The California Tech

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The Strawman Core Proposal in a Nutshell

By Tina Ding and Sarah Marzen

Staff Writers

Introduction from The Editor:

These pieces continue *The Tech*'s series on the Core Curriculum Task Force (CCTF) proposal to revise core. The December issue examined the philosophy behind the new core; this issue considers the strawman proposal.

We understand that the proposal is just that, a strawman, but Core is not going to be changed by a proclaimation of a new philosophy alone. Ultimately, courses will have to be striken, changed, and replaced.

Thus, the devil is in these details concerning implementation. Well-worded educational philosophies can win the hearts and minds of students, but even the best-laid philosophies will go to waste without effective implementations.

Additionally, feedback on this draft proposal, we hope, will help CCTF formulate a better second draft.

Frosh Fall	Winter	Spring
Freshmen Seminar	Freshmen Humanity	Freshmen Humanity
Mechanics	E&M	E&M / Modern Physics
Intro. Chemistry	Chem. Menu	
	Intro. Biology	Biology Menu
Multi-variable Calculus	Linear Algebra	Differential Equations
Programming		Breadth Menu
Sophmore Fall	Winter	Spring
Lab & Data Analysis	Lab & Data Analysis	Design & Build Lab
Prob. & Statistics		Algorithms
HSS	HSS	HSS

Multiple Paths

"Indeed, we believe that flexibility and choice at as many junctures as possible – instead of prescribed classes and few options – is an excellent way in which to improve the student experience. If multiple paths through the core exist, a student need not feel oppressed by any particular required aspect of the program." -- preliminary report

"The idea that everyone taking the same classes is fine is ludicrous. Maybe this made sense 50 years ago," said Mike Brown, Core Committee co-chair.

At the heart of the new Core is the possible implementation of multiple paths in all levels of all Core subjects to fit students' various backgrounds rather than the current more monolithic curriculum. While currently only 2-3 terms of physics and math have paths, Analytical and Practical, under the Core proposal, much more than two paths will be available in every Core class in Physics, Math, Chemistry, Biology, and the new class Algorithm.

The proposal argues that the current Core hurts the student education because it forces the student to struggle in a class that is more advanced than one's level of preparation. According to the proposal, although breadth over all aspect of science is important, "the manner in which these are acquired should be considerably more flexible and tuned for the range of abilities of the Caltech undergraduates."

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Pass-Fail

"In addition to the specific course requirements discussed above, we have considered the effects of the first two terms of P/F for incoming freshmen and recommend removing P/F for the second term." -- preliminary report

About 30 years ago, pass fail changed from being the first three terms to the first two. In 2011, we may see it step down once again as this idea is presented in the CCTF proposal and is closely tied to the creation of multiple paths. Because multiple paths will create more suitable classes for students, the proposal argues that there is no more need for pass fail's previous purpose of allowing students from different background to catch up to each other in a stress-free setting. According to the proposal, multiple paths should ensure that students will not be oppressed by the Core, and thus pass/fail is not longer needed for that purpose.

"By offering courses at an appropriate level and requiring that they are to be taken for grades, I think we can increase learning significantly while often decreasing stress and increasing happiness," said Niles Pierce, faculty member in CCFT.

Furthermore, one of the arguments against pass fail is that it allows for bad teaching. Mike Brown argued at the town hall meeting that professors that teach pass/fail classes teach badly or assign unreasonable amounts of work under the cushion that it is pass/fail, since everyone

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Physics

"The current core physics strawman requirements consist of one term of classical mechanics, one and one half terms of electricity and magnetism, and a one half term survey of modern physics (i.e., twentieth century physics).... The survey of modern physics will include brief introductions to quantum mechanics, special relativity, nuclear physics, and selected other aspects of twentieth century physics." -- preliminary report

Caltech's physics core requirements are currently among the most stringent in the nation. Even Caltech humanities majors must take five terms of physics.

The strawman proposal for this new Core cuts physics requirements down to three terms, part of the broader philosophy of "renormalizing Core requirements." Explicitly, Ph2ab (waves, quantum mechanics, and statistical mechanics) is cut from physics Core and an introduction to "mind-bending" cwoncepts of twentieth century physics is squished into the last half of Ph1c in the strawman proposal.

