U.S. DEPARTMENT OF EDUCATION

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NATIONAL MATHEMATICS ADVISORY PANEL MEETING

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MONDAY,
MAY 22, 2006

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The Panel met in the Lecture Room of the National Academy of Sciences, 2101 Constitution Avenue, NW, Washington, D.C., at 9:00 a.m., Larry R. Faulkner, Chair, presiding.

PANEL AND EX OFFICIO MEMBERS PRESENT:

LARRY R. FAULKNER	Chair
CAMILLA BENBOW	Vice Chair
DEBORAH LOEWENBERG BALL	Member
A. WADE BOYKIN	Member
FRANCIS FENNELL	Member
DAVID GEARY	Member
RUSSELL GERSTEN	Member
NANCY ICHINAGA	Member
TOM LOVELESS	Member
LIPING MA	Member
VALERIE REYNA	Member
WILFRIED SCHMID	Member
ROBERT SIEGLER	Member
SANDRA STOTSKY	Member
VERN WILLIAMS	Member
HUNG-HSI WU	Member
DANIEL BERCH	Ex Officio Member
DIANE JONES	Ex Officio Member
TOM LUCE	Ex Officio Member
KATHIE OLSEN	Ex Officio Member
RAY SIMON	Ex Officio Member
GROVER WHITEHURST	Ex Officio Member

PANEL AND EX OFFICIO MEMBERS NOT PRESENT:

JIM SIMONS	Member

STAFF MEMBERS PRESENT:

TYRRELL FLAWN	Executive Director
DIANE MCCAULEY	
IDA EBLINGER KELLEY	
JENNIFER GRABAN	
ALYSON KNAPP	

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(9:00 a.m.)

CHAIRMAN FAULKNER: I'm Larry Faulkner. I'm Chairman of the National Math Panel. Camilla Benbow, Vice Chair, is here. We will go around the table and do introductions a little bit later in the program, so I think we won't do that right now. I do have an indication here that Jim Simons is joining by phone. Is he on the phone right now?

MR. LUCE: No, but we'll try -- to call in. Just going to call this number?

REPORTER: Yes.

MR. LUCE: He hasn't called in yet, Mr. Chairman.

CHAIRMAN FAULKNER: All right. Thank you. Let me begin by thanking the National Academies for hosting the first meeting of the National Math Panel. We're meeting in the -- I suppose it's okay to call it the principal building of the National Academies. It's an exquisite building with great history.

My longtime colleague, Ralph Cicerone, is President of the National Academies, but Michael Feuer, Executive Director of the Division of Behavioral and Social Sciences and Education in NRC is with us as liaison to the panel. Michael, we appreciate your use of the hall.

MR. FEUER: My pleasure -- our pleasure.

[Applause]

CHAIRMAN FAULKNER: And thank you for being with us and thank you for staying with us. I'm anticipating that you're staying with us.

MR. FEUER: I plan to.

CHAIRMAN FAULKNER: All right. Michael's assistant, Cristyl Watson, has been very helpful in planning this event, and we thank her as well.

In the next hour we're going to be hearing from several Department of Education senior staff to brief us on information relevant to our service on the panel. Let me introduce Karen Santoro and Marcia Sprague, who will do the ethics briefing. They are from the Office of General Counsel. So we begin with our legal constraints.

MS. SANTORO: Good morning. We're here to briefly summarize the ethics rules and we're going to, in particular, focus on the panel members who are special government employees. The main ethics rule is the prohibition against conflicts of interest. What's a conflict of interest? An employee who participates in a matter that can affect the employee's financial interests or financial interests that are imputed to the employee would have a conflict of interest. Matters of financial interest that are imputed to an

employee include those of a spouse, an employer, or an organization in which the employee serves as a board member.

Now what's a particular matter? That's a matter that involves a specific party such as a contract or a grant or a matter that's focused on a discrete identifiable class. So like I said, and you heard from a number of us in our emails to you, it's very unlikely that particular matters are going to come up before this panel because you're going to be focused on broader policy issues. But we want to talk about some specific examples of what is or what is not a particular matter.

MS. SPRAGUE: Good morning. The first example that we wanted to give you is suppose that a member of the panel, or the panel itself, is undertaking a review of literature addressing mathematical learning, and it specifically includes learning difficulties, and someone on the panel might have authored a publication on learning difficulties, and the question is: what does that person need to do in that situation? They would not need to abstain or be disqualified from the literary review process simply because that publication was included in that group of literature that was being presented and reviewed.

MS. SANTORO: On the other hand, if the panel were evaluating specific curriculum products and a member had a financial interest in the product, for example royalties, or the member worked for the employer who developed the product, that would be considered a particular matter involving financial interest, and the member would have to abstain from participating in that evaluation.

MS. SPRAGUE: The next example is that if in an effort to identify best practices in teaching mathematics, the panel were to look at programs from several universities, a member who is affiliated with a particular university would be required to abstain and disqualify himself or herself from the process if a program from their university was under consideration as an example of a best practice.

MS. SANTORO: On the other hand, making recommendations regarding the effectiveness of various approaches to teaching math or performing an analysis on instructional methods, those would not be considered particular matters and would not raise potential conflict issues.

MS. SPRAGUE: And just as a final example: if a member of the panel who has a financial interest in a particular matter, and in this case by owning stock, for example, in a mathematics technology

product or being affiliated with an organization that is producing such a product, they may participate in a general discussion of the role of computer technology in the learning of mathematics, but may not participate in the evaluation of that particular product, and may not participate in the entire process in which that particular product is being evaluated. So it's the product itself, if that's talked about. It's the whole competition, or rather just the whole evaluation of products you need to be recused from.

The next ethics rule we wanted to talk about is misuse of government position. Some examples of this would be seeking an advantage for yourself and others, disclosing non-public information, or using your title in a way that suggests the Department sanctions your outside activities, and that's anything you do while you're not serving on the panel. An example is: if you wrote an article and they cited your membership on the National Math Panel as one of several biographical details, that would be fine. Or if they cited your title as a member of the Math Panel and included a disclaimer that said this reflects the personal views of the author and does not reflect the Department's views.

MS. SANTORO: Just a couple of other topics we're touching on. Lobbying -- what

restrictions apply if you want to lobby Congress. There is no grass roots lobbying. You cannot directly or indirectly suggest or request that others contact Congress or a state legislature to urge the passage or defeat of legislation or the like. Any direct communications with Congress in your official capacity as a member of this panel must be made only through official channels, so it's not something where each member is going out on their own and saying I'm here on behalf of -- it needs to be through the official channels when that kind of communication is made having to do with this panel.

None of these restrictions that I just mentioned would prohibit you from lobbying members of Congress or state legislatures or urging others to do so on your own time and in your personal capacity. If you do do so -- if you lobby Congress or state legislatures in that capacity, and the issue is related to the panel, you need to make sure that people are aware that you're not representing the panel by being there and not acting in your official capacity as a panel member.

Please also just keep in mind that when you are lobbying as a private citizen, you're not permitted to use the government resources or equipment in any way, and that would include seeking assistance

from panel staff. So please be careful about that.

The other issue that I'm touching on this morning is one that is sometimes somewhat obscured, but it's become relevant. It's relevant to this panel. It's the Emoluments Clause of the U.S. Constitution. Generally, it is unconstitutional for you to receive emoluments from foreign governments. This includes the political subdivisions of the foreign governments as well. An emolument is compensation that's received by virtue of -- it could be holding an office; it could be being employed with a foreign government; it would include salary, honoraria, transportation, per diem allowances, household goods -- I'm going through the list so you see how broad it is -- shipment costs, housing allowances. Those kinds of things.

The provision is particularly relevant to positions with foreign universities that are government-operated as opposed to private institutions, because they're political or the presumption is those are political subdivisions of the foreign government and so the Emoluments Clause would apply. This could change depending on the amount of control the university has over its personnel and contracting decisions. So it's something that we would need to look at to help you figure out whether

it applies or not.

An example would be if you entered a contractual relationship with a foreign university to teach or write and receive compensation for the same. It makes a difference if it's determined that what the panel is doing is purely advisory or not.

Those are some of the factors that would be looked at. And we just encourage you to look at the ethics primer that's in your materials, and feel free to contact us if you have questions about this.

MS. SANTORO: The most important thing is our phone number. That's 202-401-8309. Thank you very much. 202-401-8309.

CHAIRMAN FAULKNER: Don't go away. Maybe there are questions. Let's see if this group has any questions. All right. You're all clear on that. Thank you very much for the briefing.

Let me now introduce JoAnn Ryan from the Office of the Secretary, U.S. Department of Education, for a briefing on travel policy. Oh, I'm sorry. I skipped it.

Okay. I'm introducing Karen Akins, actually --sorry -- for the briefing on the Federal Advisory Committee Act. Karen Akins is with the Committee Management Office of the U.S. Department of Education.

MS. AKINS: Thank you, Mr. Chairman. Good morning, Vice Chairman Benbow and panel members. I'm pleased to be here this morning. Again, I'm Karen Akins. I'm the Committee Management Officer for the Department of Education, and on behalf of the Office of the Secretary and the White House liaison's office, I'm pleased to be here this morning to give you a quick, brief overview in the short time that we have about the Federal Advisory Committee Act or FACA or FACA or tom~to-tam|to, however you'd like to pronounce it.

In your briefing books under Tab 4, you'll find a pamphlet on the Federal Advisory Committee Act, but this morning I wanted to pull out or go over just some of the major components of the legislation. If you turn to the handout under that tab, I wanted to let you know that if you want to read about the Act itself in detail, one of the best sources of information is the Act itself. It's a short piece of legislation about eight pages long, and you can refer to that to read about FACA.

You can also refer to the GSA or General Services Administration website at www.gsa.gov to read about the Federal Advisory Committee Management Act final rule. In addition on that website, you'll find information about the government in the Sunshine Act,

and that talks about the topic of closed and partially closed meetings.

In 1972, the Federal Advisory Committee Act was enacted and became effective January 5, 1973. Not only did this piece of legislation establish the Committee Management Secretariat's Office under GSA or the General Services Administration, but also the act established a framework to cover the creation, management, operation, [and] termination of all federal advisory committees that report to the Executive Branch.

If you'll turn to the portion of the handout labeled Charter, I'd like to start with one of the major requirements of FACA is that all federal advisory committees must be chartered in order to conduct committee business. Within the Department, your charter was actually crafted from the language of the Executive Order, and this was done primarily by staffers in the Office of the General Counsel. Charters must be renewed every two years, and if for some reason a charter was to expire, the committee could not conduct business.

Charters become official when the Committee Management Office files the charter with Congress on the House and the Senate side -- the Education Committees, and a copy of the charter is

also sent to the Library of Congress. But this is a very important piece. Without a charter, you cannot conduct business.

In addition, one of the provisions of the Federal Advisory Committee Act is that each agency shall have a committee management officer. In my case, I was appointed by the Department to help ensure implementation of FACA, to work with the DFO, or Designated Federal Official, to comply with FACA. I also work on many aspects of committee establishment. That includes membership and any other advice dealing with FACA.

If you'll turn to the next page or the next two pages, I believe -- let's talk about some of the responsibilities of the Designated Federal Official or DFO. As Executive Director, Tyrrell Flawn is also your Designated Federal Official or DFO. This is a FACA requirement. Look at the DFO as basically your liaison between the committee and the Department to assist you with any questions around governing meetings and how they should be conducted. In addition to Tyrrell's many duties, she also helps the Committee Management Office to comply with FACA and GSA regulations. She also ensures that before you have a meeting, that your meetings are announced in the Federal Register notice 15 calendar days before

the date of the meeting.

And this is very important. In addition, the DFO must be present at all meetings. In the event that the chair, chairman or vice chairman could not be present to conduct the meeting, Tyrrell could also conduct the meeting.

Next page. Another important part of the Federal Advisory Committee Act is that there must be a quorum in order to conduct committee business. In the case of the Panel, nine members must be present in order to conduct committee business. One of the interesting things that you might want to know is in a time of budgetary constraints government wide, many Federal Advisory Committees often hold teleconferences. This can be considered an official meeting, but please note that even for a teleconference, nine members of the panel must be present and plugged in before you can conduct official business.

Next page. Another requirement of FACA is that all meetings must be open to the public. This was the thought when the legislation was enacted to seek advice of our citizens, to give advice and assist federal agencies. Only in small cases, or limited cases I should say, will you have closed or partially closed meetings. And those meetings would be in the

case if you're discussing matters of national security or classified information. Perhaps the panel may at some point look at proprietary information as related to grant applications or if you're discussing matters about personnel actions.

However, an open meeting does not imply public participation. In consultation with the chairperson, the DFO and the panel should decide how public participation should play out. And so in some instances, you may want to take public comment before or after committee meetings. If you do decide to have public participation or public comment, be sure you outline that in detail in your minutes, and that's, for example, things like if you are going to have public comment, in your Federal Register notice as well as in your minutes, let the public know how long they have to speak, for example. You may want to let folks know that it's a first-come—first-serve basis, that maybe everyone that intends to speak may not have the opportunity to do so.

Next page. Another major -- or a couple of major -- requirements about FACA are minutes, reports, and record keeping. It is essential that you keep detailed minutes, and this is done by the DFO or Program Office and their staff. In the case of closed meetings, you'll want to have a report that just

summarizes what took place but still with the withholding privileges of the matters that you discussed under the government and the Sunshine Act. And again, you can read more about that on the General Services Administration website.

In addition, files and records must be kept and open to review upon public requests. And again, that should be kept in the Program Office that supports the panel. And often I suggest that the files are set up where if the public were to request review of these records, they could come in and look at [them] by meeting dates. There should probably be a file section on membership with membership or the members' bios and resumes.

Again, speaking about minutes -- again, I can't emphasize enough -- in the spirit of the legislation, in order to be totally transparent to the public, minutes must be kept. Primarily for minutes, they should be set up in a format where members or who was present at the meeting should be outlined. Also, in the minutes, anything that was discussed or decided. If you have abstentions during your voting, you should note those individuals who actually abstained during voting, for example.

In addition, any papers that were issued should be noted in the minutes. If you have public

participation, you'll want to list who spoke and what they spoke about.

And most importantly, all minutes for all open meetings should be certified within 90 days by the chairperson. And so in consultation with the DFO, they should review the minutes, be sure that they're accurate to the best of their ability, and the chairperson should sign off on those minutes.

Federal advisory committees are usually established to serve government agencies in Washington, DC. Therefore, most of your advisory committee meetings probably will take place here in Washington, but at some point if the panel decides that there's a reason to travel and go out amongst the public and have meetings, this can be done. But it has to be approved by officials in the Department. You have to have written prior approval for that.

And finally, on the last page, Special Provisions. The ethics folks talked a little bit about this, but you're serving as special government employees, which are quasi-government employees. You were chosen because of your individual expertise and experience versus some committees serve as representatives where they represent a group. Because you're serving as special government employees, you're entitled to be reimbursed for your expenses, receive a

per diem allowance, and the Program Office will take care of those things for you.

And finally, I just want to thank you for serving the Administration and the Secretary. And Mr. Chairman, if anyone has any questions, I'll be happy to answer them. Otherwise, you can reach me through Tyrrell Flawn, or my number directly is area code 202-401-3677.

CHAIRMAN FAULKNER: Are there any questions?

MS. AKINS: Thank you.

CHAIRMAN FAULKNER: Thank you. All right. Now I'll introduce JoAnn Ryan for the briefing on travel policy.

MS. RYAN: Good morning. My presentation is for the more practical aspects of your participation here. Welcome to the Department. As special government employees, you are covered by federal travel regulations, just as the Secretary is, the Deputy Secretary and our Assistant Secretaries and all the employees here. So this is a sort of benefit.

In any event, all of your travel arrangements are best made through the Department, because we can get contract government airfares and government lodging rates. If you make your own

reservations, your own air reservations, you will need to pay at commercial rate, and we will only be able to reimburse you up to the government rate for the trip. For example, if the government rate round trip airfare from Los Angeles were to be $300.00 and you paid $800.00 for a commercial ticket, as mathematicians, you would see that you would lose $500.00.

So it's very important that we make the travel reservations. And Tyrrell Flawn's office will be handling that. My office certifies and processes the payments, and we're certainly available to work with you if there are problems or issues, but we really don't expect any. And I assume that most of your travel will be here to the Washington, DC area. There are certain airlines that the government has contracts with from various cities, so you will be expected to fly on those airlines to get the government rate.

And we like, if possible, for you to use the cheapest airport to get in here. I know that there are time constraints in certain circumstances, and we can work to approve exceptions to that. We're going to try to meet your needs as much as we possibly can.

We'll also be making your lodging

arrangements, and if you decide to step outside those arrangements, you will have to pay the difference over the government rate. Now hotels in the DC area, we can pay up to $180.00 a night here.

Also, you'll be reimbursed for what's referred to in federal travel terminology as meals and incidental expenses. So for the first and last day of business here, you would get $48.00 per day, and any intervening days, it would be $64.00. From that amount, we will subtract any government meals provided.

And basically that's the story on travel. We'll also pay for taxi fares to and from the airport, and at the conclusion of your trip, a person in Tyrrell's office will be working with you to process these reimbursements. And they're usually done very quickly, so you should expect payment within five days or so of the time that you submit your reimbursement request.

So my phone number is 401-3085 should you have any questions, and anyone can certainly feel free to call me at any time. And we welcome you to the Department.

CHAIRMAN FAULKNER: Thank you. Are there questions about travel? We'll all become experienced.

MS. RYAN: Yes.

CHAIRMAN FAULKNER: Thank you. All right. We have now completed these briefings, and the next thing I have on the agenda is our swearing in by Secretary Bodman. What's the drill here? Are we going to proceed --

MR. LUCE: Mr. Chairman, Secretary Bodman's not coming until ten o'clock, but I think you could take the liberty of proceeding on to the next section until ten o'clock if you wish so. I don't think you have to sit around for 30 minutes and even though you haven't been sworn in, because you're just doing informal conversation and activities and not taking action, so if you want to move to the post-swearing in, we'll keep our eye out for Secretary Bodman.

CHAIRMAN FAULKNER: It looks like the photograph and all of that is --

MR. LUCE: Yes. I think that would be --

CHAIRMAN FAULKNER: -- all tied up with the swearing in, right?

MR. LUCE: Yes, sir. So I think you could go to your opening and Deputy Simon's conversation.

CHAIRMAN FAULKNER: Well, the next stage actually is --

MR. LUCE: Yes, but we ought to open it

up to the public, Mr. Chairman.

CHAIRMAN FAULKNER: Okay. We're not going to violate any federal law here by beginning this before our announced hour, are we?

MR. LUCE: Well, let's see. We might.

[Off mic conversation]

MR. LUCE: Our FACA representative said it was okay to go ahead.

CHAIRMAN FAULKNER: Well, that makes a majority.

MR. LUCE: I think so, Mr. Chairman.

CHAIRMAN FAULKNER: Okay. Now let's go ahead and move as they're opening it. Our next stage really is self-introduction stage. So what I think we'll do is go around the table and ask people to introduce themselves, tell a little bit about your background, your employment, where you come from, but also what connection you might have with the business of this panel in general ways.

