

The Teaching Science Professor

Could science professors who focus more formally on teaching be the key to turning around the poor performance of many American students? That's the suggestion of a new survey of science professors at the California State.

The survey — published in *Science* by five Cal State professors and one Purdue University professor — gathered information from 59 faculty members within the science departments of the 23-campus Cal State system who identified themselves as “science faculty with education specialties.” These individuals are defined as faculty whose published research and departmental roles focus them on the improvement of science education within their discipline. Though this survey shows the number of these faculty members is on the rise, its authors argue they need more support in order to improve student performance.

James A. Rudd, II, one of the survey's authors and a chemistry professor at Cal State Los Angeles, said that most science education research and development is traditionally conducted by faculty from education schools. Though these individuals understand the pedagogy of instruction, he said they sometimes do not understand the content of the sciences well enough to make their work beneficial. He said it is imperative for science faculty to bridge the gap between the study of education and that of science.

“There are scientists and then there are education faculty members within science departments,” Rudd said, identifying a shortage of the latter at American universities. “There's a dire need for more attention to be paid to efforts for more science education. A lot of research shows that traditional lecture classes and cookbook labs are not the most effective way to learn science.”

The survey identified two groups of specialized science education faculty within the Cal State system: the 53 percent who had been hired as such and the 47 percent who transitioned from other roles to take on an education role within their departments. As evidence of the recent growth such roles have experienced, more than half of those hired specifically for science education positions were hired after 2000.

Though the study notes that science education faculty generally have “extensive formal training in basic science,” it found that a significant portion lack formal training in science education — defined by the survey as “post-baccalaureate training, including degrees, teaching credentials, graduate level research, and/or postdoctoral research.”

Rudd said this is a criticism often levied upon science education faculty by their education school counterparts. He said he hopes this study will help promote the need for formal training opportunities in science education.

“A large majority of those in science education don't have the formal training to engage in this activity,” Rudd said, noting that there are few institutions in the United States that award science education Ph.D.'s. “In fact, most graduate students don't believe that this is a career pathway for them. It's important that we have more formal training pathways out there and make them more accessible.”

Seventy-one percent of the science education faculty surveyed reported that they spend “about the same amount of time on teaching” as their non-education science colleagues. When considering research, however, 90 percent of these faculty members said “soliciting external grant funding and publishing peer-reviewed articles” was most important in being granted tenure. Fewer than 10 percent surveyed said there was an equivalent emphasis on “supporting scholarship in science education as compared with supporting scholarship in basic science.”

Rudd said science education faculty feel the pressure to do the same amount of research as their non-education science colleagues but with less support. He noted that they receive less grant funding and often do not have access to as many graduate students to assist their research.

As a result of this, the study notes that almost 40 percent of science education faculty members surveyed in the Cal State system were “seriously considering leaving their current jobs.” Among the reasons supplied included that some thought “their science education efforts were not valued or understood” and that they were “being overworked and burned out.”

Kimberly D. Tanner, another author of the survey and biology professor at San Francisco State University, said it was important to distinguish what exactly faculty members in science education roles are supposed to do. This, she said, would contribute to the longevity of individuals in these positions and alleviate some of these professional pressures.

“What I find most heartening is that these people exist,” Tanner said of science education faculty. “It’s nice to see that there are people who are filling these roles in departments. Still we need to sponsor more formal training pathways to help expand and build their knowledge base.”

— David Moltz

Comments

CONFLICT?

Does it matter that the authors of this study are themselves “science faculty with education specialties”? Seems a bit odd that they then conclude that this group needs more attention. This article presents them as if they are somehow outside the system.

A scientist who teaches, at 5:50 am EST on December 19, 2008

EVIDENCE OF EFFECTIVENESS?

The lede says these profs might be the key to “turning around the poor performance of many American students” — but the article doesn’t have evidence they are more effective as teachers. I hope they are, and would like to see the evidence, for all of our sakes.

Philip, at 8:25 am EST on December 19, 2008

EVIDENCE?