Some professors and students are concerned about the new version of Ph1c, which is a half-term of electricity and magnetism and a half-term of twentieth century physics. "If we don't need Ph2ab-- which is fine by me, that is a faculty decision-- then it means that we don't need quantum mechanics, not that we squish it onto Ph1c," said Professor

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Math

"The proposed math requirements... resemble the current core but with the deletion of the current version of Math 1a, which is a proof-based single-variable calculus class." -- preliminary report

Ma1a is notorious for its difficult problem sets and emphasis on proof techniques. For many Caltech freshmen, rigorous mathematical proofs are a radical departure from the techniques used in high school math courses.

Prior to the town hall discussion, almost all CCTF members were in favor of getting rid of Ma1a because it added unnecessary stress to the student courseload, said CCTF student member Neal Bansal. More specifically, opponents of Ma1a often argue that Ma1a doesn't accomplish its dual goals-- to introduce students to proof-based math or to strengthen single variable calculus skills-- efficiently. One anonymous student said that he did well in Ma1a not by learning, but by taking solutions to example problems in the textbook and modifying them slightly for homework and tests.

"I wouldn't be surprised if the committee heard more complaints from students about this one course than all other courses combined. I met with students who begged that it be eliminated, and others insisted that it come later than a student's first term," said CCTF Co-Chair Scott Fraser wrote in an email. "Interestingly, the proposal to drop it from the core brought

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New Courses

"We propose that biology, as one of the foundations of the core, receive more emphasis than in the current core... Every Caltech student should have basic programming skills... The proposed algorithms requirement will introduce Caltech undergraduates to the analysis, implementation and application of algorithms..." -- preliminary report

In addition to the major changes to the current Core courses, there will be brand new requirements: Algorithms, Frosh Seminar, Design and Build Lab, Bio menu, Breadth Menu, and a required programming course. All these courses were met with support at the town hall meeting as the majority of the students gave thumbs up in support. Algorithm was added based on arguments that the curriculum does not reflect the current state of science.

"There's theoretical science, experimental science, and then there's computational science-- this is not reflected in Core at all," said Brown.

In addition, there were also modifications to lab requirements. Ch3a, which carries of a reputation of tedious lab reports and work, will no longer be required. Students will still be required to take two terms of data analysis labs, just not restrictive to Ch3a.

"I don't have any concerns about the contents of the new courses, but there is the general concern that there will not

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Humanities & Pass-Fail

"It is an all too common story among the hum faculty that students will find the minimum line for passing, and then do just enough to stay above it with no further effort or improvement. We therefore recommend that the institute abolish P/F grading for required advanced hums as well as for the frosh hums." -- preliminary report

"Caltech students might not like it, but writing is so important," said CCTF member Neal Bansal to the changes in humanity requirements to rid the pass/fail option in humanity classes and reduce 12 required courses down to 10.

With science and engineering courses being top priorities and perhaps the only priorities to Caltech students, writing a 6-8 page hum paper is often seen as gruesome and dreadful. The call for the need for more serious writing and humanity courses roots from the alumni surveys in which alumni said they wished they had taken more writing and taken them seriously because the courses proved to be unexpectedly valuable, especially when their career paths took them into non-academic settings.

According to the CCTF report, one graduate from the period 1999-2003 noted, "Ironically, many of my electives (economics, law, history, literature, business, Japanese, electrical engineering, and computer science) turned out to have a far more lasting impact on my life than

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In This Issue

The More Things Change...

By Travis Scholten
UNDERGRADUATE

At the Core Curriculum Task Force presentation in December, Professor Mike Brown emphasized the importance of a reform in the philosophy of the Core. According to Brown, "As faculty we are a little worried that students that graduate have been exposed to lots of concepts but don't understand them, and that's actually worse." This quote, taken in the context of speaking about the current Core requirements, is quite understandable, and indeed, is very easy to agree with.