I'm Larry Faulkner. I'm the President of the Houston Endowment. This is a private foundation. We give away money, but it all stays in the Houston metropolitan area just so the applications are not already lining up. I'm a former President of the University of Texas. I left the presidency in Austin on January 31st, so not very long ago. I served eight

years in that post. I was a chemistry professor for a long time at Harvard, at the University of Illinois, and at the University of Texas.

And I have general experience in science education, but I haven't especially engaged the issues that this panel will be engaging. I'm a neutral party here. And I'll be learning a lot. I have learned a lot.

Let me turn to our Vice Chair, Camilla Benbow and ask Camilla to make some comments.

VICE CHAIR BENBOW: Well, I'm Camilla Benbow and I'm --

MR. LUCE: You'll have to move a little bit closer to that microphone.

VICE CHAIR BENBOW: Sorry about that. I'm Camilla Benbow and I'm Dean of the Peabody College of Education and Human Development at Vanderbilt University. My background is I'm a professor of psychology, but my own scholarly interests have been with mathematically talented students, and I co-direct the Study of Mathematically Precocious Youth, which was begun in the early 1970's by Julian Stanley at Johns Hopkins. And we are tracking about 5,000 to 6,000 mathematically talented youth throughout their lifetimes. They're approaching age 50 right now.

And we're studying the development of

talent and what are the factors [that] influence that development of talent into positive results in the end. So what kind of educational factors, family factors, personalities have impact on the outcomes of these mathematically talented youth.

So when we worry today about can we produce STEM professionals in the numbers that are country needs, that's the kind of work that I've been doing. Who is -- who becomes a STEM professional. And that's my interest, and I guess I do have a little bit of a dog in this fight.

CHAIRMAN FAULKNER; All right, Russell.

MR. GERSTEN: I'm Russell Gersten, Professor Emeritus, University of Oregon. I'm also Director of an instructional research group in Long Beach, California where I now reside. Most of my research has probably been in two areas, both of which are relevant to the panel. One is understanding instruction for kids with learning disabilities and generally low achievement students.

The other is classroom observational research and just understanding how curricula or programs or policies are implemented at the classroom level and some of the many, many things that get lost in the transition. I've always loved math and still do.

And we did a meta analysis recently on instructional interventions for students with learning disabilities and found a very, very small number of studies. People are aware of that, and the idea that math has been under studied, and we need more rigorous research on this as well as the fact that understanding what is effective instruction in math is equally underdeveloped. There are different theories in all. I think there's some emerging consensus. And being part of that process is very exciting.

MS. ICHINAGA: My name is Nancy Ichinaga, and I was a Principal at an elementary school in Inglewood, California for 25 years before I retired. The school, when I got there, was noted for being a very low achieving school, and low achieving means that the kids were scoring at the three percentile in the state ranking.

So I was bound and determined to prove that black kids could learn as well as the white kids, because the kids were about 90 percent black. And we were able to prove that. In about three or four years, the school achievement went all the way up to over 50 percentile. All they needed was to be taught to read and write and to do math, and we did that.

MR. LOVELESS: My name is Tom Loveless. I'm director of the Brown Center on Education Policy

at the Brookings Institution. Before coming to Brookings in 1999, I taught at the Kennedy School of Government at Harvard University. And before that, I was a sixth grade teacher in Sacramento, California. I taught sixth grade for nine years. My recent research in math has been on math achievement and especially on interpreting NAEP data on math achievement.

CHAIRMAN FAULKNER: You just have to get close to the microphone. It'll come on.

MS. MA: My name is Liping Ma. I am a senior scholar at the Carnegie Foundation for the Advancement of Teaching. I am an educational scholar studying teachers' content and knowledge about math. I have done some comparative study about comparing teachers' knowledge between American teachers and the Chinese teachers. Now I'm interested in finding out what makes that difference.

MS. REYNA: Good morning. I'm Valerie Reyna, and I'm a Professor of Human Development at Cornell University. I have a longstanding interest in the application of scientific research in educational practice and policy, and I served a while with Russ Whitehurst at the Institute of Education Sciences attempting to put that into practice.

My own research ranges from memory and

learning to judgment and decision making, but in particular I have some interest in quantitative reasoning, including probability judgment and risk communication in health.

MR. WU: Hung-Hsi Wu, Professor of Mathematics at the University of California at Berkeley. I have been teaching mathematics at Berkeley my whole professional life. And I got interested in mathematics education in 1992, and I have worked with the State of California in all aspects of its activities. So recently I've been teaching teachers, and I've been assured by my colleagues that I do not do education research, I just talk.

MS. BALL: I'm Deborah Loewenberg Ball. I am the Dean of the School of Education at the University of Michigan and a faculty member there. My fields are teacher education and mathematics education. I was an elementary school classroom teacher for 15 years, and after that continued to teach mathematics on a daily basis in elementary school.

My research has focused on the mathematical knowledge needed to teach. I've recently been working over the last five years developing survey measures of teachers' content knowledge and

investigating the relationship between alternative kinds of professional education, teachers' instruction, and their students' achievement as a function of their content knowledge.

I'm also interested in research on how interventions impact instruction and student achievement using multiple methods for studying instruction in particular.

MR. BERCH: The ex officio members may wait until the rest of the panel introduces themselves.

MR. WILLIAMS: I'm Vern Williams, and I teach at Longfellow Middle School in Fairfax County. I've been teaching math for close to 34 years, and my special reason for being on the committee -- my personal reason is to see to it that you understand that math teachers actually want to teach math, real math. And I also represent students who have the right and want to learn real math, not watered down mathematics, not calling something algebra but it not being algebra. And I've loved every second of my 34 years and hope to go for 34 more.

MS. STOTSKY: I'm Sandra Stotsky, and from 1999 to 2003, I was the Senior Associate Commissioner in the Massachusetts Department of Education. Among the responsibilities I had, I

directed the development of our K-12 math standards. It was a revision of an earlier set of standards. I also directed the complete revision of our teacher licensing regulations which included mathematics as well as all the other subjects and areas. I was also the Director of our teacher testing program and developed or revised our existing teacher tests in all areas including those in mathematics.

While at the department, I also directed and planned two major middle school mathematics intervention studies. One was a two-year study that looked at a very carefully defined coaching model, and we hired six specialists and worked with many low-performing schools in Massachusetts to figure out what were the elements in coaching that might make a difference for low-performing schools. The other was an attempt to gather information from around the state on what teachers and principals saw as relevant factors for schools that were doing well with both ends of the student body.

I also, in a very much earlier life, taught elementary school, and I continue to do research in many areas across the disciplines: mathematics, history, civic education and reading. Thank you.

MR. SIEGLER: I'm Bob Siegler. I'm a

Psychology Professor at Carnegie Mellon University, Pittsburgh, and I study how children learn mathematics at a fairly detailed level, look at the strategies that they use, how good strategies win out over bad strategies, the circumstances that lead to discovery of new strategies, how strategies are transferred once they're discovered. And recently, with support from IES, I've been looking at how we can teach low income pre-schoolers a basic sense of number through playing rather conventional board games that are quite common in middle income households but relatively uncommon in low income households.

MR. SCHMID: My name is Wilfried Schmid. I am Professor of Mathematics at Harvard University. Research and teaching in mathematics is what I do most of the time. In mathematics education, I'm an amateur, though I think a serious amateur. My interest in mathematics education is relatively recent. In 1999, my daughter was in second grade, and I realized that some of the elementary curricula in the United States are a disgrace.

I helped write the curriculum framework for mathematics for the State of Massachusetts, served as a Mathematics Advisor to the Department of Education in Massachusetts. I served on the Steering Committee of NAEP. More recently I participated in an

effort to find common ground in mathematics education along with three mathematics educators and another mathematician.

MR. GEARY: I'm Dave Geary, a Psychology Professor at University of Missouri at Columbia. Our primary focus right now is a study of the cognitive systems that underlie individual differences in early math development and learning disabilities in mathematics in young children.

MR. FENNELL: Good morning. My name is Francis Fennell. About the only people who know me as that is my sister and my college president. I'm Skip Fennell, and I'm a 30-year math educator at McDaniel College and a three-week President of the National Council of Teachers of Mathematics.

My research interests formerly, and I suspect continuing, is the establishment of a sense of number or number sense, what that means, how we can think about that, how we analyze that.

Current work includes working to define mathematics for students known as special education students and working specifically through NCTM's efforts in establishment of curriculum focal points. I also chair the United States National Commission for Mathematics Instruction. And that's probably enough.

MR. BOYKIN: Good morning. I'm Wade

Boykin. I work up the street at Howard University. I've been there for about 27 years now. I wear two hats at Howard. One is as Professor and Director of the Graduate program in the Department of Psychology, and I guess in that capacity, I've been involved in research at the intersection where cognition, motivation, culture and context all come together to help understand child development and how these impinge upon academic achievement.

The other hat I wear, I guess for the last ten/eleven years, is directing research, development, evaluation, technical support center that has been involved in school reform and evidence-based school improvement strategies in schools and school districts across the country, particularly in lower income ethnic minority communities. In this capacity, a lot of my work has focused on math initiatives and math programs.

CHAIRMAN FAULKNER: All right. Let's go back now and pick up our *Ex Officios*. I'll start with Dan Berch.

MR. BERCH: I'm Dan Berch. I'm here as a representative from the National Institute of Child Health and Human Development at the National Institutes of Health where I serve both as Associate Chief of the Child Development and Behavior branch and

direct a funding program in mathematics and science cognition and learning.

MR. WHITEHURST: Good morning. I'm Russ Whitehurst. I'm Director of the Institute of Education Sciences in the U.S. Department of Education. We are a major funder of research on math curriculum, math instruction, professional development of teachers. Our statistics division generates most of the relevant statistics that have to do with how students in the U.S. are doing and changing over time with respect to math, and internationally, a fair amount of that data is in your notebook.

We do evaluations of federal programs carried out by the Department of Education that intend to impact math, and we're responsible for the What Works Clearinghouse that has done a review of middle school math and is shortly to release findings with respect to elementary school math.

MR. SIMON: I'm Ray Simon. I'm Deputy Secretary of the Department of Education. I've been in Washington since January of 2004, so I'm a relative newcomer. I am finishing up 40 years in public education. Began my career as a math teacher in 1966. Am here to be whatever support I can. Obviously, you all don't need knowledge from me, but I'm here to try to help leverage the resources of the Department to

help you have a successful tenure, and thank you all for serving.

MR. LUCE: My name is Tom Luce. I'm Assistant Secretary of Policy Development, Planning and Evaluation in the Department. I would also point out in terms of Ex Officio members being of help that Deputy Simon did not mention he still carries his slide rule in his brief case and is available at any time to utilize his slide rule on behalf of the panel. But we are simply here to serve in any way we can to facilitate the work of the panel and not participate in the decision-making but simply be here to be a resource. And we look forward to working with you and thank you for your service.

MS. JONES: Hi. My name is Dianne Jones. I'm the Deputy Associate Director for Science at the White House Office of Science and Technology Policy. I'm a molecular biologist by training, and I started my career -- I served for many years as a professor of biology but also did a number of K through 12 and teacher education outreach activities.

I came to Washington first as a Program Officer at the National Science Foundation in the Division of Undergraduate Education. I then went [to] the Hill where I worked for the House Science Committee. I went back to higher ed. I worked for

Princeton University for three years, and then came back to Washington to my current position at OSTP. And I'm also a home school parent.

MS. OLSEN: My name is Kathie Olsen. I'm the Deputy Director of the National Science Foundation. As I think many of you know, NSF was created over 50 years ago to be the primary agency that supports basic research across all fields of science as well as math and science education programs at all levels. My Ph.D is in neuroscience, and when I actually did research, I did cognitive differences in the brain -- male/female differences.

MR. LUCE: Mr. Chairman, could I suggest maybe we take a break at this point but also tell the audience that we had proceeded with the introductions, but all the biographical information on the members is available for distribution. And all we've done in this public session is introduce each other, and their bios are available for anybody who needs them outside. And it's online as well.

CHAIRMAN FAULKNER: Yes. I think we went through, before the doors were open to the public, a set of briefings on ethics and travel policy and the Federal Advisory Committee Act and so forth. All pro forma elements. The doors were opened about 9:30. We went through the individual introductions of panel

members as you were coming in. You heard a lot of that. And as the Assistant Secretary just said, we have that information available to the public at large via the website.

I believe we are on the verge of having Secretary Bodman with us, and Assistant Secretary Luce suggested that we take a break. I think that's probably the right thing to do given what I'm hearing about timing. So let's go ahead and do that rather than begin any other agenda items.

As soon as the Secretary arrives, we'll have to reassemble here. So don't go far.

(Whereupon the matter went off the record at 9:55 a.m. and back on the record at 10:06 a.m.)

CHAIRMAN FAULKNER: Well, it's a privilege for us to have with us the Secretary of Energy, Samuel Bodman. Secretary Bodman has generously agreed to step into the breach and do the swearing in for us. Secretary Spellings is out of the country and is not able to do it herself.

Secretary Bodman leads the Department of Energy, which has a $23 billion budget and 100,000 employees, federal and contractor employees. At the Department of Energy, they know the importance of good math education in spurring innovation and improving America's competitiveness.

Secretary Bodman is himself a chemical engineer. He was a faculty member for a while at MIT, left for the private sector and became President of Fidelity Investments and Chair, CEO and Director of Cabot Corporation. He's brought remarkable energy to the Department of Energy, and it's a pleasure to have the Secretary with us today. Mr. Secretary?

SECRETARY BODMAN: Thank you. I'll get you to sit down, otherwise you'll be trapped here, Larry. Thank you. I'm very pleased to be here filling in for my friend and colleague, Margaret Spellings, who, when she talked to me about this, I told her I'd be very pleased to try to substitute for her and have the honor of swearing in the members of the President's National Mathematics Advisory Panel.

The President created this Panel and it couldn't, in my judgment, have come at a more opportune time. Many of you are aware that last year the National Research Council published a report from the academies called "Rising Above the Gathering Storm" that we've come to call the Augustine Report, after Norm Augustine, who chaired the committee. And that report does quite a remarkable job of detailing the challenges that we face in science, mathematics, and engineering education in this country. I know that Deputy Secretary Simon will be talking more about

this subject with you in a moment.

But I did want to tell you that I'm a product of the Sputnik generation, and for those of you who remember that, I went through graduate school funded by the National Science Foundation whose budgets were quadrupled in one year back in the late 50's as a result of our concerns about science.

The facts laid out in Norm Augustine's report are a matter of concern not just for professional educators, whom you all represent, but for all of us who care about the future of this nation. Improving math and science education is crucial to our future, to our future economic strength in particular, as well as our national security.

The President recognized this and announced the American Competitiveness Initiative. The goal of that is to fortify America's leadership in science through additional research funding, in the physical sciences in particular, as well as almost $400 million that has been proposed for the Education Department to help improve the quality of instruction in mathematics, science, and the technical education in our elementary and high schools.

We're particularly excited about this at the Department of Energy. While I have this captive audience, I can give a short commercial on that. But

we play a leading role in funding and supporting research and development in the physical sciences in that we're responsible for the national laboratories. And so we're, as I said, particularly pleased with this initiative.

The basis for the President's initiative is pretty simple. He believes that the solution to many of our problems really will come from science. In the years since World War II, federally funded research has given us the internet, nuclear medicine, fiber optic cables, bar codes, the global positioning system, GPS, and a lot of other innovations. These innovations have really helped power our economy while giving us steady gains in the quality of our lives. The future is certain to bring more developments of that sort and that's why we're as enthused as we are about this initiative.

We're not going to be able to uncover those new inventions and can't prepare the next generation of scientists and engineers until we ensure that our students have a real solid grounding in mathematics. The great English scientist, Roger Bacon, went so far as to say that of all the scientific disciplines quote "The gate and the key is mathematics. He who is ignorant of this cannot know the other sciences or the affairs of this world," end

quote.

I think that's a quote that every member of this Panel would agree with. This is a very impressive group of people. And I consider it, as I said before, a real honor to be here substituting for Margaret to administer the oath of office. So without further delay, let me do that.

If you would all please stand and raise your right hands. I, and please state your name, do solemnly swear or affirm that I will support and defend the Constitution of the United States against all enemies, foreign or domestic, that I will bear true faith and allegiance to the same, that I take this obligation freely without any mental reservation or purpose of evasion, and that I will well and faithfully discharge the duties of the office upon which I'm about to enter, so help me God.

(Whereupon, panel members repeated oath and were sworn).

SECRETARY BODMAN: Let me be the first to congratulate you all.

[Applause]

[Photograph of panel members taken]

SECRETARY BODMAN: I appreciate you all allowing me to fill in for my friend, Margaret. And when you see her, please tell her that I did okay.

CHAIRMAN FAULKNER: Thank you, Mr. Secretary.

[Applause]

CHAIRMAN FAULKNER: Okay. Let me -- I've just been asked if there are people in the room who need signing assistance for the hearing impaired. We would, I think, like to know whether to continue support of this service that's over here in the corner. Is there anyone who needs signing assistance? All right.

And I [am] also understanding -- well, first of all, let's finish the introductions. We neglected to allow a self-introduction of our Designated Federal Official, Tyrrell Flawn. Tyrrell, I'd like to please ask you to speak for a moment about yourself.

MS. FLAWN: I joined the Department --

CHAIRMAN FAULKNER: Stand up, please. Come use a microphone.

MS. FLAWN: I joined the Department just a couple of weeks ago. My background has been more on the grant-making side of educational programs. I spent nine years at the University of Texas MD Anderson Cancer Center and there our primary focus was on keeping these children up in school while they were undergoing treatment for cancer. And, as you know,

their survival rates have grown enormously, and so we were very successful in trying to keep them up with their grade level. And then I moved to become Executive Director of a family foundation in Austin, Texas -- about a $110 million family foundation, the RGK Foundation. And Ronya Kozmetsky there had a deep interest in math and science programs for girls, and it was really at RGK that I met Tom Luce, because his program, Just for the Kids, came to the Foundation for funding.

Most recently, I was at NIH as Executive Director of the Children's Inn and also served on the Citizens' Panel, the commission of 125 at the University of Texas, that provided guidance and recommendations to the President on the University for the 21st century.

So I'm pleased to be here, and I'd like to introduce the team that's going to be working with you all -- Diane McCauley who is our Chief of Staff, and Jennifer Graban, who is going to be doing research in external affairs, Ida Kelly who is going to be in charge of administration -- Deputy Director for Administration for the Panel. We've also got a wonderful summer intern, Alyson Knapp, that's going to be working with us this summer.

CHAIRMAN FAULKNER: All right. Don't go

away. Please give everyone in the room guidance on the pronunciation of your first name.

MS. FLAWN: Yes. It's Tyrrell -- Tyrrell Flawn.

CHAIRMAN FAULKNER: Thank you.

[Applause]

CHAIRMAN FAULKNER: All right. Now, I was also advised that we all need -- those of us who were just sworn in actually have to go make a record of this. And do you want to explain how we're going to do this?

