

## **2006-977: ENGINEERING SCHOOL, LIFE BALANCE, AND THE STUDENT EXPERIENCE**

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# Engineering School, Life Balance, and the Student Experience

## Abstract

Students who pursue engineering undergraduate degrees in Science, Technology, Engineering, and Math-intensive (STEM) institutions experience imbalance unlike most other undergraduates in co-educational institutions. The curricular demands on those enrolled are particularly intense and focused, leaving little opportunity for pursuits aside from studies.<sup>[1]</sup> As engineering education seeks to broaden its enrollment, it becomes important to better understand the student experience. This paper explores the question: What is the role of life balance in satisfaction and persistence of engineering students?

Our data indicate that engineering students have a desire for more balance than their academic environment will allow. If engineering education wants not only to recruit but to retain a larger population, it must find ways to expand its offerings and climate conditions to meet the needs of those who could be good engineering students and practicing engineers if provided the right environment and opportunities to maintain balanced lives in engineering college.

## Introduction

Students who pursue engineering undergraduate degrees in Science, Technology, Engineering, and Math-intensive (STEM) institutions experience imbalance unlike most other undergraduates in co-educational institutions. The curricular demands on those enrolled are particularly intense and focused.<sup>[1]</sup> Students tend to be highly academically oriented and need to be: if a student plans to graduate in four years, there is little opportunity for varying from the prescribed path. The high credit loads per term often range from sixteen to twenty-two hours, and course content is both technical and challenging. This paper explores the question: What is the role of life balance in satisfaction and persistence of engineering students?

The Center for the Advancement of Engineering Education (CAEE) seeks to understand undergraduate engineering students' experiences as they navigate curricula, institutions, and pre-professional expectations. The Academic Pathways Study (APS) component of CAEE focuses on the research goals of understanding and enhancing the engineering student's learning experience.<sup>[2]</sup> APS explores four areas: Skills, Identity, Education, and Workplace; this paper focuses on Education. The research questions guiding our inquiry are

- ❑ How do pre-engineering and engineering students navigate their educations?
- ❑ What elements of students' engineering educations contribute to changes observed in their skills and identity?
- ❑ What do students find difficult and how do they deal with the difficulties they face?

## Methods

APS' Mixed-Methods approach includes surveys, structured and unstructured interviews, performance tasks, and ethnographic observations, as well as examination of academic records

and transcripts. Surveys and interviews provide data on our entire cohort, while ethnography provides a deeper level of information on a subset of subjects. Each tool provides insights to inform the others, allowing generalization of specific findings to a broader population. This paper discusses analysis and findings of year-one data for which participants were first-year students. All discussion refers to Mountain Technical Institute (MT), a name we have chosen to represent a small, state-funded STEM institution. For this paper, we have analyzed data from online surveys, ethnographic interviews, and academic transcripts.

## Participants

All data were collected during Academic Year 2003-2004, during the participants' first year in college. In 2003-2004, MT had 2,667 undergraduates, of which 23.4 percent were women, and 14.17 percent, ethnic minorities; the incoming first-year class was 750 students. At MT, we conducted a variety of recruitment activities to complete our sample.<sup>[3]</sup> To be eligible for APS, MT participants had to be May/June 2003 high-school graduates, eighteen or older by October 1, 2003, and U.S. citizens/permanent residents. We also required that students were enrolled in or had the intention to enroll in an ABET-accredited engineering major. Nineteen females and twenty-one males comprised the sample. This paper discusses thirty-nine participants' data; one male did not complete one of the online surveys to provide a complete data set across methods. Qualitative data come from semi-structured ethnographic interviews conducted with sixteen participants in March and April of 2004; the interview questions focus on students' decision-making processes and activities related to their choice to enroll in engineering college. Quantitative data come from online surveys, which all thirty-nine completed in Spring 2004. Participants answered questions describing their activities and objectives as engineering students.<sup>[4]</sup>

## Results and Analysis: Quantitative Findings

Four items in the quantitative survey address the issue of balance between schoolwork and personal time. These items are presented in Table 1, along with the frequency of responses, percent of responses, mean, and standard deviation for each.

