ACTIVE LEARNING ON BOTH SIDES

-- FACULTY AND STUDENTS --

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Let me first of all thank the administration of Tokyo University for this invitation. I hope that you will take Professor Shigemasu's invitation seriously and interrupt me whenever there's either a question about the content or a question about how my remarks might apply to the conditions here. One of the challenges when you speak at a foreign university is, of course, coming from the outside, that you have no real knowledge of the conditions, you have no real knowledge what might be of interest to your audience. Therefore, I particularly encourage questions, since it will help me to orient what I am saying in a way that may be of greater benefit to you.

The official title of my talk this evening us "Active Learning on Both Sides." I want to talk about the connection between teachers and students, but I think first I should give just a little background about the center that I direct and about some of the issues that we are currently facing before I focus in more particularly on this issue of active learning.

The Derek Bok Center has been in existence for 30 years. It was founded in 1975. As I

[1] http://www.bokcenter.harvard.edu/

was telling Professor Shigemasu earlier, this is the first time a president of Harvard has had an organization named after him when he retires instead of a building, so we are very pleased to bear his name, particularly since President Bok was the person who raised the money for the center. In fact he has just published another book -- he continues to write very prolifically -- about “underperforming American universities.” So he continues to be a critic of American education in a positive way, that is, pushing people concerned with higher education in the United States to do a better job. The Bok Center itself is intended to help anyone teaching Harvard students. In the United States this would mean graduate students who teach, so-called “junior faculty,” and “senior faculty.” We are available to help all three groups.

One of the ways in which Harvard helps faculty to focus on teaching is to evaluate that teaching, having the students fill out -- now online -- an electronic form at the end of each course, whose results are published. So you can actually either look in a book or look online and find out whether “Professor Wilkinson’s course” was thought of highly by the students or detested by the students.

That is one component that helps faculty to become, shall we say, more interested in the quality of their teaching, at least as defined by students’ ratings. But another element that is becoming increasingly important in helping the faculty to focus more on the effectiveness of their teaching, I think, is a body of research on learning, particularly in the area of physics. Now, I don’t know why physics in particular is the discipline that has been in the forefront of this kind of research, except perhaps for the fact that a physicist named David Hestenes, who taught at a very large southwestern university until his recent retirement, about 25 years ago devised a new kind of examination.

At Professor Hestenes’s institution, as is the case in a number of American state universities, students transfer from other schools – particularly from two-year community colleges. They would apply to enter his physics course and he needed to find out how much physics they knew. So he created a test that had no numbers, no calculations of any kind, but focused instead on the concepts of physics. An example of the sort of question he asked would be: an airplane is flying over Tokyo and the pilot drops a can of Asahi beer. The path that the beer takes when it falls is: (A) completely

vertical; (B) a parabola that goes forward; (C) a parabola that goes backward, and so on. You can have up to five different possible answers. And he created these conceptual questions based on Newtonian mechanics -- force, inertia, friction, and so on.

The students who came from other universities and wanted to enter his class always did very badly on this examination. This had been going on for several years. But one day Professor Hestenes had an idea. This is one of these radical ideas that seems very small at the beginning but have large consequences later on. He gave his placement test to his own students -- not the students coming in from the outside, but the students who had been in his class all semester. And, as you might be able to guess, the result was that they did just as badly as the others. This was a shock to Professor Hestenes, who considered himself a very good teacher.

One good thing about physicists is that they respect data. The data in this case showed that something was going wrong in the teaching connection between the professor on the one hand and the students on the other. Professor Hestenes thought he was being perfectly clear, and the students were still confused. What could he do? Well, he completely changed his course and began giving the students more and more of what he called “ConcepTests.” English allows you to use one “t” in the middle, so he capitalized it. It’s a “concept test” with a capital “T” in the middle. He gave these tests on a regular basis and forced the students to explain to him what they were having difficulty understanding.

To make a long story short, a little over 20 years ago, in 1985, he and a colleague published an article in The American Journal of Physics about what he called “the initial state” of physics knowledge among undergraduates. What Hestenes discovered was that students do not come to university with their heads empty, waiting for us to fill their heads with knowledge. Would that that were the case, because that would make it a lot easier for all of us! But no. Students come to the university with their heads full, but full of the wrong stuff. Full of stuff that has to be taken out before you can pour new stuff in.

What the ConcepTests that David Hestenes administered revealed were all of the

mistaken ideas that students have. Now, lest you think that this is only true of students in the southwestern United States, I will tell you a second story about Harvard students. There is a project at Harvard that was conducted about 15 years ago, trying to document students' views on astronomy. We have a film showing Harvard students on the day of graduation, in their academic robes. They are about to receive their diplomas and it's a very proud moment. On camera they are asked, "Why is it warmer in Cambridge, Massachusetts in the summertime than in the winter?" You could ask the same question of students at Todai. And every single student answers the same way. Of course being Harvard students they are very eloquent and very assured. And they all say, "That's easy. It's because the Earth is closer to the Sun in the summer." Which is wrong, but plausible. In fact, they have clearly never been to Sydney, Australia, or Rio de Janeiro, Brazil, in August, or they would have been cold enough to realize that it wasn't that the Earth is closer to the sun at that time of year. It's much more complicated than that. But the point is that they are convinced by earlier experiences such as getting closer to a fire or a stove. What happens when you get close to a stove? It gets warmer.

So there are ways in which personal experience has created many, many expectations on the part of students about how the world ought to be. Another Harvard professor of physics named Eric Mazur, with whom our center is actually making a film right now, recounts the story of the student who at the beginning of the examination said, "Professor Mazur, would you like me to answer the questions the way *you* think about the problems or about the way *I* think about the problems?" Because she had two very different conceptual realities. There was the reality of Professor Mazur, which was true in his classroom, and she knew he wanted her to answer in a certain way. Then there was what she really believed, which was not at all what Professor Mazur was telling her. So this clash between what students fundamentally believe and what they know that the teachers want them to say is one of the problems that the physics community has looked into.

