TOETS 2: 2 JUNIE

Ek het verlede week skoolbesoek gedoen by 'n vorige B Sc (Ed) student (aktiwiteit aangeheg)... Dit het my laat besef dat dit nodig is dat ons bietjie oor skoolbesoek moet besin ...

As agtergrond:

- Ek heg vir jou 'n ope brief aan wat jy voor die skoolbesoek moet lees en baie ernstig moet opneem (die student moes ook!).
- Ek het 'n skoolbesoekopdrag (H6 op WebCT Assignments) geformuleer wat vereis dat jy oor alternatiewe besin ...

…….

Vir ons toets, vandag:

Tyd: 2 uur
Punte: 60

Beantwoord vrae 1 en 2 in 'n Word dokument en vraag 3 in Excel en heg dan hier aan.

Ek heg die student se aktiwiteit aan - 'n eerste les oor waarskynlikheid.
I attach the student's activity - a first lesson on probability.

1. Wat was my (Alwyn Olivier se) kommentaar op die geskrewe aktiwiteit?
   What was my (Alwyn Olivier's) comment on the written activity? (10)
2. Hoe sou jy die aktiwiteit verander, indien enige, en hoekom?
   How would you change the activity, if any, and why? (10)
3. Ontwerp 'n ekwivalente Excel aktiwiteit om die eksperimentele waarskynlikheid van die som van twee dobbelstene te ondersoek, en vergelyk dit met die teoretiese waarskynlikheid.
   Design an equivalent Excel activity to investigate the experimental probability of the sum of two dice, and compare it to the theoretical probability. (40)

OOR SKOOLBESOEK

Liewe studente, ’n paar sakies oor my besoek aan jou gedurende “skoolbesoek” en jou sogenaamde “kritles” …

Sover bepunting aangaan - ek het hoë verwagtings van julle vir die kritles en neem aan dat dit uitstekend gaan wees!
Dus begin ek met die veronderstelling dat ek jou 70 gaan gee vir ‘n goeie les. As jy alles “reg” doen gaan ek jou 70 gee.
Om 75 te kry sal jy iets besonders moet doen ☺
En as ek fout vind met iets kom ek af na 65, 60, … Ek dink jy moet baie bekommerd wees as ek jou nie 70 gee nie!

Ek beskou egter my besoek as nie eintlik vir bepunting nie, maar as ’n leergeleentheid, om met jou op professionele vlak oor Wiskunde-onderwys te kommunikeer. Browse gerus die aangehegte artikel van Shulman, waarin hy sê om te leer *om te dink soos ’n Wiskunde-onderwyser* kan ons gerus kyk na hoe dokters en prokureurs opgelei word!

Een aspek van so ’n opleiding is dat daar ’n sekere roetine is, ’n vaste manier is van dinge doen om daaruit te leer. Ek wil dat dat ons roetine tydens skoolbesoek is soos in my ONTEORIE opsomming:

Onderrig*teorie* behels pogings tot
- identifisering en beskrywing van die *verskillende opsies* (alternatiewe) wat daar ten opsigte van Wiskunde-onderrig en -leer bestaan
- identifisering en ontleding van die *implikasies* van die uitoefening van verskillende opsies ten opsigte van die aard en gehalte van leeruitkomste sowel as van die produktiwiteit (spesifiek tydseffektiwiteit) van Wiskunde-onderrig, en
- *verklaring* van die verskille tussen die implikasies van verskillende opsies.

Onderrig*praktyk* behels die *rasionele keuse* tussen opsies vir spesifieke inhoude en spesifieke leerlinge.

Ek wil dus op al my besoeke met elke student dieselfde soort “standaard” gesprek hê oor hierdie vyf issues:
- Oor *watter alternatiewe vir inhoude/aanbieding* jy oorweeg het, hoekom jy so gekies het, wat jy ge-antisipeer het gaan gebeur …
- Oor ons *waarneming (kyk!) van wat die effek van jou besluit was op leerders* se kwaliteit van leer, deelname, … – “sien” ek en jy dieselfde dinge? Ons mag verskillende goed sien omdat ons met verskillende brille kyk – verskillende verwysingsraamwerke en verskillende waardes van wat belangrik is, en ek wil met jou daaroor redeneer en “baklei”! Die vraag is natuurlik oor hoe ons konneksies maak tussen die “teorie” in ons module aan die universiteit en hierdie “praktyk” in die skool …
- Oor moontlike *verklarings* vir hierdie effek, hoekom gebeur dit …
- En as jy dit weer doen, *sal jy dit anders doen?* Hoe en hoekom?
- *So, wat het jy geleer?*

Nog ’n keer: ek sal normaalweg nie jou *keuses* kritiseer nie, maar ons moet gesels oor die *kriteria* vir jou keuses en die *implikasies* van jou keuses … Dan leer ons iets in die proses.

What NOT to do!
You will agree that if you are merely teaching the next lesson in the book, or teaching a content because the teacher told you to, or using an approach because the teacher said you had to do it like that, or if you teach the traditional standard lesson – first mark the homework, then illustrate some method, then children imitate the method … – we have nothing professional to talk about, nothing to learn in terms of the above and **it is a waste of everybody’s time, energy and money for me to drive out to come and “observe” the traditional standard lesson!**

Please do not do it! You could probably have give the standard lesson when you finished matric! **So I want to see some evidence that you have been at university for at least 3½ years and I want to see evidence that you have been in my class for 6 months!**
Everybody wants to make a difference – can it be that I and/or the course had NO influence on you!? I want us to discuss how you perceive that influence …

So, please negotiate with the teacher in general that you have the *opportunity/freedom to try different options* (see above), so that you can experience it for yourself and think about the effect on learning and eventually on the essence of your future teaching. That is why you are there!

So, please negotiate with the teacher in particular that you will do something special on the day I visit you! **I want to see you present the optimum lesson under the optimum conditions! Just this once!**

I am looking forward to visiting you!

Kind regards

Alwyn Olivier

ONDERRIGTEORIE EN -PRAKTYK IN WISKUNDE: 'N KORTBEGRIP

Onderrig*teorie* behels pogings tot

- identifisering en beskrywing van die *verskillende opsies* (alternatiewe) wat daar ten opsigte van Wiskunde-onderrig en -leer bestaan
- identifisering en ontleding van die *implikasies* van die uitoefening van verskillende opsies ten opsigte van die aard en gehalte van leeruitkomste sowel as van die produktiwiteit (spesifiek tydseffektiwiteit) van Wiskunde-onderrig, en
- *verklaring* van die verskille tussen die implikasies van verskillende opsies.

Onderrig*praktyk* behels die *rasionele keuse* tussen opsies vir spesifieke inhoude en spesifieke leerlinge.

Uiteraard kan onderrigteorie nie los van leerteorie bestaan nie; onderrigteorie is dus bloot 'n ekstensie van leerteorie. 'n Onderrigteorie berus ook op 'n perspektief op die aard van Wiskunde. Ons brei kortliks uit.

1. **Om Wiskunde te leer behels die konstruksie van wiskundige "begrippe" (in die mees algemene sin van die woord) deur leerders. Leer is 'n individuele konstruktiewe sowel as 'n sosiale interaktiewe proses.**

   Wiskunde-onderrig behels
   - die inisiëring van leergeleenthede, d.w.s. geleenthede waarbinne leerders wiskundige begrippe kan konstrueer, sowel as
   - die bestuur van hierdie geleenthede, en
   - die monitering van die leeruitkomste.

