, that-, it's hard, like, I'm not gonna lie, the material that you study is hard, and at times you will feel like you're in, a-, inadequate." And so I don't know like, it kind of helps, and it's kind of comforting to understand that, you know, I'm not the only one that probably feels the same way; I'm not the only one that's struggling here, and I think that has a lot to do with it, that sometimes I do feel like I'm the only one struggling because I don't really see it in a lot of people. Christina*

Further analysis of MT's data is necessary to draw conclusions about the relationship between emergent professional identity and institutional navigation. The geeky qualities of intelligence and seeking mastery over specific bodies of knowledge which MT students celebrate in themselves and others can escalate an already heavily competitive environment. Although analysis does not yet provide answers, it is possible that the early joy participants found in being surrounded by other geeks can be negatively tempered by the competitive climate within a STEM institution.

### **Disciplinary Knowledge**

A tendency to apply math and science knowledge outside the classroom characterizes a number of MT participants. Whether sitting at the breakfast table with college peers or remembering the development of a concept for a high-school science fair, these students employ the disciplinary knowledge they acquire to the world around them. Furthermore, they see this practice as setting them apart from other college students/age peers. This attribute, they maintain, makes them geeks.

*We are geeky nerds: we were just-, basically we kinda found a mathematical distribution for crumpled paper; it was crazy. It was fun. We crumpled the paper and measured each ridge length and all that.... It was cool cause then we learned a lot from it.... And I mean, you see me kinda getting excited right now, and I guess that's what I like to do, I mean that's, getting, it's showing people that, what I've been working on is cool.... It's just the, getting riled up about little mathematical and scientific things, I mean like with the crumpled paper. WHO CARES ABOUT CRUMPLED PAPER, right? And we're all getting excited about crumpled paper.... And application of that is huge I mean if you applied it to metals, different type of metals, how they crumple, like um, with cars and their hoods and like how that crumples I mean, if you can find the amount of force that goes into that, then I mean you can make safer cars. For like the armed forces, same type of deal. I mean, where are you gonna get that sturdiness from? I mean that's what we thought was really cool about our project. But I mean it wasn't until after we*

*developed like the nit-picky stuff, and I don't-, I mean, I guess it's (.) you see, I mean you see movies and everything, everyone's showing geeks as just glasses, pocket protectors and all this stuff and (.) I mean I don't know it's just one of those weird terms that you just see people getting excited about simple, like (.) simple stuff that really doesn't really make a diff-, doesn't matter when you first look at it, like crumpled paper. Oh who cares about it? Mathematical equations: who cares? To some extent, I mean, yeah they might bring stuff in the future, but I guess that's what it takes, that, I mean you're not just looking at, "Oh," you're not, they're just not looking at the equation there but they're looking at stuff that can arise from that. Roger*

*We were sitting at breakfast yesterday discussing whether if you put salt on your pineapple, it would decrease the acidity of the pineapple, and we talked-, I mean, we went into strong acids and weak acids and dissociation, and, then we realized it, and we're like, "No, stop, this is breakfast!" So, I think we're all kind of like that, and we realize that too, like we're definitely nerds because we can apply everything we learn to stupid stuff, you know. Christina*

Even though Christina described the breakfast encounter as, "stupid," and Roger rhetorically asked "Who cares?" neither she nor the others who use the nomenclature seem actually to believe that their practices are stupid or irrelevant. These students see their studies, passions, and personal characteristics coming together in a preliminary understanding of what their professional lives could yield.

Analysis of year-one data suggests that MT allows opportunities for students to pursue personal characteristics as a pathway for emerging professional identity. One participant found himself enthralled on a visit for a discipline and chose his major as a result:

*I went to the [working] mine for a tour; it was, it was fantastic; I loved the atmosphere, I loved the people there because they could just stand around, and if there was nothing going on, could stand around and say, "Um, we've got some extra explosives." "I'll be back." ((laughs)) And I loved it because it's like kids in a candy store, because as long as they were blowing up explosives, they were smiling more. It's what they do. They blow stuff up, they get to drill holes. Hhhhh. It was great. I loved it because I could see myself doing that. Robert*

## **The Second Year**

By their second year at Mountain Tech, many students' attitudes toward the geek identity had shifted considerably. While still acknowledging that they possessed geeky or nerdy characteristics and behaviors, students exhibited a marked desire to distance themselves from the "geek" label. Being known merely as a geek, or perceiving oneself exclusively as such, was now distinctly undesirable—more of a stigma than a badge of honor. APS participants wanted to talk about other facets of their personalities—their friends, their recreational interests, their artistic sensibilities. One telltale change in students' relationship to the geek identity is in how they describe it: Some of them refer to it as a "stereotype."