MS. McCAULEY: Yes, sir, Mr. Chairman. At this time, if the members of our audience would bear with us while we finish this last piece of the official swearing in of our appointed members, if all of the members will collect yourselves and please bring the paperwork that you were sent and were requested by Tyrrell to fill out.

As you move to the back of the room, we'll have two notary publics that will have an appointment affidavit form that you can review. They need to witness your signature along with photo I.D. -- I believe you were asked to bring that as well -- and as you go to the back, again, please bring the forms you were asked to complete. I will collect those forms as you go through the door.

All of the 17 panelists need to enter this back room where you'll get one little, small swearing in that the information or your signature that you're about to plant on this form is true and that you are who you say you are. And then at that point, the notary will sign the affidavit form. At which point, after you receive the quick oath, please let Chairman Faulkner and Vice Chairman Benbow go to the notary table first. And then other members to follow.

I believe they have your names in alphabetical order, but we have two notaries back here, and we'll do this as quickly as possible. So if you follow me, I'm headed to the back of the room.

(Whereupon the matter went off the record at 10:24 a.m. and back on the record at 10:42 a.m.)

CHAIRMAN FAULKNER: We are actually two minutes ahead of schedule. The timeline was not laid out exactly the way we executed it, but the aggregate turned out to be about right. There is one last piece of overhead and that is at your places, there has been a page placed down for additional contact information. The staff would like to have the additional information that's there if you're willing to provide it. And they said they'll pick this sheet up right from our places. So just set it aside in a reasonably

prominent place once you're done.

I think that brings us to the start of what's called the Morning Session in the agenda -- the start of that or comments from Camilla and from me. Let me make a few remarks. First, I think that the obvious starting point for me is to remind you of what is in the Executive Order from the President that set up this Panel and just, I want to go through that. I think it's a starting point for us.

The reports that we are to prepare, including an interim report by the end of January and a final report by the end of February 2008, it is said in the Executive Order that the reports shall, at a minimum, contain recommendations based on the best available scientific evidence on the following:

a) the critical skills and skill progressions for students to acquire competence in algebra and readiness for higher levels of mathematics;

b) the role and appropriate design of standards in assessment in promoting mathematical competence;

c) the processes by which students of various abilities and backgrounds learn mathematics;

d) institutional practices, programs, and materials that are effective for improving mathematics

learning;

e) the training, selection, placement and professional development of teachers of mathematics in order to enhance students' learning of mathematics;

f) the role and appropriate design of systems for delivering instruction in mathematics that combine the different elements of learning processes, curricula, instruction, teacher training and support and standards, assessments and accountability;

g) needs for research in support of mathematics education;

h) ideas for strengthening capabilities to teach children and youth basic mathematics, geometry, algebra and calculus and other mathematical disciplines;

I) such other matters relating to mathematics education as the panel deems appropriate. In other words, we have some license here to pursue things that we judge to be appropriate, and;

j) such other matters relating to mathematics education as the Secretary may require. Now so far, the Secretary has not gone beyond this charge.

We have the ability to employ various tools. We are carrying out open meetings, and I think have an obligation to receive information broadly from

the public. We also have the capacity to undertake or to charter research in certain topics that we may deem to be appropriately pursued in the time frame that we have available. That is a possibility for us.

Let me comment also that there are some parallels between what we're doing here and what was done in the National Reading Panel some time ago. In both cases, the charge was to base the findings on the best available scientific evidence. The second, the Math Panel, like the Reading Panel, is made up of membership with a broad base of expertise, mathematicians, researchers specializing in various fields relevant to mathematics learning, people with a lot of different kinds of backgrounds, people with teaching experience and with administrative experience in schools.

I, like the Chair of the Reading Panel, have been chosen as a person without any prior investment in any position that has been a part of the past of discussion and debate in this field. So I can come at it from the point of view of objectivity and neutrality, really.

We may, like the Reading Panel, need to break into working groups that are topically devised, and one of the things that we'll need to talk about today, I think, is whether we want to do that. As I

have looked at the President's charge, as I see it, the main focus of this Panel is to consider mathematics education in the United States up to the point of and into the beginning of instruction in algebra. As I interpret what swirls around this panel, that it's about preparing students for, getting them ready for entering into algebra and succeeding at algebra, where algebra is understood to be the first course, a gateway course for so many things relating to educational success, both in high school and beyond high school. That's the way I will focus, at least, my thinking about it.

I think that it's also true that the Secretary has communicated to me at least at the time of discussing this role with me that one of her main concerns was to develop guidelines that could be useful for broad coordination of federal programs. There is, I think, a large amount of money spent across many agencies relating to mathematics education in the federal government. The President's actually proposed that we spend more.

I believe that the Secretary is interested in a report from this Panel that can be useful in helping to point federal efforts largely in the same direction and in the most productive possible direction. So there is, I think, a need for our

report to address scalable options and matters that will be, in the near term, implementable. That's, I think, an important consideration for us. That doesn't mean our whole report has to point that way, but it means that some significant part of our report needs to point there.

Those are observations that I'll make as Chair as we get started. I think that the main duty today is really to flesh out what we see as the main domains of interest of activity, where the issues are so that Camilla and I can help to set up a committee structure that can begin to address those domains in a reasonably efficient way.

With that, I will stop speaking, and I will invite our Vice Chair, Camilla Benbow, to speak.

VICE CHAIR BENBOW: Well, I just have one comment on the charge, and that is something that I mentioned this morning -- is that when we're looking at math and science education and improving the performance in that area, we really have two issues that we're dealing with. One is to bring up the math literacy or scientific literacy of all children in our schools.

I think the other issue that you also hear a lot about today in many of the reports, like the Augustine Report and so on, is the need for

producing more STEM professionals. And that is really looking at the kids who are at the top, and the kinds of interventions that you need to do to bring up the achievement of those at the top and then to encourage them to go into math and science, are really different kinds of interventions that are needed than those interventions that bring up the math and scientific literacy of the typical student.

So I just mention we need to keep in mind that there's probably in terms of looking at recommendations, that there isn't one solution or one path that's going to solve both issues. Both are important. They're just as important -- each of them. But we need to pay attention to both.

And I think -- I'd just like to say one quick little inspirational quote. As you get to know me, you'll know that I love quotes. But many times people think that when you look at a very effective teacher, those parts that make that teacher so effective are often invisible. And that brings back the quote of Jonathan Swift who said, "Vision is the art of seeing things invisible." So may we have vision, and hopefully we can find and make visible those parts that make a very excellent teacher and a math curriculum. And I'll just leave it at that. Thank you.

CHAIRMAN FAULKNER: Thank you. So your task is to see the invisible. Let's move to the Department of Education overview. Ray Simon, an Ex Officio member of our Panel, Deputy Secretary, U.S. Department of Education, will make that presentation. Ray has long experience as a math teacher in Arkansas. He's also got experience as a superintendent and as a chief state school officer over a long career -- 40 years he said. Ray Simon.

MR. SIMON: Thank you, Mr. Chairman. And thank you for agreeing to chair this committee. Your long commitment to research and excellence will guide us well.

I also want to again acknowledge Tom Luce, who's my colleague at the end of the table. Tom is probably the single person most responsible for getting you together and getting you selected. He took the ball and is trying to change and turn the Secretary's vision for this Panel into reality. Tom, thank you very much for your efforts.

The Secretary, again, I know others have expressed her desire to be here. I follow-up on that and welcome you again on behalf of Secretary Spellings.

You represent a divergent set of opinions. You have, collectively, much wisdom that I

believe we can, together, produce a document that not only will we be proud of but that will benefit our teachers and children in our schools throughout America. It's clear that action is needed. President Bush has said, "You've got to know math if you're going to compete in this 21st century world."

I also appreciate your indulgence of the formalities of the ethics and form filling this morning. This community and this town is very keen on doing things right and ethically. People go to jail when they don't, so it's important that the i's be dotted and the t's be crossed. And sometimes that almost seems like a burden, but, believe me, it's for all of our protection. And I thank you for indulging us this morning in that.

I tried to think of a way to illustrate to you and, gosh, I can't teach any of you anything about mathematics, not going to try. But I want to try to illustrate to you, at least in my way, how important I think this job that you've agreed to is and what is at stake as a result of your deliberations. So as Tom already hinted, I brought with me today an old friend that I know you'll recognize. This particular instrument was given to me as a present by my brother when I graduated from high school in 1963. As you know, it has its origins back

to the 17th century. This particular slide rule is made out of fiberglass. I think it cost at the time about $50.00, more on the expensive side of slide rules.

Now you could get a cheaper slide rule. You could get slide rules made out of wood or plastic or metal or a number of other materials. The problem with the cheaper slide rules was that they tended to expand and contract with the temperature or the humidity. And working a problem in the middle of the summer, you might get a different answer than if you worked that problem in the dead of winter.

It took great skill to use a slide rule correctly. We had classes in slide rule that took several weeks. And then you just couldn't take the classes, you had to actually use the thing or you would quickly lose the ability to use it well. You had to really understand estimation when you used a slide rule because it was designed to work any problem. So multiplying, for example, 5.72 by 1,320 would take the same positioning as 572,000 by 1.320. So you had to know where that decimal point was going to wind up in your answer.

A lot of math teachers still use the slide rule today as supplemental instruction to talk about estimating and to talk about the history of how

we got to where we are. You had to be of steady hand to use the slide rule. A slight twitch or jerk could put you off by several decimal points or several hundred thousandths in your final calculation. It's safer than a cell phone. You didn't see anybody driving down the road trying to use a slide rule.

[Laughter]

This particular slide rule, the $50.00 not only bought the slide rule but it also bought a very important companion. You know, when you could use the slide rule back in the early days of my teaching, you were a God-like creature and people respected you. There was an aura about you. And I was one, as I was not as powerfully built in high school as I am today, so I had to depend on my wits to get me by as opposed to brute force. And anytime that a group of ruffians would approach me, many times I would often simply part my jacket and display the other part of the slide rule.

[Laughter]

The deluxe leather -- immediately, people would back off. Oh, leave him alone. He knows how to use a slide rule. It was the machine of choice for calculation even into the computer age. IBM even bragged in 1951 that its new computer had the power of 150 slide rules. The first calculators were known as

electronic slide rules, just like the first automobile was known as the horseless carriage. It was a way to bridge the confidence between this machine and what was to come.

This instrument that carried the world from the Renaissance to the moon was rendered obsolete overnight. It was replaced by the electronic calculator. The electronic calculator was able to do much more quickly, millions of times more quickly and with infinite accuracy, what the slide rule was unable to do even in the most competent of hands.

While this instrument had its place and a good scientist and a good mathematician could not do his or her work without this, it literally was rendered obsolete overnight. The skills necessary for today's calculations could not be done by the slide rule. George Lucas, who gave us, among other things, the Star Wars series, is a true master at the production of special effects. And I had someone call the foundation, the George Lucas Educational Foundation, and was told that a typical 10-second special effects battle scene would require 5 times 10 to the 16th power math computations and that it takes one microprocessor 40 days to render those 10 seconds. Now I can tell you, I suppose, those calculations could be done with a slide rule, but don't you imagine

the friction required to move that thing that quick. We would have spontaneous combustion of the slide rule and the operator. A very good instrument in its time, but no longer adequate for the needs of today.

Our young people will change occupations five to six times and maybe more during their lifetime. We can't afford to send them on their way with a slide rule skill in a calculator world. That, to me, is your challenge -- is to make sure that the skills we send our young people on for the rest of their lives is something more akin to this and not to this. It doesn't disrespect what was important. It doesn't disrespect good teaching. In fact, it honors good teaching and good learning.

A good teacher simply wants to know, what is it you expect of me. Let me communicate that to my children. And let me be able to teach it. And when I finish, I want to be held accountable, and I want my students to be held accountable for good teaching and good learning. That's what your document will help us do and help our country's teachers do.

You can't be cool with a calculator, though, the way you were cool with a leather carrying case with a slide rule. Something else that's not cool today -- not cool enough today -- is being proficient in math and admitting it. Adults don't

brag that they can't read, but sometimes it seems like a badge of honor to say, I'm no good in math, and I don't expect that my children will ever been good in math.

We have in our culture for too long convinced ourselves that certain students couldn't do well in math and science, among them girls, children of color, poor kids and, yes, children of parents who couldn't do well in math and science. One of our greatest challenges will be to change this culture of low self-esteem when it comes to the learning of mathematics.

Less than half of our students graduate from high school ready for college level math and science, yet 70 percent of their parents say the kids are learning enough about these subjects. One half million students were ready for AP calculus last year but didn't take it, or have the opportunity to take it. Eighty-four percent of middle schoolers would rather clean their rooms, take out the garbage or go to the dentist than do their math homework.

Teachers with strong content knowledge get better results in the classroom, yet in high poverty middle and high schools, only one in two math teachers majored or minored in the field they're teaching. In science, that number drops to one in

three. When it comes to mathematics education and the doors that a rigorous high school experience can open, we run the risk of graduating too many students with slide rule skills in a world where computer skills are necessary.

When your kids were young, how many times did you put them to bed and at their request, "Please, read me a story, read me a story," and so you read a story to them? Wouldn't it be great if every other night the youngster would say "Hey, can we work a Sudoku before I go to bed"?

[Laughter]

We have to inculcate a culture where mathematics -- the learning of mathematics is important -- as important as reading. There is good news. In the last two years, the numbers of fourth graders in our country who learned their fundamental math skills on the National Assessment of Educational Progress increased by 235,000, enough to fill 500 elementary schools. Looking at 13-year-olds, over the last five years, white, Hispanic, and African American children have made significant gains in math on the NAEP with African Americans having the greatest gains. More than two-thirds of our states have said that achievement gaps are narrowing or staying the same in math on state tests.

The President's American Competitiveness Initiative makes math and science a national priority. It starts with you. You've been asked to evaluate the effectiveness of math instruction and learning just as math is the basis of science, we must use science to determine the best ways to teach math. In the end, you'll help us create a research base for teachers and policy makers.

We want to identify the very best principles, practices, and concepts and bring them to scale to help as many schools and teachers as possible. I mentioned earlier this country is full of millions of outstanding teachers and thousands of outstanding schools. But the fact is it's still the luck of the draw in too many cases that a child will have a good highly qualified teacher every year. It's really important that every child has access to a good teacher and a good school. We've got to bring to scale the goodness that exists out there now so that when we're finished, the whole can be greater than the sum of the individual parts.

Your findings are expected to help form the basis of the President's new Math Now programs, part of the American Competitiveness Initiative. Our goal is to give students the skills they need to master algebra and higher-level math so they can

compete in the 21st century global economy. Math Now for elementary students and Math Now for middle school students will promote scientifically-based practices to get children off to a good start in elementary school and to help older students struggling with math to catch up.

The President's Advanced Placement and International Baccalaureate incentive program will put $122 million in fiscal year 2007 that'll, in addition to other things, train 70,000 teachers and triple the number of students passing AP tests. The National Math Panel, as you heard, was modeled after the National Reading Panel that gave us the basis for Reading First, which has been a singular most outstanding initiative for this country's children to learn to read.

I have a personal reason for wanting to be a part of this panel. In addition to my interest as a teacher, and those interests are two, and I carry them next to my heart everywhere I go, my two grandchildren. I have little Alex who's four-years-old, and on the other side, I have little Anna, who's one. I picture Alex and Anna, and I want each of you to picture your children or grandchildren or some little child that's especially close to you, maybe a neighbor, but I picture my little grandchildren and

your faces in the poorest most destitute school in this country, a school that has, for some reason, not been able to attract good teachers and retain good teachers. Maybe the teachers are outstanding, but they absolutely don't know how to get good results. I picture Alex and Anna in one of those schools, and I say what can I do to help guarantee that it's not the luck of the draw that they get a good teacher.

If little Alex has a teacher three years in a row that does not properly instruct him, he likely will not graduate from high school. That's a tragedy. That's a tragedy. We cannot let that happen, at least in the area of mathematics. We will have differences in this panel as to what's important and what's not, but I'm asking you for Alex and Anna and for your face to come to agreement on a core group of principles and a core group of research that we can share with our teachers who are hungry for the latest of what works.

I have the utmost respect for teachers and students and parents and school boards, or I wouldn't have spent 40 years of my life trying to make things better. This is a chance we have to make things better right now, and those changes could be historic. And while the product of your deliberations will certainly be a new beginning, it cannot and

should not be the end. In 30 years, maybe my little Alex or Anna will be fortunate enough to be a part of a group such as this, and maybe one of them will have the opportunity to address an esteemed group of science and math educators such as yourselves. And maybe little Alex or Anna will say, you know, I brought as my guest today an old friend that I know many of you will recognize. It's an electronic calculator.

[Laughter]

It was the machine of choice for calculation in the late 20th and early 21st centuries when my granddad was still working. It was rendered obsolete overnight.

I thank you for your contributions that you will make over the next several months to make sure when this gets rendered obsolete, that there's something there to take its place and that our children are ready for that. And it's an honor for me to share the panel with you. Thank you very much.

[Applause]

It's my pleasure now to ask to come forward Diane Jones who was introduced earlier and Martha Snyder, Associate Director, White House Domestic Policy Council.

MS. JONES: For the record, I never had a

slide rule, but I had a DNA code on decoder watch -- helped my husband identify me.

MS. SNYDER: Yes, I don't think we have any props so it probably won't be nearly as entertaining as Deputy Secretary, but thank you for the introduction, and thank you for the wonderful remarks.

Diane and myself are here to kind of give you the White House perspective on this Panel and how important this is not only to the Secretary, but it rises a step above that. It rises to the President. He commissioned this by Executive Order. He finds this incredibly important to our nation and to the future of education. And I would, first of all, just like to thank all the panelists who have come today and who have agreed to participate in this very, very important effort.

Really, the process of creating this Panel actually began, while it is a part of the American Competitiveness Initiative, it really began with No Child Left Behind, which requires that every student knows math and knows reading and the belief that every child can learn and that every child should have access to a high quality education. And really the only way to do that -- the only way to make sure that students are learning and that students have

access to high quality education is through research-based instruction. Teachers, in order for them to be able to teach, they must know what to teach, and they must know how to teach math.

We're oftentimes told that research shows us -- research shows us this, or research shows us that. But a lot of times we look further into those studies and, in fact, we see that not all research is created equal. In fact, there was a report done by the National Academies, where we sit today, that showed us just that, that a lot of times the research that we have out there, particularly on math education, is not research to the level that we want research to be.

The work of this panel is absolutely critical. Your charge is to comb through all of the relevant research and possibly even commission new research, where and when appropriate. We want this Panel to sort through the scientific and quasi-scientific studies and parse those out from those that are anecdotal. This Panel is long overdue. And we want to be able to understand the links between educational content, methodology, and student learning. And, again, thank you on behalf of the White House. Diane is now going to say a few things. But from the President and the White House, we

greatly appreciate your efforts.

MS. JONES: I'll just add that the President's Science Advisor, Dr. Jack Marburger, also appreciates your participation. As the President's Science Advisor, he understands first and foremost that the scientific method is what has to help guide our educational processes into the future. And as we do in medicine and in biotechnology and nanotechnology, we have to look to the research and the research results to inform the future.