   'n Basiese opsie wat telkens in Wiskunde-onderrig uitgeoefen moet word, is of leerders geleentheid gegee word om hul kennis na aanleiding van die uitvoering van take/die oplos van probleme te konstrueer, of by wyse van vertolking van beskrywings (uiteensettings, verduidelikings) wat aan hulle verskaf word. Indien dit d.m.v. take/probleme is, is daar die opsie om die probleme individueel of in kleingroepe op te los.

2. **Om 'n stuk Wiskunde te *verstaan* beteken per definisie om dit te koppel aan en te interpreteer in terme van reeds-bestaande kennis.**

   Onderrig moet dus kinders in staat stel om potensieel nuwe kennis te kan koppel aan hul bestaande kennis. Een benadering is vir die *onderwyser* om die formele inhoud vir kinders te verteer ('n *top-down* benadering of *logiese volgordening*). 'n Ander benadering is om die onderrig te baseer op en te struktureer volgens *kinders* se bestaande kennis en natuurlike ontwikkeling ('n *bottom-up* of *kind-gesentreerde* benadering of *psigologiese volgordening*).

3. **Wiskundige kennis sluit in *logiese kennis* (kennis van logiese noodwendighede en van logies-verantwoordbare alternatiewe), *sosiale kennis* (kennis van konvensies waartoe mense gekom het), *fisiese kennis* (waarneembare verskynsels in die fisiese werklikheid) en *strategiese kennis* (heuristieke).**

   Onderrigteorie moet hierdie verskeidenheid van basiese wiskundige kennistipes ondervang: verskillende kennistipes word op verskillende wyses geleer en dus onderrig.

4. **Om enige Wiskunde-inhoud te beheers behels die bemeestering van die betekenis, funksionaliteit, aard en logika van spesifieke inhoude, die onderlinge samehange tussen inhoude en paraatheid (vaardigheid, vlugheid, soepelheid in die reproduksie en benutting van die inhoude).**

   Onderrigteorie moet dus aandag gee aan die vraag *hoe*, asook in watter *volgordes*, vir hierdie verskillende vorme (dimensies) van beheersing voorsiening gemaak kan word.

5. **Om Wiskunde werklik te beheers beteken egter meer as om die inhoude (*produkte*) te bemeester - dit sluit ook in die *prosesse* of wiskundige *handelingstipes* waardeur die produkte geskep word, bv. simbolisering, abstahering, veralgemening, spesialisering, definiëring, aksiomatisering, bewysvoering, modellering, ens.**

   'n Onderrigteorie moet hierdie prosesse insluit.

6. ***Wat* kinders leer word tot 'n groot mate bepaal deur *hoe* hulle dit leer: kinders se houdings en perspektiewe op wat Wiskunde is, hoe dit geleer moet word, oor hul vermoë om dit te leer, ens. beïnvloed wat hulle leer. Wiskunde-onderrig en -leer geskied in die sosiale kookpot van die klaskamer.**

   Onderrigteorie moet dus ook aandag gee aan die *klaskamerkultuur* of *didaktiese kontrak*, dit is die interpersoonlike verhoudinge wat in die onderrig-leersituasie kan bestaan, in terme van sowel die onderlinge verwagtinge wat die deelnemers van mekaar koester, as die verantwoordelikhede wat die verskillende deelnemers opneem en die kodes wat die interaksies tussen persone beheer.

Alwyn Olivier & Piet Human, 22 Februarie 1998

TEACHING MATHEMATICS: THEORY AND PRACTICE

A theory of teaching mathematics involves attempts

- to identify and describe the *different options* (alternatives) that exist for teaching and learning mathematics
- to identify and analyse the *implications* of choosing different options in terms of the nature and quality of learning outcomes as well as productivity (in particular the time and cost efficiency of teaching)
- to *explain* the differences between the implications of different options, if any.

The practice of teaching involves making *rational choices* between alternatives for specific contents and specific students.

A theory of teaching is obviously not independent of a theory of learning; a theory of teaching is merely an extension of a theory of learning. A theory of learning also explicitly or implicitly assumes a certain perspective on the nature of mathematics. We briefly outline some essential dimensions of a theory of teaching:

1. To learn mathematics means to construct mathematical "concepts" (in the broadest sense of the word). Learning is an individual constructive as well as a social interactive process.
   Teaching mathematics involves:
   - initiating learning opportunities, i.e. opportunities in which learners can construct mathematical concepts, as well as
   - managing these learning opportunities, and
   - monitoring the learning outcomes.

   A theory of learning must repeatedly choose between the options of giving learners opportunity to construct their knowledge via solving problems/completing tasks, or via the interpretation of explanations (expositions) given to them. In the case of tasks/problems, there is the option to solve the problems individually or in small groups.

2. To *understand* a piece of mathematics means, by definition, to connect it to and to interpret it in terms of an already existing framework of knowledge.
   Teaching must therefore enable learners to *potentially* can connect new knowledge to their existing knowledge. One option is for the *teacher* to digest the formal content for learners (a *top-down* approach or *logical sequencing*). Another option is to base teaching on and to structure teaching according to *learners'* existing knowledge and natural development (a *bottom-up* or *child-centred* approach or *psychological sequencing*).

3. Mathematical knowledge includes *logico-mathematical knowledge*, *social knowledge* (conventions agreed by people), *physical knowledge* (observable phenomena in the physical world) and *strategic knowledge* (problem solving strategies or heuristics).
   A theory of teaching must provide for these different basic types of knowledge: different types of knowledge are learned differently and should therefore be taught differently.

4. To master a piece of mathematics content means to understand the *meaning, functionality, nature and logic* of specific contents, the *connections* between contents and to develop *skill* in the reproduction and application of the contents.
   A theory of teaching must therefore address the question of *how*, and in which *order* to provide for these different dimensions of understanding.

5. However, to really understand mathematics requires more than mastering the contents (*products*) – it also includes the mathematical *processes* through which the products are established, e.g. symbolising, abstracting, generalising, specialising, defining, axiomatising, proving, modelling, etc.
   A theory of teaching should provide for these processes.

6. *What learners* learn depends to a large extent on *how* they learn it. Learner's attitudes and beliefs about the nature of mathematics, about how it should be learned, about their ability to learn it, etc. influences what they learn. Mathematics-teaching and learning happens in the social melting pot of the classroom.
   A theory of teaching must therefore also address the issue of *classroom mathematical culture* and the *didactical contract*, i.e. the inter-personal relationships that exist in the learning-teaching situation, in terms of both the underlying expectations participants have of each other, the obligations and responsibilities that the different participants assume, and the codes which govern the interactions between participants.

Alwyn Olivier & Piet Human, 20 February 1998

The Signature Pedagogies of the Professions of Law, Medicine, Engineering, and the Clergy: Potential Lessons for the Education of Teachers

Professor Lee Shulman
President, Carnegie Foundation for the Advancement of Teaching

Delivered at the Math Science Partnerships (MSP) Workshop:
"Teacher Education for Effective Teaching and Learning"
Hosted by the National Research Council's Center for Education
February 6-8, 2005
Irvine, California

MEL GEORGE: Well, ladies and gentlemen, it's a great pleasure now to welcome to our midst Lee Shulman, and to ask for his wisdom and advice as we think about teacher education. One of the things that I was so excited at his willingness to talk with us was his ability to put things in a slightly larger frame than some of us are used to thinking about. Lee, at one point in his life, was on the faculty at Michigan State University and even held an appointment in medical education, even. And so he has thought about the professions broadly, and has pondered the relationship between the preparation that other professions use for their professional graduates as contrasted with teacher education.