Table 1. Quantitative Survey Items Addressing Balance and Stress

How often have you ...	0 Never (%)	1 Rarely (%)	2 Occasionally (%)	3 Frequently (%)	Mean (St. Dev.)
1. Worried about keeping up with your schoolwork?	0 (0)	4 (10.3)	13 (33.3)	22 (56.4)	2.46 (.68)
2. Felt stressed?	0 (0)	4 (10.3)	21 (53.8)	14 (35.9)	2.26 (.64)
3. Felt you did not have enough time to pursue non-academic activities?	1 (2.6)	7 (17.9)	21 (53.8)	10 (25.6)	2.03 (.74)
4. Felt you did not have a "social life?"	5 (12.8)	14 (35.9)	16 (41.0)	4 (10.3)	1.49 (.85)

Note: N = 39

These data reveal that in Item One all of the surveyed students at MT reported feeling some amount of concern about keeping up with schoolwork. In particular, a majority of students (56.4 percent) indicated frequent concern about keeping up with schoolwork, the highest response value available to them in the survey. Similarly, responses to Item Two reveal that all of the surveyed students reported feeling some level of stress; nearly thirty-six percent of the students reported feeling frequently stressed, the response option indicating the greatest amount of stress. Note that no student reported a complete lack of worry about keeping up with schoolwork, nor did any student indicate an absence of stress.

In Item Three, all but one student indicated some lack of time for pursuing non-academic activities; a full twenty-five percent of students reported frequently feeling unable to pursue non-academic activities due to a lack of time. Finally, data from Item Four reveal that ten percent of the students reported feeling frequently that they did not have a social life, while another forty-one percent reported occasionally feeling this way. Thus, these data reflect a population that frequently is worried about coursework, often is stressed, often sacrifices non-academic pursuits for academic ones, and has a tendency to feel shut off from social interaction.

Interestingly, these four balance items are not significantly correlated with either overall satisfaction with the institution or the decision to study engineering in the coming year. Thus, this level of imbalance and stress does not appear to be directly related to persistence. However, Item Four was found to have a significant correlation with a change in interest in studying engineering over time ( $r = -.35, p < .031$ ). This correlation indicates that the more students felt as if they had social lives, the more likely they were to report their interest in studying engineering had increased since starting college at MT. Taken together, these data suggest that, while these students often have felt overworked and stressed, those who managed to maintain a social life, a key element of balance, are also the individuals who are most likely to thrive academically, in spite of the stress. Perhaps balanced students are also students with a greater interest in engineering.

### **Qualitative Findings**

APS qualitative data indicate that MT students have a desire for more balance than their academic environment will allow. Analysis of first-year data indicates that

- ❑ engineering studies at MT attract a certain type of student, whether male or female;
- ❑ women are largely happier than men in their pursuits;
- ❑ women seem to work harder at maintaining balance.

Our analysis also indicates that it is not easy to be a balanced STEM student: engineering school is an imbalanced environment, given the emphasis on math and science curricula and heavy homework expectations. Despite MT's STEM focus, the problem is not unique to this campus; engineering students at institutions with broader offerings report similar experiences. This lack of balance may be an inhibitor of engineering-education's efforts to broaden and deepen its ranks. <sup>[5]</sup>

According to our qualitative data, the institutional imbalance is somewhat mirrored by the focused, hardworking people who choose to matriculate to MT.

One participant reflected that, as a high-school senior,

“I would consider myself as almost a part time student....I had class ‘til 11 every day, and then I’d go work from noon to five, or noon to six....I didn’t take any music or foreign language my senior year, and I didn’t take any PE classes, I didn’t take any fluff classes at all, ‘cause...I thought I could spend my time more wisely making money and getting work experience than taking pointless classes in school....I want book smarts. I want to learn a lot of logic based and common sense, too. I just want to be a really smart person ((laughs)) that’s what I look forward to is just becoming smart.” *male*

Other students reflect on their experiences with peers at MT and the sort of students they encounter on the campus.

“Oh there’s just not that big of a variety of people here, and that’s just what it comes down to....It’s not that big of a deal....You could say that the kids who go here, their minds are logic based, and other people’s aren’t.” *male*

“Sometimes in a place like this it’s harder [to have right-brained interests] because you meet a lot of left-brained people.” *female*

“There aren’t any non-engineering students. Well there’s a couple but they’re mostly upperclassmen and it’s kinda hard, you know because they’re not where you are so, contact is limited.” *male*

“I can do the math; I can do everything....I’m way ahead of the curve on [everyone] else, so I’m pretty good at it....Talking about classes: I would much rather take a PE class than take an extra math class. Especially since there’s a lot of kids here that have never run a mile in their life; they just come. [If you’ve ever participated in sports] you’re the best at every sport.” *male*