Now in the last 20 years or so a number of other disciplines in the United States, including biology and mathematics, have begun to look at what we call "student misconceptions." And the student misconceptions turn out to be quite general. That is, in any one field students will generally have problems with the same area, and they turn

out to be quite specific, not only to the field but also in the sense that they are resistant to change. You have to work very hard to get the students to change their minds about things like why the seasons change, or why evolution has occurred, or why if you have a frictionless surface does Newton's First Law of Motion actually work -- that a body in motion will continue in motion unless opposed by an outside force. None of these concepts are intuitively obvious and all of them require a great deal of effort to change the students' minds.

This body of research into student misconceptions has been, I think, fundamental in helping teaching centers in the United States, including the center that I head, seriously engage faculty with the concept of improving their teaching. Because teaching occurs not between equals, as would be the case in a peer review journal, but between students and a teacher -- who by definition knows more than the students -- it is not often held up to scrutiny in terms of its effectiveness in producing learning. And this is not easy. Creating the kind of test to show whether learning has occurred is hard. Nevertheless, the kind of ConcepTest that David Hestenes devised, is one valid measurement. And by that measurement, American universities, including Harvard, still have a very long way to go.

Now I'm sure that some of you at least are familiar with the distinction between formative and summative evaluations. Formative evaluation is evaluation that helps someone improve. You could imagine a coach coaching volleyball or figure skating, and the coach gives instructions to the volleyball team or the figure skater – "Change this, change that. You'll do a better job." Summative evaluation occurs on the day of the match or the day of the figure skating championship when the judges say, "You have won first place in the women's figure skating championship with a score of... "whatever it happens to be. So, formative evaluation requires the teacher to evaluate the student in order to know what is being done well and what needs improvement. Summative evaluation, on the other hand, is the evaluation that carries, as we might say, rewards and penalties -- the final grade in a course or the diploma you receive at the end of your time at the university.

Now one of the things about active learning is that it involves a lot of formative

evaluation. Why is it called “active”? Well, there are several reasons, one being -- and this again goes back to the work of people like David Hestenes -- a growing suspicion that traditional forms of teaching, including the lecture, are not effective, and in fact appear to produce much more learning than is actually the case. Normally there’s relatively little feedback in a lecture. As the lecturer, you can see whether the students are awake or asleep. Lately, at least at Harvard, students bring their laptops to class and take notes on the laptops, so you can’t actually tell whether they’re taking notes on the lecture or messaging their friends. So even that kind of visual feedback is limited.

But what you don’t know at all is what is going on in students’ heads. This is actually a very interesting and very old philosophical problem, at least in European philosophy -- the so-called problem of “other minds.” The British philosopher Gilbert Ryle spent part of his professional life at Oxford looking into this question of other minds. Briefly put, you have no direct evidence about anybody’s mind but your own. Everything else you know depends on inquiries based upon indirect evidence. And that means that it is not at all certain. How do you know if someone is in pain? How do you know what they really think when they say something? I was introduced when I first arrived in my initial visit in Japan 10 years ago to the distinction between “hone” and “tatemae,” which is another instance of “other minds.”

So the question is, “how do we know what our students know?” And the answer is that we don’t know, really. We know what our students do, not what they think. We can ask them to say something, to write something on an examination -- perhaps we could ask them to actually perform something. If you have a music student, you would ask them to play. If you have an art student, you would ask them to draw. But if you have a physics student, maybe you should ask them to perform an experiment, or maybe you just give them a word problem and expect them to fill in the blanks with the proper numbers. There are many solutions, but I simply want to underline the fact that *any* kind of evidence about student learning is indirect, and that is one of the difficulties about judging how successful we are.

Now, things like the ConcepTests and other supporting evidence suggest that lectures are fun for the lecturer, a wonderful way for faculty to express themselves, potentially

inspiring, but have a very limited effect on actual student learning, and are best combined with other kinds of teaching. One of the interesting experiments that this physics professor at Harvard I mentioned earlier, Eric Mazur, has conducted is to take the lecture and to make it into a kind of sandwich. So you have some talk (some lecture), and then there's question, and then some more talk, and then maybe a little ConcepTest, and then some more talk, and so on. The sandwich succeeds in getting the students actively involved during the lecture.

Lectures in the United States have been the object of a certain amount of criticism in the last few years. I think in some ways it's misdirected criticism. I actually love to lecture, but the only responsible way to do it is to interrupt yourself periodically and let the students into the conversation. Partly, I think, because it's important to hear their questions, and partly because it's important to hear their answers to your questions, so that you have a better idea of how much they are understanding. Again, if you look at the sea of laptops out there and you hear the click of keys, you know they're busy, but you don't know what they're doing, and you certainly don't know what they're thinking.

So, one of the premises of active learning is that it should bring students and teachers together in a dialogue structured by questions, and that the questions should have something to do with the material that is currently being studied. Students can ask the faculty questions, the faculty can ask the students questions. You can almost plot in a linear fashion, I think, the degree of learning as a function of the frequency of questions. The more questions, the more learning. And the more feedback, the more learning. I think that, due to its rigorous entrance exams, there are probably very few students at Todai who are surprised when they get here by the kinds of courses they take or the kinds of questions they get asked. You may prove me wrong, and I would be happy to hear exceptions, but that's my assumption. By contrast, the United States is not a country where the secondary school system -- the high school system -- is strong. It's inconsistent. In some instances there are good schools, and in some instances there are terrible schools. Harvard University at least makes a claim that we take the best students from the best high schools and we take the best students from the worst high schools. This is because we want to have a mix -- geographical, ethnic, class. We want to have a

very diverse student body whose constant is intelligence -- a very smart, diverse student body. But intelligence is not the same thing as knowledge, as you can see from the answers that the Harvard graduating students gave about why the seasons change.

