Teaching Loads and Teaching Science

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By chance, I was working on this when I received a mailing from Paula Carlson including an article from the NY Times on eliminating large freshman lecture courses. The issue of methods of teaching science and calculating teaching loads are not unrelated. I discuss this below in the Analysis and Conclusions.

I. Data

A. National averages

http://www.nsta.org/main/news/stories/college_science.php?news_story_ID=46967
The national average for science faculty at primarily undergraduate institutions (PUIs) is 13 hours of contact time. This is based on treating lab contact hours equally with lecture contact hours. Except for math faculty, about half the contact hours are lab time.

B. Calculating teaching load

There is no uniformity in calculating faculty loads, especially as concerns non-lecture courses. Some factors to consider in determining teaching loads include the following:

1. **The number of distinct course preparations required, as opposed to number of courses.**
   See http://www.uwgb.edu/sofas/campusReports/SPBC/

2. **Size of class. Contact hours are often determined by multiplying the number of students by the amount of time spent with them.**
   See http://nces.ed.gov/pubs98/98002.pdf and
   http://www.unlv.edu/unlv/Colleges/Sciences/Biology/NewPage/governance/goverd4.htm.
   UNLV gives extra credit for large classes.

3. **The relationship between contact hours and equivalent semester hours:**
   a. **Equal credit: Winston-Salem State and Longwood University**
      http://www.wssu.edu/academicaffairs/aa_standardload.asp and
      http://www.longwood.edu/ncate/6personnel.htm

      From Winston-Salem State: Academic Affairs Standard Teaching Loads

      "The standard teaching load for the faculty in the tenured and tenure-track category is at the reference level of 24 for 12 of the 15 departments at the institution. The three departments that are below the reference level have average teaching loads ranging from 18 to 22 semester hours per academic year. The faculty teaching load for the Department of Computer Science represents a guideline of the Computing Sciences Accreditation Commission which requires that faculty teach no more than nine hours with three preparations or 12 semester hours with two preparations. The teaching loads for this department usually range from 9 to 12 semester hours per semester.

      "In the Department of Life Sciences and Physical Sciences, contact hours are used. One credit hour equivalent equals one contact hour. Therefore, 12 contact hours per semester is considered a standard teaching load even though the credit hour value may be less."

   b. **0.75 credit: Austin Community College**
      http://www.austincc.edu/admrule/4.03.004.htm

From the website: "One laboratory hour equals 0.75 contact hours unless defined differently elsewhere in this document. The number of lecture equivalent hours and lab hours for each course is determined from the course descriptions in the official College catalog."

Faculty Load: 30 lecture equivalent hours (LEH) during a 9 month contractual period.

c. 0.67 credit: UNLV and University of Texas System
http://www.unlv.edu/unlv/Colleges/Sciences/Biology/NewPage/governance/goverd4.htm and http://www.unt.edu/policy/UNT_Policy/volume3/15_1_9.html

From UNLV: "To provide an equitable conversion between the contact hours spent in laboratories or scheduled "break-out" sessions (e.g. discussion sessions in Honors Science) and credit hours for workload assessment purposes, the College of Sciences has adopted the policy that every 3 contact hours is equivalent to 2 CHE (i.e. a 2/3 conversion factor).

"For seminar and readings courses, each credit hour formally assigned may count as 0-1 CHE towards a faculty member's teaching load, depending on the nature of the course. For these types of mentoring courses, the faculty member may negotiate the teaching load reduction with the department chair (with approval of the Dean), based on the amount effort required to conduct the course."

d. Determine the number of course preparations: AAUP
http://www.aaup.org/statements/Redbook/rbwork.htm
From the website: "For undergraduate instruction, a teaching load of twelve hours per week, with no more than six separate course preparations during the academic year."

4. Weighted loading: Gustavus Adolphus College
http://physics.gac.edu/~chuck/teaching.htm

From the website: "The model that I am suggesting is an attempt to take into account several of the important factors in teaching load, class time, preparation, and grading. Class time and preparation time are both associated with the number of contact hours but are not directly related to the number of students in the course. Grading load, however, is strongly linked to the number of students and the type of course. For these reasons, the combined score for a faculty member is calculated by combining contact hours and number of students:

"Combined Score = # of Students * X + # of Contact Hours * Y

"The multipliers, X and Y are somewhat arbitrary, and I have settled on the following values because I believe that they most closely approximate reality. X can be 0, ½, or 1 depending upon the type of class that is being taught. A normal class would use the value ½ (times the number of students) to approximate the grading load, while a writing course would use a value of 1. Seminars, or other courses where there is little or no grading involved, would use the multiplier of 0 for X. To tabulate preparation and class time, I suggest using values of Y like 1, 2, and 3. A value of 2 would be used for normal courses, assuming that it takes just as long to prepare for a class as to teach it. If a faculty member has multiple sections of the same course, one of these would be assigned a value of 2 for Y and the other(s) would be assigned a value of 1. The last value, 3, might be used for a course that the faculty member has never taught before and must spend more time preparing for (I haven't made use of it

yet). "

II. Analysis and Conclusions

A. Determining teaching load is not easily quantifiable.

Availability to students outside of class, class size, whether the class is being taught for the 1st time or 21st, required preparation, and amount of grading required all matter. And at some point, increased load actually leads to decreased value to the institution. Morale suffers, preparation suffers, tests are altered to be easier to grade, assignments get a bit shorter, and on it goes. Perhaps most important in all this is the issue of fairness. Are concerns heard? Is the need for justification applied only to a few while others slide by? Are there rewards for those willing to do extra?