And that's a subject of great interest to me. I serve on the advisory committee for a Center for Religion, the Professions and the Public, which is trying to think about what professionals need to understand about the increasing religious diversity in this country, for example. And so the notion of professional education, both pre-service and in-service, is a very nice context in which to put our thinking about teacher education.

Lee Shulman is currently the eighth president of the Carnegie Foundation for the Advancement of Teaching. And I did not know that its mission is described as follows:

it is “to do and perform all things necessary to encourage, uphold and dignify the profession of teaching.” That’s a really powerful mission statement, and we assume that you are well on your way to accomplishing that for all time, Lee.

He’s a past president of the American Educational Research Association, and a past president of the National Academy of Education, and a fellow of the American Academy of Arts & Sciences. So both his background and his present position at Carnegie are a wonderful preparation for his talk today, which is entitled “The Signature Pedagogies of the Professions of Law, Medicine, Engineering and the Clergy: Potential Lessons for the Education of Teachers.” It’s a great pleasure to welcome Lee Shulman.

[APPLAUSE]

PROFESSOR LEE SHULMAN: Thank you very much. The Carnegie Foundation is now 100 years old, so we’re getting fewer and fewer excuses available if we don’t achieve our mission. But teaching seems to be a problem that reinvents itself in every generation. So the ones that we’re facing in 2005 bear some resemblance to those that my predecessors saw in 1905, but they’re quite different, as well.

If someone asked me over the last 35 years, “What do you do?” I would say I’m a teacher educator. That is the most persistent theme in my own career, from my first day of teaching at Michigan State University in 1963-- where my teaching responsibilities were to teach 1,000 future teachers a day in two, 500-student sections--to the last course I taught at Stanford -- which was a course that I team-taught with my successor at Stanford, Linda Darling Hammond, on the Foundations of Learning for Teaching for future secondary school teachers of mathematics, science, English, Social Studies and Foreign Language.

As has been explained in Dr. George’s introduction, I’ve spent a great deal of that time trying to understand the complexities and the challenges of educating teachers by looking through the lenses of the parallel problems and challenges of preparing people for other

professions. Because I find what professionals have to do-- whether we call them teachers or lawyers, priests or nurses-- extraordinarily complex and endlessly fascinating.

The job of the arts & sciences faculty member is to bring students to a depth of critical understanding of a discipline. The professor of history wants students to develop a critical grasp of history. To know and understand the discipline is certainly a sufficiently ambitious goal for any of us teaching either in the elementary and secondary or higher education within a subject area or discipline. But when you're preparing someone to teach, then preparing them to know, to think, to understand what they need to understand in order to practice is just the beginning. There is much more. The educator in a profession is teaching someone to understand in order to act, to act in order to make a difference in the minds and lives of others-- to act in order to serve others responsibly and with integrity. As we say in our Carnegie Foundation studies of education in the professions, professional education is a synthesis of three apprenticeships—a cognitive apprenticeship wherein one learns to think like a professional, a practical apprenticeship where one learns to perform like a professional, and a moral apprenticeship where one learns to think and act in a responsible and ethical manner that integrates across all three domains.

A professional is not someone for whom understanding is sufficient. Understanding is necessary, yes; but not sufficient. A professional has to be prepared to *act*, to *perform*, to *practice*, whether they have enough information or not. You've got 32 kids in front of you and you need to act. You can't say, "You know, give me an hour to figure out what I know that will help me decide what to do next." You've got to act on the fly with insufficient information. It's true of a surgeon during an operation; it's true of a member of the clergy counseling the bereaved. Action is equally important, maybe more important, than understanding.

But even that isn't enough. As we've seen, as we look at education for the professions, professionals not only have to understand and perform, they have to *be* certain kinds of human beings. To use the language of the education of clergy, they have to undergo a

certain kind of *formation* of character and values so they become a kind of person to whom we are prepared to entrust the responsibilities of our health system, of our education system, of our souls and of the kind of justice we expect to see pursued in this society.

And so a great deal of what's involved in educating professionals is educating for character. And we all know that you could have the most skilled classroom teacher who understands their subject matter deeply. But if they are not a person of character, there's something deeply deficient there. And so when we look at professions, we are looking at the challenge of teaching people to understand, to act, and to be integrated into a complex of knowing, doing and being.

At Carnegie, we are now in the midst of a 10 year study to understand how people are prepared for practice in law, engineering, the clergy, teaching, nursing and medicine. We've essentially finished our work in the first three fields. We're now writing up our studies of the education of lawyers, engineers and clergy. And we are pursuing the work on teaching, nursing and medicine.

I want to speak to you this morning about some of the insights that I've been having as a teacher-educator as well as someone who's spent about a decade of my life in a medical school as a medical educator looking across all of these fields. We can learn a great deal from looking at those fields; just as it will turn out they have a great deal to learn from us.

Let me begin by describing what I was doing about two weeks ago.

About two weeks ago, at about 7:30 in the morning, I parked my car and went to the ninth floor of the teaching hospital of a major American medical school to join a team for the whole morning to do clinical rounds in internal medicine. It had been years since I had done that. In fact, it had been since the mid-point of my career at Michigan State, in about 1972. And it reminded me of both the excitement and, in a very interesting way, the routine associated with clinical rounds.

Clinical rounds are the way the practice of medicine is taught. Clinical rounds go on every single morning of the week, Saturdays and Sundays included. Clinical rounds involve a multigenerational team: the chief resident, who is usually in her fourth year of post-M.D. training, a senior resident, usually in his or her second or third year post-M.D., a couple of first-year residents, several third-year medical students in their first rotation as medical students, and a pharmacy intern.

We had a set of patients to visit. And with a few exceptions, they were the same patients the team visited the day before, and the day before that. One of the interesting things that are happening in the world of medicine that is changing medical education dramatically is that the curriculum materials of clinical medicine instruction-- which has been constituted of patients lying in beds-- is becoming much more transient. When I started in medical education, if you were having your gallbladder out, you were going to be in a hospital for 8 to 10 days. That meant that the "curriculum" stayed in place for that long.

My administrative assistant had her gallbladder removed six months ago, laparoscopically. She didn't spent one night in the hospital. She was admitted in the morning, remained in recovery for a few hours after the procedure, and she was in the recovery; she was home that night. Well, great for her, great for cost control in the health care system. But what a pain for medical education! You know, what would happen if the pages in your textbook disappeared before you had a chance to read them carefully?

I mention this because of the fact that what I'm going to be talking about this morning, which I call the "signature pedagogies of the professions," are not eternal and unchanging. Even though they seem remarkably stable at any one point in time, they are always subject to change as conditions in the practice of the profession itself and in the institutions that provide professional service or care undergo larger societal change.

But we were visiting patients that, alas, were there for longer periods of time. And what was fascinating is the routinization, almost to the point of ritual, of clinical rounds. You

come to a room where a patient who is on our docket is in bed. Somebody on the team knows that their responsibility is to report on a patient, and then to explain what's happened since the last time they rounded, what's going to happen next, and then to take questions about the situation from colleagues on the team. The routine is such that everybody knows what they're supposed to do.

Equally fascinating was the observation that it was often unclear who the teachers were and who were the learners. At times it was the third year clerk who presented the case, and everybody else was learning from that person. At other times it was the senior resident. And so the roles of students and teachers were changing. Unlike a lot of educational situations, everyone was visible, nobody could hide. That's a very interesting feature of signature pedagogies. Everybody was a member of the clinical team with a role and responsibilities, and could be expected to ask or answer a question, or perform an examination or procedure, at any moment. Hiding was impossible; anonymity wasn't an option.