I also would like to see some EVIDENCE that these profs are more effective , either with better grades for students or satisfaction.

such evidence is very hard to obtain experimental studies tend to be small scale and hard to generalize. survey studies that compare performance across many courses that also provide CATEGORIZED data about the course are almost non-existent.

at University of Hertfordshire we are pioneering this approach where CATEGORIES include: use of group work, use of electronic discussion forums; use of MLE, % of assessment as coursework.

whether prof has formal education training and/or is appointed a education specialist would be another v. important CATEGORIZATION.

please can anyone interested in pursuing this line of evidence contact me off-line, d.e.kornbrot@herts.ac.uk

kornbrot, Prof at University of Hertfordshire, at 9:55 am EST on December 19, 2008

EDUCATION INTEREST AND SCIENCE TEACHING

I teach at a CSU system school in the physics dept. I have anecdotal evidence that the study is correct as well as hard data. I pre test and post test my students to see if my changes in teaching the introductory algebra based physics classes have any effect. Every effect including how the classes evaluate me is swamped by the class size. I hope they took class size into account in their study. I am going to look the study up. Thanks for pointing it out. I wish I had been part of the study team.

Adjunct George, at 10:15 am EST on December 19, 2008

DUH

Professors who focus on their teaching skills teach more effectively? Who knew.....

Phronesis, Director, Institute of Professional Ethics at University of Northern Colorado, at 10:35 am EST on December 19, 2008

TEACHING SCIENCE (OR ANY COLLEGE-LEVEL SUBJECT) PROFESSOR

There HAVE been studies done about teaching effectiveness — in the humanities as well as the sciences. See John V. Knapp, *Learning From Scant Beginnings: English Professor Expertise* (U. of Delaware Press, 2008). At the risk of walloping yon dead equis!!!

JVK, Philosopher-King at ?, at 11:00 am EST on December 19, 2008

WHERE'S THE EVIDENCE?

The evidence is there where scientific evidence customarily is, in the research literature. In my field (physics) there are now several dozen physics departments in which serious research is conducted by physicists (not education professors) in the complex arena of the teaching and learning of physics. Many of them (including my own) award PhDs in physics for such research.

I am well aware that many physics (and other science) faculty who have had teaching as one of their major professional functions throughout their careers are blissfully unaware of that research enterprise and clueless about its findings. They deny any responsibility for actually knowing something about their teaching function (in stark contrast with their attitude about their research function) and it would never occur to them to use their classroom time as a learning opportunity for themselves.

Unfortunately, there are indications of this endemic attitudinal problem in the CSU report. Perhaps it will help to stimulate the growing national effort to do something about it.

Don Langenberg, Chancellor Emeritus at University System of Maryland, at 12:30 pm EST on December 19, 2008

EFFECTIVE TEACHING

Thirty years ago the Doctor of Arts degree attempted to wed academic content with effective teaching. Although this degree has apparently fallen out of fashion— a program arguably ahead of its time), its tenets are not only 'catching on', but appear to be fashionable, even. (What goes around, comes around?)

Timothy J. Duszynski, at 12:35 pm EST on December 19, 2008

The physics education researchers have a lot of good ideas, but I have a few criticisms:

1) They generally take it as a given that mastery of certain skills in the context of the topics in the standard, traditional physics curriculum (a list of topics largely unchanged for decades) is what students need, and then they design teaching tools around that narrow set of assumptions.

That would be fine if it were just in the context of research—research projects require focus! However, they tend to be quite harsh on people who value some other set of skills.

2) Even that might be fine if they weren't adopting many of the strategies of time-share salesmen and evangelical preachers. I went to one of their workshops and came away so disgusted that it took me a year to even consider using clickers.

I should emphasize, however, that these criticisms mostly apply to the leaders of the field (who all have books to sell at their workshops). The science education people that I work with in the CSU system are much less evangelical. Also, there's one leader in that community whom I like, because he begins his presentation by noting that there are multiple things one could emphasize in a science class, and that he is not claiming that his area of emphasis is the only possible way to teach physics. Ken Heller at U. Minnesota is definitely one of the good ones. (Interestingly, he didn't have a book to sell.)

CSU Physics Professor, at 12:50 pm EST on December 19, 2008

GRANTS AND PUBLISHING FOR PEDAGOGY RESEARCH

I should also say this about pedagogy research and promotion in the CSU:

It is possible to get grants and publish papers on pedagogy research. Some departments value that more highly than others. One problem that my friends in pedagogy research complain about is that many science faculty (including tenure committees) can't distinguish between high and low quality in pedagogy research. Almost anybody can try something new in class, give a test after the innovation, and compare the results in the class that saw the innovation with the results in a previous class. It's a fine thing to do, and we should all try doing it. You can even talk about it at a professional meeting, and perhaps even get it into a third-tier pedagogy journal.

