

Engineering College Council
October 30, 2007
ILR Conference Center

ECC Members Present: Elizabeth Altman, Richard Aubrecht, James Becker, Joseph Bonventre, Kenneth Brown, Jay Carter, Tim Costello, Robert Cowie, Sarah Fischell, Kent Fuchs, Michael Goguen, Geoffry Hedrick, Frank Huband, Gretchen Knoell, James McCormick, Venkatesh Narayanamurti, Evelyn Taylor Pearson, Robert Shaw, William Shreve, Robert Smith, Roger Strauch, Sophie Vandebroek

William Shreve opened the meeting and introduced the topic of teaching excellence. ECC members introduced themselves. New ECC members included Robert Smith, Geoffry Hedrick, Michael Goguen, Sarah Fischell, and Frank Huband.

ECC Terms and Retirements

Kent Fuchs announced that all ECC members will be appointed to 5-year terms. ECC members retiring from the Council will be emeritus members and can attend meetings. Kent presented recognition plaques to retiring members in attendance: Richard Aubrecht, Kenneth Brown, and James Hauslein. Other members that are retiring include Kenneth Arnold, Charles Brown, Randall Ledford, and Albert Suter.

College Update

Kent opened his presentation by saying that he wouldn't go through all of the slides, but would focus on a few of them and then engage the Council in discussion.

Highlights

- New deans and directors include Rick Allmendinger (EAS), Associate Dean for Diversity (Starting on 1/1/08), Chris Ober (MSE), Associate Dean for Research and Graduate Studies (As of 9/1/07), Frank Wise, Director of AEP (As of 7/1/07).
- Strategic Plan Progress

Faculty Trends – The college's goal is to grow the faculty by a total of 30 from 200 to 230. The Faculty FTE chart shows faculty size over ten years. It shows filled lines in full time equivalents. There is a slight decrease in the faculty FTE because a number of faculty have gone on phased retirement. The general trend is to grow the faculty. Half of the growth is in BME and the other half in the five other strategic areas of excellence:

- (1) systems biology and biomedical engineering;
- (2) nanomaterials, nanoscience, and nanodevices;
- (3) energy, environment, and sustainable development;
- (4) information, computation, and communication;
- (5) advanced materials; and
- (6) complex systems and networks.

It takes \$3-5M of endowment for every faculty line that we add. We are most proud of our new faculty.

Faculty Diversity - We also have targets to diversify our faculty to achieve both gender and minority (faculty of color) diversity. Our goals are to have 20% women and 7% URM faculty. We have received a \$3M NSF Advance grant that two of our faculty lead (Sheila Hemami and Marjolein Van der Meulen). The Advance goal is for every Cornell science and engineering department to have 20% women. Carolyn (Biddy) Martin, Provost, is the Principal Investigator.

Strategic Oversight Committee - A faculty Strategic Oversight Committee (SOC) has been formed to guide the faculty hiring process. The SOC will approve the search plan, the candidates selected to interview, and the offer decision. This is the first time we have had a review process with some teeth in it. Zellman Warhaft developed this committee and the guidelines in summer 2007. The committee will be chaired by Rick Allmendinger (EAS). Chris Shoemaker (CEE), Chris Ober (MSE), Claude Cohen (CBE), and Zellman Warhaft (MAE) make up the rest of the Committee.

Biomedical Engineering – Kent reported that he recently made a Biomedical Engineering (BME) presentation to the Board of Trustees. The BME department is engaged with the entire university and with Weill Medical Center in Manhattan. In 2002 the Provost asked Kent to produce a strategic plan to guide the future of core research and teaching fields, to build a first-rate BME department, and to develop long term capital and facilities plans. Ten (10) faculty and senior lectures are now part of the BME department. Only Mike Shuler, the Chair, was here when the department was started. The other 9 faculty have salaries budgeted in the department and many have appointments in other departments as well. They were recruited to Cornell to help us build excellence in this area. Our goal is to have 15 BME faculty. You can be at the top of your field with a small faculty. David Skorton our new president is a member of the BME Department. Areas of focus include:

- Mechanics
- Imaging and Instruments
- Micro- and Nanobiotechnology
- Molecular, Cellular, and Tissue Engineering
- Biomaterials and Drug Delivery

There are now 55 PhD students in the program, 35 MEng students and the undergraduate minor is graduating 45 students each year. 33% of the students are women and 12% are from underrepresented groups.

Facilities Master Plan

- The Life Sciences building will be finished this year. It is being built by Skanska, James Becker's company. It will be the home of BME. Currently 37.5K gsf has been allotted but we need a total of 45K. Negotiations to secure this space are underway.
- The Physical Sciences building construction started this month. It is 197K gsf facility. The main building will be completed in two years, and the atrium connecting it to Clark Hall will be done in three years. We are also renovating Clark Hall.
- Gates Hall, the CS/CIS building is being designed. The planning was delayed for a year as we negotiated the budget and phasing with the President.
- Olin Hall will undergo a \$14M upgrade, including new windows, air conditioning etc.