And because of the fact that the "rules of engagement" of clinical rounds had become so routine, the teachers didn't spend any time at all with what you might call "classroom management." And by that I don't mean "discipline," because clearly that wasn't much of a problem. They did not need to practice classroom management in the sense that those of us who use group work in our classrooms, have to give the students a fair amount of instruction about what it means to be a member of a collaborative group, what their roles and responsibilities are, and how do they decide who's in charge. The power of routinization in signature pedagogies is such that those questions have already been answered. The rules of the game are clear.

On that morning, we progressed through four different kinds of rounds. I'm not going to go into the details, but they went from work rounds to teaching rounds to something called "M&M, morbidity and mortality reviews, in which we systematically looked at cases that hadn't gone well and asked what had gone badly and what we can learn from the experience that could guide individual clinical practice in the future. And then a

large, 50-person "quality assurance" meeting was held (it's a monthly occurrence) in which all the members of the department in all generations from full professor to medical student gathered to review some serious problems of infection that were occurring in conjunction with inserting "central lines" in intensive care patients. In quality assurance reviews, the question was not what individuals could do to improve quality, but what the institution itself ought to do collectively and corporately to reduce these rates of infection. The focus was not merely practice, but more broadly it was on needed changes in institutional policy.

Why do I go into this kind of detail? This kind of teaching of professional practice has its parallels in most of the professions that we've been studying. So for example, if you went to the first year classes in any law school in America, you would find law's equivalent of clinical rounds. Except instead of there being seven students involved, there would be 120. You'd be in a lecture hall, except that it would be much more pronounced in its curvature so that students were much more likely to be able to see one another, even in a large class. And if I were your teacher in torts or criminal law or constitution or contracts, I would be closer to the center of the arc that was formed by the curved rows of seats.

How many of you have seen the movie, *The Paper Chase,* with the famous portrayal of the ominous Professor Kingsfield? You have a sense of what a large law school class is like. One of the first things you see is the routine. It doesn't matter which of the first year classes it is, the rules of engagement are the same. A faculty member enters the room. The students know what the cases to be discussed that day are. And without any kind of preparatory good morning or whatever, I turn to address one of you:

"Ms. …

JUDY CONROY: Judy Conroy.

PROF. SHULMAN: "Ms. Conroy" Please tell us about the case of *Brown v. Board of Education.*" And you would not be free to say whatever you felt like about *Brown v. Board of Education,* because that is a trigger, in the same way that it is in medicine, for a routine *protocol* of performance, literally, of rendering an account of the case. You are being taught "to think like a lawyer." And I don't care if you're at the University of Colorado Law School or at the New York University Law School, or at the John F. Kennedy Law School in Oakland, the engagement rules are the same, much as they are doing clinical rounds in medicine.

But what we also will know-- what all of you law students will know-- is that at any second, the teacher-as-sniper can pivot and say, "And Mr. Labov! Do you agree with Ms. Conroy's account of the case, or do you disagree?"

JAY LABOV: Disagree.

PROF. SHULMAN: Disagree! Thank you very much. Before you tell me your disagreement, I'd like you to restate in your own words Ms. Conroy's argument, and then offer your own. Notice, I am also conveying subtly, *you'd better be paying attention, closely, to what your colleagues are saying.*

In elementary education research, there's a lovely concept called "accountable talk," or "accountable speech." And what's so important for kids and teachers to learn is that when you're participating in a discussion, your contributions are accountable for their continuity with those that preceded and with the text or source materials on which the conversation is based.

You can't simply say, "Well, you know, the way I feel is." No, you are responsible to add one link to a chain of discourse. And so one of the other things you see in the law school class that, to me, is directly parallel to the clinical rounds is that even in large room, students feel accountable. They are visible, they never know when they will be asked to perform, and they had better be ready. They also know precisely what it means

to perform. The faculty is not playing hide-the-ball; the students understand the form of what is expected of them, even if they often do not know the particulars.

I give these two examples, and I could give others from other fields, of what I have been calling lately "the signature pedagogies of the professions." What I mean by"signature pedagogy" is a mode of teaching that has become inextricably identified with preparing people for a particular profession. This means it has three characteristics: One, it's distinctive in that profession. So you wouldn't expect clinical rounds in a law school. And even though it might be very effective, you wouldn't expect a case dialogue or case method teaching of this sort in a medical school.

Second, it is pervasive within the curriculum. So that students learn that as they go from course to course, there are certain continuities that thread through the program that are part of what it means to learn to "think like a lawyer," or "think like a physician," or "think like a priest." There are certain kinds of thinking that are called for in the rules of engagement of each course, even as you go from subject to subject. The third feature is another aspect of pervasiveness, which cuts across institutions and not only courses. Signature pedagogies have become essential to general pedagogy of an entire profession, as elements of instruction and of socialization.

What are some of the characteristics of these pedagogies? I've mentioned a couple already. The first is that they are habitual, they are routine. The rules of engagement in this kind of pedagogy are repeated again and again and again. And it doesn't seem to make the classes boring, which is really quite interesting. Many of us who've taught at earlier grades have been taught the importance of novelty: "keep changing things for the students, because novelty breeds motivation and interest," we were told. We advocate constant novelty without taking sufficient cognizance of the strain it places on the students and on the teacher, of constantly changing the rules of the game.

And it's not at all unusual for new teachers, when they want to try something new with their classroom, simultaneously to change the grouping structure, to do a simulation for

the first time, to experiment with role-play and other novel instructional elements. Indeed, it's not unusual for a novice teacher to change about four features at once, and then wonder why the whole thing goes up in smoke. And they spent *so* much time planning it, "And don't those kids *care* how much, and how hard I worked?" Tears are not unusual in those circumstances, especially with our new teachers. They really haven't thought through how important it is to keep control over the sources of unpredictability and variation and challenge that the students are being asked to confront at the same time. And what's fascinating in the signature pedagogies of these professions is the extent to which the novelty comes from the subject matter itself, not from constantly changing the pedagogical rules.

A second thing, you see, is that both the students and their thought processes are made visible in the signature pedagogies of the professions. I don't know if you've seen videotapes of large lectures in the liberal arts and sciences in colleges and universities. But you show me a classroom with 200 students in it for a 9:00 o'clock class, and you just pan your little video. Students are sleeping, or they're reading the paper. If it's a wireless environment, they're on the net. The level of attention and vigilance on the part of the students is frighteningly low. But again, we can encounter the same phenomenon in classes of 35 as well because so many of our pedagogies aren't designed to keep everybody visible and on their toes.

In the signature pedagogies, whether they involve small groups like a design lab in an engineering or architecture program, or large groups like the core courses in the law school or the business school, students know that at any moment in time, they are visible and accountable. They will not only be asked to comment on the topic. But regularly, they will be asked to build on the contributions of those who spoke before them. The nature of the pedagogy in many of these cases-- and again, it's part of the ritual-- is not only to say, "Mr. Labov, what's your view?" But it to immediately say, "And what might be your argument in support of that view? Are you using different evidence from Ms. Conroy's, or the same evidence? And why did you think that evidence was…." So the thought processes themselves become highly visible.

I believe we are now seeing the emergence of what I believe is going to be new signature pedagogy in higher education in large classes in which students now are being given these wonderful wireless "clickers." You know those? When each student in the large lecture class pushes a button in response to a question from the teacher, not only is her view being registered, but the teacher knows who is clicking. The teacher has a running record of each student's responses over time. We have created conditions of visibility and accountability in the heretofore vapid anonymity of the large lecture hall.