Now, given the fact that -- at least at Harvard -- the students come from many different backgrounds, and given the fact, as I have tried to emphasize, that not just in physics but in many other fields student misconceptions are very common and very pervasive and don't change very easily -- they resist change -- it's all the more important to get feedback from the students on a regular basis about what they understand and what they don't understand. Devising ways to get feedback has become a big experiment that's currently being carried out at Harvard and other American universities at a number of different levels. Let me just mention a couple because I think it may make what I am trying to say here more concrete.

The very simplest kind of feedback at Harvard is what we call the "Minute paper." The "minute paper" is when you take sheets of paper and hand one out to each student five minutes before the end of the lecture. There are two questions they must answer on the paper. The first one is: "What was the most important thing you learned in today's lecture?" and the second is: "What is the most important question you still have?" In other words, what didn't you understand? What was the most important thing you *did* understand and where are you having the most difficulty? When we ask faculty to predict the answers to minute papers administered in their own courses, they are extremely good at predicting answers to the first question -- What was the most important idea that the students learned? And that's natural. The faculty are the ones that write their own lectures. They should know what the most important thing is that the students are supposed to learn. But they're terrible at predicting what the students will *not* understand. Because everything for the faculty is clear. That's their field. They spent years and years studying these things. They don't see any problem at all. And I understand that.

I'll give you a personal anecdote. When I'm not directing the Bok Center, I'm also teaching modern European culture, and that includes French literature. Sometimes students will ask me, "What is an *easy* book in French?" I have a very hard time

answering that. There are some stock answers -- Saint Exupéry (The Little Prince). I know that's easy, but I don't have difficulty with the other novelists and I can't tell whether Camus is easier than Mauriac or easier than Stendhal. I really don't know. It's *all* easy for me. I'm not a good person to ask. So instead I say, "Go ask a language teacher. They'll be able to tell you much better than I will."

I think one of the difficulties that comes with becoming a faculty member is that you lose the ability to see difficulties from the point of view of our students. There is a kind of professional amnesia that takes over. The French have a very nice word for this. They call it a "déformation professionnelle" -- a professionally induced deformity. And this kind of "deformation professionnelle" is something that we need to take seriously, because that would lead us to listen closely to our students when they tell us what the most important question they still have might be. We can't answer that question ourselves because we're no longer in the same intellectual states that our students are. And I'm not just talking about differences in generation and the fact that their music is not our music, and so on. I'm really talking about *our field*. What *we know* in an intimate way *prevents* us from understanding what they *don't* know in an intimate way. And therefore we need them to tell us.

Most of the time, at least at Harvard, they are very happy to tell us. They're not shy and sometimes they don't all agree. Sometimes there are two groups, let's say, some of whom have one problem, some of whom have another problem. But what *never* happens is that every single student has a different problem. The problems are also aggregated. And they're consistent from year to year. When you start doing this kind of research in your field, there's a steep learning curve at the beginning, that is, you have a lot to absorb at first, like creating a course and writing out your lecture notes, but the good news is that the second time you can rely on what you did the first time. The second time you get information from your students, there will be certain issues that are very familiar to you because the students last year had the same problems. This is valuable information. It allows us to focus our teaching on areas where the students are going to have difficulty, and perhaps to go more rapidly over areas where they are *not* having difficulty. This in turn allows our teaching to become more efficient.

Now this is the low-tech solution. All you need is enough sheets of paper to hand out to the students and enough time at the end of the lecture to have them fill this out -- five minutes -- it's called a "minute paper" but it should be probably should be renamed a "5-minute paper" -- and then the willingness to read what the students wrote. A high-tech solution could be to do this by email, or on a course website. There you have the students answer the same kinds of questions, and send you their answers by email. Even better, at Harvard we are able to link the students' pictures with their answers, so you can see what they look like. If you teach 200 students, it's nice to know that Sally Smith looks like this and Charlie Jones looks like that. And also that Sally had had a problem with the lecture last time. You can look out and say, "I'm going to answer Sally's question today." That's a connection that is one component of active learning. So we can go from paper to electronic means. The communication, however, is what is most important -- not the tools, but the concept.

I'll stop in just a moment to take my own advice and see if there are questions. Let me just say that I think that one of the big obstacles in doing this, at Harvard at least, is that it forces faculty to rethink their own role and perhaps to be just a little more humble about what they do and don't know -- this paradox that I mentioned before that knowledge can be an impediment, not a help, in understanding students' misconceptions. Just because we know the right answer we may not be able to so easily understand the wrong answer.

I remember a conversation with a good friend, a mathematician friend who is now the dean at a wonderful little college of science called Arrive Mud College in the vicinity of Los Angeles. But for a long time he was on the Harvard Mathematics faculty, and at one lunch he said, "Jim, what's the difference between a great mathematician and a great mathematician who is also a great teacher?" And I said, "Well, I guess the great mathematician has invented or come up with a novel proof of some kind, has done wonderful math." And he said, "Oh yeah, yeah. That's the easy part." A great mathematician *just* has to come up with a new proof or thinking in a different way. A great mathematician who is also a great teacher not only has to come up with wonderful mathematician's research and find out what's right, he has to understand all the wrong answers that the students would give and why.

Why are these wrong answers plausible, at least to the students? Because the students are not just answering randomly -- or at least 99% of them aren't. They don't just close their eyes and put a finger on a multiple choice answer. They're not making this stuff up. They're telling us what they *really* think. And as I said at the beginning, it is not that their heads are empty. Their heads are full -- full of misconceptions. When they tell us what they *really* think, then we not only have to listen to what they say, but we have to understand the logic behind it -- the logic of getting warmer when you come closer to a fire, for instance, and then applying that logic to thinking about the seasons. The fact is that Newton's laws, beautiful and interesting as they are, are abstractions. There is no such thing as a frictionless surface. If you read Newton's laws and you try to imagine how could we go and test this, you would need to do it in outer space, in a situation where there's no atmosphere, where there's none of the kinds of conditions that we are really familiar with obtain [apply].