- A 4th Floor 7500 sq. ft. addition will be added to Phillips Hall to upgrade and expand ECE's space.
- A new Engineering building was approved yesterday by CFPC including the project concept, the site, and permission to begin the feasibility study. Carpenter Hall and Hollister Hall will be replaced with a new facility on the corner of the quad. We will build 250K gsf and demolish 100K gsf. The timeline for the building design will be completed by 2009-10, with construction taking place in 2010-13. The facility will cost a total of \$181M. Mechanical and Aerospace Engineering and the college administration, will be housed in the new building.

Discussion

Venky Narayanamurti - How will it be funded?

Duffield Hall and the Life Sciences building have been funded by gifts. It is not clear how the Physical Sciences building will be funded. Part of it will be debt financed by the university. The new engineering building that will replace Carpenter and Hollister Halls will be funded by a combination of gifts and college debt financing.

William Shreve – Is there a vision for the use of the new engineering building?

It will enhance the teaching capability of CEE and MAE and provide 30% more space for CEE, 50% more space for MAE, and a set of student collaboration facilities. It will also allow other departments to grow as this and other buildings such as Gates Hall go up.

Context for Today's Meeting – Kent Fuchs set the context for the meeting. In our previous meetings we have discussed faculty recruiting and mentoring, the Facilities Master Plan, the common curriculum, college communications and the capital campaign, the MEng program, educating the engineer of 2020, and areas of strategic research. Today's focus will be on teaching excellence.

2008 Spring ECC Meeting - The spring 2008 ECC meeting will focus on energy and global climate change. The new Cornell Center for a Sustainable Future will be discussed as well as the college focus on energy which includes seed grants, the hiring of new faculty, and the development of new curriculum. The alumni association spring conference will also focus on energy. I would like to involve you in some of these presentations.

Teaching Excellence – As we look at teaching excellence, the focus is not on the students, but rather on the faculty with an emphasis on the question, “How can we help them enhance their teaching effectiveness?” That is the question that should provoke your thinking. We have developed a tentative plan to create a Teaching Institute that we have not yet implemented and we are seeking your advice. At the university level a similar discussion is going on and our Vice Provost, Michelle Moody Adams, will present that initiative in a moment. We welcome your comments on that too. We also want to focus on teaching visibility, rewards and incentives for teaching excellence?

Joseph Bonventre – Has there been any impact of BME on engineering physics enrollment?

Kent Fuchs - There are now more freshman interested in engineering physics than computer science. There are also a lot of students minoring in BME.

Are you concerned about the CS drop?

Kent Fuchs - What is surprising is that it has not yet begun to increase. The CS dept is looking at changing the introduction to CS course.

David Gries –There is a new Information Science, Systems and Technology (ISST) undergraduate major too. Some students that would have gone into CS are now going into ISST. Perhaps we should look at the sum of the two programs.

B. Shreve – Do students going into ECE impact CS?

Kent Fuchs – I think CS enrollment is more impacted by the national press. CS enrollment was too high and the drop also reflects a market correction.

Venky Narayanamurti – We had the same effect at Harvard. There was a precipitous drop over the last few years. We changed the introductory CS course and our enrollment is just about to turn around.

Sarah Fischell - When you say influenced by the national press do you mean jobs going offshore?

Kent – Yes.

Sarah Fischell – Is ECE's drop recovering from the dot com bubble?

Kent Fuchs - I am not worried about ECE's enrollment being too low. You have to map on this the 5th year of the MEng program. ECE, CS, and OR have the largest MEng programs.

James Hauslein – In the 70s-90s there was a 6 year joint MBA program. JGSM is gearing up again for that next year with a goal of 20 students. Is that message getting through to the students?

Kent Fuchs - This is a big change and we are spreading the word. There is a Knight family endowment to help fund some of those students. It is powerful to have an engineering degree and an MBA.

Robert Shaw – Those of us from Engineering Physics are very proud (Referring to EP's #1 undergraduate program ranking by USNWR). Do we analyze why and how it is that those rankings are so high?

Kent Fuchs – We spend a fair amount of time on this. The undergraduate rankings come out in August. The undergraduate program rankings are based on input from deans, associate deans, and department chairs. This ranking is reputational only. At the graduate level there is quantitative data that we provide to U.S. News. To enhance our reputational ranking we need to be visible.

Evelyn Taylor Pearson – I see that is BME ranked #21. On the previous slide what is the definition of contact hours?

Kent Fuchs – Contact hours equal the number of students in all the courses times the number of hours the faculty are in front of those students. We don't have an undergraduate major in BME, so we are happy to be ranked at all. US News lists about 30-50 schools in their rankings.