### **Culture of Difficulty: In the Garden Amongst the Weeds**

As with other engineering institutions, a strong culture of difficulty exists at MT, having a powerful effect on students’ experiences.<sup>[5]</sup> One female participant noted, “This school’s really ridiculously hard.” The perception that MT is an extremely difficult learning environment exists apart from notions about the institution’s rigor. Students are proud that MT is rigorous and that they have the skills, work ethic, and intelligence to be successful in an environment of high expectations. However, MT’s difficulty is not a source of pride, but rather of anxiety, defeat, depression, and hopelessness. Difficulty is an enemy of balance, and all MT’s students feel the effect.

Research into learning indicates that learners perform best in conditions in which difficulty can be managed; new information and/or tasks should be presented just beyond a student's present capacity, making her/him stretch to acquire the new ability or knowledge. If material is presented at a too-rapid pace or at a level that is significantly beyond the student's ability, s/he can become overwhelmed and frustrated; students struggle to gain mastery in such a teaching and learning environment. Additionally, the student's emotional reaction to the difficulty further complicates her/his ability to gain mastery over the new knowledge. <sup>[6]</sup> Students who feel frustrated or defeated by their learning experiences do not gain mastery over new material.

MT students repeatedly describe circumstances of unmanageable difficulty. A strong perception that courses are designed to "weed" students out permeates the campus. Physics, Calculus, and Chemistry are frequently described as "weeder" classes, designed to cull out students unable to meet the demands of a MT education. A number of campus experiences are described as "make or break." Nor is MT alone among STEM institutions in having a weeder mentality; STEM education traditionally has prided itself on a practice of getting rid of those "unworthy" of a scientific, technical, or education pedigree. <sup>[5]</sup> If the students were not highly internally motivated, hard working, and dedicated, the learning environment could be catastrophic. As it is, the difficulty exacts a high toll on student morale as they worry about their own performance and that of their peers.

In describing an engineering design course a student reflected:

"That kind of scares me that a guy in charge of a group of engineers would not ask them to do that [design a space-weather station for \$100]. He woulda allocated more money, just to do the same thing. And I can understand that there's a lot of groups going through, and they have to pay for the data processing equipment but it's kind of depressing that we're doing things that most engineers wouldn't do or in their right minds get around to." *male*

Other students observe

"The amount of material that each professor gives you in such a short period of time, (because in order to graduate in four years at MT, you have to take a whole bunch of credit hours every single semester,) I mean, it's ridiculous....I like to understand everything...even though it's not related to my major. I mean I don't mind learning something extra that might come in useful no matter where I am, so it doesn't bother me any but just how much the professors give you. And you don't have enough time usually to cover all of your information that they're giving you, if you want to stay caught up in all of your other classes, too. So that's the hardest part for me. *female*

"After the first year, year and a-half, your classes start to mellow out a little bit. Like the weeder courses are done with." *female*

"And that's one thing that bugs me. And I know this school is very difficult for a lot of people here, and I can see that. Because I mean, that's where I see that this

school is a good school...[Before I enrolled at MT, I'd taken] nearly three semester's worth of calculus. And that first semester here, which is supposed to be easy... I was expecting to breeze through that like all A's on everything. I struggled to get an A. I didn't have a good teacher, but I was still able to pull out that A. For someone else who had never taken calculus before, I'd be sitting there, 'How would you do that? How could you come to this school with no previous knowledge of calculus and learn it?' And I was saying, 'Okay, that is why people are failing out of MT.' And I saw, the classes are hard here...If I'd taken that much calculus and when math is my strong point, if I'd done all of that before and I know what I'm doing, and I struggled to like get a 90-, a barely an A, then what must the other people be going through? How would they be feeling right now? And it's like, 'Wow, no wonder so many people fail out.'" *male*

"I try and find as many upperclassmen as I can to talk to. That's one thing, they keep 'em so separated. It's like, we've gotta wait until we've finished weeding out all the freshmen that don't belong here, and then we'll introduce them to the other, the other levels, the other grades." *female*

"I'm not a person who likes to kick people out, and I think everyone should get an equal opportunity....If they're in this school, that means they deserve to be here. But maybe, just maybe they don't deserve to be here, I mean, I'm struggling saying this, just because it's just something that I don't know. I've got a good friend up here who's really struggling with stuff; I don't want to say he doesn't belong here, just 'cause he's a good person and everything. He's smart, he's got potential, but this is a hard school and just maybe this isn't where he belongs. I mean, do you see what I mean? I think that schools reject people for a reason, and I definitely don't like the feeling of being rejected." *male*