*I'm not saying nerds aren't cool people. It's just that's how you stereotype them: they're always in front of the computer, they're doing this [to] their computer; they're comparing computer parts, computer accessories. When you get into that stuff it's just a little too far for me. I know what a computer is, and I know some components of it. I know some C++, I can write programs. But when you go all out into that, it's kinda: "Ooof, step back, that's too much for me." Roger*

*Coming into MT, [I thought] a MT student, stereotypically, was somebody who sat in their room in front of a computer and did homework all the time. I do a lot of homework and sit at home and do my homework, but I also have to be active a certain amount during the week. On the weekends, I definitely go out and be physical. So I guess I don't fit with the considered stereotype of MT. . . . I'm proud to go to MT, and I'm proud to be considered being smart enough to go to MT and to do engineering and stuff, but I don't find pride in being considered a person who sits in a room and just does nerdy stuff all the time. Kate*

Although Max did not use either “stereotype” or “stigma” in this next quotation, he clearly believed that a geek stereotype exists—and described it in strongly disapproving terms; he needed to distance himself from behaviors that he found extreme, and which he felt himself surrounded by at MT:

*I feel like I'm different from most of the kids at this school. . . it's really hard to talk about this. I feel like I'm different from most of the kids at this school because, I don't know, most of the kids at this school are just so weird. I don't know why. But they're just so weird. Like they just don't have social skills. Or maybe I just haven't gotten to know them. I guess what it comes down to is I feel like I have a bigger picture on what it all means than the kids at this school. Because a lot of the kids at this school, all they do is school. They don't go out; they don't have fun. All they do is school. And I feel like I have a bigger picture — that GPA isn't the hugest thing in your professional life. And I like to have fun. [I: When you say they don't have social skills, what does that mean?] ((sighs)) Kids say, bark out the weirdest things. Walk around like their grandma dressed 'em. ((laughs)) I mean, just in general, you look at somebody and you see and hear 'em, and it just makes you go: What?! Just bizarre things. I mean, kids here say and act and do just weird things. Unexplainable things. . . . It makes 'em seem out of touch with reality. All those kids in high school, when they opened their mouths they probably got shot down or made fun of or something. And here, they're all the same. ((laughs)) So, I mean, I don't know; I think it's weird. Max*

We might consider Max’s comments downright “anti-geek,” but he was not alone among sophomore participants who worked to move themselves away from the geekiness widely described on the MT campus. No other participant spoke as harshly about the geek identity, but the sense of backlash embodied in Max’s statement was indeed shared by most students. The critique simply came out in softer, even apologetic, tones:

*There's definitely a lot of students here who are quote, unquote nerdier than me, [who are] really into some other stuff that we wouldn't really consider normal in the world. I*

*mean, there's the engineering world and there's the — the out-of-engineer world. [laughter]. My whole life I've tried to balance that. I know I've always fit into school. I know I've always been one of the smart kids or whatever, and always studying, stuff like that. So when I was younger I tried to find a balance, just so I wasn't gonna be called a nerd or whatever, or a geek — try to make friends all over the place, in different cliques. ... That was one thing that I noticed in my suite last year. I was able to relate to every one of those kids. There was a basketball player, there was a baseball player. There was a more nerdier — gosh, I hate using that term but it's just — more studying, quiet-type. Then there's more of like the party kid. I was able to relate to like everyone in the suite, which is really cool. Roger*

The concept of “balance” in the preceding quote was widely expressed. Students frequently expressed their desire, and need, to offset study with play. When asked about what she does in her leisure time, Christina responded,

*Oh, I don't know, probably act stupid. . . . there's less pressure for me to act smart [laughs]. [I: When you're not an engineering student?] Yeah, when I'm not in that place — sitting, just hanging out with your friends, watching a movie or whatever. You know, goof around and not take myself too seriously like I have to in school. Christina*

In fact, a desire for balance is widely expressed among MT undergraduates, as earlier analysis of this data has revealed.<sup>13</sup>

*I have nerd qualities, but it depends on what you consider a nerd. I love to study; some people love to build cars, I love to study. [laughs] So I think being a nerd is a prideful thing, but you can't go to the extent that you just don't do anything but study or just watch computers. I think you should get out and live a little. But for some people, that's their life and they don't mind it, you know? They don't know anything different than just staying in their room, eating in front of their computer, and stuff like that. [I: And you know people like that?] Not, not many. I don't really know many. For the most part, most of my friends do stuff outside. And they love to try new things, and they want to go to new restaurants, they want to try new games and stuff. Grace*

Others spoke of the richness of their friendships amongst peers who were willing—or able—to engage in a social way:

*There are such high caliber students at this school it's unbelievable. I know a lot of them might be considered geeky or kind of socially inept. And I don't really hook up with those guys — I don't think those guys really hook up with anybody — but the guys who I have found that are outgoing and friendly guys, and cool guys, are just unbelievable people. Just stellar personalities. It's really cool. I mean I have a really awesome group of friends. Max*

Friendships provided an essential outlet for this student, who described feeling “excited and happy” about her life despite the sometimes overwhelming burdens of the classroom, and the confining lifestyle it imposes:

*I think it has to do with my friends. That's what really pops into my mind. Just knowing that I can call them and talk to them or call them and be like, "Hey, let's go to Starbucks," or, "Hey, what are you doing tonight, let's watch musicals." . . . I guess I just get such a high off of understanding things, seeing how much I've done today, that I can just rocket off of that too. Because, I accomplished so much. . . . I really enjoy my classes; and friends just make your life so much better. Grace*