Roger Strauch – How did we end up with a #7 college ranking given that the average specialty ranking would be lower?

Kent Fuchs – They are not correlated. Colleges are ranked by Deans. Specialty programs are based on listings by Deans and Directors of the top 10 programs.

Sarah Fischell – Is there data that goes into the college undergraduate ranking?

Kent Fuchs – No, it is reputational only.

Michael Goegen - Tell me how this matters? For funding?

Kent Fuchs – It doesn't matter that much. We don't advertise it as some schools do. We track this, but we don't want to spend too much time on it.

Richard Aubrecht – I want to complement you on the development of a Strategic Oversight Committee. You have an opportunity to remake the college over the next 5-10 years. This committee can link faculty hiring to the strategic goals.

James Hauslein – The second column was a ranking of Agriculture. How does that relate to engineering?

Kent Fuchs – Here Agriculture means the Department of Biological and Environmental Engineering. They have a lot of our premed and biological students in their major. Faculty have joint appointments in Engineering and vote in our college. It is a tight coupling. The students get a joint degree in both colleges.

Promoting Teaching Excellence at Cornell – Michele Moody-Adams (Vice Provost for Undergraduate Education and Chaired Professor in Dept of Philosophy)

Michele Moody-Adams introduced herself and explained that she oversees:

- Living/learning initiatives for first year and upper year undergrads
- Academic initiatives - some aimed at students from educationally and economically disadvantaged backgrounds
- Co-curricular initiatives and service learning
- Consistency of undergraduate programs across the colleges
- Support and development efforts to enhance learning and teaching on campus

Cornell's commitment to be the best research university for undergraduate education couldn't be fulfilled without addressing what goes on in the classroom. Engineering faculty have been especially active in sharing innovative teaching techniques.

Revising tenure and promotion standards is harder. The Provost is considering mandating that colleges provide evidence that they are carrying out peer evaluated teaching as part of the tenure and promotion process. We are almost at the verge of giving out too many teaching awards versus creating a culture where teaching well is part of the culture and valued in and of itself.

Sophie Vandebroek – How do you measure teaching excellence?

Michele Moody-Adams – That is the 64M\$ question. Some of the answer is found in assessing what students have learned. Another part of the answer doesn't appear until 5 or more years down the line. The other part of it is our ability to see individual interactions – that students aren't confused; that students can master the material. I think the long term outcome of learning is most important.

Sophie Vandebroek – Are you measuring it for every professor?

Michele Moody-Adams – Like every institution in the US and now globally, we are under pressure to demonstrate we are evaluating and assessing student learning. How to do that is in dispute. Some of the skills won't be fully developed until sometime in the future.

The engineering college is doing innovative things in this area in part because of outside accrediting agencies. This will vary from field to field. We are under pressure from the university accrediting body - Middle States Accreditation. They have introduced outcomes assessment in their accreditation process.

Robert Shaw – Do we even know what “learning” means? Some folks who know a lot of facts can't solve problems.

Michele Moody-Adams – Some of the skills you want students to develop won't emerge on a test. You want conceptual learning and the understanding of deep problems. Some of the things we are doing include using different styles of teaching and modes of learning. For example, building something using facts and theories that have been learned is very difficult to measure. The true test is whether they built the thing successfully. There is a lot of debate about learning styles that I hope will be discussed at the proposed teaching institute.

Center for Learning and Teaching

Why do we need to do more?

The Center for Learning has the smallest staff allotted to faculty teaching support (1 person). Some, but not all, of the youngest faculty have had the most intensive preparation for the classroom. Our mid career faculty may have had the least preparation.

There is controversy about whether different learning styles make a difference, but I have been converted to believe that it does matter. To ensure life long learning we must create active, agile learners who can continuously retool and revitalize their careers.

Faculty demands are great and teaching skillfully is less time consuming than teaching badly. Helping faculty become better teachers also helps them manage their effort.

We are thinking of creating a new university center for Teaching Excellence and rewarding departments that are successful at teaching effectively. The Center should be dedicated to working collaboratively with faculty, teaching assistants, administrators, and student service personnel to advance and sustain a university culture that values and rewards teaching excellence. The services and activities most important to realizing this vision are consultations with faculty and academic units, dissemination of information about effective teaching, and ongoing support for efforts to create and sustain a culture of teaching excellence.

Faculty are more prone to take studies of teaching seriously if they can have a role in researching if those theories work. MIT is very strong in this area. Success will require collaboration with relevant units and faculty involvement in developing teaching related research programs.

The best means for delivering services could include one-on-one consultations, group events and activities, and web-based assistance. Harvard does a full day teaching workshop once or twice a year. We need to collaborate with Cornell Information Technologies and coordinate our efforts with the CU Library. Cornell could also take better advantage of the national foundations that support teaching.