If you think about population genetics if you're a biologist -- the power of a single mutation to alter a species because it gives some individuals an advantage in, say, the search for food -- the power of that mutation might become apparent only over a span of hundreds of thousands of years. No human being has any conception of hundreds of thousands of years, except as a mathematical abstraction. So to get students to understand population genetics... we laugh at students who don't believe in evolution, but evolution is a counterintuitive idea in some ways. And I think many of the ideas that we feel are central to our own fields, if we think about it a little bit, turn out not to be obvious at all, but to be counterintuitive. We've just forgotten quite how counterintuitive they are.

Professor Shigemasu: If you keep talking...everyone has been silent.

Professor Wilkinson: So I'm going to stop. This is a good chance for someone to say something or to raise your hand. How about a question from you?

Professor Shigemasu: So the distinction between formative evaluation and summative evaluation is very important. And we understand formative evaluation as maybe for

making teaching more efficient. My question is what is the role of the Bok Center in facilitating active teaching?

Professor Wilkinson: That's a very good question. In the first case, we try to offer them tools. For instance, on our website we have what we call "Early Evaluations," which are a form of formative evaluation. You can either download a print form or you can administer an electronic form to your students so they can tell you things about what they understand and don't, or how they are liking the course in general -- what they consider is good and bad about the course over the last few weeks. We try in workshops to demonstrate different models of getting information and in general we try to give examples of courses that are using these techniques, including this film that I mentioned to you showing Professor Mazur, who is trying to get information in *every* lecture using this sandwich technique. So we try to offer tools and at the same time we try to help faculty understand that the students may appear to know more than they actually do. That's been the focus of what I've been saying this evening, and I've been talking in a way that I would probably also be talking to Harvard faculty. So we work both to make faculty aware of the problem and then offer them a few tools with which to address it.

Professor Shigemasu: Thank you. You still have plenty of time.

Tom Gally: You mentioned at the beginning that you treat the graduate students, junior faculty, and senior faculty differently in terms of these programs? Do you treat them differently, and if so, how?

Professor Wilkinson: Yes, we do. Teachers change over time, and the problems they face also change over time. So we do treat graduate students differently, not just because they're beginners but also because the issues of beginning teachers are not the same as those of more advanced teachers. Beginning teachers need a lot of support because they are often unsure of themselves; and they need a lot of information about teaching techniques, but they particularly need a chance to try out teaching before they actually get in the classroom. So we use a technique for beginning teachers called "microteaching" that involves bringing a group of five or six graduate students together and having each one teach the others, seriatim. So for five or ten minutes one will talk

about a topic they've chosen, then the next one will get up and talk about another topic, and so on. The feedback from their colleagues after each presentation is an initial source of information for the novice teachers, but we also videotape them. We will sit down privately with them afterwards and give them a second chance to look at the tape and get feedback from Bok Center staff.

Junior faculty already have some experience teaching. They often have taught small groups, but have not taught lectures very often. So for them we focus on lecturing, and we also focus on tools -- multimedia, syllabus design -- just the tools of the trade. Senior faculty -- some of them at least -- have moved to the point that they're no longer concerned about themselves and their own, let's say, ability to convey the aura of a professor convincingly, and they know something about the tools. They're finally focused on the students. So we give them information about student profiles, where the students are coming from, the kinds of research on student misconceptions that I mentioned here. The difficulty with senior faculty is that they have, let's say, 20 years of teaching behind them and are more resistant to criticism, I think, in part because if they accept the criticism it's not just about today, it's about the whole previous 20 years of teaching. They sometimes find that a challenge. So, in addition to helping them focus on the students, we also try to be extremely diplomatic with the senior faculty. I must say that some of them, at least, have become great friends and allies of the center -- not all of them, not even a majority perhaps, but certainly a critical mass. And the most interesting moment is when senior faculty begin to understand that teaching is intellectually interesting. Not just their field, not just their discipline, but pedagogy is intellectually interesting. You can see the light bulb come on, you know -- "Okay, we got this one!"

So, we offer them different things, both because they (teachers) have different needs in terms of their trajectories, but also because they have different, I might say, psychological needs. Beginning teachers are hungry for help and support and they have nothing to lose if you tell them they are doing a terrible job. Of course we do it in a very gentle manner. But still. Senior faculty have a lot to lose and you have to be much more delicate in dealing with them.

Q: The Derek Bok Center itself collects the results of this feedback process?

Professor Wilkinson: Yes, we try to practice what we preach, so we have public orientation sessions where we solicit feedback. On our website... people can let us know. We have a formal evaluation process for virtually everything we do that is formal and large. We also have a retreat twice a year where the staff gets together for a whole day, and for the retreat people make suggestions. It used to be that the only suggestions were how to improve things. In other words, it was sort of "Well, this is good. Let's make it better." About five years ago we decided that that was a distorted picture, that we also had to ask, "What's bad?" Not just what could be improved. So we focus on both now, looking back on the last six months. "What are the things that were the greatest success and the things that you never wanted to have them happen again, and concretely what can we do to improve?" So there's the analysis and there's movement toward some kind of concrete solutions. We have information coming from the outside which we tabulate. We have a database. We can compare the results of this year's winter orientation with last year's. On the first of February of this year we will have a one-day teaching conference. Last year we had one at this time also. So we'll look at the results, not just the numbers, but also at the written comments and compare them. That provides material for self-examination. Then there's also an external body, a committee, that periodically looks at the Bok Center and gives us information. I would like it to meet more often, partly because I think it's good for us to hear outside [opinions] -- not clients, but faculty members. But also partly because I think it's important for the faculty to know more about what *we're* doing. So those are three avenues of input.

Q: Sometimes at the level of "honne," I think there are more people who pay attention to research than teaching. Is it true?