So we challenge this Panel to look at the research, separate that which is anecdotal, less rigorous, maybe isn't as independent as it should be, from that which is high quality, rigorous and independent, and let all of us know what the research shows. Teachers want to know what the research really shows. Parents want to know what the research really shows. And the Administration wants to know what the research really shows. And we thank you for your participation, and we look forward to your guidance in finally learning what it is that the research shows. Thanks.

[Applause]

CHAIRMAN FAULKNER: Okay. The next presentation comes from Kathie Olsen from the National Science Foundation. Kathie's background is in

neuroscience and has been with OSTP before NSF and then before that as Chief Scientist at NASA.

MS. OLSEN: And before that, at graduation from high school, I did get a slide rule. And I actually found it about a month ago. And it's not one trial learning that you learn. I mean it took me a while to even do my multiplications again. But I do appreciate it. And I want you to know that girls were allowed to carry theirs in their purse, and it was a lot easier to find than a cell phone in the purse. So just that in terms of background.

NSF also wants to thank the panelists for taking your time, and we're looking forward to your report.

I think many of you know that the National Science Foundation was created over 50 years ago, as I said, to be the primary agency that supports basic research across all fields of science and engineering as well as math and science education programs at all levels. Research supported by NSF has fueled many important innovations in research, in understanding how people learn and in education practice. This work is essential if our country is to maintain the skilled work force and the mathematically competent populace that is essential for economic growth and improving the quality of life and health

for all Americans.

The Act of 1950 that created NSF authorized and directs NSF to initiate and support four specific things. Number one, basic scientific research and research fundamental to the engineering process; two, programs strengthen scientific and engineering potential; three, science and engineering education programs at all levels and in all fields of science and engineering; and four, an information base on science and engineering appropriate for the development of national and international policy. We also do a report every two years with statistics that we accumulate from K through 12 to industry input into R&D.

Legislation over time added new requirements for NSF including fostering the interchange of scientific and engineering information nationally and internationally and addressing issues of equal opportunity in science and engineering. So we have programs that address from No Child Left Behind for science literacy for all, but also programs addressed for the work force in the 21st century.

In the NSF 2007 budge request, the President has re-emphasized NSF's mandate to improve mathematics and science education. The request includes a special priority at the K through 12 level.

This emphasis for NSF is a focus in the President's American Competitiveness Initiative, which has been discussed earlier. The NSF position in this education research, practice and evaluation effort is central, yet almost limited in scope. It is essential that we partner with other agencies that also have education mandates like the Department of Education and who extend and implement results. This is why this Math Panel is a critical instrument in implementing the President's vision and a high priority for the National Science Foundation and for me personally.

NSF conducts its work in a community-based manner. All of our programs are grants, are bottom-up efforts, taking the best ideas and advice from the science and education communities about their priorities and needs. Proposals to the National Science Foundation all go through the merit review process combining ad hoc peer review, panel review, and program officer expert judgment for program balance and identification of transformational potential. This merit review process is our hallmark, and the internationally recognized best practice for funding the highest priority most excellent research. The core values of broadening participation and the integration of research with education are integrated throughout the Foundation.

However, NSF's core education programs are conducted in the education and human resource directorate. Although all of our directorates have programs, our primary focus is in education and human resource, EHR as we like to say. These directorate programs have a long history of excellence in mathematical education research, program development and evaluation as well as a long history of cooperation with our education partners and federal agencies, universities, state and local departments of education, schools and with teachers and students directly.

An early effort was with institutes for mathematics and science teachers, and that occurred from like the 1950's to the 1970's. And many people, even probably in this room, participated or were, what I like to say, some of the chosen participants. But two issues contributed to the sunset of the program. First, the cost. Actually, to do that now would require two-thirds of the total EHR budget. And also a time issue. In these cases, eight weeks of living in a dorm was required in these institutes.

So NSF has moved on, and their contributions to mathematical education and research and development is focused in a number of areas. One, science and learning centers. And these are

conducting research on the basic research of how the brain works and how learning takes place. We collaborate with NIH on many of these projects and also the Department of Education.

We have centers for learning and teaching, and they're conducting research specific to classroom practice and developing the next generation of researchers and teacher educations. And in fact, one example is led by Deborah Ball, who is on this committee, who is studying the kind of mathematics preparations that teacher educators need in order to be effective. We have instrumentational materials development program funds, and this is innovation in classroom materials. We have teachers' professional continuum programs, which funds research and development on critical issues including achievement gap, integration of science and math, teachers' practice.

NSF is also [a] partner with the Department of Ed on the Math-Science Partnership where, in our programs, what we do is a partnership between departments in higher education and school districts. We believe that the National Math Panel is important to the nation and is also important to NSF as a way to improve our understanding of what kinds of innovations are effective and under what conditions.

We are here to help you and provide you with any information that you need. The work on the panel can also complement the efforts, again, of the Academic Competitive Council, which is mandated by the Budget Reduction Act of 2005.

NSF has taken a lead role in cooperation with the U.S. Department of Education in building an inventory of mathematics and science education programs in the Federal Government and developing appropriate metrics for evaluating the effectiveness of these programs.

As Larry Faulkner says, that we are looking forward to your interim report in January `07 and your final report, because we hope at NSF to use the report from this panel to design solicitations focusing on your recommendation to allow us to move forward. Thank you very much.

[Applause]

CHAIRMAN FAULKNER: Okay. I think we're now going to go into a period here where we'll do a little elaboration of the President's charge, and that'll be done by Russ Whitehurst and Dan Berch. Russ, are you going to speak from there? Okay then. Russ is the first Director of the Institute for Education Sciences within the Department of Education. He has responsibility for the National Center for

Education Statistics, the National Center for Education, Evaluation and Regional Assistance, the National Center for Special Education Research and the National Center for Education Research. That's quite a collection. He has come to the Department of Education from Stoneybrook, where he was Chair of the Department of Psychology and a Professor of Pediatrics. Russ, do you want to start?

MR. WHITEHURST: Well, thanks very much Mr. Chairman, and members of the Panel. The speeches are now concluded, and we will have an opportunity over the next hour to begin the serious work of the Panel in thinking about the job in front of the Panel and how you will accomplish it. My colleague, Dan Berch, and I are going to try to tag team this just to get the discussion going with respect to --

CHAIRMAN FAULKNER: If you're going to do that, why don't I at least make some comments about Dan. I want to remind you that Dan was, when he did his self-introduction, indicated that he is with the National Institutes of Health and directs a new program in math and science cognition at NIH at the National Institute of Child Health and Human Development, and he served on math and science initiative here at the Department of Education once before. So the two of you are now an official tag

team.

MR. WHITEHURST: Thank you, again, Mr. Chair. You have -- this Panel has a challenging task, but it also is, I think, an inspiring task. You've been charged by the President with generating reports that contain recommendations based on the best available scientific evidence. The guidelines for the evidence you are to look at are in the ten points that Chairman Faulkner went over with you previously, but I think those points need to be deconstructed or cracked open a bit to start to think about what kind of evidence would be useful to inform those points and what kind of evidence is available.

And so, again, that's the task here, and Dan and I have no intention of taking up the hour talking about it but rather to go through the points, mention a few ideas we have, and then, we hope, have you pick up those ideas, reflect on them, add your own ideas as we begin to flesh out the charge.

In order to shorten the task somewhat, I hope you will agree with me that points h), I), and j) or 8), 9) and 10) -- I prefer numbers -- this is the National Math Panel after all -- that h, I and j are, in effect, other categories. These allow the Panel to take up matters that aren't specifically enumerated in the previous points. So I'm not going to address

those.

And point g), needs for research, is, of course, near and dear to my heart and, I expect, Dan and Kathie Olsen's as well, but that, if you will, will be a residue of the Panel looking at what's available and then determining what it wishes it had that it could not find.

So now we've cut it down to points 1) through 6) or a) through f), and I want to perhaps simplify it a bit further by suggesting that point f is where we want to end up, that is it asks the Panel to identify, make recommendations with respect to the role and appropriate design of systems for educating children. Understanding that children are not taught mathematics, nor do they learn mathematics, as cognitive beings only or as a function of good instruction from teachers or through a system that holds them accountable for particular standards, that all these pieces and parts have to fit together in systems.

And so as we go through the components, in the end, I think the Panel will have to glue them back together and come up with policy recommendations that make sense for the total task of educating children in mathematics. So now we've cut it down to five points -- from ten to five so quickly indeed.

So let's go to point 1) which is to make recommendations with respect to the critical skills and skill progressions for students to acquire competence in algebra and readiness for higher levels of mathematics. And the question then is, "What does that mean?" For me, it means two types of information. One would be the information that comes from a task analysis of what it means to get to the point of being competent in algebra. By a task analysis, I mean steps one would need to go through logically in order to get from point A to point Z. This morning I flew from Long Island here. The airplane had to depart from the gate and go out on the runway before it could take off. And so one could say that in order to get here, one had to go through those steps, and a pilot would need to do that in order to achieve the goal. And I would expect that the mathematicians on the Panel will have a lot to say about the skill sequences that are necessary and logical in order to arrive at the end point of algebraic competence.

But there's another type of knowledge that is relevant here, and that would be empirical knowledge that's developed from, for example, longitudinal studies that look at the relationship between early skill sets and later skill sets. And it

may be that -- and it is likely to be the case -- that those two sources of knowledge, the task analysis and the empirical studies, will have to be fit together to generate a coherent set of recommendations.

One could look at learning to play the piano, for example, and say that if the end goal is sight reading, that students of the piano and children learning to play clearly have to learn to read notes in treble and base cleft before they can sight read. But how much of that do they need before they start sight reading, and what form should it take, and are there different outcomes for children who have certain experiences versus other sorts of experiences?

So that's, for me, the meaning of the first question: what do we know about the task itself and the logical sequences that are inherent in the task; and, what do we know from the empirical literature that would suggest a primacy of certain sorts of skills over other skills?

In reading, for example, we have a rich empirical literature of longitudinal studies that have indicated, for example, that phonemic awareness, a skill set that is not evident simply as children talk or read but is an underlying skill, is a critical prerequisite for later reading competence. Are there such underlying skills and competencies that are

relevant for learning math?

That's my initial take on it. And, Dan, do you wish to add anything?

MR. BERCH: Yes. Thank you. Just following up on Russ's comments, I'd like to pose two fairly specific questions that we might be interested in having you answer or respond to, not today but downstream. And please understand that these are designed to be illustrative, by no means comprehensive or exhaustive.

One question might be what evidence is there regarding the sequence in which critical, conceptual, factual, and procedural knowledge and skills should be acquired as well as the nature and development of their interdependencies.

Another example -- what evidence, if any, exists to support the contention that learning to recognize patterns, represent relationships, and make generalizations in the early elementary grades will ultimately lead to greater proficiency in algebra?

MR. WHITEHURST: Would members of the Panel like to engage this topic now?

CHAIRMAN FAULKNER: I think what we're doing here -- just to sharpen the focus of the discussion here is that we're actually saying we're talking about what is encompassed in item a) of this

President's charge which, again, I'll read to you the critical skills and skill progressions for students to acquire competence in algebra and readiness for higher levels of mathematics.

Have Russ and Dan appropriately captured it or is there more to be said?

MR. LOVELESS: Can I ask a question perhaps that Russ or Dan could respond to? I understand in terms of interpreting empirical evidence how one would apply scientific standards, but on the task analysis part, it's not as clear to me. Do you have any thoughts on what would be the standard by which we would make judgments?

MR. WHITEHURST: No. You're quite correct, of course, that a task analysis involves -- is not empirical in the sense that one goes out and collects observations on students learning math in particular situations to answer the question. There may be among those on the Panel people who have expertise with respect to rules that would be applied to task analysis. A simple rule would be temporal priority. One would not lay out a task analysis in which Step A appears before Step B in the analysis if in fact one could imagine circumstances in which the sequence could be reversed.

But I presume no particular expertise on

this. It just struck me that there are strong claims with respect to the premise of certain skills for later skills in mathematics. I hear for example that students simply have to learn to divide fractions before they can possibly contend with the subject matter of algebra. Will the Panel confront those sorts of claims, and, if so, what rules will it use to decide whether to substantiate or endorse those claims?

MR. FENNELL: I think sort of a related question relative to the sequence is to how that's applied, and that is, as you know, 49 of the 50 states have something in the name of curriculum guidelines and the like, and they're sort of all over the map in terms of what's what and so forth. So if you take that sequence in terms of how it impacts the teacher who's dealing with that on a regular basis, there's some similarity, and there's wide difference depending upon topic.

And then once you get even deeper than that, the question becomes how critical is that topic at a particular grade level, and what is the depth of the topic, and what's expected. And then you raise, you know, another point. As you think about the role of say division of fractions and what that connects to, where that should come, which is an important

issue, and then proficiency in that and how it connects to other things is equally important.

MR. WHITEHURST: Well, that may be an appropriate segue into point b) or charge b), which is the role and appropriate design of standards and assessments in promoting mathematical competence. It seems to me that charge a and charge b are logically connected, that is if the Panel can make conclusions or draw recommendations as to what students should be learning when, then those recommendations are connected to what standards should look like. And one would ideally not want the standards or the curriculum guidelines in Arkansas to be different than they are in Oklahoma or New York. Presumably, mathematics is a universal language. And so the design of standards and the assessments related to those standards seem to be connected to the first point.

It's also, as we look at the evidence from TIMSS and other sources on the nature of standards and curriculum sequences across the world, we know that the United States is unusual in the number of topics that are covered at each grade and the likelihood that those topics are repeated at the next grade. Most countries have a sequence that looks much more orderly than that and has a logical progression to it. So here, I think the Panel has to

grapple with the issue of what standards should look like.

And then on the assessment side, I mean it seems to me assessment has two meanings here. One would be high stakes assessment. You know, how frequently should they be given to whom, under what circumstances. And the other is assessment down at the classroom level and how that should be occurring and how it should be linked to the broader assessment systems that are in place.

MR. SCHMID: Is it appropriate for us to look at NAEP, the quality of NAEP?

MR. WHITEHURST: Questions addressed to me as to what the Panel -- what is appropriate for the Panel to do --

MR. SCHMID: Talk about assessment, that would seem to me much of instruction, of course, is assessment driven today.

MR. WHITEHURST: Yes.

MR. SCHMID: NAEP has considerable influence, and maybe some of us think that NAEP is not well constructed.

MR. WHITEHURST: Well, I think that to the extent that the national assessments, including NAEP, are based on a framework and the framework is, if you will, a specification of what it's expected

that students should know and be able to do at particular ages, and if the panel wishes to address framework and standards, then, yes, it's open. But it's the Panel, of course, that will decide whether it wants to delve into this area. You needn't seek my permission to --

MR. SCHMID: No, but let me point out that, of course, the frameworks is one thing. The questions on various assessment tests are another. The process that gets from one to the other is essentially a black box. And that, I think, is something we ought to talk about.

CHAIRMAN FAULKNER: Deborah?

MS. BALL: In item 1), you commented helpfully about that we'll have to sort out what counts as evidence, and we haven't settled the question about evidence about the logical analysis of tasks. But you said that item two is linked, which I see that it is. However, I'm not sure whether now you're urging us to interpret or whether we should be interpreting item two as research on the way in which standards and assessments in fact impact practices. A lot of folk wisdom about that, and it's a different research domain. So I'd be curious whether you could provide a little bit of insight into what you imagine to be the appropriate evidence for comments about the

role and appropriate design of standards and assessments?

MR. WHITEHURST: The evidence base here is, to my knowledge, not particularly strong, but one could look for example at effects at the state level of changes in assessment and accountability systems. So the State of California generates a new set of standards for mathematics. Previous standards were in place for a decade. One could look at kind of an interrupted time series design to see if whether performance has changed in a way that seems reasonably connected to the change in policy with respect to standards and assessment at the state level. One could look at variation across states in terms of the standards they have in place and whether that variation relates at all to achievement outcomes. To the best of my knowledge, that's the kind of empirical literature that's available.

And then there's the alignment question. Once you have a framework or you have a set of standards in place, do the assessments themselves map on to those standards in a way that seems reasonable? You can have very good standards and poor assessments, probably not good assessments with poor standards, so it's not bi-directional. So there's an alignment issue here. Kind of logical analysis as

well as the empirical analysis that is embedded for me in this question.

CHAIRMAN FAULKNER: Mr. Wu?

MR. WU: I would like to go back to the assessment question. You refer to classroom assessment and then high stakes assessment. There's a great disconnect between the two kinds of assessments. In mathematics, what we value the most -- in fact, nothing to what we value but what's needed, absolutely essential to mathematics is sequential orderly thinking that imposes coherence out of a sequence of ideas. And that is not at all respected in the high stakes assessment items. Because an overwhelming majority of the items would be multiple choice and, therefore, all students have to know to have sort of factoids in their minds and then they can check off. And with that in mind, with the overriding importance of the high stakes tests, there is very little incentive for our teachers to carry out any kind of classroom assessment other than multiple choice. So basically one is impacting the other.

And I wonder if this is something that within this Panel to discuss that maybe we can somehow reverse this trend. Because if you only have students doing multiple choice and be very good at it, one should do some research as to how well that reflects

the mathematical capability of students instead of the more coherent constructive responses.

MR. WHITEHURST: Vern?

MR. WILLIAMS: I'm looking at a), the critical skills and skill progressions for students to acquire competence in algebra. I think we perhaps need to decide what algebra is, and if we can decide what algebra is, maybe we can decide whether students need a very excellent grounding in arithmetic skills. Because some people's definition of algebra, you don't really need to teach much of anything in grades K through six.

If you look at some of the state standards and their testing, what they call algebra is basically putting a few ideas together and maybe discussing the rain forest. But if you are expecting the kids to be able to do an algebra course and to think algebraically, then we need to go in a specific direction as opposed to having the students prepared to do basic mush in seventh and eighth grade.

CHAIRMAN FAULKNER: Other comments on a) and b)?

MR. FENNELL: One statement to follow up Wu's and that is that teachers are really faced in virtually every state with the demands of the annual state test, whether it's -- we're picking on Ray, I

guess -- State of Arkansas or some other state -- and so the need to focus on that because of the high stakes nature of it pulls them away from the sort of formative assessment that he was discussing, the kind of deep questioning, the kind of time on really interesting examples because of the challenges and the demand for performance on an assessment that, because of its very nature, especially if it's multiple choice driven, is minimal in what it's able to assess.

So we're sending the people who are out there every day 180 days a year and a long time in the summer getting ready for the next one a really mixed message -- we need to do well on the state test, but we also want them to think deeply about important math topics and have the kinds of conversations that he alluded to. So I hope we tackle the issue of assessment and what it really means. Because I think it means multiple things, at least as we interpret it in this country right now.

MR. SIEGLER: I'm wondering how far back it's reasonable to track the process of math development in our effort to improve getting into algebra at the usual time. There's research that when kids come into school, there's already a very large, more than a year on average, gap between low income and middle-income kids in their math knowledge. And I

think a lot of times, teachers and schools are blamed unfairly for problems of socioeconomic disparities that in fact have been set in motion long before the kids even hit school. Now it's not that the schools play -- bare no culpability here and have nothing to do with it, but it's important to recognize that fact.