At my previous university, it was quite easy to compare teaching of a freshman physical geology class. Each semester we offered 5 lecture sections of 120 students each. (Labs were taught by graduate students.) Though we used the same textbook and met for the same number of hours, there was not a lot more in common. One of my colleagues never showed a slide, overhead or video. He lectured and wrote on the board. Another taught the course as part of a video series broadcast on a local PBS affiliate. He would meet a few times during the semester with the class, give them tests, and they would work on their own. I put a lot of time into Powerpoint presentations, online notes and essays, video presentations, and learning to tell stories and jokes. As far as the university was concerned, we were all doing our job. What kept me going was the feedback I got from students and an occasional pat on the back from a colleague. (Don't underestimate the value of a pat on the back.) Obviously our teaching loads were different despite looking the same on paper.

B. Assigning a weight for a lab differently from a lecture assumes that the two are easily distinguishable.

If we are to move toward a model of science education that is increasingly hands-on, the designation of lecture versus lab will need to go. If this occurs, will a 3-credit course still meet 3 hours? Unlikely. But if faculty are willing to spend more time in class with students for those same credits, will we essentially tell them that the extra time isn't worth it to the institution by devaluing it? Is the institution willing to hire more faculty to handle the additional classes? You can bet that at places like MIT, much of the work of teaching is being done by graduate assistants, relatively cheap labor. How will UD address the need?

C. There is a huge difference between creating scientific literacy and educating future scientists.

Freshman classes in any field often act as a filter of future majors. If students can't make it through an introductory class in a field while finding the material intrinsically interesting, they probably have no future in that field. If they can do well without attending class, more power to them. If they drop out, well, they're adults and can make their own decisions. In this model, getting students who don't perform out of the classroom as quickly as possible is a priority. Why throw pearls before swine? Of course, this approach assumes that many in society understand the intrinsic value of science, and that an adequate number of them will want to be scientists. That assumption is now being called into question. It does not bode well for the future of the American economy nor society. Nor is the model here at UD.

Creating scientific literacy is quite a different problem, and one that should be solved well before students get to UD. Quite clearly, it has not been. Americans are increasingly illiterate. They have mastered the ability to read but seldom use it. They watch TV instead. The average American watches more than four hours per day. The average time per week that the American

child ages 2-17 spends watching television is 19 hours, 40 minutes. And the average time per week that parents spend in meaningful conversation with their children is 38.5 minutes. (Statistics from http://www.tvturnoff.org/images/facts&figs/factsheets/Facts%20and%20Figures.pdf.) We live in a wealthy society where it is possible to get by without knowing much, even to rise to power. However, in the sciences, it is quite easy to measure the depths of student ignorance. An interpretation of a poem may be shallow, a policy may be contentious, but the identification of a mineral is right or wrong, and a scientific theory can be tested against reality. There is little room in faking in the latter case, nor much need for justifying to the student why they received a failing grade when they call feldspar quartz. "But I studied four hours for this test," I've been told by a student. That doesn't make the wrong answer right, but it does explain much of the mindset of students. A minimal amount of effort entitles them to succeed.

So how do we as science educators break through this? First, we maintain the standards. Ultimately students respond to a challenge. Flunking or dropping a course can be an important learning experience, as will be being fired when they fail to show up for their first job. On the other hand, mastering material is very rewarding, and students shouldn't be deprived of that opportunity. Secondly, we need to become public relations experts. The message of the value of science is not getting through. We have to promote it, often in terms of economics, because that seems to be what matters most to Americans. Thirdly, the move towards smaller classes without the lab/lecture distinction is welcome. One of the great values of UD is the personal relationships that develop. That will happen more in smaller classes. However, institutional support will be required.

D. Moving Forward.

If we are to make the transition away from the lecture/lab format, we're going to need an occasional pat on the back and a sense that we're not the only ones on campus asked to justify our teaching loads. UD needs to seriously consider some weighting system that takes into account more than just one distinction (lab/lecture) and applies to all faculty. I've seen nearly every member of the Department up here at Goldthorpe during the Break. We're willing to devote ourselves to our teaching and to UD. But we also have obligations to our families, health, and profession that we value tremendously. Living a balanced life is one of the best examples we can set for our students.