Professor Wilkinson: Oh yes. This is a very complicated issue and we could spend a long time on it, but let me give you my short answer because I think this is one of the fundamental questions of any good research university. The fundamental question is, "Is there really room for teaching or are you just pretending because it's now fashionable to talk about teaching?" So my standard answer has to do (as Professor Shigemasu knows) with the normal standard distribution curve. I would say that in any research university

you have three groups of faculty. One group I call the “Pioneers.” These people are really interested in teaching, and they’ll be interested in teaching no matter what. But they’re a very small group -- maybe one or two in each department or area. And usually they don’t talk very much about their interest to their colleagues because they would lose face if they did that. So if you’re interested in teaching, if you’re the director of a center or a dean or something like that, your job is to find out who these people are, discreetly, of course, so that you don’t embarrass them in front of their colleagues. But nevertheless, find out who they are, invite them to lunch, make them your friend, seek out their advice, because they’re going to be very helpful.

Now, the group [on the other side] I would probably call the “Dinosaurs.” They will never be interested in teaching, never, no matter what you do, so just forget about it. They’re not worth the effort. But the third, middle group is the group you’re really interested in. This is actually the majority -- the people under the bell. These are the “Skeptics.” Being a skeptic is not the same as being a dinosaur. Being a skeptic means that you *might* be interested in teaching if the conditions are right and your colleagues won’t laugh at you, and so on and so forth. My vision of progress is that you begin to make inroads in under the bell over time, and I think the most important thing to remember is not just that there is this group of interested faculty, but that you have to think of this as a long-term proposition.

The Derek Bok Center has existed for 30 years. I’ve been Director for 18 years. I will have long since retired by the time Harvard University transforms its research ethos into a research-plus-teaching ethos. At the same time, having been director this long I can say that things have changed, and in my opinion they’ve changed for the better. Teaching is more important on campus as a result of several things. It’s generational to some degree. Younger faculty, for whatever reason, seem more interested in teaching, more interested in a lifestyle that would accommodate contact with students than an older generation. It has to do with the reward structure; it has to do with external pressures; many kinds of influences coming together.

So I would say that at Harvard right now if you had some kind of measurement of a “honne” interest in teaching that maybe a third of the senior faculty are genuinely

interested. That's double what it was 10 years ago. So we haven't yet even reached the halfway point, but we're making progress. One of the advantages of being a cultural historian is that I know that cultural change is slow. But slowness is also a guarantee that it's hard to reverse once it takes place, and the current focus on research is itself a historical phenomenon. Universities did not always define themselves in these terms. I will predict that probably after all of us, with the exception of some of the younger people here, have retired, the pendulum will be swinging. It's already starting to swing, and it will continue in that direction up to a certain point. People will understand that it's possible to be a great research university *and* at the same time to devote time to teaching. And in part they'll understand it because teaching will be of interest to them. I think one of the great challenges is to take external pressure and make it an internal kind of mission. In other words, to make sure that the motivation is not extrinsic and external, but intrinsic and personal. That takes a long time. There's a saying in the United States that "progress occurs one retirement at a time." So, maybe Harvard is an example of that. I won't speak for Todai.

Professor Shigemasu: (talks about party, asking questions later)

Professor Wilkinson: I'll talk for another 10 minutes or so and I do encourage people to interrupt me. I know I was guilty of not having stopped earlier. So thank you for holding me up to my own avowed principles. Let me take up again with this whole question of faculty involvement and how to work in terms of the culture.

I've talked a lot about reaching out to students, getting student input. What about getting faculty input? What about hearing from them about their interests and their problems? One of the difficulties, at Harvard at least, is that conversations about teaching are very rare, and the same mathematician friend whom I quoted a little while ago -- his definition of great mathematician and a great mathematician who is also a great teacher -- reported (probably about eight years ago) that one of his colleagues came up to him all happy and my friend asked, "Did you have a breakthrough in some problem you're solving? Did you have a good day?" And [the colleague] replied, "Oh, you'll never guess what happened. Today was the department meeting and I talked about teaching. And I wasn't ashamed." That is, I think, an indication of some of the barriers to this

kind of conversation.

Again, in a culture where research is the gold standard, the *only* standard in some ways, teaching is thought of as something you do if your research is not going well. Teaching is a kind of refuge from the rigors of the laboratory or the rigors of the library. In that sense teaching is often thought of in terms similar to childcare. It's dealing reactively. It's dealing with minds less well-furnished and not as advanced as our own, and there's something essentially babyish about it. It's like reading bedtime stories to kids. In other words, the intellectual level at which you're doing your research is not the same intellectual level at which you're conducting your teaching. Now, I think there's a kernel of truth to this. I myself, as someone who deals with a number of European languages, am always frustrated by the inability of American students to read anything other than English. You really have to translate just about everything for them. And I do that, actually. I'd rather translate things and have them read them, but a part of me really resents the fact that they won't put in the time to learn the languages that they should learn to do research in French, German, or whatever.

So there *is* a distance between you and your students, and there are ways in which they're not as prepared, but the fallacy is that conceptualizing a field and teaching a field requires a depth of understanding in order to make it accessible to others that is not at all a trivial depth. You really have to understand something very well to teach it. In fact, in the beginning of the first book of Aristotle's *Metaphysics,* he talks about different levels of knowledge -- practical, theoretical -- and he says, "The greatest knowledge is possessed by someone who teaches a subject, because he needs to knows the reasons, the causes, the '*hai aitiai*' of the phenomenon." And I think that there is truth in this, that understanding the subject well enough to focus on its essentials is an intellectual challenge of the first order. And it's one many faculty try to avoid. The natural sciences in the United States are generating new information at a fabulous rate. Not only in the United States but worldwide. But in the United States faculty try to "cover" the field, and by "cover" the field they mean give the students all the information about everything that has happened -- in immunology, cloning, genetics, whatever the field -- which is impossible. So they put it on their website and they say, "Okay, read this." That's also impossible. What they don't do is say, "You know, the

five fundamental concepts that you need to learn this semester are the following." That, I think, is an intellectual challenge that faculty ought to be much more willing to confront. So, in addition to understanding all the ways you can get something wrong, what's intellectually interesting is to try to figure out how to convey very complex material in a way that your students can understand without dumbing it down, without distorting it.