However, after considering the suggestions and proposed reforms that the CCTF have suggested, Professor Brown's quote is equally applicable. How can it be that the elimination of a math and other science courses and the implementation of a programming class, an algorithms class, a freshman seminar, a design lab, and another biology course is part of any attempt to ensure that students graduate with a solid understanding of the sciences? In fact, such an attempt would seem counterproductive, as it compromises an understanding of the foundations of science in favor of having students learn a little bit in the other sciences. That is to say, under the proposed changes to the philosophy of Core (The CCTF's "content and breadth" philosophy), students could very possibly leave Caltech with a less comprehensive understanding of science than under the current Core.

> "[A]ny changes to the Core should relieve some of the pressure students feel due to their workload. The CCTF proposals do not. Instead, they add further requirements and additional classes, all without actually adjusting the course load here at Caltech."

Moreover, these proposed changes do nothing to address the issue of the workload at Caltech (the so-called "Caltech Syndrome"). According to the Student Experience Conference Report, "A sign that the Core may be the culprit [of Caltech Syndrome] is that many students find that (the) workload improves significantly after Core." Under the CCTF recommendations, the Core still consists of 5 classes each term, which is in and of itself a major source of stress and frustration for students – especially in the area of problem sets. As the SEC Report points out, "They [students] will often triage select material to learn in order to complete problem set as quickly as possible and not fall behind in other work." Therefore, any changes to the Core should relieve some of the pressure students feel due to their workload. The CCTF proposals do not. Instead, they add further requirements and additional classes, all without actually adjusting the course load here at Caltech. (Perhaps a switch to four classes each term would be beneficial…?)

While the SEC Report has done a good job of identifying areas of improvement in terms of academics at Caltech, and while the CCTF has attempted to address some of these issues, the proposed changes do not reflect a significant departure from the philosophical status quo, as far as Core is concerned. As the old saying goes, "The more things change, the more they're the same."

First Term Sleep Deprivation and Second Term Resolutions

By Yang Hu
UNDERGRADUATE

At Caltech, all freshmen undergraduates are given two terms of pass/fail, a no-grades system that allows students to experiment with their habits and to adjust to college life. By the end of first term, I was convinced that life at Caltech is not only about learning science but also about coping with chronic sleep deprivation.

Expecting to be on top of things, I came to Caltech planning to get to bed at 10pm and start my day at 7am. I was a strict believer of Ben Franklin's quote, "early to bed, early to rise, makes a man healthy, wealthy, and wise."

Perhaps, I was a bit too optimistic. Perhaps, I only thought I was a strict believer. Regardless, every effort of getting to bed early was thwarted.

During orientation, I rotated out of Fleming house. My temporary room was situated right by the Dabney courtyard. On those first nights, I would attempt to sleep at 10pm, only to be awakened by Darbs. At first, I had to endure four hours of music, which I shut out by closing the windows. Then, movies and "Rock Band" were projected into my room. I used blinds to deal with the projector lights. Alas, the problems kept coming. On the next night, the fire alarm went off at 2am (it probably had to do with the Darbs).

I was okay with these minor nocturnal disturbances because I assumed they would be temporary.

I told myself, "I will have a normal sleep schedule when term officially starts."

I did not.

My hope was to get away from the nighttime hustle bustle by residing in Avery house, where I knew I could get a full night's rest without having to put on a pair of earplugs. Apparently destiny would not have me be a "slave" (the other houses gave this nickname to Avery students for their studiousness) but instead, a Rudd. Ruddock is a fine house filled with helpful students, especially freshmen who share the same enthusiasm as I for getting homework done on time. The only downside is that everyone—freshmen included—is nocturnal.

Walking through the house late at night, one may see students frolicking, doing homework, and gaming. Because everyone slept past midnight, it was much easier to go with the flow than to ride against it. By the second week, my sleep schedule became skewed and the time spent sleeping dwindled. Campus activities such as midnight madness, midnight Millikan pumpkin drop, and midnight coffeehouse served to positively reinforce staying up late. House social activities such as dances, ice skating, and laser tag also occurred late into the night.

Unfortunately, college is not only about social interaction but also academics and sleep is often sacrificed to make up for time spent in these two important areas of college life. Some of us are too busy, others waste too much time, and still others have bad habits of staying up late for no particular reason (I was in the last category during first term), but we should not let these excuses rob us of a full night's rest.