We are proposing to dissolve the current Center for Learning and Teaching in order to create a new Center for Teaching Excellence reporting to the Vice Provost for Undergraduate Education and led by a person with advanced credentials in a discipline other than education. We would hire consultants in STEM, social sciences, and arts and humanities and develop partnerships with Cornell colleges and schools. We are hoping that the colleges would be willing to collaborate with us including on the provision of resources – invested in every sense of the word.

There are some challenges in achieving this vision. The greatest importance at Cornell has been placed on scholarship and research – we are fighting this tradition. We need to think deeply about teaching too. Faculty are typically the people who did very well in their field and they don't understand the learning difficulties some students have. Others believe good teachers are made, not born – some don't agree. Academic freedom is sometimes perceived as “the classroom belongs to the faculty”. The classroom is not the private preserve of the faculty member.

TA services should be linked as a supporting service for faculty. We can develop programs that help prepare future faculty.

When developing new services and a new center we need to be careful not to incur new costs at the expense of the colleges. Our goal to hire the new director before the end of Fall 2008.

Robert Shaw – What do you know about what your customer wants? Are professors asking for services? If it is at top down initiative it will fail.

Michele Moody-Adams – We did a study in the spring of 07 during which we looked at the current center and interviewed people around the colleges to assess the need and interest of developing a center like this. The need and interest was very high. We will be going to the academic deans at which time we will invite the colleges to let us know how they want to collaborate. What would this center need to look like to meet their needs?

James McCormick – Kent, maybe you could give some background on Felders and other things we have done.

Kent Fuchs – David Gries will do that later.

Venky Narayanamurti – We are facing the same problem at Harvard. There is great sensitivity to it being driven from the top down. Engineering needs to do it locally with the center helping to provide resources and setting high level policy. It has to be based where the teaching is actually done.

Gretchen Knoell - At some point are you going to share what the demands are on the faculty at a research university? If we could off-load things that are just administrative effort - buy them services - that would free them up for their teaching and research.

Kent – The trends are not good in this area. There are fewer staff per faculty than there used to be. Today faculty have to do things their assistant used to do. That is true nationally. The demand on the faculty to raise funding to support their research is more intense than it used to be. Each faculty member needs to bring in roughly on average half a million dollars per year. Each one is an entrepreneur.

Gretchen Knoell – Perhaps we can support them writing these proposals at the university level.

Michele Moody-Adams – There are some support services, but the number of proposals has increased and the amount of funding has decreased.

Kent Fuchs – We don't support proposal writing in general.

Michele Moody-Adams – Teaching is a complex thing and includes advising. Some other institutions use professional staff to advise – we don't do that at Cornell. Those faculty that do advising well are putting a lot of time into it.

Kent Fuchs – We want faculty to be nationally and internationally visible, to be editors, and to have start-up companies.

Jay Carter –Have you considered making it a virtual center where all of the resources would be embedded in the colleges—like the CIT model?

Michele Moody-Adams – That is one of the models we have been considering. The effectiveness of the people we would be hiring would be better. There is, however, virtue in having a place to come together for collaboration – or some occasions scheduled regularly to bring faculty together.

Richard Aubrecht – I was surprised that you didn't mention senior faculty mentoring junior faculty. Is that model applicable here?

Michele Moody-Adams – This is the beginning – a core structure. Mentoring is an important resource – using our senior faculty. We are going to work on an initiative in that regard. Some of our retirees and phased retirement faculty want to participate in mentoring.

James McCormick – What sort of characterization of successes and best practices (transfer of knowledge) have you considered? It sounds like we are embarking on discovering it all at Cornell instead of learning from others.

Michele Moody-Adams – No we made site visits to other centers, and have done phone interviews to determine what others are doing.

James McCormick - Have those findings been written up in terms of dos and don'ts yet?
Michele Moody-Adams – No we only have one person now and he couldn't possibly do that. We have been looking at other web sites and best practices and that knowledge can be dispensed quickly. My sense is that at the college level individual units are already doing this. Some departments have long standing histories of valuing teaching and having workshops.

Kent Fuchs– We have learned we need a structure of full time people working on this. One of the first tasks will be to have them find the best practices that are working elsewhere. The new director will have to demonstrate a deep knowledge of these best practices.

Joseph Bonventre – We've had some experience at Vanderbilt, Northwestern, MIT, etc. We have been funded by NSF. It is a major component at the Peabody School at Vanderbilt and a focus of John Bransford, who has written a book on how people learn (http://education.byu.edu/news/2005_features/bransford.html). Bransford is a Professor of Education and Psychology at the University of Washington-Seattle and Principal Investigator and Director of the NSF funded Center for Learning in Informal and Formal Environments (LIFE). Personally, I was involved as a content expert. It is difficult to do without increasing the amount of time you have to devote. I wanted to bring in technology – there was a technology infrastructure (students interested in doing modeling) and an assessment infrastructure that could tell you what you how to develop exams to determine if the teaching techniques are working.