I'll tell another story about another mathematician. This is a very famous man, a professor at the University of California AT Berkeley, a computer scientist and mathematician, whose graduate students went out and had a disproportionate success. One of his graduate students came to Harvard and talked at the Bok Center. He said, "I'll never forget my graduate work with Professor Bloom at Berkeley. I would go in every week to present my research and Bloom would sit there and he'd listen and he'd say, "Can you simplify that a little bit? I'm having trouble understanding. Can you just simplify it? Just simplify it." And the poor graduate would say, "Well, I'm trying. Okay, okay." He'd try to put it in simpler terms, and Bloom would say, "Well, that's a little better, but can you simplify it some more? I'm tired." The process whereby the graduate students forced themselves to try to simplify the material for someone who knew more than probably anyone else in the field was a very healthy process. It forced them to try to cut to the essentials, and this was something that his graduate students took with them when they left Cal-Berkeley. And as I said, they've gone on to positions of eminence at a number of universities, and I'm sure that having to confront Professor Bloom every week and his tiredness and his need for simplification was really important.

So, substitute your students for Professor Bloom and think about them saying, "Well, could you simplify this a little bit? I'm tired." I think that's not a bad thing to have to do. I don't know about you, but I really don't like, even in publications, a kind of jargon that just takes refuge behind long phrases. I try to imagine an intelligent but unsophisticated reader. My favorite person is actually one of my two sisters, who is a graphic artist, who is very smart but not a historian by any stretch of the imagination. I think, "If I can write this so Holly would understand it, that's pretty good. I'll settle for that." It's a very good mental discipline to have to bring something down to a level... again, you're not oversimplifying it, you're not distorting it... but you're making

something that's essential first and foremost in front of the students, so they can tell it's essential, instead of "covering" by just throwing everything in. That is the kind of discipline that I think we need to enforce upon faculty.

Now I started by saying that we need to hear from them. We can listen to them in a number of different ways, and I think we need to take *their* problems just as seriously as we need to take the students' problems. We do that by having lunches with faculty, by inviting them to each other's lectures, and then having a lunch afterwards, by just getting together in the late afternoon for tea or coffee, trying to create conversations. It's nice to have a neutral area like my center or maybe even the faculty club, but really the idea is to get the faculty to talk either to us or to each other about what's going on well, what's not going so well, and to do it in a way that is formative. In other words, it gives them support, it gives them feedback but does not say, "You're a terrible teacher and you'll suffer for it." It's always struck me as very odd to me that faculty will submit manuscripts for peer review and not allow their colleagues to watch them lecture. Now, why is that? Why are they unafraid, or less afraid, to submit a manuscript for peer review? It could get torn apart by reviewers, at least in the United States. I know faculty who have had some very nasty reviews come back saying, "This really needs to redone completely." Somehow that's okay, but having faculty colleagues watch you lecture is not okay. The privacy of teaching is something quite extraordinary.

I just want to end with what I hope is a balanced statement: Not only are students' input and the active learning component of students something that we need to encourage, but there's also an active component on the part of faculty. The Bok Center is very interested in finding out as much as we can about both. We started last semester by having a survey where we compared faculty and student attitudes to learning in 10 large courses. So we had about 500 students and 10 faculty -- a small number of faculty, relatively. One of the things we discovered, and I will end with this, shows the power of research to inform teaching. We asked the students and the faculty to list four factors that contribute to success in a course, and the factors were: intelligence, hard work, luck, and curiosity. Now 85% of the faculty say that there was only one thing that would determine the students' success in the course. Does anybody want to guess? It was actually curiosity, which tells you a lot about faculty motivation. They entered their

disciplines because they were intellectually curious. The students split evenly among all four. One quarter of the students said luck, one quarter said hard work, one quarter said intelligence, only one quarter said curiosity. So that suggests to me that there is really a gap between faculty expectations and student expectations. That's another reason to bring these two worlds together, at least in dialogue. We hope to do more studies of this kind and publicize the results. So now we have 14 minutes. I will stop and solicit questions.

Q: This may be a bit of a wrong-headed question, but there are several types of lectures and courses. And if I can divide them into two types -- one is knowledge-based lecture, in which the teacher tries to transmit knowledge. The other, I'm encouraged to ask because you are a specialist in French literature, and particularly in the field of literature and philosophy, I think the lectures are not expected to transmit pure knowledge. Rather a kind of influencing the students to encourage them to think critically and so forth, which can't perhaps assist in terms of knowledge tests. I don't know whether I'm right or wrong, but again, I'm encouraged to ask you because you are a specialist in European literature and you may know figures like J.H. Finley, and so forth -- the eloquent Harvard professors. And if they hadn't been interrupted in this way, their lectures would not have been so eloquent as I understand it. So I'd like to know if you've got the concept of diversity in the types of lecture and in what way you can cope with that diversity.

Professor Wilkinson: Well, you've asked about four different questions. Let me try to "unpack" them. Finley was actually one of my professors when I was an undergraduate in the 1960s and I would not have wanted to stop his lectures at all. I think he is an example of the inspiring lecturer. However, each week we met in a group of 20 students to discuss what Professor Finley had talked about in lecture under the guidance of one of his assistants. So in this case an inspiring lecturer was supplemented by a chance for us to ask questions. We would not have dared to interrupt him. It would have been too bad. It was almost a theatrical performance the way he gave lectures about the Greek Classics -- Homer, and so on. And with pacing. This was in the days of microphones, so he would hold his microphone like this. It had a very long cord. He would walk all the way to the end and then he would spin and snap the cord, so that if you were starting to

fall asleep you were woken up immediately by this “snap!” and then he would proceed back in the opposite direction. His lectures were theatrical, but at the same time they were very kinesthetic and they kept you awake. That kind of lecture is relatively rare, but I would not want to interfere with that at all. I would simply want to supplement it. So that’s one thing.