Sleep is essential for a person's health and wellbeing and not only because the NSF (National Sleep Foundation) says so. Research done by the Harvard Women's Health Watch suggest that chronic sleep loss contributes to health problems such as weight gain, high blood pressure, and a decrease in the immune system's power. Other sources suggest an increased risk of more gruesome health problems.

Not only does sleep loss take a toll on one's physical health, but it also impairs one's ability to learn effectively. While many students pass off dozing off during lecture or being constantly being tired as a common dilemma among college students to be shrugged off, long term sleep deprivation is more academically deleterious than what meets the eye.

Not only is there a higher tendency to snooze in class, but there are also higher tendencies to be late for class or even skip class entirely, skip breakfast (the most important meal of the day), fall asleep doing homework, dedicate entire weekends to sleeping in (recent research suggests sleep debt cannot be repaid), and worse yet, to begin the process anew by sleeping late the following night. Plus, stress levels tend increase exponentially. Having a late sleeper as a dorm roommate, I have observed the aforementioned consequences happen to him on a daily basis.

Of course, it's commonsense to get enough sleep. Who hasn't experienced the pain of wanting to fall asleep at an inappropriate time? Yet, sleep, especially an early bedtime, seems to take second priority for college students. Stress from a heavy workload, time commitments, and life always seems to interfere with getting enough shuteye. It only takes a simple redefining of priorities to fix this problem (for those who consider it one). Why not create a list of resolutions with "getting enough sleep" as your first priority? If at first you don't succeed, try again. Persistence will eventually pay off (at least that's the hope).

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Paths, from Page 1

"What's the point in having a student suffer through a course that is considerably more advanced than anything in their background, if they are simply going to emerge from the course with only a shallow understanding (at best) of the subject material, however sophisticated that material is?" said Kurt Litsch, student member of the Core Committee Task Force(CCTF).

A major concern results from the formation of 3-5 paths in 7-10 classes that previously either did not have paths at all or had only two: the lack of teachers to instruct the new classes. This concern is much felt by the faculty, whom under this new Core would have to teacher more on top of the current load.

"The proposal has a lot of praise, but certain details will be problematic, such as the math staffing," said Danny Calegari, the Richard Merkin Distinguished Professor of Mathematics.

When a student at the town hall meeting asked how the faculty would go about filling the teaching positions, Brown replied humorously yet truthfully, "Beats the hell out of me."

Niles Pierce, faculty member on CCTF, suggests in an email interview that one method of filling teaching positions may be to create new distinguished lectureships that could be used to recruit full-time lecturers with outstanding teaching abilities.

"These distinguished lecturers could help to cover some of the paths and ensure an excellent student experience in those courses," said Pierce.

Other concerns that were addressed at the town hall meeting include the meaning and value of a Caltech education to outside parties and companies. Student at the meeting voiced their concerns that with such diversity in the core, students coming out of Caltech will no longer all carry the high standard that they do now.

Students also addressed the concern that those in less advanced path will fall behind the student in advanced path over time.

"Care has to be taken in ensuring that the students' choices in paths during a previous term will not severely restrict their choices in paths for later terms," said Litsch.

Similar to the discontent over the lack of student bonding over math and physics classes, students at the town hall meeting argued that more paths will lead to less student body unity and more stress in finding help from upperclassmen and fellow students.

"Bonding will be discussed quite a bit more now because it was more of a student concern than faculty expected at the town hall meeting," said Litsch.

In addressing the lack of good teaching at Caltech, a student at the town hall meeting asked "if one teacher in a path is much better, then wouldn't all the students flood to take that path over the other path?" Brown replied that the situation would not undesirable since it would be a natural selection way of weeding out the poor teachers. "It is a win-win situation," he said in another interview.

Math, from Page 1

out clearly stated arguments for its position in the core."