It's also true that the math achievement of kids when they start school is predictive as late as tenth grade at least of their math achievement. And so I'm interested in pursuing the roots of algebraic understanding back as far as possible. Is that appropriate on the Panel, or is that sort of a bridge too far?

MR. BERCH: Actually, you gave examples for two of the questions I was going to raise in a moment, so now I don't have to say anything. But, no, as we move ahead, I think we would agree, yes, that's the case. And we'll, you know, discuss that with respect to the instructional approaches and some of the earlier factors that might shape the situation.

MS. STOTSKY: Good. I would like to just raise as a question as to whether we can also explore or how we might explore what I would see as some relationship between b) and e) in terms of the cut scores on assessments which become a critical issue for students and the kind of tests that we give

teachers and the cut scores that are then used for licensing teachers, because those two are highly related to a lot of what else takes place and --

MR. WHITEHURST: Certainly when we go to point e), which has to do with teachers of mathematics, I think issues related to the selection and placement of teachers including licensing exams and how they're used at the state level to select teachers initially for entry into the profession and place them in the jobs is certainly, for me, a critical issue that I would hope the Panel would address.

CHAIRMAN FAULKNER: Russell?

MR. GERSTEN: There is a body of research on -- it's often called curriculum based measurement, it's a very confusing term -- that is of pretty decent quality, and I think that research needs to be looked at carefully, especially in terms of validity and reliability of these short assessments that teachers tend to give. And I think we could use this and go beyond some of the specific measures developed by researchers. But there hasn't been an intersection with that community and the math ed community to date, and bridging that gap would be important.

MR. WHITEHURST: Shall we move ahead to point c) which is, for me, the cognitive psychology

question. It addresses the learning processes which are mental processes and brain processes that are underway as students learn mathematics and what we know about those and how they would relate to policy. So I'll ask my colleague, Dan Berch, to address that since that's a major focus of funding at NICHD.

MR. BERCH: Well, and certainly we want to discuss that aspect of it. I also wanted to point to the part that relates to what Bob mentioned a moment ago, mainly how students of various abilities and backgrounds learn mathematics which perhaps seems to imply that those processes may be different or perhaps they aren't.

So one broad question we could pose is how and to what extent do factors such as socioeconomic status, gender, learning disabilities, and socio-culture background influence the development and learning of basic numerical and arithmetic skills. And again, one could unpack these processes in various ways, and we'll -- if any of you wish to speak to that further, go ahead. But I think that sort of lays out broadly the kinds of issues that we would want to treat with respect to c).

MS. REYNA: And I think that brings us really back to some of the points that were made earlier. You know, if we think about these processes

of learning as a causal analysis of how we end up at a successful outcome, we can begin to think about how to change some of the predictive facts that we're currently living with. Although it is the case that disparities in socioeconomic status and other issues cause differences at the beginning of schooling that are reflected in later success, I see part of our charge is how are we going to change that.

And one way to change that is to look at the causation, to look at the nature of learning. Because it is certainly the case that there are worked examples out there where that causal trajectory has been changed. And the kids that we might think of as at the bottom to begin with end up at the top. So I think that this notion of how children learn and how students learn is key to achieving a different outcome.

MR. BOYKIN: It also seems to be the case that point c) and d) or 3) and 4), whatever system you're using, are connected insofar as there could be interaction between the processes by which people from different backgrounds learn and how that interdigitates with instructional practices and context that are put into place to optimize learning outcomes.

MR. LOVELESS: In terms of policy

questions I think that the field would be interested in has to do with accelerated students of mathematics. The question of when kids should take algebra for example, which has changed a great deal. Back when I taught, it was fairly rare for eighth graders to take algebra. I think in the mid-80's, the percentage was around 15 percent. We're now approaching 30 percent. So the percentage of eighth graders in algebra courses has doubled. What do we know about that? Is that the appropriate year? Is it the appropriate year for some students and not for others?

We're also seeing a trickle down effect where now algebra is being offered more and more for seventh graders and even for sixth graders. Again, in terms of what guidance can we give in reading the evidence on the effectiveness of these approaches to people out there who have to decide this stuff.

MR. WU: I'm sorry -- good question. What do you mean by algebra is being taught to seventh and sixth graders? What kind of algebra is being talked about?

MR. LOVELESS: I have no idea of the type of algebra, just the percentage of kids who are enrolled in a course called algebra.

MR. WU: Unless that term is explicated, I don't know that we can do much about it. I mean --

so you know it -- so --

MR. LOVELESS: I totally agree with you, but the data only goes so far. They don't describe the courses. They just tell us the name of the course the kid is enrolled in.

MR. WILLIAMS: That takes us back to my original comment about what algebra is. I can tell you it's many different forms for six, seven, eighth and ninth grade. There are seventh graders doing real algebra, but there are also seventh graders doing something that's called algebra.

MR. WU: In terms of age appropriateness, this is not just purely a psychological study, I believe, because one has to also look at international data. The fact that eighth graders are learning algebra, at least to me, that's nothing new because I took a course -- I went through normal channel of middle school in Hong Kong. That's in the 50's. And certainly I was taught algebra at grade eight -- algebra meaning the proper use of symbols to search for solutions and then solving equations of more than degree one. So there's a lot of data out there; of course, it has been going on for a long time in Asia, Europe and so on. So I think these things are not quite isolated. It's not a psychological study.

MR. BERCH: Valerie?

CHAIRMAN FAULKNER: I'm not sure what Valerie wants to say, but do you want to respond to this Dan?

MR. BERCH: Just a quick comment about -- this relates to the question that I raised earlier -- if one wanted to use the phrase of pre-algebraic skills and what does that mean, and that's why I gave those examples of recognizing patterns, etcetera that some have contended are important in the early grades. Are they? Do we know that? Part of the question is related to what is algebra, what are preliminary skills that you need to work toward that we know that those are important and that they do in fact lead to better proficiency in algebra.

MS. REYNA: And this directly relates to the 1a) comment earlier about what are the logical sequence of skills. It only makes sense to talk about eighth grade if in seventh grade, sixth grade and fifth grade, the right prerequisite skills have been taught. So I think that those are intertwined. Also, I believe there have been studies that have sampled classroom content to look at this exact question of the nature of what's being taught in the classroom that's called algebra versus non-algebra. I can't retrieve any of those references at the moment, but I don't know if Russ has them memorized. No. Okay.

Well -- I think those are available. So I think those two questions are intertwined, and that is an important policy question.

MS. BALL: I do think that Vern's point is one we'll have to come back to over and over, because not only are there differences about the so called implementation of something called algebra. But there are genuine mathematical differences on the subject. And when Russ mentioned earlier the need for a kind of task analysis, I think quite correctly we're going to have to worry about the take the cover off that word and start worrying about what we mean mathematically. Because otherwise the rest of it just won't make any sense at all.

Although I agree that we have to do these different kinds of work, if we don't scrutinize carefully what the mathematical domain is we're talking about -- and it will be difficult to do because it's not exactly the domain of anybody's expertise. It's closest to being the mathematician's area, but there are a lot of aspects of the skills involved in a domain that experts often can't detect and haven't been the object of study by psychologists either. So I think we have a challenge ahead of us, and I think it's a crucial one.

CHAIRMAN FAULKNER: Were you about to say

something, Tom?

MR. LUCE: No, sir.

MR. BOYKIN: Just one more comment. You know, we've talked in this discussion about the issue of the progression and the sequence in learning of skills, but I think also we may need to consider the issue of the rate at which skills are acquired. Just like in reading, you have this issue of catch up literacy for kids in the ninth grade.

You might need to think about issues of catch up mathematics as well for kids who need to get up to speed relatively more quickly and is that trajectory something that's needed to be considered as well, not just a progression sequence but also the acquisition rate. This might require -- you know, a different process -- set of processes.

MR. BERCH: If I could just comment on that. There are here sequences that are endogenous and there are sequences that are exogenous. And the endogenous sequence is whatever the developmental progression is that makes sense, is organic, to get the mathematical competence. But the schools impose an exogenous sequence, and that's the expectation for performance at particular grades. So while I imagine, though I do not know it to be the case, that an untutored adult, given the appropriate instruction,

could learn mathematics, the fact is that a child who is badly behind in sixth grade is in great trouble because that instruction is not likely to be forthcoming. So just a riff on your point that I think we need to pay attention to that issue and certainly Math Now and Middle School Math Now are, in part, policy prescriptions to deal with the issue of children who have fallen behind and need extra help to get where they need to go.

CHAIRMAN FAULKNER: Anything else on c) or 3) -- learning processes or students of various abilities and backgrounds? There's a lot in that. Yes, Professor Wu.

MR. WU: It's a question to psychologists. I understand that there has been research on how people learn, but now I want to get the specifics on whether the kind of data you have -- what kind of data you have on not just learning simple numbers but more involved processes, for example multi-step thinking, acquisition of the concept of generality, how the learner uses abstract symbols? How much data has been accumulated? How much research data has been accumulated on more involved mathematical processes of the kind I describe?

MR. GERSTEN: I think around here we want to also go back to Camilla's point that we want to

look at both on processes for all kids but for this upper two or five percent that come with a lot of talent and interest in math, the learning processes there, what is a sensible sequence for this group. Is it just moving them ahead in the traditional sequence or really doing different kinds of things.

I also think one thing we're going to have to grapple with is the recommended approaches for students with math difficulties and disabilities. There is a tension between some of the research, which tends to look at very explicit step-by-step approaches and shows some success in fairly limited domains and what else to do with students who tend to pick up ideas and procedures much more slowly. So really, just trying to think through what we know for this group. It's something the field of special education and the schools really struggle with -- what do you do? Is it just more drill, more of the same, or radically different?

MR. GEARY: In response to the question what do we know about the mechanisms underlying complex problem solving, I think we have data on psychometric tests that kind of look at global performance that kind of sums performance across a number of items and then the predictors of that, but we don't have the type of what are the kids doing at

this particular trial to solve this type of problem for algebra and more complex skills that we do on number counting, arithmetic for example. And that's something we do need and we do need to know the relationship between what's going on with the problem-solving during algebra as related to earlier --

MR. WU: But even problem solving for arithmetic questions. I mean a lot of very difficult arithmetic questions.

MR. GEARY: Oh, sure.

MR. WU: So how much -- how good is the data then?

CHAIRMAN FAULKNER: Deborah?

MR. GEARY: It depends on the task. The data are very good for some types of problems and less well studied for others, probably the more complex the problem, the less the data in general.

MS. REYNA: I'm not going to review the literature. Don't worry. But I would say there are some major obvious areas of research that have been done, that have addressed that. Some of the old work by the Gestalt theorists on -- they were very concerned with the nature of transfer which I think is an issue that's going to come up again and again, both in terms of instruction as well as in terms of assessment. And by transfer, I mean you teach one

thing in the classroom, a particular problem, but naturally you want students to be able to solve problems like that that are not identical to the one that's been instructed.

And another area of research would be a whole -- there's a lot of work exemplified by Professor Siegler's work and others on proportionality and reasoning, like that, that has multi-stage and process-oriented and highly detailed in a variety of areas that range from arithmetic to more engineering - like problem solving using math.

Then there is the area of research that probably is best exemplified by the Newell-Simon approach which is means-end problem solving in which there was a lot of work on that at one time that looked at multi-step and sub goals and looking at the SOAR model and other kind of models like that.

So this is not to say -- so there's existing research out there on some of these issues of induction, generalization, transfer and multi-step problem solving. But there are certainly gaps in that knowledge as well.

MS. BALL: Valerie, can I ask you a question? Does that research tend to be generic or specific to mathematical topics and domains?

MS. REYNA: Some of it was more generic,

but in many cases there -- people were looking at very specific kinds of torque problems, for example, and things like that, so some of it is quite specific as well as general.

MS. BALL: Can I go back to my other comment that I didn't make before? I just would like to flag that as a panel, or at least as a panelist, I want to be very careful as we move into questions of ability, learning disabilities, the advanced student, because we live in a society in which race, which hasn't been mentioned so far, and ethnicity, culture, socioeconomic status interact dramatically with how we label students. And I'm very uncomfortable with us not finding ways to intersect those as we move into that territory, because the data on the enrollment of students into these programs and the intersection of culture and race is troubling. And I would like to make sure that as a panel, we aren't blind to that as we move into that question about quote "different abilities" and what we mean by ability in this society and school system.

MS. MA: May I make an observation? I am originally from China. I had my own middle school education in China, and now I moved to here. I have an observation which is that now we are talking about letting students learn real algebra and we want to do

research to find out how children can do that, but in many countries over the world, they are already doing that, like those seventh graders, eighth graders are already learning algebra, and based on my study during recent years, at least I found that Russian students, Indian students, students from Singapore, Taiwan, Japan, and China, they are already doing that.

So I was wondering what -- it really puzzles me that we want to find out how children can do it. On the other hand, people are already doing that or have been doing that for many years. So it's really a puzzle -- it really puzzles me.

MR. WILLIAMS: That's an excellent point. In fact, I teach students from Korea, from China, and they seem to not have a problem. Their parents don't need to do research. The country that they're from, they didn't need to do research. They have the attitudes, and their teachers had the content knowledge to teach the subject. And that brings me to my next point for d), instructional practices. If we expect the students to learn real mathematics, then we need to also deal with the instructional practices. It doesn't matter whether a kid is instructed if they're not really going to learn content anyway, or if content is not expected.

But if you expect the kid to learn real

mathematical content, then maybe we need to compare some of the methods that we've been using in the past, some of the educational fads, maybe direct instruction is not so bad after all if you have a product at the end that you're expecting.

But if you're not expecting a product, then the teaching method really doesn't matter. And if you don't have assessments that will determine whether you've succeeded, then instructional methods don't really matter. So I think your point's well taken.

The other countries seem to have dealt with this without a problem, but when I speak with my students as to how they were instructed in the particular countries that they're from, it's a lot different than the way we instruct our students here.

MR. SIEGLER: An interesting point about Liping Ma's reference to international data is that the TIMSS analysis of eight different countries and teaching practices in each of them that overlapped with a fair number of the countries you mentioned and also had the Czech Republic and the Netherlands, several other European countries, was that these systems are incredibly different in the way they teach math, that the local kinds of questions you might ask, for example, is it better to emphasize procedures

first and then get into conceptual understanding, or is it better to go with conceptual understanding first and then go into procedures, there's no right answer to that, because there are countries that achieve really high levels of success that do it every which way at the level that that question is asking.

And what people like Jim Hiebert and Jim Stigler have identified as the overarching regularity is that in all these societies, there are eventually strong links between conceptual understanding and the procedures that depend on that understanding. The details are irrelevant. It seems like there are a lot of ways to skin that cat, but you do have to reach that integration. And they identified the U.S. as a real outlier in never reaching that integration. And even to the extent we talk about conceptual understanding, it's in this kind of inert knowledge way like this is the definition of x and that's the last you will hear of x forever more. You know, it just sort of sits there by itself. You may be tested on it, but you don't need to actually say well, what does x have to do with the procedures that rest on x. And, you know, I think addressing how we can get teachers and textbooks to help kids do that integration is really a very central part of the challenge we face here.

CHAIRMAN FAULKNER: Ready to go to d)? Vern has raised d), or 4) as you prefer.

MR. WHITEHURST: Well, I think we are into 4) or d), depending on which you prefer. And I think Bob Siegler's point is really a critical one, but I would add to it that while there seem to be many ways to skin the cat, there are clearly some ways not to skin the cat. And so it's not that everything works. There are some things that clearly don't work, and this country may have captured more of those things than its fair share. And, you know, I think one of the things the Panel can address is given the various routes to the goal, which of those are productive routes and which of them seem to be non-productive. And I think TIMSS data will be helpful there.

This point about instructional practices, programs and materials could well occupy the Panel alone as a topic for the next two years of work. It has a lot imbedded in it, and I think some choices will need to be made as to what to emphasize.

One, for example, could look at the evidence, and I can tell you it's relatively meager, on the effectiveness of commercial curriculum textbooks for example. My office has looked at that. I mentioned earlier we're extending it to elementary

school math. There is not a large literature on the effectiveness of the kind of textbooks and materials that districts can go and buy off the shelf and build their curriculum around, but that's certainly subject matter that one might wish to address.

One can look at topics like ability groupings. When should they start? When are they destructive? When are they useful? People care about calculators and slide rules. You know, when should they be introduced into the curriculum? When are they appropriate? When are they inappropriate?

There are a lot of microgenetic kind of learning processes one can deal with, and Deborah Ball on the Panel is an expert in that area. So a teacher who is carrying out instruction about subject matter that's going to be covered in the next hour, how should child successes and mistakes be handled by that teacher in order to enable learning.

So there's really a broad range of practices, materials, and instructional approaches, and I think the challenge for the panel will be to think of those and focus on those that are most relevant for national policy.

Did you want to add something? Go ahead.

MS. STOTSKY: I just wanted to ask if we would be able to draw upon, and I was really thinking

more about e) where we began as opposed to d), and whether we'd be able to draw on some international data for teacher training in particular that would suggest some of the big differences that also exist in most other countries that I'm aware of and our own form of teacher training.

MR. WHITEHURST: If the data are available, we can certainly find those data for you and provide them to the panel. TIMSS has certainly collected some information with respect to the training and background of teachers. PISA, the OECD project for 15-year-olds, also has data. I think we're going to be frustrated, though, with the level of detail that's available, and we may end up needing to focus on case studies. We know a lot about the training of teachers in particular countries and could certainly contrast that with what happens in the United States.

MR. GERSTEN: I'd like to spin off a discussion Deborah and I had earlier this morning of in terms of curriculum, Russ is correct. There are very few studies of curricula effectiveness. The qualities of them and the scope of them is often limited. But the whole idea, as a Panel, if we could come up with frameworks for useful curricula teacher editions that would actually be pragmatic. As Bob said, it's less, you know, which do you teach first?

Is there one best way to teach math? But just something that is both useful that does -- that we -- whatever we can learn from the studies of implementation of curricula to date so that we don't make those same mistakes again and try to kind of proactively give guidance for developing curricula. I think insofar as we could do that, it would be a major contribution. And it's a huge problem now.

CHAIRMAN FAULKNER: Dan, why don't you carry this segment forward, and then we'll go to general discussion.

MR. BERCH: I think we want to focus here more on instructional practices in a broader sense that may influence development of materials, curricula, etcetera. One of the questions that we had similar to something that Bob asked earlier about how far back do we go, it might be what kinds of instructional approaches have been shown to help young children make a successful transition from early informal number learning to school-based arithmetic.

Another, which relates to something that's treated by many different curricula, but the underlying issues are by no means clear, what evidence do we have regarding the proper use of and role for concrete as well as virtual manipulatives for the learning of basic arithmetic concepts and skills. What kinds of instructional strategies, if any, have

been shown to be effective in ensuring that the underlying mathematical concepts and principles are abstracted from working with such manipulatives?

Again, I think those kinds of questions and many others that you could come up with would cut across some of the other more specific kinds of things that one might deal with with any given curriculum.