However, a good study requires working with large samples, doing comparisons between sections to see if they're comparable, controlling for variables, checking statistical significance, and doing detailed analyses of tests and surveys and interviews to really understand what happened. Performance on a few test questions could be due to any number of factors. Good pedagogy researchers do these things and put a lot of time into it. They have degrees in the subject and are really trained to do this. I know one person with an excellent background in the subject who has expressed frustration at seeing colleagues without a background in pedagogy research present less impressive work and still get credit for having a paper or presentation. Everybody should try to evaluate the impact of his or her teaching methods, but not every investigation should be treated as a piece of high quality work for tenure and promotion.

CSU Physics Professor, at 1:35 pm EST on December 19, 2008

WHAT A BUNCH OF CRAP!

Let's see ... how should I teach this?

How about, "Here is "Topic A." (We spend some time on Topic A.)

Then, "Here is "Topic B." (We spend some time on Topic B.)

Generalize this. We are now ready to test this knowledge. Ready?

Duh!

DFS, at 1:50 pm EST on December 19, 2008

OF COURSE THE STUDY IS CORRECT

Of course the study is correct. In my long-ago days as an Ivy League college student, the science and math teaching was dreadful. According to my classmates with children at that school, it's still dreadful. The problem: the teachers teach as if they were teaching to an audience of students who are clones of the teachers. They don't connect with students who comprise a diverse audience. The key to good teaching is learning how to communicate with people who think and learn differently than you do.

Luigi, at 2:20 pm EST on December 19, 2008

WHY LIMIT EXPERTISE?

So, either you are a science faculty member with an education specialty (the enlightened ones, it seems) or an unenlightened scientist, or an education professor with no science background (equally unenlightened). I find this categorization limiting at best. At the University of Missouri, we have lots of different folks who

contribute to the effort to improve science teaching and learning for undergraduates—scientists without formal education training, science educators who hold appointments in science and education departments simultaneously, science educators fully in the college of education, other education faculty members. The key is that we share goals related to improving science learning and we respect the various perspectives and experiences we bring to the table. The problem is too big for any one of us to feel smug in our own little sphere of expertise. Let's open the doors to all of us who have something to contribute.

Sandra Abell, Professor of Science Education at University of Missouri, at 5:50 pm EST on December 19, 2008

NO, LUIGI,

The goal of college professors is to start with an established, minimally-qualified set of students, teach to them from a minimal level of knowledge, and stimulate the students who may be stimulated, in that setting.

What you are espousing is what high school teachers are expected to do, within their Herculeanly-defined requirements. Go and blame K-12 instruction — most importantly the **education majors** — when their tasks are not met. After all, their "expertise" is required.

DFS, at 7:25 pm EST on December 19, 2008

LA REGIME DE LA PEDAGOGIC/ ACADEMIAS MODES OPERANDE

The Idea that the "La regime de la pedagogic" teaches science or tries to install confidence that what they teach is actually science would be a valid question. I see academic ventures as the tail wagging the dog, real science goes on in Industry, science philosophy is what's taught at the academic ventures level, a continual battering into the students' heads that the core subjects, and the related math game is real science is possibly believed by the actual professors, however reality is an entirely different subject. Current academies focus is to keep students occupied with near meaningless trivia for four years and beyond, granting them certification that allows them to testify with credibility in a courtroom, patents, health education, welfare bla bla. Any person in the world having mastered reading, writing, and knows math is a matter of very simple constructs can self educate at a level unattainable in academia (Armed with the internet). Education occurs from interest alone. The rich and famous, promoted by our academic caste system into grants and things like nobel prizes, should realize all they are up to is political science, the real scientists, discover truths that permit better instrumentation without so much as a peep. Discovery is its own reward. Academia compared to the internet is like comparing the Hubble Telescope to any or all earthbound optical systems that study outer earth objects. The Hubble is magnitudes above ground observation, regardless of whatever astronomy has to say. earthbound observations made through several atmospheres with the earth traveling 79,000 MPH, the sun traveling at 200 meters per second, the galaxy going at 600 meters per minute is the latest estimates to deal with, compared to an independent observer like the "Hubble" simply cannot be compared, unless you're in the business to defend the falsehood of astronomy taught at academic in our current dark ages

jackiecox, research, industrial scientist, at 9:45 pm EST on December 19, 2008