Michele Moody-Adams – We will need to incorporate assessment techniques into the center and across disciplines. In doing this, we will have to fight elements of the faculty culture. Academic freedom is a function of our ability to show that the trust placed in us as teachers and researchers is something that we have earned. We can show this by demonstrating that we are teaching people things that matter and we can document that. Assessment is a crucial part of that. We need to do this slowly because if we move too quickly people will push back.

William Shreve – Nationally, the focus on teaching and learning has focused on K-12. Students at that level have experienced innovative teaching and will be disappointed with a traditional teaching model. Normally that is bridged by an education department, which Cornell doesn't have. Bringing in what is happening nationally will be critical in order to learn from what is already happening.

Frank Huband – (Kent circulated ASEE publications – the Journal of Education and Prism) ASEE started in 1893 with the Ferris wheel. They invited engineers and engineering educators to come to the site of the Chicago World Fair and they decided they needed an organization to promote the discipline and educational quality. We have had a meeting every year since and we publish journals and white papers. 25-33% of engineering faculty participate in ASEE. We have a global conference annually – this year 400 faculty and 100 students participated. The focus is on K-12 and a magazine "Go for It" is sold and distributed to schools, the girl scouts and corporations. The International Federation of Educational Societies is currently developing a global engineering dean's council to enhance the quality of education worldwide. We have regional meetings. The goal of ASEE is to encourage people to think about engineering

as a career and to enhance the quality of an engineering education. We have two meetings in Washington DC and engineers swamp the hill meeting with congressmen and their staffs. We have a second meeting in a warm place that focuses on issues that impact the future of engineering.

Teaching Excellence – David Gries, Associate Dean for Undergraduate Programs

Mike Duncan, Associate Professor in Chemical and Biomolecular Engineering has been named the “New York State Professor of the Year”.

Rebecca Brent and Richard Felder hold a workshop at the ASEE meeting every year. They will be at Cornell on January 17-18, 2008 to give a presentation on evaluating teaching.

James McCormick – Is that workshop optional?

David Gries – Yes it is optional. 30 or 40 faculty will attend out of 200+ faculty.

Research and Project Teams

When we look at teaching we are using conventional methods and undergraduate research and project teams. That is something that we can do that pure teaching colleges cannot. Some project teams are very large. The Solar Team, for example, included students from Architecture, Art, and Planning and the Johnson Graduate School of Management. Not all teams have to do with competition. Aqua Clara for example, is a service project in Honduras that helps communities develop pure water supplies. 34 graduate and undergraduates participated in the project this year.

Academic Excellence Workshops (AEWs)

We also have a collaborative learning program. Students who take Academic Excellence Workshops got a half a grade better than those who did not (B+ vs. B). We are now introducing collaborative workshops embedded into Math 191 and 192.

Three changes from the curriculum transformation were voted on and implemented.

- Collaborative learning sections applying math to engineering problems were added to Math 191,
- The introductory computer course (CS 100) was changed to either a course based in Java or a course based in MatLab with an added one credit self paced on-line course (CS 100),
- A new chemistry course for engineers (Chem 209) was developed to focus more on subject depth rather than breadth.

This past year we conducted a student experience survey. 47% of the respondents rated faculty instruction in engineering courses as being of high quality or extremely high quality. 19.7% rated instruction as low quality or extremely low quality. Given this result, it is clear that we need to do some work to improve instruction.

James McCormick – How many gradations of ratings were there?

Lisa Schneider – It was measured on a five point Likert scale.

Venky Narayanamurti – Are these junior and senior courses or all courses?

Lisa Schneider – All courses.

James McCormick – Most customer research shows use of a 7-10 point scale is a better measurement.

J. Bonventre – Is there a relationship to the size of the course?

Lisa Schneider – We don't have that data.

Evelyn Pearson – Were there open ended comments?

Lisa Schneider – There were many comments that are hard to summarize because they ranged all over the place.

Robert Smith – Was that 19.7 number consistent over several years? How do you feel about that? It is a troubling statistic.

David Gries – Letting the faculty know that teaching is important can change a faculty member. A faculty was put up for tenure and promoted to Assoc. Prof but not given tenure until their notion of teaching quality changed. He went to a workshop and came back and implemented teaching changes and his evaluations went up and he got tenure.

Robert Shaw – It is more than that. They have come up through a process that didn't teach them about teaching.

David Gries - I agree that our PhD program should include content about teaching.

James McCormick – Have those scores been shown to the faculty? Both those numbers are distressing.

David Gries – Students, faculty, and staff have access to teaching evaluation summaries. They are available on line since 2003. Our course evaluation survey is over 20 years old and needs to be redone.