Let me follow-up by one other statement -- that while we do want to be certainly open to the kinds of data and other information we may have from other countries, if it were a simple matter of mapping those on to what we do, we wouldn't need this Panel. And so with all due respect to the fact that there are successes elsewhere, there are failures in some cases that have been demonstrated in trying to adapt those procedures to other contexts, cultures, etcetera. So that's part of the reason we need to explore the evidence-base in certain domains.

CHAIRMAN FAULKNER: Dr. Wu?

MR. WU: I want to bring up one point which I was reluctant to in detail at this juncture, but I think for future reference, it's important to note in all these discussions about how students learn, what's the instructional practices, given assessment is the centrality of mathematics behind all these. Let me illustrate this with the following point. I think Bob or somebody mentioned the fact

that in the American classroom, you can see students' learning procedures, and sometimes you see them learn conceptual understanding, but then they're not brought back together.

Now behind all that is really a statement about the fact that there is no satisfactory or almost very few satisfactory textbooks which expose students to both so that the teachers at the mercy of the textbooks most of the time would be left to do one or the other. So it's a reflection not so much of instructional practices, because a teacher teaches only from the book, and the book leaves something out. Unless the teacher is superbly equipped, is not going to be able to bring them together.

And the other thing about for example how people learn something more complicated such as proportionality, it's not generally recognized, but the mathematics as exposed, as given in most textbooks, if not all, is extremely flawed. And I look back -- I learned these things from those books myself. I look back and I ask myself, "How did I ever manage to learn it?"

I mean so these things -- I don't think we can decouple the basic mathematics from all these discussions, and I think this is what makes mathematics education more complicated. Because it's not just one thing, not cognitive psychology, not

pedagogy, but whatever you do, the mathematics is intrinsic. And that is something I think we'll have to grapple with later on.

MR. FENNELL: So it goes back to the teacher and how that teacher is prepared. And in this country, at present, those preparing to teach elementary education receive -- the majority of those preparing to teach elementary education receive their mathematics background at the community college level. Those who teach middle school mathematics -- as we talk abut middle school mathematics certification programs around this country, and there are now 40 states that have some version of middle school mathematics certification -- that mathematics background varies.

And so the issue of what it takes -- content, background -- to become a teacher and, as importantly, what we can do engage them in this profession through mentoring or other programs, and keep the good ones teaching, and have them help mentor those coming into the profession.

We all know the statistics. One half of the teaching profession is leaving the profession in 5 years, 30 percent of the teaching profession within three, so it's as much a problem of preparing good teachers and retaining them as it is anything else. And somewhere along the line, the accreditation

groups, be they NCATE, or TEAC or whatever, needs to be engaged in this discussion. Because to an extent, they help drive some of the concerns about anyone who is connected to teacher education knows about on a daily basis.

CHAIRMAN FAULKNER: You seem to be moving into 5)e).

MR. WHITEHURST: Yes, we have. And of the topics that are on the list, this is the one about which I know most, and so let me point out a conundrum here. There are two sources of evidence with respect to the effectiveness of teachers on outcomes. The whole body of so-called production function studies largely done by economists -- they're called production functions out of -- the metaphor is to a factory and you're producing something, and the question is what are the variables that affect the quality of that product.

And so we have a literature going back 35 years that's tried to look at characteristics of the preparation of teachers or the training of teachers, their verbal characteristics, the scores that they get on certification exams like PRAXIS, to relate those predictors to outcomes. And sadly, though the relationships are there, they're generally quite weak. I am not sure I have the numbers exactly right, but they are close to right. There's a recent study

that's been published using longitudinal data from North Carolina looking at the value-added for student achievement in mathematics as a function of the PRAXIS scores of teachers, and the study takes advantage of a discontinuity in policy in North Carolina where they increased the PRAXIS score that was necessary in order to pass the certification standards in the state.

One would think that the PRAXIS II examination, which is a content examination, would be a powerful predictor of student learning. In fact, the difference between the performance of students and teachers at the 75th percentile or above on the PRAXIS exam versus those at the 25th percentile or below was the difference between the 50th and 51st percentile in terms of achievement on the state examination.

You can go to other variables. Experience has some effect. Better to have a teacher who's been teaching five years than a teacher who's been teaching one year, but again, it doesn't control a lot. One can look at verbal ability. It tends to be a predictor but not a powerful predictor.

So you go through all of these production functions. You add them all up. And you end up, you know, if you had a large applicant pool, and you were able to use all that information, and select the best teachers, you might be able to move students 5 percentile points up.

The other source of information we have is on actual performance differences among teachers, and so now you take a measure of student gain and you categorize teachers in terms of those who consistently produce large gains and those who consistently produce small gains. Those differences are huge. And so the difference between a teacher who's consistently above the 75th percentile in producing gains and a teacher below the 25th percentile in producing gains can be virtually a year of learning for a student who has the good luck of getting a good teacher or the bad luck of getting a bad teacher.

So teachers are incredibly important. We have measures in place and methods in place that allow us to tell the difference between successful ones and unsuccessful ones. But we're not very good at telling ahead of time who's going to fall in which of those categories.

And connected with a point that Deputy Secretary Simon made, we know also that there's a serious maldistribution of teacher competence with respect to characteristics of students and schools. So the most advantaged students get the best teachers by and large, and the most disadvantaged students do not.

So my own feeling is that we know enough here to be able to say some things that are drawn from

relatively strong evidence that have powerful implications for public policy. And I hope the Panel will address the issue of teaching, because I can think of no other variable that controls as much outcomes for students that is within the public policy realm.

Do you want to add anything, Dan?

MS. STOTSKY: Could I ask if you are aware of any studies of math ed courses in particular? We're just beginning to get some information on the content of syllabi for reading courses. But I am not aware of any information on the content of math ed courses. As far as the content of the licensure tests, that's another black box, and I don't know what information would be available at all for that.

MR. WHITEHURST: Yes, there's some recent syllabi studies for reading. I know of no such studies for mathematics.

MS. BALL: There are some studies now on content of mathematical preparation. And also in between the production function and what Russ is talking about, there's also research on actual mathematical knowledge of teachers and its relationship to instruction and performance, which is different than the production function. So I think we'll have to dig into all of this in order to get at the actual content and its relationship to

effectiveness.

MS. STOTSKY: But they're being taught in their own --

MS. BALL: Right.

MS. STOTSKY: -- ed courses?

MR. SIEGLER: So, I'd like to ask what did the teachers do differently who were consistently in the top 25 percent versus the bottom 25 percent?

MR. WHITEHURST: Well, that, too, is a black box.

[Laughter]

And in part, that's excusable. I mean the availability of longitudinal data systems that allow one to determine at scale which teachers are consistently producing gains and which are not is quite recent. And so we're just getting a significant number of studies who are taking advantage of the existence of such data to explore relationships between inputs and student gains in classrooms. And I think a logical next step is to see if one can determine what the performance differences are between the teachers who are consistently generating gains and those who are not. I'm perhaps not as optimistic as some might be that one would easily be able to package that information and turn it into a professional development program for teachers. But certainly one has to try that, because knowing what are the

characteristics of an excellent teacher and a poor teacher is very important.

CHAIRMAN FAULKNER: Let me ask Dan if he wants to add anything to the tag team here.

MR. BERCH: Well, just a little regarding -- it's already been said to some extent -- while most people would agree that our teachers need to strengthen their knowledge regarding particular concepts and their skills in mathematics in order to do a better job of teaching, exactly what are those kinds of concepts and skills in order to do a better job of teaching school mathematics. And that's part of the issue. What do we know about that? What don't we know? Do we need any more research, and of what type, in order to answer those kinds of questions.

CHAIRMAN FAULKNER: Okay, Tom?

MR. LOVELESS: Just to add on to Russ's summary. There was a recent study by Brian Jacob at Harvard that took up the question that maybe good teaching is much like pornography. We can't define it, but we know it when we see it.

[Laughter]

And so what Brian did was look at how do school principals rate teachers and then check the data and find out who were the really high performing teachers in terms of value added over time. And it turned out that school principals actually are quite

good at distinguishing say the 75th percentile teacher from the 25th percentile teacher. But the bad news is they're not very good at distinguishing anyone in the group in between. So the 74th percentile teacher and the 26th percentile teacher, the principal's at simply a coin flip. Maybe there's something that we should be encouraged from that, but there's also some bad news there.

MR. WU: Am I to understand that you have no way to desegregate those two groups of teachers in terms of their mathematical knowledge? Is that true? Is there any data on mathematical knowledge of those two teachers?

MS. BALL: Yes, there is.

MR. WHITEHURST: On PRAXIS --

CHAIRMAN FAULKNER: Dr. Ball has some recent data.

MS. BALL: You're jumping ahead. This is part of what we're going to have to work on. It's a complicated territory, and we're going to have to define some terms to make progress here. Because we're mixing up characteristics, preparation, performances by teachers. We have to talk about -- so you just asked about math knowledge, but the question earlier was what do they do differently.

MR. WU: No, no. I think a much cruder question -- what Russ mentioned that there are two

groups, one group that --

MS. BALL: There is evidence --

MR. WU: -- 75 percent below 25.

MS. BALL: Right. So math knowledge --

MR. WU: So you have those two groups of teachers.

MS. BALL: Right.

MR. WU: Was any study done to these two groups of teachers as to -- just the crudest terms.

MS. BALL: All I want to say is we have to work on this, because there are several questions on the table. Because what Bob asked was is there something different about what they do. And you're asking is there something different about what they know. And those are not the same question. And we shouldn't try to answer this in 30 seconds. This is actually the literature we have to dig into. It's complicated. But there are answers to these questions, I think.

MR. SCHMID: Yes. I mean I hope. Of course. I mean we have to look at data and the more reliable data, the better. However, I hope there is also room for common sense. If we want children to learn to be able to -- well, learn, let's say be comfortable with the arithmetic of fractions, which many of us think is important to get into algebra, it is just a matter of common sense that teachers who

themselves have trouble adding fractions will not get their students there.

MS. BALL: The question -- beyond that --

MR. SCHMID: So I think that that's -- if we say that the direct correlation between measurable content knowledge and teaching outcome is relatively low, there is room for common sense -- that certain skills need to be taught and teachers who don't have those skills themselves will do a poor job. I don't think for that we need a large set of data.

MS. BALL: That's not where the research question is. I mean that's sort of obvious. You're right. It's beyond that is what's --

MR. WU: I'm not asking the research question. I'm asking the most obvious. That is that is there any data at all --

MS. BALL: Yes. I already said, yes, there is, but we're not going to answer it in 10 seconds --

MR. WHITEHURST: There's a large literature -- let me take that back. There's a literature that has looked at the relationship. Again, production function studies between mathematics courses taken at college and outcomes for students. And the relationship is a positive one up to about five courses after which there doesn't seem to be a lot of gain. Of course, one doesn't know the content

of those courses. It's simply counting how many math courses students had. I mean the fact is that most of our knowledge, except the most recent, is relatively gross with respect to the variables we've been looking at.

CHAIRMAN FAULKNER: Russell?

MR. GERSTEN: I just want to support both Tom and especially Deborah's point. These topics about what is an effective teacher, who is the best person to judge them, the data that has come out would support Tom's idea -- going back to Tom Good's research that his observers could tell chaotic classrooms. But they could not discriminate the higher and average achieving rooms. All of these variables need to be defined pretty precisely, the types of knowledge and what we mean by effectiveness. And even down to the point effective on one criterion measure for kids may not be exactly the same as on other measures. And I think if we're systematic about that and say this is what we really know and can give some more precision to this -- because common sense does not -- I mean in classroom observations, there are other things going on, and many of the findings have not been intuitive -- what people have found.

MR. WILLIAMS: Common sense, though, I still think content is obviously the most important thing. You wouldn't have someone teach you to drive a

car who can't drive. So I think that's number one on the list. We can solve all these other problems, but until we get math teachers who know math, there's no where else to go.

CHAIRMAN FAULKNER: Yes, Wade?

MR. BOYKIN: Point of information, this exercise we've been through the last hour, is it designed just to give us a chance to ask questions and make comments, or was it designed to actually go through and perhaps modify or extend these charges that are in this particular order? Just what's the point of this?

CHAIRMAN FAULKNER: I think it's both of those things. What we're going to do is to take this discussion and try to move into the afternoon to organize how we do the next part of our work. So I see this as a way of kind of working through in the consciousness of the Panel what these points mean to us. And if they need to be extended, well, we can talk about extending them. But you sound as though you'd like to extend one?

MR. BOYKIN: I'm just asking for clarity right now.

CHAIRMAN FAULKNER: Okay. Well, I see this as an exercise that is about scope really. What is the scope of our work as we understand it at this moment? Now there may be chances for us to go beyond

what we do here at this moment to define that scope, because we're going to have to bite off some pieces that we can deal with and try to deal with things that need to be done first first. At a later stage in the life of this Panel, we may end up deciding we want to change the definition of some of these things a bit. But right now, I think what we're trying to do is get our arms around the most important and most immediate tasks, and I think this has been a pretty useful discussion actually.

We're actually ten minutes deep into lunchtime so I might ask if there's anything anybody's going to explode if they can't say. Otherwise, I think we'll break.

Let me just add -- I want to reinforce, as Wade gave me a chance to say what I think we've been doing here, but I'd like to reinforce the importance of our being highly disciplined as we go forward. We're being asked by the President, by the Secretary of Education, by the nation really what we think is known and what we think we can advise on the basis of what is known. We need to be disciplined when we make that judgment about what we think is known versus what we judge on our own or take from lore or from any other basis. We need to be very hard-nosed when we go forward.

There is a lot riding on this. If our

report, of course, turns out to be negligible in importance, nothing will be riding on it. But if it turns out to be a valuable report, a lot of dollars will be spent, and the lives of children and families and the welfare of the nation will be affected by what we say. Our part of the bargain is that we have to be disciplined about judging what we say to be true. And so I want to urge everyone as we go into this next stage to be very careful about what we're willing to sign our names to.

VICE CHAIR BENBOW: I guess I've been keeping rather quiet, but I guess I'd like to emphasize a couple of points that I heard in the discussion. First of all is: what is it that we want them to know; so what is algebra; what is it that we want them to know?

But the second point is: how do we want them to know it; how do we want them to learn those concepts? And I think that's something that needs to be specified, not just the what but how they want to learn it.

And then, from my own tradition, I'm going to come back to the importance of individual differences and building on the differences that people bring to the task. And, yes, you know, kids at the top, the bottom, at the middle -- they respond to different instructional strategies, and we need to

take into consideration where the children are and how we might best build on the strengths that they bring and where we can expect them to go. And so, again, coming back to the fact that -- I think that we have to take into account instructional practices and for whom at the same time.

And we're really, when you think about academics -- I always go back to how do we develop talents in other areas, in the arts, sports and so on, it's much more performance-based in those areas -- where are you, and you go from there. So you don't have eighth grade tennis classes, eighth grade piano classes, or eighth grade skiing classes. You tend to say, well, where are you, and then we go from there. I think it actually applies to academics, too.

CHAIRMAN FAULKNER: Okay. Let's break for lunch. We're actually about 13 minutes late. Let me suggest that we come back into session at 25 minutes after the hour.

(Whereupon, the matter went off the record for a lunch break at 12:24 p.m. and back on the record at 1:29 p.m.)

CHAIRMAN FAULKNER: We have a plan to run until about three o'clock. We're going to have to stop at that time, and I think we have some members actually who need to leave before then, so let's see how much we can get done.

The goal here in this session is to discuss the next steps for the Panel. What I'd really like to do is talk about how we are going to organize to do whatever it is that we think we need to do. We spent quite a bit of time before lunch talking about what it is we think we need to do.

Let me suggest that we will need to break up into subgroups to work on tasks, and as I listened to the discussion that our colleagues conducted, Russ and Dan, I think that it is possible to think about the agenda that's in front of us in terms of groups that might be dedicated to the five areas that were discussed plus needed research.

And I actually think about them. Let me give you short names for them. I called the first group tasks and skills. I called the second group standards and assessments. I called the third one learning processes. I called the fourth one instructional practices. And I called the fifth one teachers. And then you could do a sixth, which would be research.

It occurs to me that these are tiered, that they're not necessarily pursuable in parallel. Anyway, six groups running in parallel is a lot of groups for a panel this size. But it seems to me that the issues of tasks and skills, identifying what it is people need to learn and learning processes, how they

learn it, are underneath everything else. And that we might concentrate for some period of time with two task groups running on those two issues.

Above that, or below it, depending on your point of view, but the next level of evolution seems to me to involve standards and assessments and instructional practices. And then after that comes teachers and research.

I'm going to throw that out for discussion here as to how we might proceed, and Camilla may have a different concept. But what I would like to do is out of the discussion that will follow now, try to understand how we might organize. And I have in mind that we will organize into subgroups of some number operating in parallel and they could either be sequential or all parallel. So let's see what you think. Tom?

MR. LOVELESS: Two suggestions. One, I think the question that Vern raised about defining algebra needs to be one of the key things of one of those groups, maybe the first one.

CHAIRMAN FAULKNER: It seems to me that it's the first group, the tasks and skills group.

MR. LOVELESS: And then the second point is -- I would suggest that we hold off on the further research question until we find out what the research is. In other words until the other five groups report

back, it seems to me just sort of jumping the gun to talk about what the research needs are at this point.

CHAIRMAN FAULKNER: Well, I would agree, and I'd suggested it for the third tier, but you can also envision it as part of some consolidation phase of this group at the end of whatever it is that we do that we can visit that topic. But I agree it's not an early topic.

VICE CHAIR BENBOW: Tasks and skills connotes a little bit of low level skills, and I was hoping that we could perhaps use, I don't know, conceptual knowledge and skills or something like that so we get a little bit deeper more high level tasks that we're thinking about, too. And it's just a matter of semantics, but sometimes semantics are important.

CHAIRMAN FAULKNER: Yes, Bob.

MR. SIEGLER: I'm wondering a little about the timeline here, which I've been wondering about actually since I saw that we're supposed to have this interim report by January. Now if we adopt this or some similar kind of schema, would we be trying to get through at least the first level of topics by January, or maybe the first two? Or are we supposed to get through all these topics by January and be able to present a report that we'd be willing to at least temporarily stand by?

CHAIRMAN FAULKNER: Well, I think that we're supposed to deliver an interim report. The Department members may want to speak to that issue. I'd say, speaking for myself, I think it would be good that if we were to use this tiered organizational plan, it would be good if we could, at least on an interim basis, get through the first two tiers by January. And I think it's unrealistic to take a tiered structure and try to get through all three tiers by January. But that's just sort of the way I would look at it.

The President's order isn't too definitive about what ought to be in the interim report. It just says there should be an interim report. As a matter of practice, I think that the Department is interested in using the interim report to guide program activity in the next year or so. So the more useful information we can put in this report, the better. Mr. Secretary, do you want to speak?

MR. LUCE: Well, I would simply say, though, I think that's totally up to the Panel obviously. We don't want the Panel to issue even an interim report that they're not comfortable with. But I would say clearly, we would hope that if you're in agreement on some subjects, you would share those in the interim report so that sooner rather than later, we can start guiding grant distribution of the

Department. So it's strictly, though, up to the Panel to define what it's willing to put in an interim report.