Then you raised the question of how can we test students’ knowledge of something like French literature. I think that there are ways to do that. One is to see what kinds of questions they would ask. Students, at least at Harvard, are not terribly good at asking questions -- productive research questions. They’re just questions that have been provoked by the lecture. So I might ask the students at the end to fill out a “minute paper,” but I would be more interested in, “What question did my lecture leave you with?” Not so much “What is confusing you?” but “What kind of question could you ask of the material?” If we’re doing Stendhal, for example, “What question would you have about his approach to heroes?”

Tom Gally: “So you’re testing their curiosity?”

Professor Wilkinson: That’s right, exactly. And trying to elicit their curiosity. As for dividing lectures into content-based lectures and what you might call, I won’t say literary-based or philosophical-based, but where the issue is your attitude or orientation toward something rather than actual factual knowledge, I think that the factual knowledge lecture needs to be, if not eliminated, at least reduced. A lot of the facts can be learned outside of lecture. I think this is where the inefficiency of lectures becomes the clearest. You can have students read it ahead of time. You can put it on your website. You can devise other ways for them to prepare themselves for the lecture. I think, unfortunately, one reason for content lectures is our inability to get students to work outside of lecture. But that’s not a reason to continue to simply provide content-filled lectures when we actually live not just in the age of the printing press but in the age of electronic communication. Content lectures were fine back in the days of Abelard in the beginnings of the university system in the 12th and 13th-century Europe, but that’s been supplanted by other means of communication. I think a lecture should be a place where students are encouraged to think, encouraged to assimilate information, and encouraged

to put it in some kind of context rather than a place where they meet this information for the first time. At least the groundwork should have been laid by prior work on their part.

Actually, when you think about it, there is a kind of "iceberg effect" in teaching. Here's my schematic drawing of an iceberg. One-ninth of the iceberg is above water. Ice floats, but it's still rather heavy. Eight-ninths of the iceberg is below water level. The lecture, what we see, is here [in the top one-ninth]. What we're expecting is that students will take notes, re-read them, do the readings we've assigned, and think about what we've said outside of class. All of this happens outside of our own area of inspection. We can't. Unless we follow the student home, unless we have a teaching police, we're not going to know about the eight-ninths beneath the surface. We're not going to know how well they spend their time. I once gave a student who worked at our center a video camera and said, "Here's the deal. I want you to make a film about how you study. If you make the film, we'll give you the camera." So she did. She made a film and showed lots of candid shots -- almost two hours of candid shots -- of her and her friends outside of class. It was amazing. They practically didn't study at all. They did lots of other things. They watched television, they ate food, they were on the phone, they spent time with friends. Harvard is a residential college. It assumes that teaching and learning go on outside of the classroom. Nevertheless this was a revelation to me and a reminder of the mysterious depths of the eight-ninths of the iceberg that we don't usually get to see.

So, I think that ideally lectures should not be a substitute for what students ought to do outside of class. However, there can be great variation in lectures, and really good lectures, including those by John Finley at Harvard that are very traditional, but very inspirational. There can even be good lectures that are hard to understand. There's been some research that suggests that a certain level of difficulty, of challenging the students, actually results in better learning. I hate to mention it because it sounds as if the worse lecturer you are the more your students will learn and I don't think that's the right conclusion, but there are faculty at Harvard, for instance, who are not native English speakers. The students have to pay particular attention to understand them. And that sometimes can be a very positive thing. They're not just typing away on their computers. They're actually trying to listen. So, there are many kinds of good lectures, including the two that you mentioned. But I think that the least good is the content-based lecture. I

would use them sparingly and try to get the students to assimilate content some other way and only use the content lecture as a last resort.

Q: Perhaps you heard from Professor Shigemasu that we started student evaluation only four or five years ago, and I am very much interested in how to utilize the results of students' evaluation to improve the lectures. Lectures I think are still very important. Would you kindly tell me your experience how to utilize the reference of students' evaluations to improve lectures. I checked your website and I am especially interested in consultation because we do not have such a system in the university. What kind of consultation or what kind of advise do you give to the faculty?

Professor Wilkinson: Our own evaluations have both a numerical and a written component. I think the written component is more valuable than the numerical. For the numerical we have a five-point scale. If you scored very, very high or very, very low that's significant, but in between 3.1 and 3.3, say, I don't really think there's a difference. So my first suggestion is to take the written comments seriously. The second -- and this is leading into the consultation question – is that we offer a service of, I would say, translation for faculty. We say, "Bring in your evaluations. Our services are confidential, so we will not tell anybody what they say. But bring them in and we will help you understand what your students are trying to tell you." Very often, students have an understanding that something is wrong in the course but they can't diagnose what it is. Doctors have the same problem. There's the so-called "presenting symptom" and then there's the real disease. A person comes in and says, "My wrist hurts," and it turns out that they're about to have a heart attack. But you have to be a good doctor to find that out. So you have to try to figure out what is really going on with the students.

And there is a further complicating factor that in a large course you may have more than one population of students. Now, maybe at Todai everyone has received such similar background that they all think the same. At Harvard this is not the case, so you might have 20% of the students who feel that the lectures are too fast-paced, 40% of the students feel that they're just about right, and 30% of the students think that they're too slow, and so on. So you have to try to be willing to deal with sub-populations. You also have to be willing to translate the problems into a solution. And that's where the

consultation comes in. One of the things about American students is that they are very sensitive to the faculty's attitude toward them. So we want to be reading between the lines to see whether the faculty are coming across as angry or interested in the students, and we also want to be trying to figure out what pedagogical problems are there.