"It's kind of comforting to understand that 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." *female*

Other studies have described the almost mythical notion of difficulty in STEM education and how those demands require foregoing other aspects of one's life, i.e. balance. <sup>[3]</sup> Changing pedagogic practices to maintain rigor but tame difficulty could go far in improving students' experiences, diversify enrollment, and benefit persistence, as well. Furthermore, because quantitative data indicate that students who feel they "have a social life" have an increased interest in studying engineering, providing an academic environment which fosters social interaction and other forms of balance could be fruitful in enhancing engineering students' experiences.

### **MT's Students' Interests**

Students demonstrate a wide range of interests: mountain-biking, playing soccer, swim-team diving, volunteering in public-school programs, repairing discarded medical equipment for use in

underdeveloped countries, trebuchet building, teaching children tennis, and practicing digital photography, for starters. It is critical to note that broad interests are not indicators of distracted students with poor academic performance; the students who speak most passionately and repeatedly about balance possess some of the highest GPA's in our study. Among the eight students who are observed through ethnography, after their first year at MT, all four of the women were on the Dean's List. One of the four men had a GPA, 2.9, that was below 3.0; one of the men was on the Dean's List, with a 3.7 GPA.

One female, a 3.7 GPA Dean's-List student, embodies a (dizzying) breadth of interest and frequently describes her need for greater balance than her academic pursuits at MT will permit:

“Right now I'm in the five year physics program where I'll get a bachelor's degree, a master's degree, and then I'll get two minors; I'll get one in public affairs...and one in biological engineering....After I get my engineering degree and my physics and that stuff is solid for me....I would like to also do that for psychology and biology and art, but I also think that I can do a lot of self-work on that and stay on the base that I already have in physics. If I go to a specialized area for biology and physics, maybe instead of doing just biology in general, I will be able to generalize it to a certain thing, but I'm not sure how degrees work for that...I've heard about companies sending their employees to school to learn about certain things so they can apply it to their field and, to me that's what works for me, but in either case, I still want to go into the biology thing;...genetics is another thing that I just would love to work with and go into and (.) I think I just [need] to try to find...some kind of a career application....But what I don't like though: I couldn't spend my life at a computer.” *female*

### **Why Balance Matters**

Students describe the importance of the activities they pursue to maintain a whole self. Balance helps them be better students and happier people. Making choices about balance is not unique to engineering undergraduates; the need for a comfortable and achievable mix of work, leisure, challenge, pleasure, and social connections is a common refrain in most Americans' daily lives. In contemporary professional understanding, William Sullivan notes, “The demands and stresses of highly competitive work are expected to be balanced or at least relieved in the intimate realm of personal life.” This expectation of balance takes the form of desire for meaningful personal relationships with friends, significant others, and offspring, as well as interesting pursuits not related to professional activities.<sup>[7]</sup>

Other studies into engineering education indicate a forced narrowing of interests may be a problem for retention in engineering colleges.<sup>[8]</sup> Some students experiment with finding an appropriate mix early in their academic careers.

“I coulda gotten straight A's in junior high, but I just knew it didn't matter. I knew I was smart enough; I just didn't want to because I'd rather mess around and not pay attention at school and just have fun. Then freshman year I was like, ‘Shoot, I gotta go to college,’ ((laughs)) and then I just buckled down. I buckled



down too tightly freshman year. Oh I was [really] a nerd. Like girls would like me, and I'd be like, 'Nope,' I would shut 'em down: 'I gotta go do some homework.' I've eased up a lot. I [like] having fun but I have to get my priorities straight and do my schoolwork, too. I have pretty good grades here; I've got a 3.6.... This semester I'm taking 19 and next semester, I'm taking 21.... Well, it's really only 18 because I'm taking a music theory class that puts it over into 21. We have to take a liberal arts class through here, and so that's one of the liberal arts classes that I'm choosing, and music theory's really easy for me. I like [it]; it'll be nothing." *male*

MT students describe various, ongoing efforts to keep balance, given the demands of their curricular expectations.