For another student, friendships with non-engineering students enrolled outside MT served as an important reality check against being too geeky:

*I have a journalism major friend at Dartmouth, and my best buddy from high school is double majoring in German and anthropology at Cornell. [When I] go home, and we'll go to the pool or go have lunch, I'll start saying something and she'll be like: "Hilary, you're doing it again." "I'm doing what?" "You're talking in engineering language." And like, you don't even realize you do it. But you do that. Hilary*

Ultimately, there emerged for many second-year students a line of demarcation between the "geeks" and "non-geeks"—and most APS participants envisioned themselves on the non-geek side of the border. They considered their lives to be more socially rich and more balanced than those of the stereotypical geeks; they rejected identities defined entirely by schoolwork, computers and computer games, and math and science:

*I think there's like two kinds of engineering students. There's really nerdy ones that just don't have very many social skills and just do their homework religiously — and whether they do it [because they] like to learn, or just to get the good grades, or just do it just because they're told to, I don't know. And then there's kids that think for themselves — I guess a little cooler kids. I don't know [if they] talk more, but they're more social. . . . Nerdy kids are not any more smart than the kids who have social [skills] — screw-off kids, I guess. So, yeah, there's two kinds of kids. I definitely do my homework, so I guess I'm a little bit nerdy, but I'm a social kid too, and I kind of screw off a little bit. Michael*

### **Further Analysis Needed**

The findings reported in this paper are based on two years of data. Analysis of subsequent data has just begun and interviews for year four will soon be underway. To gain better understanding of what geek chic actually means for emergent professional identity, several areas of further analysis have begun to crystallize.

- What does this identity mean for satisfaction and intention to continue as an engineering student?
- What does this identity mean for commitment to the profession of engineering?
- Is it enough to be a member of a geeky community to remain committed to engineering or are other communities needed to foster different avenues of identification with the institution?
- How does this social network affect students in their third and fourth years of study?

Some students thrive in this intensely focused academic microclimate; other students begin to wilt given the high doses of certain inputs and complete absence of others. At MT, our next step in data analysis is to develop a clearer picture of how campus culture fails certain students and what that might mean for changing recruiting and retention practices for our campus to improve the quality of personal and educational experience for MT's students.

### **Conclusions and Significance**

Astin, Pascarella and Terenzini, and others report findings indicating the importance of student engagement with an institution and with members of a campus community to the graduation and movement into the workplace for undergraduate students.<sup>14, 15, 16</sup>

Although in the first year geekiness is important to some MT students' satisfaction, others reject being so narrowly channeled. Strikingly, some students who spoke at length about their ambivalence about geekiness are those who have struggled with whether or not to remain engineering students and whether or not to remain at MT. One male participant who distanced himself from geekiness even in his first year of study left MT to pursue his engineering degree at a comprehensive institution. When his last interview took place to collect data on why he left MT, the participant described being thrilled that he could enroll in humanities classes which he had been unable to pursue at MT. His interest in engineering had not wavered, but his concerns about the narrowness of engineering in a STEM-focused institution had.

One female participant who had dropped an important extracurricular activity at the beginning of her junior year so she could study more intensively struggled with depression, a sinking GPA, and increasing doubt that engineering was the right choice for her. When she returned to visit her parents over the holiday break, her engineer father became so concerned about her well-being and degree satisfaction that, after she had returned to MT to begin Spring semester, he called to recommend that she transfer to another institution so she could pursue a teaching degree—even though that meant that he would need to fund at least one additional year in college. After she had made the decision not to continue her engineering degree, this participant re-engaged in her extracurricular activity with a striking outcome: her grades and health improved, as did her interest in her engineering courses. Nevertheless, she has now left MT and engineering—two semesters short of completing her degree—and is pursuing a teaching certificate at a nearby comprehensive institution.

The cultural identity of geekiness in its introversion, intensity of focus, application of specific knowledge reveals something about the students at MT—and other engineering-education institutions. By and large, the high number of credits required in intensely focused areas of study is the norm for undergraduate engineering education. However, this intensity may be preventing students from engaging with other parts of their identities, to the detriment of the students and to the field of engineering. If embracing geeky aspects of oneself in the pursuit of an engineering degree forecloses embracing other aspects of one's identity, possibly some students opt out of engineering; others may avoid ever engaging with the geekiness of engineering, given negative cultural perceptions.

As Engineer of 2020 and contemporary ABET criteria indicate, the future engineer required in the workforce to maintain the United States' technological advantage must engage broadly with

a rapidly changing technological environment.<sup>17, 18</sup> If engineering college forces breadth out of engineering students so as to meet the four-year graduation expectation, it is possible that this quality of engineering education forces out students who could be highly competent practitioners in the engineering field.<sup>13</sup> Allowing engineering students to embrace the curious, intensive, applied qualities of geekiness while making room for them to stretch beyond its narrow disciplinary constraints might well allow engineering-education institutions to improve their retention numbers, even while better meeting the nation's needs for more engineering talent.

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