Lisa Schneider – These results did inform the task force and form part of the rationale for the teaching center.

Sarah Fishcell – There is a long history here – faculty look back on their undergraduate experience and realize they had at least one crummy professor each semester.

Besty East – We are not on the low end of the COHFE scale for teaching.

David Gries – It may also have to do with how the questions are phrased.

Michael Goguen – I am passionate about this whole area and funded one of the programs we will discuss later on. One of the things I liked was that it was tough at Cornell, but I was disappointed about the exposure to world-class professors. The root cause is a business model problem – publish or perish. The problem is a natural outcome of that. Is there any thinking about breaking the one size fits all model for faculty? Could there be a teaching track to recognize the flaw in the business model?

David Gries – I think we are trying to recognize the flaw and in most departments you will find the senior faculty teaching the introductory courses.

Kent Fuchs – You can also think of it from the research side. Maybe we need the research faculty track and the teaching faculty track. Most faculty, however, can excel in both.

Venky Narayanamurti – We had a task force this past year look at this. It is a long-term problem. I am considering making some teaching appointments, but I am not sure I will get them through the tenure system. The culture change is the most important. You have a chance to develop a new set of values when you hire new faculty. We say we value both teaching and research, but we put more value on research – you only need a passing grade in teaching.

William Shreve – You may end up with the best instruction with separate tracks, but students may not end up working with the best faculty.

Michele Moody-Adams – Research measures are easier to quantify (journals, papers etc). Measures of accomplishment may not be as useful when we look at evaluating teaching. There is no peer review process to show you that other faculty at the university are teaching your students well enough.

Richard Aubrecht – We have to think about this in the context of tenure – a 40-year model. We need people who will stay current – the leading researchers – to teach upper level courses. If you think of Cornell as one of the top 10 schools, we are looking for a small subset of faculty who can both teach and do research well.

Michael Goguen - Given realities, there is a subtle difference between someone who is up to date (staying on top of the research being done) versus someone who is a proactive publisher and researcher.

Kent Fuchs - In BME the 2 senior lecturers attempt to deliver what Mike Goguen is proposing. They do much of the innovative teaching.

David Gries continued his presentation explaining that we are behind our peers in supporting our faculty in teaching. We need help in the university and in the college itself. There is currently no one person who can spend time on this issue in the college.

We hope the Engineering Teaching Excellence Institute Director position could be a joint appointment with the University Center for Teaching Excellence.

Discussion and Feedback:

Venky Narayanamurti– Have you tried to write a job description for the director? Will that person have a teaching role?

David Gries – We have not done that yet, but we have decided that the person needs to have a PhD in engineering.

Sarah Fishcell- The methods of measuring teaching excellence are student surveys and the ABET process. Are there any others?

David Gries – Peer evaluation – Brent and Felder in January will address that in January.

Sarah Fishcel – Undergraduate education is partly about learning course content and partly about how to work in teams, solve problems, and build intuition. I wouldn't want to lose the emphasis on that experience. You have to give in to the fact that you can't measure all of that. You have to ensure that it happens.

Joseph Bonventre – Do you know what the faculty want?

David Gries – No we don't and we don't have the staff to assess that. We have to create a situation where faculty realize they are not doing as well as they could and ask for help.

Robert Shaw – I wouldn't take this job unless there was a senior professor from the school who was supporting this initiative. There needs to be a real board with decision power.

Venky Narayanamurti – You need a handful of faculty who have already bought into it.

The ECC broke for their morning Executive Session. The Executive Session notes will be posted on the blog section of the ECC web page.

Integrating Engineering Applications into First-Year Calculus – Mike Kelley, Professor, Electrical and Computer Engineering, and Lisa Schneider, Director of the Learning Initiatives Program

Lisa Schneider - Integrating engineering applications into first year calculus was one of the recommendations of the Curriculum Transformation Task Force. The revised course uses an integrated approach to teaching math, science, and engineering through workshops that provide a collaborative learning environment. The workshops are 50 min sections embedded in the Math course. They are offered once per week and facilitated by Teaching Assistants and Course Assistants.

There were perceptions held by, and complaints from, engineering faculty that students didn't connect earlier learning and apply it in higher level courses. Using math to solve engineering problems enhances student learning, promotes their ability to apply math principles, and increases retention. Other colleges that are doing the same things have also realized positive learning gains and retention outcomes.

Mike Kelley – The Academic Excellence Program that these workshops are based on began almost 20 years ago in response to a presentation by Richard Felder. I volunteered to lead it. Now, 20 years later hundreds of students are participating, and Charles Seyler and I are teaching ECE 210 this way. Students don't go to sleep in these sessions. They are engaged with each other and it is a social activity. I can't imagine why instructors wouldn't use these sections.

Robert Shaw – Have you ever asked your colleagues why they aren't using them?