"It would be really easy just to be too focused on school.... I've realized that a 4.0 really doesn't mean anything; you can still do good in school, you can get a 3.5 and be involved in all these other activities. Those activities are gonna make you a lot better of a person than just by having a 4.0 and nobody's gonna ask you 10 years from now what your GPA in college was; it's not that important.... If you're just going in with a 4.0, but you don't have any activities to back that up, they're not [going to] see you [as] very beneficial to the work environment." *female*

"For next year, I've scheduled that I have a class at 9, I have a gym class at 10, and the other class at 11, and then lunch. For me, I mean, that's like perfect. You learn some, you get out, move around, you learn some more and go back ... get some lunch, come back and hit the books again." *male*

"I might've done some more playing the first part of the semester because last semester I was like, 'I have to get on top of things immediately!' And this semester's more like, 'Well, I need to have fun, too,' and I think I worked a lot more than I maybe should've the first part of last semester, didn't have as much fun as I should have." *female*

"I can do the math, I can do everything... but like, when it comes to Friday night, what I'm gonna want to do? It's not math!" *male*

"I wish this school had more going on than just everyone taking the same classes doing the same homework; it's kind of boring, and I wish I could sit down with someone and be like, 'Dude, have you done the physics assignment,' and they'd be like 'What are you talking about? I'm a government major!' or something like that. I wish there [were] more things going on, but everyone does the exact same problems every day. [That] gets a little old." *male*

The work does take so much time and like trying to balance my social life and my other activities with my school work cause I still have that drive to do the best that I can do and that takes a lot of time, but I still want to be involved in other things

and so [I'm] finding that balance and trying to figure out what's important for me." *female*

"And you know, afternoons or whatever, that's the usual thing, sometimes go out, hike up the creek or something. Every now and then, you have that burning desire to get *out* and do something. I like leaving an afternoon free to sort of do that. [That outlet]...it's critical, like in the winter. For a couple weeks last winter we had a lot of snow and stuff, and pretty much you were locked up inside and it's like, yeah you can start out spending a lot of that time, you know, "Ooh, yeah, I've got lots of time to study, learn, get all of this stuff out of the way," and then you slowly go stir-crazy. And after about a week of that, you can't concentrate on anything. So, I don't know, personally I have to have the outlet. But I guess that's sort of, a lot of that is from my past, I was in Boy Scouts for years and years so, I'm used to spending a lot of time in the outdoors, a lot of time doing physical activity." *male*

MT students recognize that there are whole-life issues and career factors associated with achieving personal and professional balance:

"I always think about my aunt because she is a real people person, and she's just an awesome lady. She graduated with science or computer-programming, something...But she got hired so much quicker, and she was at the top of a chain by her first year out of college because she can explain and talk to people. And she can solve these things that she actually understands and that she has made, but she can talk to the people not in this computer science talk. She can talk to them normally and explain why this works and why this is better than this one...I wouldn't be satisfied with just cranking out numbers all day long, or programming computers, you know? I would want the interaction between other people." *female*

"If I had a job that I didn't like, the way my personality is, I would not be there for long ((laughs)) just because...I figure having a good time and enjoying my life is more important than racking up zeros in some invisible checking account." *male*

"If I had kids, I would want to stay home with them...like my mom was for me... I think that it'd be nice to have kids, but I also think that if I did, I couldn't do what I want to do as far as my career goes. I don't care about the career itself; it's just what I want to be able to do in it...I don't want it to be like ...'I'm working towards *this* career, I'm working towards *this* grade.'" It's not about those things for me. It's a little deeper than that." *female*

### **Lengths Students Will Go to Have Balance**

Our qualitative data demonstrate that students pursue a broad range of interests to find and maintain balance. Intense activity is a release for three of the female participants. One is a

varsity ski-team member who completed her first year of study with a 3.2 GPA; another is a varsity swimmer who completed her first year of study with a 3.9 GPA; a third, active in a demanding club team that practices four nights a week, completed her first year of study with a 2.6 GPA. For each of these participants, the discipline of their activities, regularity of practice, competition/performance, and social network provided from other teammates are important factors in their ability to maintain their heavy course loads.