Thus a feature of signature pedagogies is the visibility of person and process, which is therefore associated with accountability. And it's remarkable, at all levels of the educational system, how low students' sense of accountability is. You can go through two weeks in many elementary school classrooms without being held accountable for contributing to the class discussion. And you may do your worksheets, but that accountability is simply acknowledged by a score or grade at the top when it's handed back.

This kind of accountability is not only students' accountability to the teacher; it's an accountability students have to one another in the sense that most of these pedagogies involve the learners having to engage in accountable talk, to build on each others' work. Whether it's actively collaborative, as it might be in collaborative groups in a calculus classroom, or it's serially collaborative, as in a law school or a medical school exchange, I suspect this is a distinctive feature of signature pedagogies.

What happens when people who are used to being invisible, to burrowing down when faced with a pedagogical challenge, suddenly or regularly find themselves visible, accountable, and if you will, vulnerable? You inevitably begin to experience higher levels of emotion in a classroom. There's a sense of risk. There's a sense of unpredictability. There's a sense of-- dare I say-- anxiety. And for some, anxiety morphs into terror.

As a psychologist, I would argue that a certain measure of anxiety is adaptive for learning. It's good to be a little anxious; it leads to more attention and vigilance. But while moderate anxiety is adaptive, terror is paralyzing, and one of the great pedagogical challenges is to create an environment that is simultaneously risky but not paralytic. That's why teaching is tough. And in law schools, we know that at least the stereotype is that the sadistic law professor values terror and tries to promote it. I'm not sure what the evidence for that is; we certainly know that it can often be experienced that way.

On the other hand, when public, accountable interaction becomes a signature pedagogy and it becomes routine, it also gets habituated. Much of maturation involves transforming debilitating fear into tolerable anxiety. It is no accident that just about the earliest game that any infant plays is peek-a-boo. And you all remember what that dance looks like. You come over to visit your new niece or nephew, and mom is holding the baby, and you go, *"Peek-a-boo!"* And the baby looks at you and bursts into tears. And you feel so guilty, you feel so terrible. And then you realize that although the baby has burst into tears, the baby is now looking at you expectantly. And you realize the baby wants you to do it again.

And you do it again, and they burst into tears again. But about 10 minutes later, if you've kept it up and if they're old enough, they are now giggling with that absolutely enchanting and delicious joyful sound of new babies having a really good time. The infant has begun practicing the life-long process of transforming terror-into-delight. Terror occurs in the absence of control. Although I don't want to do a seminar on the psychology of infant development here, the pedagogical equivalent of this transformation is recapitulated in law school and medical school. And as students begin to know what's going to happen, get control, understand what they have to do in order to manage the anxiety, it becomes very adaptive and very educative.

So some of the features of signature pedagogies are that they are habitual, routine, visible, accountable, interdependent, collaborative, emotional, unpredictable, and affect-laden. I've further labeled these signature pedagogies with three different kinds of

descriptors: pedagogies of *uncertainty*, pedagogies of *engagement*, and pedagogies of *formation*.

I call them *pedagogies of uncertainty* from the teacher's perspective as well as the students'. They depend so heavily on student responses to one another and teacher adaptations as well, that one because really can't know exactly what the track of the conversation is going to be. The teacher can prepare meticulously, and indeed typically must be fully prepared. There are implicit decision trees that grow out of predictions of where the conversation and exchange is likely to go. But when you and I are teaching in one of these signature forms, we must be prepared for contingencies and so must the students.

That these are pedagogies of uncertainty is both important and fitting for pedagogies of the professions. A characteristic of all professions is that professions are fields in which people make decisions and act under conditions of unavoidable uncertainty. And so the very uncertainty that is essential to the pedagogy is also socializing future professionals to the conditions of practice.

Signature pedagogies are *pedagogies of engagement*. I could give this lecture even if all of you were sleeping. It wouldn't be much fun, but a lecture, except for the nonverbals and the nods, can be performed without active engagement from students—and often is.

A necessary degree of engagement, which is clearly a prerequisite to all effective learning, is built into these pedagogies. Signature pedagogies don't work unless students are responding. You can't teach dialogically if you don't have an interlocutor who's going to dialogue with you. And it doesn't work all that well if it's only between you and one other person without the participation of a wider circle of colleagues. Signature pedagogies are thus pedagogies of engagement.

The third feature is that these are *pedagogies of formation*. I mean "formation" now in the theological seminary sense, or the religious education sense. They are pedagogies

that can build. identity and character, dispositions and values. They teach *habits of mind* because of the power associated with the routinization of analysis. But I think in a very deep sense they also teach *habits of the heart*, as well, because of the marriage of reason, interdependence and emotion.

I was thus both relieved and impressed on clinical rounds to observe that one of the major changes between what I used to see 25 years ago on the teaching hospital floor, and what I saw a couple of weeks ago, was the emphasis on the interpersonal, the moral and the ethical aspects of clinical practice. Again and again I heard the senior resident ask the more junior people, "How are we going to talk to the family?"

For example, we discussed the case of a young woman, 23 years old, who had been in the ICU for four weeks, and after all that time and every clinical test that they could imagine, they still didn't have a clue about why she was in a coma; they just didn't know. How do you talk to the parents? How do you talk to the fiancé? What do you say? And how is that different from what you say to the family of the 70 year old Army veteran who is an alcoholic and is in the hospital to try once again to recover from his alcoholism? What are the connections between what you yourself feel and what you can communicate to others? And what is your responsibility? How far does it go? They engaged deeply with these questions, and as they did, I observed their pedagogies of formation.

Universally, these were pedagogies of action, because exchanges typically ended with someone saying, "That's all very interesting. Now what shall we *do?"* It wasn't enough to be able to say, "Ah! Now I understand the diagnosis." That's lovely, very nice, but now what are you going to *do?"* "How much will it cost?" "If we expend finite resources in the service of this patient, what will we refrain from doing for another?" Again, the pedagogy immediately places the emphasis on action. And since all action involves value choices, often ethical decisions as well, we were seeing the juxtaposition of the intellectual, practical and moral imperatives working conjointly.

Another interesting question about these pedagogies is: why do they persist? Why do they last so long? I think the answer is that even though I can point out the flaws in every one of these signature pedagogies-- and each is flawed -- by and large, they work. They achieve the ends for which they were "designed", or in a kind of Darwinian sense, they survive the competition with alternative pedagogical means. There are far more complex sociological and political reasons why they persist as well, but this is neither the time nor the place for that analysis.

Why have I told you this long story when we're here to talk about teacher education? As I said at the beginning, I'm a teacher-educator. One of the things that strike me as a teacher-educator is that it's very, very difficult for me to find the signature pedagogies of teacher education. Unlike the other professions, where people do not apologize because the way law or medicine is taught at Berkeley is essentially identical to the way it's taught at Stanford or Irvine, or UCSD, in education, every teacher education program seems to feel that it needs to be special, singular or unique.

I would respectfully propose that a major challenge for the education of teachers and the professional development of veteran teachers for this next generation will be to recognize that what we desperately need is a suite of signature pedagogies that are routine, that teach people to think like, act like, and be like an educator. We need signature pedagogies that respectfully recognize the difference between pedagogical thinking associated with promoting deep understanding in mathematics, and doing it deeply in English literature, or in history. And that we build our programs of teacher education around these kinds of signature pedagogies.

I'd like to end my remarks by describing my current candidate for one of those signature pedagogies. This is based on work that my colleagues and I are doing at the Carnegie Foundation. The senior scholar at the Foundation who's leading this work is a superb teacher educator named Anne Lieberman. We have collaborating teacher-educators from all over California and the nation, who are beginning to work with us.