The single greatest problem the faculty have is clarity -- presenting a clear, well-articulated series of lectures, each one of which both looks back at the previous lecture and looks forward to the next one. One of the examples that we use is the tour guide, who says, "Yesterday we visited Matsumoto. Tomorrow we are going to Nagano. The day after we are going back to Tokyo where we will spend four days..." and so on. It's telling the students where they are, where they've been, and where they're going to go. This is just one example of the kind of concrete suggestion we might offer.

So: getting the faculty to share, having some sense of what's really behind the student comments, and then being able to suggest concrete solutions. The first thing you can say is, "Oh, it must have been a really hard semester." So you can help the faculty feel supported -- someone cares -- but you really want to get them to the point of talking about the solutions and asking them to come back. It's iterative. You don't just give them advice and send them away. Just like a doctor wouldn't give you a prescription and say, "I never want to see you again." He says, "Come back in three months and we'll do more tests."

I think this is a really important question and we're already over time. I would be happy to give you my card if you want to email me with more specific questions, because I actually have lots of experience in this, and it's tricky. Ideally you tailor what you're doing to each separate faculty member because each faculty member is different.

Q: My question is also related to student evaluations. Anyhow, I want to know what you are observing or what the center monitors in each course, regarding not just the performance of each lecturer, but for example the class size, or you also mentioned that some lectures are just given simply by the lecturer, but sometimes the seminar type or some discussion group should be added to support that course, right? So that type of curriculum structure or any type of, say, class system or so. I think that type of thing is

also needed to enhance active learning. So in that regard I want to know what the center is doing to improve the course itself or the curriculum structure type of thing.

Professor Wilkinson: Well, one of the things we're doing is trying to reduce class size. That's the simple answer. We're trying to help all freshmen, all first-year students, have a chance to be in one course of 12 students, no more than that -- a freshman seminar. And the number of those has approximately doubled over the last six or seven years. We need to have about 150 in order to have every single first-year student. We're now up to about 130, so we're close. In a very general sense, small is good. That's not to say that the large lecture in the hands of a really superb lecturer like Professor Finley, and others, isn't a good teaching vehicle, but even there, supplementing it with discussion sessions is a good idea. The more students do themselves, the less they simply sit, and the more they either restate what they've heard, ask questions, do exercises, become involved even in projects outside the classroom. The more that happens the longer the retention and the better the understanding.

So one of the things that we're trying to do is to document this with the kinds of ConcepTest questions and evaluation questions that I've mentioned in terms of physics. We're also working with some other institutions -- MIT, which is only one subway stop away from Harvard -- has done some very impressive research on different kinds of science teaching. They now have good data suggesting that the kind of active learning that you're pointing to -- where the students work in small groups, they solve problems together, and then they report their solutions back, at the end of, let's say, 15 or 20 minutes, several times in the course of one course meeting -- that the depth of understanding and the length of retention, that is, their ability to remember what they learned after the course is over is remarkably greater than in a standard course. So we're beginning to get data.

Of course, part of the issue is persuading faculties to teach small groups. We're actually training senior faculty in how to direct group discussions. They're often more afraid of 12 students than they are of 200. With two hundred they can just lecture, but the twelve they've got to ask them questions, and do group process work. I think learning to manage a group is one of the big obstacles to active learning. It's a skill that can be

learned, but it's not a skill that most people are equipped with. It needs at least a little attention. We have a number of techniques, including a course, in discussion leading. So we're trying to increase active learning in part by making faculty less afraid to engage in it.

Q (Matsuda-san): I'd like to know the involvement of teaching assistants. Your sandwich teaching looks like you need assistance from TAs. Not absolutely necessary to have enough number of TAs to be effective for doing such sandwich teaching or Minute papers. Do you train the teaching assistants very well before you start to lecture?

Professor Wilkinson: We try to. The answer is yes, teaching assistants are very useful for this kind of sandwich teaching. They're not essential for the Minute paper. It's certainly possible for a single person to read 200 Minute papers, or you can even just do every six or every 10. You don't have to read them all just to get a flavor. But the training of graduate students is a work in progress. All of the graduate students are supposed to be trained, but the departments they are in are responsible for what that training consists of. That means there's a great deal of variation across the training landscape. One of the things that [we] have done ... is to create a draft for some workshops for graduate TAs on specific topics. So, a day-long workshop on how to give feedback, a day-long workshop on how to conduct a small-group discussion with the use of interactive techniques -- all sorts of things that we hope will demonstrate not just talking at them but getting them actively involved.

Ultimately, what I hope is that Harvard will make a certain kind of teacher training part of the doctoral requirement for the PhD, and I think that will happen. I would predict that in the next five years or so it will become part of the requirement. That, I think, will be a milestone, but right now I would say that out of maybe 1200 teaching assistants across the campus, we probably in one way or another deal with at least half of them every year. Different ones have different problems, depending on their field, but overall they are our major clientele. And I think it's a great age at which to reach students. Graduate students, as I said earlier, are quite open to information and support. Once you get them interested in teaching, I hope that they will stay interested for the rest of their professional careers.

Q: I think that graduate students will become faculty members -- some of them -- several years later, so having such experience is good for teachers and also good for them, too.

Professor Wilkinson: Yes, absolutely. And it can have long-term effects.

Q: At our university we started to use like a TA system several years ago, five, seven years ago? But we are not using them so effectively. We are just using them as like a hand. So we need that kind of experience. At least myself, I don't have any experience to be a teaching assistant when I was a graduate student, so it is different for me to use TAs for such active teaching.

Professor Wilkinson: One thing we do with the TAs, they also get evaluated by the students, and for the ones that get the top evaluations, we give a party every semester. We have a certificate and they can put on their CV, "I got a Certificate of Distinction in Teaching." We give them champagne and eclairs. So, positive recognition, I think, is also very motivating, particularly for them. A little bit goes a long way for graduate students.

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