At the end of the town hall meeting, CCTF Chair Mike Brown asked those in favor of keeping Ma1a or something like it to put their thumbs up and those in favor to getting rid of Ma1a to put their thumbs down. The majority of students there put their thumbs up, a result that visibly surprised Brown. Vocal town hall supporters of Ma1a included freshmen that found Ma1a extraordinarily difficult and a junior math major that had passed out of the course. Some students at the town hall liked the rigor of Ma1a, and some noted that Ma1a-- one of the Core courses without a practical and analytical track-- is a bonding experience for freshmen and helps freshmen figure out if they want to be math majors.

"Based on the town hall, I'm 99% sure that we will reintroduce some type of Ma1a class into Core... based on informal discussions with faculty members afterwards," said Brandon Hensley, a CCTF student member.

Caltech's math department will be happy to see some form of Ma1a reintroduced into the new Core, said math professor Danny Calegari. According to Calegari, the material in other math Core courses is selected largely for "the benefit of the rest of the Institute", since courses such as linear algebra and differential equations provide students with the mathematical tools needed for courses taught in other departments. "Ma1a iws unique among the math courses in Core in that it emphasizes key skills, such as logical deduction and rigor, that are not stressed in the other courses.... We view these skills as vital and important for any area of science, and not just for mathematics," he said in a phone interview.

Professor Barry Simon, who served on the last committee charged with revising Core, echoes Calegari. "My opinion which I think is shared by my colleagues is that for a variety of reasons, Ma 1a is the most essential part of the Math core," he wrote in an email. "If there is a desire to drop the core to four math courses, the only sensible way is to keep the topics in the current Math 1 and drop one of 2a or 2b-- or in the spirit of allowing students flexibility, letting them choose between the two."

Both Calegari and Simon said that, as far as they could tell, no one in the math department was seriously consulted about changes to math Core requirements. "It is unfortunate that after the initial math appointee to the CCTF [Calegari] resigned because of scheduling problems, he was not replaced nor, as far as I can tell, did the committee ever seriously consult with anyone on the math faculty despite the fact that Math represents roughly 30% of the current and proposed revised core," wrote Simon.

"I believe we now have a new [math faculty] member on board, remedying this unfortunate absence," wrote Fraser in his email.

Physics, from Page 1

Brad Filippone, Chair of the Core Curriculum Steering Committee, i.e. the committee entrusted with maintaining the current Core. "I'm uncomfortable about this proposed Ph1c... it may be very painful for the students, and I wouldn't want to teach it either."

According to CCTF student member Neal Bansal, combining physics courses has been done in previous Core Curriculum committees, with unfortunate results. The current Ph2ab used to be Ph2abc, but was shortened to decrease the number of required physics terms. Teaching the same amount of material in fewer terms just doesn't work, said Bansal.

CCTF member and Astronomy and Physics Professor Fiona Harrison agrees partly with the specifics of the strawman proposal. "Physics 2 has always been fairly difficult to engage students in, and I support a reduction of the number of terms of physics required," wrote Harrison in an email. "That being said... I don't think it is plausible to cover all of E&M and give any real introduction to modern physics in three terms."

The proposed changes to physics Core didn't spark as much discussion at the town hall meeting as changes to Pass/Fail, Humanities, or Ma1a, but a few students defended the length of the current physics Core. One student took issue with "renormalization" of Core requirements, arguing that math and physics were more fundamental subjects than biology and chemistry-- as such, the proposed changes to math and physics Core would devalue the Caltech degree, producing scientists that didn't understand quantum mechanics. CCTF spokesperson Scott Fraser disagreed, arguing that the current Core didn't produce Caltech graduates with good understanding of topics such as quantum mechanics.

According to several CCTF members, the committee is considering alternative systems to the proposed three-term physics requirements. One alternative would be to keep the current Ph1 as is, cut Ph2, and require students to take a physics "menu course" that spreads the half-term twentieth century physics survey into an entire term. Alternatively, this fourth term of physics could instead require one additional physics class from a long list of classes with significant physics content (e.g., optics, physical chemistry.)

Humanities, from Page 1

any of my core classes."

Furthermore, the proposal argues that the stress burden of Humanity courses, which is the reason for why they are available to be taken on pass/fail, is overstated. The report notes that students blame humanity courses for adding stress especially in the first two years in which "classes are too difficult and poorly taught." The reasons driving changes in humanity courses again root back to the need for multiple paths to be opened. The report claims multiple paths will help to diminish the poor teaching in Core classes.