We begin with a critique of teacher education that all of us have known for years. It's very hard to learn to practice without powerful, consistent models of practice that we can study deeply, that we engage with deeply, that we can reflect on deeply, and over which we have some control with regard to quality and character. If you had to design a system to violate all those principles, you would have designed traditional student teaching. Every candidate is assigned to a different place; there is enormous uncertainty about what they're going to see, what they're going to do, and how their own learning and performance will be monitored and guided.

Can you tell me that if you go to five different student teaching placements in the same morning in five different schools, you can predict what the student teacher is going to be doing in each of those places? Of course not. But if you were doing that with a medical resident, you could make quite a precise prediction of what they would be doing and with whom, because clinical rounds have a pattern and a routine. If you were doing that with an architecture student in a design program, you also could make reasonably solid predictions. So the first problem that I see in teacher education is the incredible uncertainty of the pedagogical models of practice.

One of the things that we are just beginning to take advantage of now, and I would predict will revolutionize teacher education and professional development in the next decade, is the potential of very rich, powerful, multimedia documentations of teaching, learning, and classroom life. If there are extraordinary teachers of Shakespeare who are teaching in urban settings, or of AP calculus in rural settings, or whatever combination of content and pedagogy is critical for neophytes to observe and learn from, vivid multi-media cases of those practices are not currently available.

But in the future we will have deep, rich case materials that permit us to study, analyze, slow down, review in depth, and generally work through the practices and thinking of teachers who will become exemplary cases of teaching. Like cases in other fields, these will be available in every teacher education program in the country. There will be multiple models, not just one canonical form. I don't happen to believe that there's such

a thing as "best practice" because I think that best practices emerge contextually, historically, in settings. But there sure are worse practices.

You need a very rich body of case material, the same way that people learning chess. What could be more predictable than life on a chessboard? Look how few the options are! Eight squares by eight, and only a few legitimate moves for each piece…and yet, look at how many books of cases of chess playing there are in which you can play through, analyze, read the commentaries, read the commentaries-on-the-commentaries, and then practice it yourself. And now there are computer-based systems and this is just chess!

So the first thing we're working on-- and we're not alone-- is beginning to develop libraries, archives, of extraordinarily rich documentations of teaching that ideally are not only snapshots, but help you see what the teacher did at the beginning of the year to organize the class so that the rules of engagement got learned in practice. Ultimately, you will be able to observe how kids develop during the year. We will have cases that document how the teacher learns from her or his practice. There will be evidence from student work, so that the archive includes student writing, student problem-solving, students talking about how they're feeling and thinking.

I invite you to go to the Carnegie Foundation website (http://www.carnegiefoundation.org) to see the beginnings of this kind of work at the elementary, high school and college levels. And as I say, we're only beginning it, and there are others at work in this arena as well. But the whole idea of having rich cases of practice is, I think, the first absolutely indispensable ingredient in the needed signature pedagogies of teacher education. But that alone enough, because one while there are many collections and books of cases in medicine and in law; they don't teach themselves.

Teacher educators must learn to work with these kinds of materials in order to teach with them. Even in the hands of highly skilled teachers of teachers, the use of cases in the education of new teachers is complex, uncertain and in need of substantial empirical

study. At the same time that we're developing this growing archive of classroom practice at the elementary and secondary level, we're developing a second archive of teacher education practice. We are working with sites where teacher-educators are working with their students, the future teachers, using these kinds of case materials and teaching the students how to engage with and learn from these cases; how to engage with one another interactively as they learn to analyze, deconstruct, critique and plan their own work on the basis of these cases.

We thus turn our attention to a second set of materials on "what do accomplished teacher-educators do with these new tools" that must be developed and field tested. This is the second stage, which is the teaching of new professionals by professional educators, and it runs parallel to what we document at the level of classroom school-teaching. This is the level at which we would expect to discover, construct, refine and elaborate the signature pedagogies of teacher education. In this second stage, moreover, we would make direct connections between helping novice teachers learn to analyze and critique cases of practice, and guiding them to apply what they are learning to their own actions as student teachers or interns.

Signature pedagogies in the professions connect thought and action. Law schools fail miserably at this because the emphasis is so heavily on learning to "think like a lawyer" that the students rarely are expected to *do* anything; clinical education in law schools is usually elective and for many students almost nonexistent. In medical schools, in really good engineering programs, in seminaries, they *do* have to act. Well, we have to understand how well, how faithfully-- and I don't mean that in the clergy sense-- the students who learn the practice can apply it in practice. And so the third stage of our Carnegie work is we are now following the neophytes, the novice teachers, from the teacher education settings, where we're studying how they're taught, into their own classrooms to see how they practice, based on what they've been learning from their cases.

When you have videotapes and other forms of documentation of the practice of new teachers who have been learning from the prototypes of practice in the first stage, you have completed the loop. You have a pedagogy that moves from accomplished practice of teaching to accomplished practice of professional education to the emergent practice of neophytes, with all the potential for a feedback loop back into better documentation, analysis, and materials development in the first stage. It would lead to a program of signature pedagogy for teacher education that combines the best features, on the one hand, of *case method*-- where you're dealing with the rich, growing archive of existing cases. And on the other end, our best ideas from *lesson study*, where you're now setting teaching and learning objectives, jointly designing instruction to accomplish those goals, actively engaging in teaching to try it out the design, seeing how it works, and bringing that back to the seminar or workshop in which you're working on learning to teach.

I call this tripartite conception either the triple play, or in winter-- when you still had a hockey season-- that "hat trick." One of my colleagues says that the triple play is a defensive metaphor, and we should imagine this work as an offensive initiative. So he wants me to include the fourth step, which is reflectively moving back from the implementation in novice's classrooms to the redesign of the teacher education, and call our approach a *grand slam*. Names aside, we have an example of trying to design signature pedagogies for teacher education that learn from the signature pedagogies of other fields.

This model bears serious family resemblance to what we do in clinical medicine, where the clinical team deliberates and agrees on an intervention with the patient, the action is taken, and the team returns the next day and to monitor progress and change. The medical student or intern or resident in charge stays with the patient during the intervening time, and comes back and reports. Or in the pedagogy of a design studio in engineering, where students critique each others' designs, and then make adaptations. These are variations on the logic that underlies lesson study. That is, lesson study is part of a larger, generic pedagogy of design, experiment, evaluate, redesign engaged collectively and collaboratively, with lots of visibility, engagement, passion, and

accountability among all members of the learning group. This is the language of signature pedagogies, and it is a model we must aspire to in teacher education.

Lest we lose sight of the context of these remarks, I must remind you again that **no signature pedagogy is a replacement for deep content knowledge** in any of the professions. In teaching, that deep content knowledge is of two kinds: rich and profound understanding of the subject matter one is teaching, whether mathematics, history or biology, as well as understanding of the principles of learning, development, motivation and instruction. These forms knowledge are foundational, necessary but not sufficient. The signature pedagogies of professions are designed to transform knowledge attained to knowledge-in-use, and to create the basis for new kinds of understanding that can only be realized experientially and reflectively. Taken together, they will help construct the forms of *pedagogical content knowledge* with which I have been engaged for many years.

This is enormously exciting work. The accomplished practitioners with whom we work in the first phase of the triple play are active collaborators with whom we work very closely to document and analyze their own practice. And in doing so, they, in effect, begin investigating their own practice. They become co-investigators, and they become enormously interested in what other people can learn from their practice, which is not something they've thought about before. And yet it changes, in some sense, their sense of their role. They realize that once their work becomes the basis for these new multimedia cases, they are not only teaching their own students; they are teaching students of teaching they will likely never meet, who are studying their practice and trying to learn from it. Moreover, those students of teaching need to learn not only from the documentation of their successes, but also from the honest representation and analysis of their errors. Over time, we in teacher education will need to collect and organize hundreds and probably thousands of such cases.