“Our [swim] coach is really great, the girls on our team are awesome; we’re really close. And I think it helps me; I think it helps me be better in school, because if I have practice in the afternoon and stuff, I know I have to get it done. Now that I don’t have swimming each day, [I procrastinate, thinking] ‘Oh, I only have an hour and a half of workout practice, well I can do it later,’ whereas if I have swimming, I have to do it then and there....[Swim team] teaches a lot of lessons that you don’t necessarily get in school. It teaches a lot of teamwork and self-discipline and motivation and it’s kinda taught me that hard work really does pay off all the time, not just some of the time.” *female*

“I can keep up, but I don’t think I know the material as well as I should because I have so many classes. I think it’s mainly challenging because of ski team. ...But I don’t think I could’ve made it through the semester with the amount of work if I didn’t have my release, which is skiing....It’s just a great group of people to go hang out with on the weekend. It’s like you leave on Friday afternoon, and school is out of mind, out of sight; everything is just gone. You just have fun all weekend, and you know it’s, I should be studying during that time but it helps me relax and calm down. And then when I come back on Sunday night, I can re-gather and start over clean, which makes it a lot easier to stay focused.” *female*

A “typical day is about five hours of class; [it] either starts at 8 or 9, but I get done pretty early; I’d say 3 is usually the latest. After that I probably study for awhile and then, I have dance four nights a week; I have dance practice from 9 to 11 [p.m. Monday through Thursday]....It’s a club so it’s really nothing much to this school but it’s a lot to me. It’s something to do; something to take your mind off [school] especially after a test, ‘cause tests usually go until 8:30 or 9 [p.m.] and that’s about the time that dance starts. So right after a test, I can just go out and take it out and exercise. It’s great....I’ve been dancing since I was seven, and I really like it. There’s just some feeling that you can get on stage even if there’s no one there. It’s really nice. I love that feeling....When I came here I didn’t think they had a dance team, so I was pretty, pretty bummed, and I didn’t know what I was gonna do. I was gonna find a dance studio and take dance classes there, but it was really awesome that they have a dance team here. I really like the team.” *female*

Leaving campus for a different environment is a release for two of the males: interestingly enough, each of them, independently, seeks the much more diverse academic and social environment of another university within an hour’s drive of MT.

“I have not been entirely pleased with the social atmosphere. Actually I haven’t really been pleased at all with the social atmosphere here. There isn’t really one. ...I wouldn’t consider kids at this school to be that incredibly social because they’re here to work. They’re not here to party; they’re here to work, and it reflects. I think that’s why I leave every weekend, you know, I leave and I go hang out with my friends from high school and stuff. I don’t feel like I’m incredibly bored and never get to go out and have fun, because I do it. I leave.”  
*male*

“Off campus I’ve got a bunch of friends who are into all kinds of different things. That really helps me out, it keeps me sane, you know. Whenever things get a little too concrete around here, I can drive up to Northern State and go to their little campus coffee shop and discuss politics or whatever. I think it personally helps me because I have a different perspective. I can sort of see the other side of issues.” *male*

A female participant, determined to pursue fine art—for which she has received national recognition—squeezes her co-curricular interests into marginal hours.

“I have the passion for [art], and then next semester, I’m gonna take oil painting from 4 to 7, [on Friday nights]. I found a class online; they actually offer it here, so I was running in circles, jumping around and I was just, I was so excited for it.”  
*female*

In contrast, one male participant “balances” by prioritizing which classes he will or will not attend, especially in light of the prescribed course offerings for first- and second-year students.

“Your course selections are pretty laid for you if you know what your major is....One of the things that I really looked into was balancing my [Fall and Spring] schedule properly....Next semester is filled with a lot of non-engineering classes; I’ve got [an interdisciplinary core course]; I’ve got economics, all those. And my thinking as far as that is, I’m not really motivated in those classes. But I’m more motivated for learning in the Fall semester, so I figure, I take ‘em then; that way I have the most motivation that I can ((laughs)) because I know that if I’m taking Economics spring semester, it’s like, ‘Do I really want to go to Econ today? Hmm.’” *male*

### **Implications for Engineering Education**

Given the widespread and repeated calls to expand the ranks of engineers in the United States, it is important for engineering education to pay attention to research findings that suggest trouble spots. Our data indicate that MT students desire greater balance than their academic environment will allow. Other institutions must examine their own cultures to determine if these findings are applicable to engineering colleges as a whole. If engineering wants to recruit and retain a larger population, it must find ways to expand its offerings and climate conditions for students who could be interested in engineering if the environment met their interests and needs.

Our next step will be to further investigate studies of college students not enrolled in STEM disciplines to develop better understanding of how balance affects undergraduate populations generally. With an improved understanding of the role of balance in the success and satisfaction of undergraduates, we will better be able to place APS research in a useful context as part of potential reform within engineering education.

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