The change in humanity requirement is specifically to require 8 out of the 10 requirement humanity courses to be taken on grades, while the other two will serve as elective hums not intro or advance hums. The two electives will still "encourage students who have already satisfied their advanced HSS requirements to explore interesting subjects without feeling like they might endanger their GPAs.

Caltech students rushed to the podium at the town hall meeting in defense of pass/fail in humanity courses. One student voiced that writing in English or History does not reflect or improve scientific writing, but that idea was quickly opposed by Warren Brown and shouts of opposition from the student audience. Brown stated that writing is accessible in all fields, and that students who write good humanities papers tend to write good scientific papers.

Reducing 12 courses to 10 is the tradeoff to the elimination of almost all pass/fail in hums. However, the humanities department unanimously opposed the change from 12 to 10 classes, even though they will be on grades, according to Cindy A. Weinstein, Professor of English and Executive Officer for the Humanities.

"It sends a bad message about what we value if we drop hum requirements," said Weinstein.

New Courses, from Page 1

be enough faculty members interested in teaching these new courses. The frosh seminars in particular would suffer severely from having an excessively high student-faculty ratio," said Litsch.

Other relatively minor changes include replacing Ch1b with a Chem Menu class. According to Bansal, Ch1b is a mishmash of what was previously two courses since the last time Core was revamped, Ch1bc was squished into Ch1b. Brown believes that this makes the class hard to teach well and rushes things.

Biology, which currently receives the least emphasis in the current Core, will be revised from the current requirement of the difficult to teach Bi1. The first term will be a "true introductory biology course," and a second term is added as a Bio Menu course to cover more interesting and advanced topics.

"Caltech should be on the cutting edge, and bio is at the cutting edge of every single field. We should recognize the increased importance of bio in the Core," said Bansal.

Lastly, all these courses would have paths as well.

Pass-Fail, from Page 1

will pass anyway.

"Pass Fail is a band-aid for faculty... cramming more stuff into fewer terms and teaching through problem sets," said Warren Brown, humanity faculty of the Core Committee Task Force.

"P/F is very detrimental to learning. It's just human nature that when time is short and A=B=C=D=P\neq F, the commitment to total comprehension of a topic is not the same as when time is short and A\neq B\neq C \neq D \neq F." said Pierce.

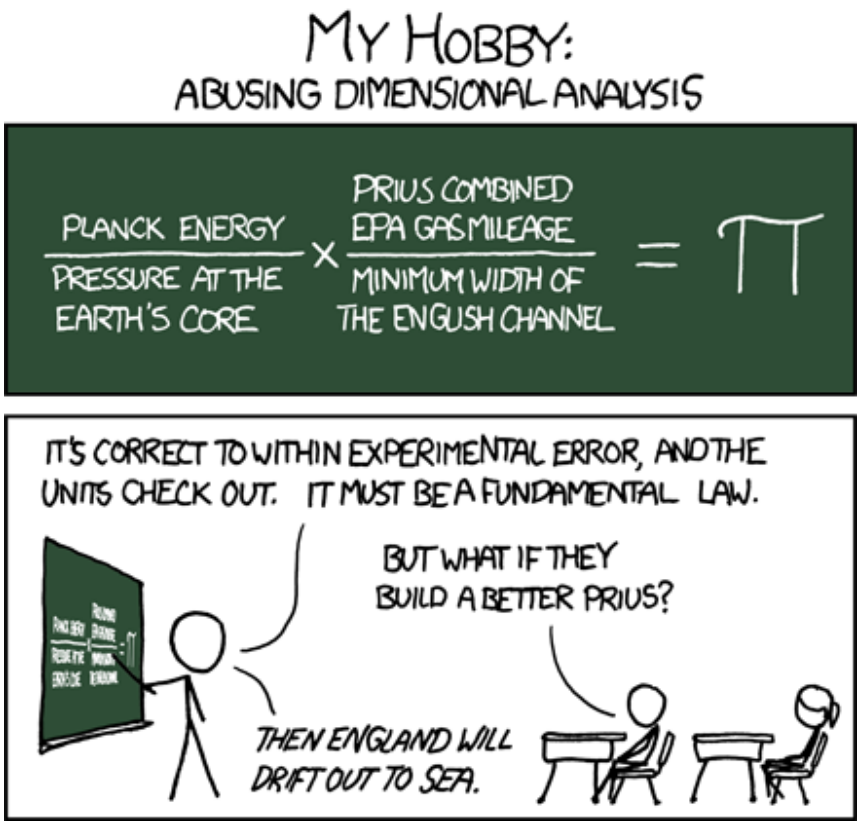
However, as some students at the meeting pointed out through their experiences of non-pass fail Core classes, the bad teaching or unreasonable work load does not go away with pass fail. All core physics have 9 problem sets and quizzes, and the work load for math does not vary from pass/fail terms to other terms.