The work with teacher educators is equally important and exciting. The complexity of preparing others to teach is grossly underestimated. It is at least as daunting as preparing novices to design bridges, argue legal cases or conduct surgery. As we document and

analyze the ways teacher educators learn to use these powerful new tools in the education of new teachers, we come to more deeply appreciate the challenges associated with this role.

And finally, this project provides something we've generally been lacking, which is a way of systematically following those who are learning in our professional development and teacher education programs, and feeding back what we learn into the redesign of the professional development process itself. If this kind of approach works, it should profoundly change programs of professional development in school districts. Professional development will no longer be dominated by snake-oil salesmen coming in on weekends, getting paid thousands of dollars to teach us about "the brain and learning," or some other fad. Instead, that money is going to be invested in teacher research groups, the way it is in Japan and China and other nations, where teachers work together studying their own practice, joining with teachers in other schools to study each others' practice, and develop new understanding and learning from that kind of investigation.

Thank you for your attention.

[APPLAUSE]

MODERATOR: There is a little time for questions. And thank you for graciously agreeing to that, and for challenging us and expanding our horizons. So Jay or Janet or somebody will move the microphones. Please speak into the microphones. So the first question is way in the back.

BARBARA SCHULTZ: This is Barbara Schultz speaking. I wonder if you could speak to the use of the Web, Web-based professional development in the future: how you see that connecting teachers, or not?

PROF. SHULMAN: Yeah, Barbara, in my fantasy life, the Web becomes absolutely central to this work. It becomes central in a variety of ways. First of all, if we're going

to develop the rich archive of case material that we need, we ought not to expect every teacher education or professional development program to be doing this sort of work solo. Instead, as is the case with other fields, as a profession we develop, we critique, we share, and then we make available case materials that are drawn from a variety of sites.

We at the Foundation have developed a whole series of Web-based sites now, that-- Where we create galleries of these examples. And then we connect them-- and here, we're still a couple of years away from doing this well-- to list-serves that permit people using these cases to communicate with one another, to post problems, to post innovations, things like that. So we've got an entire staff of about five or six people working on exactly the challenge that you've implied. Which is how do we make use of the power of the Web to really accelerate this development. I think it's essential.

I'm thinking about the comparison between the legal, medical and education professions in terms of the training of young teachers, and young professionals in the other areas. And it seems to me that the core development program for lawyers and medical students is the same. If you're going to be a psychiatrist or a pediatrician, you go through the same core training. If you're going to be a litigator or a contract lawyer, you go through the same courses to get there.

If you're going to be a kindergarten teacher or a high-school physics teacher, you don't have the same experience. And so my question is, how do you get that set of signature pedagogies around a core training that really is very different? I don't want to give education an excuse to say, "We can't do it, because being a kindergarten teacher is different from being a high school physics teacher."

PROF. SHULMAN: Yeah. No, it's a very good observation. Engineering is a little bit more like teaching in this regard. Because even though there are certain fundamental courses in math and physics and what have you, the undergraduate preparation of engineers begins to break apart fairly early as they move to electrical and mechanical, and civil and what have you. And yet, in the design programs where they're really doing

practice, I think there are a lot more family resemblances in the signature pedagogies, even though what they're designing may range from circuits to robotics, to models of bridges or airplanes.

And so I'm somebody who has been a strong champion of the domain specificity of teaching for many, many years. And I certainly don't believe that one size fits all in teaching. And yet, if we took the kind of model I'm describing and asked, "Could you use that kind of discipline"-- and now I mean it in the signature pedagogy sense-- "for preparing primary school teachers, as well as teachers of high school mathematics?", I think the answer is yes. I think that the fundamental structure of the pedagogies could be very much the same.

But ultimately, what you're asking is a lovely empirical question. I love the challenge of trying to figure it out through doing it. But we have thought a lot about the core problem, and whether there should be more of a common core, for example, for future teachers than there is now. My own bias is that the common core for future teachers is a damn good undergraduate liberal education, which teaches them to think in certain kinds of critical, skeptical and ambitious ways. But I think the question is one we have to explore.

LINDA GOFF: Hi, Lee, Linda Goff.

PROF. SHULMAN: Yes?

MS. GOFF: Lee, I haven't gotten a chance to bring you up to date since the last time we talked, on where we are in the California Science and Math Initiative. But precisely what you've been talking about, many of us have been talking about in terms of putting together area-specific summer institutes for UC students coming up and studying teaching, to become teachers in sciences and mathematics. And we've talked about your ideas of signature pedagogies. So I'd just like to tell you that there's others that have been reading and learning about what Carnegie has been talking about in this area. And I think UC is very interested in moving in that direction; many of us are.

We're going to have probably a major meeting in the spring on this, where we're going to bring people in specific disciplines in science and mathematics together-- probably at Lake Arrowhead, we're trying-- to start developing what those signature pedagogies might be in physics, in chemistry, in biology and others. And I just wanted to let you know this, because it would be great to have Carnegie there at the table with us.

PROF. SHULMAN: That's wonderful. I'm also participating in a meeting in Berkeley at the Mathematical Sciences Research Institute this spring, which is going to be focused on the mathematical knowledge needed by elementary school teachers. And it's very encouraging to begin to see more and more serious investment by my colleagues in the disciplines, in the arts and sciences, in this kind of work. Because without them, it just can't happen. So I'm delighted to hear about this.

MODERATOR: I see two more questions, and I think that may be all we have time for. Judy?

JUDY: Well, I wanted to know whether or not there's any chance that we can mine the archives of the National Board for Professional Teaching Standards, those beautiful, wonderful cases that are there, and the videos, to use in our teacher preparation programs?

PROF. SHULMAN: You know how to tear a guy's heart out, don't you? [Laughter] Well, it's a serious problem. Both my wife, Judy Shulman, and I have been working very hard to try to break loose the now-over-40,000 successful National Board teachers-- I mean, successful in the sense of passing. There are probably some wonderful materials among teachers who didn't achieve passing score, but still have-- And the Board has been very resistant to make it possible to use that archive. There are all kinds of legal reasons and informed consent reasons, and things like that. Will you join me in trying to make that happen?

Yeah, I mean it's-- I know they've got lots of other problems. But the fact is that those archives could be invaluable. Now that said, I don't know-- I'll assume most of you are familiar with those archives, or what's in a National Board portfolio. By the standards we're now using for defining "what has to be" in a fully and richly elaborated case of teaching, what's in a National Board portfolio is nowhere near enough to learn from.

And so our purpose would be to go into those archives, identify teachers whose teaching-- And then go back to those teachers, and instead of just using what's in the archive-- And that's what we've done with Yvonne Divans Hutchinson in South Central L.A. My first understanding of her teaching-- She's a 38-year veteran in Watts, teaches high school English-- was when my wife, Judy, who works very closely with the National Board, brought me Yvonne's National Board classroom practice tape. And I was blown away! Well, Yvonne now is the largest single entry in the Carnegie gallery; it doesn't include that tape. 'Cause we've had to go back with Yvonne and tape in her classroom. Tape her commenting on her own practice, get student work.

So we need to get into the archive, but we have to understand, that will be the take-off point for what we need to do next; it won't be the golden fleece that we needed, that we can now shift over. But yeah, we got to get through those folks.

MODERATOR: So you got a volunteer here?

PROF. SHULMAN: Yes, thank you, Judy.