We're stating our preference, but we -- you know, this is for you all to decide in terms of how far you can get. You spoke before the break about people signing their names to something, so that's really up to you. We proposed it this way because we've asked Congress for 250 million additional dollars to put behind recommendations of the Panel in grants. But that's up to you all to decide. That's why we had a time period with a final because you're going to have to judge your own workload and pace.

MS. STOTSKY: Could I just ask how the work plan would proceed? I really have no idea of what you're thinking about. I know that there are staff here. I'm just wondering whether each one of these five areas, because they're all highly important areas, should be able to have contact with staff who would at least do a review of the research literature that seems relevant and to have the questions all raised that need to be raised. I mean that might be at least a beginning, which would then point us to whatever there might be for cross-references. But somehow each question should have staff members who can help to prepare for an initial review by the whole group at the next meeting all the different areas of

the research literature that is there or other literatures, not necessarily empirical studies, and then what are the questions that can be teased out from the existing and what can't be.

CHAIRMAN FAULKNER: Well, I think that we do have some staff capacity here, and we have, I think, the ability to get some things organized for the group. What I would have in mind is that we would be running at least two sub panels in parallel. They would each be under the leadership of some chair who is well suited to doing it and that in the next meeting, we would need to use a large part of that time to go over what the issues are and what is known, begin to grapple with what is known. We might have some sessions where the whole come together to talk about what is going on in each one of these panels, but I think that the business needs to work in more localized form. And so we'd be talking about roughly, if we did two of these, half the group in each one of those groups --

MR. SCHMID: Well, I understand that we obviously have to split up in some form into sub panels organized around certain themes, but it seems to me there is at least one issue which does not fit neatly into this organization, something that I think many of us get iffy about. This is the issue of -- well, it certainly would be a policy recommendation

appropriate for this committee to make -- that is curricula that are being supported by EHR and the NSF that have many of us upset. I think there is a great deal of money being wasted, and NSF, EHR is doing tremendous damage to mathematics education in the U.S. I think this panel has to speak to that.

MR. GERSTEN: I just have a couple -- these are more logistical issues. One, I think Wilfried's point -- I mean under -- there is a curriculum, instructional materials piece, and that is going to be one of the key pieces, at least I envision it that way. So what we want to think now is more structurally how we're going to do things.

But my one concern, Larry, about the way you have this tiered thing is given the fact we have what, seven months, and that large groups of eight or nine people who don't have a lot of history of having worked with each other, it feels like there could be problems there. And the way -- the advantage is technically there could be more linkage and more coherence between the parts, but the National Reading Panel tended to have groups of approximately three to four, and I have a feeling that would functionally work better, groups of four or so, unless there are some of these really kind of deep topics where we want it slightly larger. But I'd say in most cases, probably three, in some cases, five to six might --

CHAIRMAN FAULKNER: Take tiers one and two and run them in --

MR. GERSTEN: Yes. That's correct. Yes. Because I don't think things are going to be dramatically different in instructional processes. It'll be more fine tuning. Plus a lot of the first couple of months is getting to read the studies or the major papers, and I think that would be a more efficient way of doing things and people working together. It's hard because these topics, there's a lot of overlap more than what -- the way the NRP cut things up. The overlap was a little bit. It was more distinct. But I'd see the eight or nine being problematic, those large groups.

CHAIRMAN FAULKNER: Deborah?

MR. BOYKIN: If the interim report is going to be used in part to inform some near term grants competition programs, I would be concerned if we only got to tasks and skills and learning processes, and we didn't get to talk about instructional processes or teacher capacity, because those issues we would hope could also be in the umbrella of what we want to inform about grants programs as well. So I certainly would not want to preclude that possibility that all these issues, to some degree at least, get put into whatever recommendations are made for near term grants

competitions.

CHAIRMAN FAULKNER: Deborah?

MS. BALL: And that coordinates pretty well with something I wanted to say, which is, logically, I would put instructional practices and teachers together rather than putting standards and assessment next. Standards and assessment is partly about policy and our knowledge about policy, and it's intervention as well as it's about following from the tasks and skills. So I think it would help us if we put instruction and teachers and teaching closer together. So if you go with this tier system, or if we do, or if we pursue for it once, I would put those in the first four.

CHAIRMAN FAULKNER: Put standards and assessments separately or --

MS. BALL: I would have that after --

CHAIRMAN FAULKNER: Pursue five --

MS. BALL: In some sense our knowledge about and our recommendations about if we can get to that could be informed better if we understood instructional practice and teacher quality better.

CHAIRMAN FAULKNER: Well, is any tiering needed? I mean is it possible just to pursue all five things at the same time?

MS. BALL: That's -- I mean that's -- question. And that follows a bit from what Russ said.

CHAIRMAN FAULKNER: None of them depends on the outcome or the trend of thinking of other ones. Yes?

MR. GEARY: Well, I think the learning and processes at least will depend a great deal on what the mathematicians say [are] the concepts and the skills. And so certainly there are things that are already known and things we know we don't know that could be done as a preparation for fine-tuning to that particular content. And probably the other areas could do that as well. They could begin to gather what is known about math and algebra and pre-algebra and then fine-tune it to content once that's explicitly defined.

CHAIRMAN FAULKNER: Wilfried?

MR. SCHMID: Yes. I suppose the question of what constitutes an algebra course has to be settled first. I mean if we talk about what's the proper way to prepare students for taking algebra let's say in eighth grade, we need to know what it is that they're supposed to take at that point.

CHAIRMAN FAULKNER: Deborah?

MS. BALL: Could you just speak to the process a little bit, because when I think about our work in the next months, I thought that something we'd been told earlier was that we'd be having testimony or conferring with others. I mean I don't want to

retrace ground that has been already argued about many times in the last decade without finding a disciplined way through that.

And I'm wondering about what our ideas are of how to do that and whom else we're going to be consulting with or working with to get to that point. I mean these are questions that are not new to this Panel. So for us to do anything different from what's already been done several times over is going to require us having a smart process about how to be disciplined, which is I think one of the things you were urging us to be just before lunch.

So could you comment on what you're envisioning?

CHAIRMAN FAULKNER: Well, I'm not sure. I think we may need advice from the Department or from others about to what degree we have an obligation to receive open testimony. Is there someone who can speak to that issue?

MR. LUCE: Well, I would say that in the National Reading Panel case, hearings -- not hearings -- but open meetings were held in different parts of the country, and Dan can speak to how that was done. On the other hand, although this is modeled after the National Reading Panel, you all have -- the Chairman has wide discretion with regard to that, and I think that's a decision for you all to make. But at least I

would like for you to know from Dan and Russ what was done in the National Reading Panel instance. You might want to describe that, Dan.

MR. BERCH: Well, I can say a little bit about it, but as we've talked about it before, we're using that panel somewhat as a template, but there are clearly differences in terms of some of the goals and the nature of the domain we're studying here. So it's by no means desired to have that drive our processes precisely in the same way.

But it turned out here that the Reading Panel felt they needed input from different regions before arriving at their choice of subgroups or working groups, and they received testimony from approximately 125 different individuals and organizations across the country from teachers, parents, students, policy makers, etcetera.

And then they extracted several key themes everywhere from the nature of the importance of scientific evidence to the role of teachers to dissemination, etcetera, and they formed their topics out of that.

Now their charge was not as explicit as the charge that you're given in the Executive Order, so we've already made a step in that direction. But as you discussed earlier, we're still not as clear how to frame those things within each of the topics.

There are some other ways in which they overlap. The Reading Panel took several days after to go over their results from the hearings. They discussed dozens of topics, and then narrowed their focus to things such as phonemic awareness, phonics instruction, fluency, vocabulary, comprehension, teacher education and computer technology in reading instruction.

And then they also had a methodological approach that they developed in terms of screening the data that they were going to examine. And I won't say more about that at the moment. That's another element in terms of the criteria for the kinds of studies they were going to examine.

MR. WU: But how much time did they have before they issued the interim report? How much time did they have?

MR. BERCH: Well, initially, they were going to come out with a report earlier than they thought was feasible after they got into it for a while. So --

MR. LUCE: Different timeframe.

MR. BERCH: -- they came up with a -- right. They had a different -- they did come out with an interim report. But again, I can go into more of that, but I think we have to be guided again by the fact that they tended to focus on, although they said they would focus on a fairly wide age range, a lot of

the work was aimed at getting to the roots of reading and the early developmental aspects of that which, again, to some extent you're bound by the framework of the Executive Order. And others may want to speak to that. But you may decide that you need to place greater emphasis with respect to certain topics or certain grade levels pursuant to the charge in the Executive Order. And if that sounds rather amorphous, I guess it is. But that's, to some extent, up to you as long as it's within the general guidelines of the Executive Order.

CHAIRMAN FAULKNER: You looked like you were getting ready to --

MR. LUCE: No, I just -- I think he covered it later. I would just say the timeframe was different and the specificity of the questions that you've been asked -- and, again, you can amplify -- you know, we have a framework in the Executive Order -- - are different than the National Reading Panel. So we want to model that, but we don't have to be slavish to that approach. And insofar as public hearing goes, that's up to the Panel.

MS. STOTSKY: Could I just raise a different approach, which is not anti-research, but it seems to me that some of the basic decisions that have to be made are policy decisions that don't have empirical backing. They're not susceptible to

empirical research.

For example, if one wanted to stake-out right away the idea that we should expect most children in this country to take Algebra I as defined appropriately by mathematicians for grade eight, what would we need to do in order to assure that children would be able, most of them, to reach Algebra I. What would we do for those populations that might have difficulty, the SPED population or the ESL population? What would we need to do in teacher education to make sure that the teachers who taught in grade eight were appropriately trained?

In other words, reverse exactly what in a sense it seemed as if we were doing proceeding from what's empirical and then go to policy. But if we could, start with a couple of basic policy questions based upon an international setting, international standards, what we think we need to do, and then proceed to find out where we have to go from there.

MR. SIEGLER: In terms of the logistics of getting this done in a reasonably short time, I like Russ' idea of dividing this into four or five, probably four, initial level committees that would be relatively small and would produce explicitly interim interim reports. I mean these are all going to change after everyone has a chance to deliver their perspective on them, but I think getting something on

paper is going to be very useful for providing the kind of discipline that you were talking about as being crucial to getting things done quickly.

CHAIRMAN FAULKNER: Well, let me intervene here for just a moment, because several important ideas have been put on the table. One of these is Sandra's comment about whether the policy questions should be discussed first. I have understood from the Executive Order that the goal is to generally prepare students for success in a course in algebra. And so I'm in a sense presuming, Sandra, that we're starting with that question already.

MS. STOTSKY: At grade eight?

CHAIRMAN FAULKNER: Yes.

MS. STOTSKY: At grade eight? I don't know that that's --

CHAIRMAN FAULKNER: I didn't say that.

MS. STOTSKY: Oh, okay.

CHAIRMAN FAULKNER: I just said --

MS. STOTSKY: But that's what I was saying --

CHAIRMAN FAULKNER: -- a course in algebra, okay. It's clear from discussion today that we have to eventually settle what that means but anyway, it seems to me that preparation of students for that is a given in this Executive Order. If I am wrong about that, probably I should be corrected. So

I think that the question of definition, the question of international comparisons and so forth, those are valid. But it seems to me the goal or the target is defined for us. Tom?

MR. LUCE: I would just say that I agree. I think, however, the Panel could certainly define, and, number two, the Panel could give advice as to whether that ought to be eighth grade if it chooses to do so. As a policy, we've said in the Department it's clear algebra is a critical gateway course to college success. I mean that, I think, is policy -- I think I can say that's policy at the Department and has been.

CHAIRMAN FAULKNER: Dan, do you --

MR. BERCH: I can't speak to policy of the Department so --

CHAIRMAN FAULKNER: Let me go on to a couple more issues. Another one is the timing. I think that we do have a short time until the January interim report. We have a much longer time available to us before the final report. I don't think that we ought to be driven so hard that we end up producing results that we don't want to stand by or that turn out not to have been worth the effort. I think what we'll do is report as well as we can in January, and we will front load the process. That is we'll have more meetings earlier than -- we won't try to spread them out uniformly during the time that's available.

But, we do have a longer time available to achieve sound ultimate results, and we ought to try and keep the eye on that. The last thing I think that's been raised is really in connection with the Reading Panel was that there were elaborate hearings to try to define the topics of the subgroups. My sense listening to this morning's discussion is that we don't need hearings to define a reasonable set of subgroups. We, seems to me, have those pretty well staked out and that we could go right straight into a subgroup structure. But if I'm wrong about that, people should comment on it. Let's go to those points. Wilfried?

MR. SCHMID: Let's say it seems to me to decide on what should be in an algebra course, I don't think we need public hearings for that. They're not going to help. For the deliberations of these subgroups once they are constituted, it would be helpful if we could start from a certain point and that point being let's say some definition of what an Algebra I course should be like, number one. Number two, certain skills that almost surely are necessary in order to survive in such a course. If sub panels of this Panel look at these questions elaborately, we're not going to get very far by January. That's clear.

On the other hand, I don't think there is

an awful lot of disagreement or there will be an awful lot of disagreement in trying to define what is an Algebra I course. I don't think there will be an awful lot of disagreement on the skills that are necessary to get there. If we could start from that as a basis, I think we'll get on much faster.

CHAIRMAN FAULKNER: Okay --

MR. FENNELL: Wilfried, the only thing that I would be cautious of with regard to what you just said is that I hear you focusing almost solely on what an Algebra I course ought to look like, and Dan, a couple of hours ago, you raised, I think, a very good question about what does algebra look like as generalized arithmetic, as patterns and so forth at the elementary school level building toward the course that Wilfried just defined. So I wouldn't want to lose sight of algebra as it's configured prior to that formal opportunity. And I'm speaking for you, so please echo in if I'm misrepresenting you.

MR. BERCH: I'll respond to both and hopefully others will weight in from the *Ex Officio* about the purpose of the panel. And certainly it's not to determine what's appropriate in an algebra course. Let's go back to the Executive Order, the policy stating that our goal is to foster greater knowledge of and improved performance in mathematics among American students. And then the Panel shall

advise the President, Secretary, etcetera, including with respect to the conduct, evaluation and effective use of the results of research relating to proven effective and evidence-based mathematics instruction.

Now within that framework, as others have said, we're looking toward algebra as this gateway and certainly the acquisition of algebraic concepts and principles and then what do we need to do in order to prepare students toward that end, which doesn't mean we aren't interested in what goes into an algebra course. And that'll help drive part of the questions we ask earlier. But I think we don't want to lose sight of sort of a larger set of goals here so that, at least as I would see it, if we constrain the objective in this particular way, then we aren't going to be interested in children who may never take a course in algebra.

MR. BERCH: And I don't think that's appropriate to limit it to that for the Panel.

MR. SCHMID: Well, maybe what I said was easily misunderstood. I mean I think that obviously there will be many things for us to say and to think about, but, again, if we talk about an aim and the aim let's say is to get children ready for a course in algebra, we need to know what that course is roughly. We need to have some idea of the content of what should be called an algebra course, and I think we

should also have some idea of prerequisite skills, and I don't think that these two issues -- I mean these two issues will help to structure the rest of the discussion. I think if we, as a Panel, tried to define the content of an algebra course, the prerequisites, then it's going to be a very slow process. I also believe that let's say on these two issues, I mean what should be in algebra, what are the prerequisite skills -- there is a lot of information that we have out there, and I don't think a lot of disagreement on this Panel.

MR. GERSTEN: Just a clarification. Did you say you don't think the -- does the algebra course need to be defined before others can work or not? I just couldn't hear you.

MR. SCHMID: Well, I think the answer is yes.

MR. GERSTEN: Yes. Okay. I just really wasn't sure.

MR. WILLIAMS: I second that -- that the answer is yes. If you're going to prepare students for an algebra course, it's been so bastardized, the word has, that no one at this point really knows what it is. Now 20 years ago, we would have all agreed on what algebra was. But in this case, if that's our goal, to prepare students for that course, we need to know what that course is.

MR. LUCE: Mr. Chairman, I just want to clarify with respect to the Executive Order, I don't believe the Panel is prohibited from fleshing out what is algebra. I don't think the Executive Order prohibits you from doing that in any way.

CHAIRMAN FAULKNER: Okay. Deborah?

MS. BALL: I just think that if we become a curriculum committee where we're defining a course, we're in big trouble. I don't think that that's how I read our charge. And before we agree on that, I definitely want to hear other people's thinking. I see us as needing to talk about the nature of the domain we call algebra, which is the way I interpreted your comment, Vern. But I don't subscribe to the idea that we're going to define a course. I find that very problematic. I don't think that that's the charge of this group. And I stand to be disagreed with, but I'd like to hear that discussion. Because two different things are to say, "What's this domain of mathematics?" [and] "What are the skills involved?" I do think we need to talk about that. I don't think that means we should define the course.

MR. LUCE: Nor did I mean to say curriculum. We can't define curriculum.

MS. BALL: That's where we're heading.

MR. LOVELESS: We don't have to define the curriculum --

MR. SCHMID: No. I mean we're not --

CHAIRMAN FAULKNER: Hold it, hold it. Let's get orderly here.

[Laughter]

MR. LOVELESS: We don't have to define the curriculum, but the phrase is competence in algebra. And surely we should be able to define that.

MR. LUCE: Yes.

MR. LOVELESS: If we can't define what competence in algebra is, I don't see how we can fulfill any of the Executive Order.

CHAIRMAN FAULKNER: Valerie?

MS. REYNA: And my understanding of what you said is that if we talk about what competence in algebra is and what the skills are, then we work backwards. It's not the only thing we're going to do. We're just talking about the order in which we do things. Is that correct? Okay.

CHAIRMAN FAULKNER: Ma?

MS. MA: And there is something going on -- something called algebra, which is not algebra out on the stage. The schools, they are teaching what they call algebra which is not considered as algebra from mathematics view. That needs to be cleared. That's the point.

CHAIRMAN FAULKNER: Well, we're going to have to work through all this. There's just no

question about it. I mean it's part of this first task group in a serious way.

MR. GEARY: So, we don't have to define a course curriculum, but certainly I would imagine there are core concepts and skills that are there. But there are also core pre-algebraic concepts and skills that I think the mathematicians should give us some guidance on as well that we can know, okay, you know, what aspects of arithmetic are really, really key and downward from there just to provide some structure. And, of course, then we'll tweak it and fill things out or modify.

CHAIRMAN FAULKNER: Wade?

MR. BOYKIN: I'm guessing my body language is giving me away. Just a couple of things. One is that in the charge, it certainly says algebra, but it also says and also higher mathematics levels. Now I don't want us -- I mean hitting the algebra is ambitious -- not so much to think that that's sort of the end point for where we want to put people on, our students on, sort of a track towards. And I think something also is to be said about just helping students become better mathematics thinkers. Because you can take mathematics and apply it to sciences, social sciences, whatever the case might be. If we get so narrowly focused just on getting through an algebra course, I think that truncates our charge in

ways, I don't think, necessarily you want to do. We need to think broader and even further than just that in our comments.