The general student consensus from the town hall meeting seemed to oppose losing a term of pass/fail. Passionate students at the town hall meeting voiced their concerns over this proposed idea from it allowing students to be less adventurous in taking classes to the bonding and de-stress that pass fail bring during the first two terms.

"Pass fail is very important, as a cushion and a bonding experience and a way for people to understand their limits, but I'm not sure if the second term is necessary," said Neal Bansal, student member of the CCTF.

Faculty on the CCTF feels however, that losing pass fail is necessary and appropriate in complementing the addition of multiple paths in Core courses. "It's important to keep in mind that the proposal is not: "keep the current courses and get rid of P/F for Core (except for 1st term and two HSS electives). The proposal is: "create appropriate courses and get rid of P/F for Core (except for 1st term and two HSS electives)," Pierce emphasized.

XKCD by Randall Monroe



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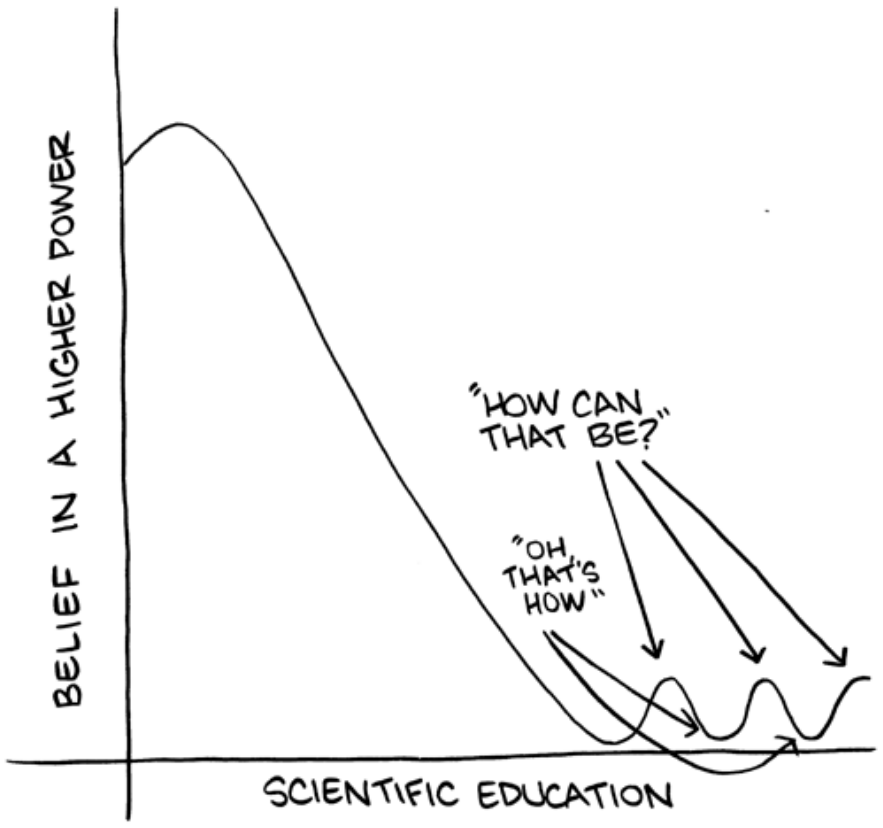

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