MODERATOR: Claire?

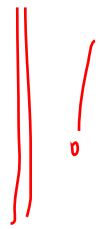
CLAIRE KOMIVES: Claire Komives, San Jose State. Something that you said near the end of your talk-- Well, first of all I want to say that I'm totally-- I think this is a great idea, of the signature pedagogies, because they are also assessable--

PROF. SHULMAN: Right!

PROF. KOMIVES: -- for the programs. But something that you said at the end of your talk about-- That if people entering the profession of teaching can see these signature pedagogies and be familiar with them, much the same way we are all familiar-- even though we're not lawyers or doctors, but we know what they have to go through-- that would be, in a sense, a selection for them. If you may find their vocation to teaching, that they would see themselves fitting into that mold. It sounded like that was something that you were suggesting at the end of your talk.

PROF. SHULMAN: Well, you know, one of the things I'm finding, Claire-- and hi, neighbor. Your colleague, David Whitenack, by the way, is already working with us on this project and we're hoping that that will be the beginning for much larger collaborations with the San Jose State teacher education faculty. And your Dean and Director of Teacher Ed have been visiting with us, as well. But one of the things we're discovering is, once you've got these archives, it turns out that people are much smarter than those of us who created them are, for figuring out exciting ways to use them. And I'll just give one example.

At the Harvard Graduate School of Education, there's an Urban Superintendents Program. And one of the people who teaches in that program is Richard Elmore, Dick Elmore. He gives a course for future urban administrators and superintendents. They use this archive, and just the Yvonne Hutchinson tape-- not tape, but website-- for a full week, in training urban superintendents. And the argument is: you people are going to be responsible for creating school systems and school organizations that can make this kind of teaching and learning possible. You can't do it unless you know what that kind of teaching and learning looks like! Otherwise, you'll make efficient systems for something other than that kind of teaching.



So they're spending time looking at it and saying, "What will we have to do at the superintendent's level, at the principal's level, at the district level, to create the conditions that would make that kind of teaching commonplace, and not heroic?" So I never

anticipated that kind of use of these. So I think once you've got case materials out there, the worst thing to do is to restrict people's use of them, as long as they use them ethically. Let them, then, use their creative juices to figure out things that those of us who authored this stuff weren't smart enough to do.

Thank you.

MODERATOR: Thank you very much, Lee.

[APPLAUSE]
END

Klasoefening

Ons vat nou twee dobbelstene en gooi hulle, dan bereken ons die som van die twee getalle wat gegooi is. Die een dobbelsteen se waardes maak die kolomme uit en die ander een die rye, die som is dan waar die gegewe ry en kolom ontmoet, in die tabel hieronder.

1) Voltooi die tabel hieronder om al die moontlikhede wat gegooi kan word te bereken.

	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

2) Hoeveel moontlikhede is daar?

3) Hoeveel keer kan ‘n total van 5 gegooi word?

4) Wat is die waarskynlikheid om 5 te kry as die dobbelstene gegooi word? Gee dit as ‘n breuk en skryf dit in woorde.

5) Hoeveel keer kan ‘n total van 7 gegooi word?

6) Wat is die waarskynlikheid om 7 te kry? Gee dit as ‘n breuk en ‘n desimaal.

7) Skryf nou die waarskynlikheid vir al die getalle neer.

8) Watter getal het die grootste waarskynlikheid om gegooi te word? Gee ‘n rede vir jou antwoord.

By ‘n kermisstalletjie kry jy die kans om twee dobbelstene te gooi. Jy sit jou geld op die total wat jy dink jy gaan gooi. As jy reg is kry jy dubbel jou geld terug en as jy verkeerd is niks.

9) Op watter getal anders as 7 sal jy jou geld sit en hoekom?

10) Hulle sê vir jou as jy jou geld op 12 sit en jy gooi dan 12 kry jy drie keer jou geld terug. Wat sal die rede hiervoor wees?

11) Wat is die kans om 13 te gooi?

SKOOLBESOEKOPDRAG

Identifiseer, beskryf en ontleed verskeie klaskamerepisodes* wat jy as tekenend / nie tekenend beskou van die beginsel: *Problemoplossing moet die fokus van die onderrig en leer van Wiskunde en Wiskundige Geletterdheid wees*.

Verskaf ook 'n geheelbeeld van die stand van probleemoplossing in die skool ...

* Jou waarneming van onderwysers se lesse, maar ook jou eie pogings!

Teoretiese raamwerk
Verskillende mense gebruik dikwels dieselfde woorde soos "probleemoplossing", maar gee heel verskillende betekenisse daaraan! Mense kan dan maklik dink hulle praat dieselfde taal of praat oor dieselfde ding, maar eintlik praat hulle oor heel verskillende goed!

Wat is 'n probleem?
Vir iets om 'n *probleem* te wees, moet daar een of ander blokkasie of struikelblok wees, d.w.s 'n wiskundige probleem is 'n taak wat jy nie weet hoe om op te los nie. Anders is dit mos nie 'n probleem vir jou nie!

Ek sal dit effens aanpas: 'n Probleem is 'n taak waarvoor jy nie 'n *geroetineerde* (outomatiese) oplossingsmetode het nie.

Wat is probleemoplossing?
Wanneer 'n onderwyser of 'n handboek *eers* die nodige wiskundige konsepte en metodes vir 'n probleemtipe ontwikkel en dit met 5 uitgewerkte voorbeelde illustreer, en dan leerlinge *toepassings* aan die einde van die hoofstuk laat doen, sê hulle dit is probleemoplossing. Dit kan tog nie wees nie - leerlinge weet dan reeds hoe om dit te doen! Ons noem hierdie soort take bloot *oefeninge!*

Ons sou in plaas van *probleme* vs *oefeninge*, die terminologie *nie-roetine probleme* en *roetine probleme* kon gebruik. Maar wat ek met *probleme* bedoel is dus nie-roetine probleme en *nie* oefeninge of roetine probleme nie!

Die volgende is 'n nuttige raamwerk om tussen verskillende benaderings te onderskei. Gebruik dit asseblief in jou opskryf van hierdie werkstuk!

- *Onderrig vir probleemoplossing:* Die onderwyser onderrig *eers* vooraf en apart die "tools" - die nodige wiskundige konsepte en metodes in die abstrak, en dan word dit *agterna* toegepas.
- *Onderrig via (deur) probleemoplossing:* Die onderrig *begin* met relevante probleme en die wiskundige konsepte en metodes word ontwikkel *terwyl* leerlinge die probleme oplos.
- *Onderrig omtrent probleemoplossing:* Die onderwyser illustreer in die algemeen probleemoplossingsmetodes.

Met probleemoplossing in die klaskamer bedoel ek dus *onderrig via (deur) probleemoplossing.*

Die onderliggende perspektiewe
Die twee benaderings *onderrig vir probleemoplossing* en *onderrig via (deur) probleemoplossing*

- Is gebaseer op heel verskillende onderliggende teorieë oor die aard van kennis (epistemologieë), in besonder die aard van Wiskunde, verskillende leerteorieë (insluitend die aard van geheue) en verskillende perspektiewe oor die betekenis van "verstaan", en
- dit lei tot totaal verskillende klaskamerkulture (die onderlinge verwagtings en verantwoordelikhede van onderwysers en leerlinge), en
- dit bepaal op sy beurt wat (en of) leerlinge leer.

Spreek al hierdie aspekte in jou werkstuk aan!

Verdere agtergrond:
NCTM se Standards oor probleemoplossing
Teaching problem solving
Hiebert et al
Problem solving teacher