William Shreve – Have you asked the students why they don't use them? Or why they do use them?

Mike Kelley - This recommendation only was approved on a 3 to 2 vote. Engineering faculty thought we were imposing this on the Math department. In fact the Math department was more positive than our TAM faculty who teach Math. They put manpower and money into developing the sections.

Round tables are critical to ensure good collaboration. Some improvements could still be made. For example, 50 minute sections are too short. Students complain they can't finish the assignments. 70-75 minutes would be better.

Student training includes having them take turns facilitating for 10 minutes each. Feedback from the students, TAs and CAs is being solicited.

Mike continued his presentation emphasizing that the faculty member must show up at least half of the time at the sections.

I taught a class of students who hadn't had any calculus using the workshops and all of them passed the test. They applied what was learned in that course.

Sarah Fischell - Why aren't faculty going to recitations? That isn't good leadership.
David Gries – Sometimes there is not enough time.

William Shreve – Do all the AEWs give you an extra credit?

Mike Kelley – No, in the Math courses they are integrated into the course. There is no extra credit.

Evelyn Pearson – Is there a feedback loop to the lecturer?

Mike Kelley – In principal there is through the list serve, but in practice this feedback loop is not working consistently yet.

Synergy between Research and Teaching: Fun with Fluid Dynamics - Charles Williamson, Professor, Mechanical and Aerospace Engineering

Integration between the research lab and the classroom in both directions, and full circle (class – research – class), enriches teaching and learning. In this setting undergraduates teach other undergraduates. Top seniors act as TAs for credit. They are sometimes the best TAs you have.

Existing program and activities that support and facilitate UG research include:

- Undergraduate Research Fellowships
- NASA Space Grant and Engineering Learning Initiatives Summer Research Grants
- UG research conferences and poster sessions
- Design projects

Over the last 17 years, 160 student researchers have worked in Professor Williamson's labs. This experience has been an excellent stepping stone to graduate research and national fellowships such as the Merrill Presidential awards.

Oblique Wave Resonance

The serendipitous discovery of oblique wave resonance opened my eyes to the potential of undergraduate research. Oil traveled down wire and was heated and evaporated. As it moved downstream the axis of the vortices were oblique not vertical. The net result is interaction waves – large angle oblique wave resonance.

We asked the question, “Where was the wave coming from?”, and used a muffin fan to amplify the flow to produce the oblique waves = Serendipity. A grad student came up with a PhD and two major papers from the work.

That success set me on the way to involving undergraduates in my research.

Wing vortex experiment.

Sara Purdy, and MAE undergraduate major, conducted engineering on drag reduction by wake interference. Using an upstream interference plate, she was able to reduce system drag by up to 76% using a 25% plate.

Flying a Rotating Cylinder

Professor Williamson demonstrated flying a rotating cylinder by flying a Bic pen. Forward motion produced by spinning the pen backwards resulted in weight balances and the pen flies.

This illustrates a demonstration of the interface of research and teaching.

ABET Program Education Objectives (PEOs) – Deborah Cox, Assistant Dean for Strategic Planning, Assessment, and New Initiatives and David Gries, Associate Dean for Undergraduate Programs

Deborah Cox gave a presentation on the ABET Program Education Objectives (PEOs). It is the responsibility of the institution seeking accreditation of an engineering program to demonstrate clearly that the program meets the ABET criteria. During her presentation, she highlighted the following:

Program Educational Objectives (PEOs)

2004-05 Definition: Statements that describe the expected accomplishments of graduates during the first several years following graduation from the program.

2007-08 Definition: Broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

Direct and Indirect Measures

Option 1: Eliminate the College PEOs and roll the program based PEOs up under the College Mission Statement.

Option 2: Simplify the College PEOs to ensure they are consistent with the program PEOs and measurable using at least one direct measure.

Deborah asked the ECC members for their feedback on these two options:

Jay Carter: Having something unified is easier. Keep the objectives and outcomes simple.

Sophie Vandebroek: Doesn't ABET have a set of objectives and measures? Why do we have to come up with them?

Deborah Cox - ABET does not have a set of standardized measurements for Program Outcomes (ABET a-k), but not for Program Educational Objectives. One of the things we learned during the ABET review of 2004 was to keep objectives and outcomes as short a list, and as simple, as possible.

Kent Fuchs: ABET wants the colleges to have the flexibility to create their own standards.

David Gries: You can define your own objectives.

William Shreve: The program ABET process will be helped if you have the college process in place first. Use the Mission Statement to replace PEOs.

Deborah Cox: The preference would be to drop the PEOs if we use the Mission Statement at the college level. Do we need to elaborate on this?

Robert Shaw: Why don't you eliminate the PEOs if they don't help you?

Deborah: We would like a vote from the ECC on which option we should choose.

After further discussion, a vote was taken. The consensus was Option 1 - eliminate the College PEOs and roll the program based PEOs up under the College Mission Statement.

Computing Requirement in Engineering – David Gries

The Curriculum Transformation Task Force felt computing is so ubiquitous that students should know more than one language - both MatLab and Java. We changed the requirement to a 14 week course in either Java or MatLab based (4 credit course) and plus a one credit course in the other language.

The one credit courses are self paced using lectures on the web (Blectures = on-line lecture + blog) and discussion sessions.

Programming assignments and tests require mastery. If your program doesn't work, you must fix it. You must get an 85 out of 100 on the test or you take the test until you can

pass. Some students have resubmitted a program 4 or 5 times. This approach has changed the student's attitude towards learning. This helps students who don't know how to program and those with experience how to undo their bad programming habits.

Every student also gets a one-on-one session with an instructor, a TA, or a senior-level consultant.

Concept Oriented, Peer-based Learning – Chris B. Schaffer, Associate Professor, Biomedical Engineering

To improve learning we should center education on critical concepts and make the learning peer based -- Shift the focus from transferring information to integrating information.

I ask students to take the first step of information transfer by reading the material before class. I spend the lecture helping students incorporate the information into the way things work using concept oriented questions and discussion with peers. I give a web based quiz the evening before the lecture to ensure students have done their reading.

Using clicker technology, I implement the six steps of peer instruction advanced by Professor Eric Mazur from Harvard:

1. Ask questions
2. Let students think
3. Poll individual answers
4. Have students try to convince their neighbors
5. Poll revised answers
6. Reveal correct answer and explain how to solve the question

Each ECC member was given a clicker and Professor Schaffer demonstrated this six step process using a question about how much volume of liquid is displaced by a boulder floating in a boat compared to that same boulder at the bottom of the pond.

The metric that measures whether you know something is your ability to teach it.

Discussion:

Robert Shaw – At the end of our discussion some people in our groups still had the wrong answer. How do you make sure they understand the right answer? Will they personalize the group discussion more than the instructor's answer?

Chris Schaffer – I haven't had that problem. I end the discussion with an explanation of the how to solve the problem.

How challenging should the questions be?

Chris Schaffer - Hard enough so that half of the class gets them wrong.

William Shreve – Often students (frequently women) are afraid to go against answers of male students. It is an issue of self confidence. The anonymous nature of the clicker helps this.

Sarah Fischell – This approach gives students practice in solving problems. Do you match a clicker to a student?

Chris Schaffer - Yes

James Hauslein – That is almost like exception reporting. Do you try to intervene with a student who constantly gets the wrong answers?

Chris Schaffer - Yes in larger classes we did this. In smaller classes at Cornell, we tend to know the students well enough already.

Robert Shaw – How many questions do you ask?

Chris Schaffer - I ask about 15 questions in a lecture – ½ lecture and ½ questions.

Robert Smith – How much work does it take to link the on line quiz and reading to the questions?

Chris Schaffer - The hard part is writing good questions.

Lisa Schneider - Is there a mechanism to share the questions?

Chris Schaffer - There are many published questions – some are available through an NSF site. I get a lot of questions from students who come to me during office hours.

Evelyn Pearson – Is this a new course or did you have content from a previous course?

Chris Schaffer – This course was developed from scratch – but the pay off is worthwhile. It does take more work.

Faculty resistance to use this approach comes from the amount of work it takes to develop the course with questions. There is a significant outlay of a time with an immediate payoff to the student and a long term payoff to the instructor.

Initially you get flooded with questions from students because they finally know enough to ask questions.

Robert Smith – Did students think it was a better qualitative experience?

Chris Schaffer - Students were neutral. Student judgments can be based on things other than how well they learned. For example one student responded, “Prof. Schaffer didn’t teach me anything – I had to do it all myself”.

Robert Cowie – Do you cover the same amount of material in a lecture?

Chris Schaffer - You cannot discuss as many topics in lecture, but you can cover the same range of topics in the course because the students do pre-reading and participate in discussion in class. It is important to have the carrot and stick approach. If a student comes to the lecture without having done the reading, it is not useful.

Sarah Fischell – Has anyone tried this in recitation?

Chris Schaffer - Yes – if I did teach a recitation it would be in groups with a TA coming around to help.

Robert Shaw – Has anyone studied two groups - a traditional group versus a group using this model - and looked at the retention of the material?

Chris Schaffer –Eric Mazur has done that in retrospect and looked at how well students did in the two modes of delivery. The results are surprising. Students do equally well on problem solving (quantitative) and do much better on the concept oriented learning in the peer based session.

Kent closed the meeting by bringing the ECC back to the beginning. He restated the goal to create a culture and infrastructure to support learning. The ECC feedback from the executive session will be very helpful and unless there is something confidential we will share it with department chairs.

The ECC met in Executive Session.