CHAIRMAN FAULKNER: That's a good suggestion or a good point. But I'm also, I think we need to meet the prime focus, too, which is a clear --

MR. SCHMID: I think that let's say when algebra is given as the focus, there is an underlying understanding that algebra in effect is the gateway to college mathematics, and so I do not believe that when we focus on getting students ready for a course in algebra that in any way that means limiting the scope, rather the opposite. We want to be sure that students, let's say when they're just before high school or as they enter high school, they do what is absolutely necessary as a trajectory towards college mathematics.

MR. WU: Well, when we talk about learning algebra properly, it implies all the things you want. If they learn algebra -- learning -- of course, now learning has a very ambiguous meaning, but when we talk about learning -- how to get students to learn algebra, we mean in particular that they don't just memorize a few formulas. We mean that they learn it, understand it and can use it. And that is exactly what you need for them to do science and do statistics, whatever it is. So I think that what you

want is completely consistent with what is being put on the table.

CHAIRMAN FAULKNER: Dan?

MR. BERCH: I guess in relation to the pre-algebraic skills, I wanted to clarify something that Skip mentioned. And during the break someone said to me that perhaps I was misquoted, which may be the first of many times. But the question I raised earlier wasn't meant to suggest that we know what those pre-algebraic skills are or that things like recognizing patterns and making generalizations are indeed the critical skills.

I was raising the question about or suggesting that there are certain people who've contended that those are critical, and that if children in the early elementary grades engage in certain kinds of tasks that seem to be reflective of pattern recognition, etcetera, that they will indeed be acquiring skills crucial to algebra later on. And I was suggesting a question one might pose is do we have any evidence that that's indeed the case.

And that may be a perfect kind of example for something where there might be a disagreement amongst panel members with respect to whether you need evidence to answer those kinds of questions or whether there would be disagreement or not about the prerequisite skills. And I believe that that's where

-- I mean that's where a lot of the action will be. It may not be at the endpoint of saying this is what you need to know, but how do you get there.

CHAIRMAN FAULKNER: Sandra?

MS. STOTSKY: I just wanted to say that in Margaret Spelling's cover letter to the panelists, it does say, and I'll quote, "As you know, it is crucial that America's students receive solid math instruction in the early grades to prepare them to take and pass algebra and other challenging courses in middle and high school." So there is the conflation of algebra with a course, and this does not seem to be something that one can easily separate according to her charge. Algebra and other challenging courses in middle and high school.

CHAIRMAN FAULKNER: Russell?

MR. GERSTEN: I just -- procedurally, I think the task of defining what should be covered in algebra, not in the exact week-by-week scope and sequence, and what is critical for students to go from age four, the kind of work Bob is doing and Sharon Griffin is doing, to grade seven, those are critical tasks. I don't believe that the panel has to wait until that task is completed before looking at what we know about teacher knowledge that's relevant, what we know about teaching practice, what we know about the measures that predict difficulty in learning

arithmetic. I don't think it's a good use of our time. I don't think it meets the need for Math Now to just say here's what we know about valid assessments of things in the area of mathematics K-6.

There are certain procedures that work better, certain ones that help teachers, certain ones there's no evidence. I think that could go on while -- concurrently -- and I think, Larry, that's what you originally proposed -- while the work on the content and skills and logical analysis and mathematical analysis goes on. That's my feeling, and I guess there's disagreement there.

CHAIRMAN FAULKNER: What I'm inclined to do -- Camilla and I don't need to talk about this, I think -- but what I'd be inclined on the basis of this discussion to do is to set up four concurrent groups dealing with conceptual knowledge and skills, dealing with learning processes, instructional practices and teachers, and leave the assessments and standards for a bit later discussion. But also to use a recursive method where the individual groups have worked separately but be required to come back into the center for kind of midpoint reports so that there's some chance of linking these groups or going so they don't just end up as separate shifts.

MR. BOYKIN: Could you say those groups again -- those four groups?

CHAIRMAN FAULKNER: The four groups -- it's everything but standards and assessments. It would be conceptual knowledge and skills -- these are the little short labels I'm using here -- conceptual knowledge and skills, learning processes, instructional practices, and teachers.

MS. REYNA: Point of order. I think it was mentioned earlier that d) and e) might be combined. Would that be useful to do at this stage or you think it would be -- since you brought that up, d) was the instructional practices, programs, materials, e) was the training of teachers. Should that be combined or separate?

MS. BALL: I'm just saying they should operate at the same time.

CHAIRMAN FAULKNER: Those are so separate, it seems to me.

MS. BALL: Yes, they're very different issues.

CHAIRMAN FAULKNER: Okay. So I'm inclined to do that, to go with four, to try to recursively work them. Are you pretty comfortable with that?

MR. GEARY: I want to be part of more than one group.

MR. LOVELESS: Why are we saving assessment?

CHAIRMAN FAULKNER: I'm worried about the

numbers of people and getting this group divided. I think we're just -- I'm not sure three is a good number for a subcommittee. And if we go to five, trying to run five in parallel, we're going to have a hard time covering it. That's the main reason. Do you agree?

VICE CHAIR BENBOW: Yes.

CHAIRMAN FAULKNER: Do you agree with the four?

MR. LOVELESS: Well, I raise that because I am in particular concerned that we take a look at NAEP and whether or not it is doing what we would want it to do, and in order to do that, if we're going to put that off, I think that needs to start. Perhaps we could fold that into one of these groups, but I think it's a question that needs to be looked at.

CHAIRMAN FAULKNER: But are we going to transform it in the next six months anyway?

MR. LOVELESS: No. No. Well, that's not the point. We may decide that it needs to be transformed in the next --

CHAIRMAN FAULKNER: I just see that subject, standards and assessments, as less bearing on what the Department is worried about doing in the next budget year. Maybe I'm not right about that, but I see it that way.

VICE CHAIR BENBOW: I also think that in

terms of standards and assessment, they should follow from what we decide on these other four committees, so it's kind of funny to be thinking about the standards and assessment without knowing what the results and conclusions are from the first four committees. So I think it's a logical sequence. I think we have to go there probably as a whole group, but we need to go through these other literatures first to come to some decisions.

MR. GERSTEN: It throws me a little bit that the formative assessments which is stressed in the language of Math Now really fits more into either three or four, either instructional processes or curricula effective teaching practices? What kinds of data can teachers really use? And so it's almost splitting the summative assessments, the high stakes ones, from those that inform teaching and maybe moving that part into the teaching end?

Should the formative be in the teaching end not the standards and assessments? I think that would be a better fit.

CHAIRMAN FAULKNER: Okay. Let me just elaborate a little bit further. Deborah raised a question earlier that never really got answered, and that is what about receiving testimony? What I would be inclined to do is to begin right away letting the individual task groups start to do their business.

And I would propose that the task groups receive whatever testimony they've judged to be appropriate and needed in their work. That way it gets targeted toward the individual missions of individual groups rather than trying to receive it all as a whole. But tell me what your thinking is about that. A nodded head.

MR. FENNELL: I'll ask Dan. Dan, when you received, I think I heard the number 125 plus testimonies, to what extent did that affirm your position or slow you up?

MR. BERCH: Well, okay, I wasn't involved with the panel at that point in time, but on the basis of their report and, again, this is from I think four -- correctly -- regional hearings, and they noted -- and I didn't include my state -- there were policy experts, university faculty in addition -- it wasn't viewed so much as slowing it up. The decision was made that that was going to be part and parcel of their approach to developing the themes, which would then lead to the designation of the subgroups. So unless I'm hearing you --

MR. FENNELL: Well, I'm just --

MR. BERCH: -- that was their --

MR. FENNELL: -- I'm just saying a clock is ticking here, and that clock is --

MR. BERCH: Right. And he's raised the

idea here of if we form the subgroups first, could we -- you know, would it be appropriate to hear testimony that's more specific to that domain, which, you know, we want you to weigh in on that.

MR. GERSTEN: I think the idea of letting the subgroups decide about having a hearing, there's a couple of advantages. Logistically, three or four people getting them in one place is easier. What I've heard from my colleagues who were on the NRP was they found the hearings kind of a little chaotic because all this -- you know, things came in a random order; extreme positions were voiced.

But on the other hand, they made a huge conceptual leap from when it began to when the report came out. Those five pillars of reading, that wasn't there before. And that just helped the field phenomenally. It helped the reading field phenomenally. So my sense is let the subgroups do this. They can be more focused then. And they really could help hopefully some groups make conceptual leaps. And if a group doesn't want to do it, they don't have to.

MS. STOTSKY: What I would like to say is in part response to what Russ was saying, which I would agree that it would be useful to have some testimony to what the subgroups were doing. But I also would like to raise a question to Camilla about

the notion that standards are the last thing, because if the first group is conceptual knowledge, and if conceptual knowledge and skills is going to be defined by the end goal, which is algebra, then you're starting with standards. Because the standards represent what a society expects of kids at a certain age. And this is what leads to what you prepare teachers to do, what the whole curriculum is shaped by.

So in a sense, it's not the last thing, it's the first thing. And if that first thing is what is being asked for in the first subgroup on conceptual knowledge, then that would make sense. Because then you could have hearings on: Is this where we want to go by, for example, a certain grade? That's going to change not only the math curriculum but [also] the science curriculum. We know that this is pivotal.

MR. WU: I disagree with that because you don't write standards until you know what you're doing. And we're trying to find out what we're doing. I mean what is it that you want students to learn about algebra. So I am in agreement with the one being proposed that we get the subject of algebra defined, get the preparatory materials defined. Once you know that, then writing of the standards is more a political process. But I don't think we should have the standard precede what we want to do.

MR. WILLIAMS: Can I ask a question how you're forming the sub committees? Are you assuming that a) and d) will be two different sub committees? Well, let's just say a) is working on conceptual skills and critical skills, etcetera, etcetera, and d), they're studying instructional practices, programs and materials independently. Why would you split those two up?

CHAIRMAN FAULKNER: You were about to say something --

MR. BOYKIN: Just a sort of on a similar page to his comment, it just seems that we will have these four subgroups, but you also said that this should be a recursive process. And it is that all four of these to some degree are interrelated. They aren't orthogonal areas. And so I just hope that even if we move forward with these four subgroups, we don't operate in four silos.

And so if there are hearings or whatever the case going on, that's opportunity for all people to be a part of it, even if each group sets their own hearings, whatever is going to be their set of activities, that the opportunity is available for all of us just to take part in these kinds of discussions. Because you might get insights that will help all the other subgroups as well.

CHAIRMAN FAULKNER: I guess the short

answer that I'll give is that if we all try to work on everything, we will get nothing done.

MR. GERSTEN: Yes, I agree -- as opposed to give feedback on the drafts from our colleagues.

CHAIRMAN FAULKNER: We are going to have to divide down in order to be able to make any progress, and I think we can try to use a mode where it is possible for people to cross visit and so forth. But recursiveness will be important. I think it's the only way we'll be able to keep some kind of coherence in the overall report ultimately. But I just can't see how we can proceed without some --

MR. WILLIAMS: So overlap --

CHAIRMAN FAULKNER: It's too large a topic.

MR. WILLIAMS: Overlap will be fine. If people who are on a committee setting critical skills, if there's a lot of overlap with d), that's perfectly okay.

MS. MA: Also, I agree with him that if you don't have a), how does d) work? If a) is not decided, how will the group d) work?

CHAIRMAN FAULKNER: I originally proposed it a) and c) run in parallel at first, and then we'd pick up the other ones later for a reason. This group overall seems to want to run four groups. There is going to need to be some recursiveness and overlap in

order to make that happen.

MS. REYNA: Maybe a good way to decide would be to ask people who can envision being on d) whether they feel that they need the information on a) before they can really pursue their task --

MR. WILLIAMS: -- which materials will fit a)? You don't know that because you don't know what a) has done.

MS. REYNA: Start with a), not with d).

MS. BALL: I think we're losing a little track of what these mean, at least as far as I interpret them. Because a) asks, and I think properly, what's the range of mathematical skill with algebra as a focus, what is it that students have to learn. And Russ said earlier there are two sources of evidence. But these others aren't all narrowly focused on curricula for algebra. Like for example, d) is going to include what research is there on instructional practices of particular kinds and what affect do they have on student learning. That's not all going to be research on algebra. And neither is the teacher knowledge question all going to be algebra.

We are supposed to be investigating what the evidence base is for things in these categories, and the amount of overlap you're anticipating I think will be just fine. But it's beginning to sound as

though we thing b), c) and d) all follow from a). And I don't think that they do. There are other research studies and other kinds of evidence to consider besides what a) will answer.

CHAIRMAN FAULKNER: I agree with that, Deborah. Yes. Dan?

MR. BERCH: At the risk of muddying the waters further, let me suggest that you don't necessarily have to divide up according to these letters or numbers as the case may be. Certainly the report -- what you come out with must speak to each of these issues. And it seems reasonable to start with that. But if you find that there should be, you know, elements of each that need to be regrouped in ways that will help you get back to this more effectively, it's certainly possible to do that. Again, that may be opening a can of worms but --

CHAIRMAN FAULKNER: What I'll agree to is once we get these groups appointed and each one has a chair, the chairs can trade subject matter.

VICE CHAIR BENBOW: I just think we're heading -- we've decided we're going to head west, all right. And everybody's heading in that direction. We can do the short course adjustments later on and get aligned later on if we decide that, you know, west is San Francisco, not Portland. But, you know, I think we can get going and know we're heading in the right

direction and get a lot of work done.

CHAIRMAN FAULKNER: Russell?

MR. GERSTEN: I think I could, and I think Deborah could answer Bob's question about how group d) could function simultaneously with a). There are practices, some of the work done in pre-K and K on building a sense of number and operations and estimation and magnitude and work in fractions and proportion and rational numbers that definitely make sense to explore implications of that while the group is finalizing the algebra course. So I think they can be done concurrently.

CHAIRMAN FAULKNER: Okay. Yes?

MR. SCHMID: Well, to me, it seems at least intuitively obvious that certain things are necessary for algebra. Maybe, again, we can use some common sense. So I would think that if children are to be successful in algebra, there must be a number sense. There must be an ability to calculate relatively early. There has to be the ability to calculate with fractions in early middle school. And if we sort of in the large agree to these, then that can perfectly well inform the discussion of subject d). And that is, of course, what I would argue for. There are some obvious things that would be necessary for success in algebra. And I don't think there has to be a lot of discussion of those before you can

profitably talk about d).

CHAIRMAN FAULKNER: What we will do next, I think, is start getting these four groups set up. I will ask all of you where you want to be, so you might want to give some thought to it. You may know the answer right now, but you don't have to give us. We'll do this by email. And we'll get the groups set up.

We do need to talk about subsequent meetings. My preference would be to set the subsequent meeting dates up, all of them, soon. Where are we, Tyrrell, on knowing anything about anybody's calendar.

MS. FLAWN: I have no information on anyone's calendar.

CHAIRMAN FAULKNER: Okay. Well, we're going to need to work on that right away. I'd like to try to keep a pace up pretty aggressively in the next several months so that we can get as much as we can get done done before the first of February of next year. And I think we'll just have to check on your schedules now, right?

MS. FLAWN: So the thought would be to have another meeting in say eight weeks and then eight weeks --

CHAIRMAN FAULKNER: Something like that maybe. Maybe even sooner. Six weeks?

MS. FLAWN: [Off mic]

CHAIRMAN FAULKNER: Tom says five.

MR. LUCE: I think we're talking about the entire group and the sub groups are going to have to go on --

CHAIRMAN FAULKNER: I think at the next meeting, we ought to schedule a group of the whole, I think, again. We're still forming ourselves, and I think we ought to do that. After that, it's not out of the question we could do some separate subgroup meetings. But let's try to get the whole group together. And I think the signal I got from the Assistant Secretary was six weeks.

MR. LUCE: I just didn't know if you mean meeting of the whole or of the subgroups and whether you were having them work in the interim. That's all.

CHAIRMAN FAULKNER: I think it should be the whole next time and then I think we can talk about mechanics. But we ought to get three more dates set up, I believe, separated by roughly six week intervals, something like that?

MS. FLAWN: And is that here in Washington or --

CHAIRMAN FAULKNER: Well, my inclination would be to try to publicize what we're doing here around the country and maybe to marry the meeting sites around the country. But do you have any sense

of that yourselves? Everybody, who wants all Washington? Who wants anything but Washington.

[Laughter]

Who would like to see us be in other parts of the country so that the nation gets a little more knowledge --

MR. LUCE: I think, in particular, if you're not having great deal of public hearings across the country, it would really help to publicize the work of the commission, the Panel, if it were held in different parts across the country. We do face a message issue to the country in terms of the importance of math for everybody. And one of the hopes of the Secretary is that the work of this panel would help communicate that.

CHAIRMAN FAULKNER: Let me ask a question.

MR. LUCE: But that's up to the Panel.

CHAIRMAN FAULKNER: Let me ask a question, though, of you. Actually, I think it was in Karen Akins's talk where it said we would be meeting in Washington unless we have a special dispensation.

MS. FLAWN: We can --

CHAIRMAN FAULKNER: Dispensations are possible.

MS. AKINS: Special permission, yes.

CHAIRMAN FAULKNER: Okay.

MS. FLAWN: It's just a matter of filing

the information then --

MR. LUCE: She can't hear you without the microphone, Tyrrell, is what she's saying.

MS. FLAWN: I'm just saying that we can meet in other locations, and the Management Organization Committee will help us do that. So wherever you all would like to meet, we can provide the necessary information ahead of time.

CHAIRMAN FAULKNER: Okay. We'll work on that. Are there other items that need to be talked about -- organizational --

MS. STOTSKY: Did you clarify the subcommittee meeting? I'm sorry. I didn't quite hear. These were the plenary meetings, right?

CHAIRMAN FAULKNER: We're talking -- I mean I think at the next meeting, we will have at least some plenary activity, but mostly it will be subcommittee activity, but we will meet as a whole group.

MR. WU: We're not going to set a date now? By email?

CHAIRMAN FAULKNER: I think it's going to be impossible to do it around this table. Let's do it by staff work.

[Off mic]

CHAIRMAN FAULKNER: Well, I wouldn't know anything about my own schedule, so we might as well

wait and do it.

MR. SCHMID: Will future meetings again be in this format, let's say essentially one day of meeting, or will there be an attempt to let's say have two days?

CHAIRMAN FAULKNER: That's a good question -- think about it. It's not out of the question that the next meeting, for example, might benefit from a little bit longer time so that the task groups can actually engage for a little longer time, especially in their first engagement. That's something worth thinking about.

MR. SCHMID: Well, if we have a two-day meeting, it would be conceivable that various subgroups can at least come up with enough for even the preliminary report. But so I would argue to have the next meeting at least for two days.

CHAIRMAN FAULKNER: It's definitely worth thinking about. Thank you. Any other comment on that? Any reaction to that? The Reading Panel, did they do multiple day meetings, Dan?

MR. BERCH: Yes. It varied somewhat. I don't know the exact, you know, for all the different meetings they had, but we can get that information.

CHAIRMAN FAULKNER: Well, there's only so long you can usefully be in a committee meeting, but if you're combining subgroup work, it can be useful to

have a little more time. I'm not sure what else we need to do. I got a message that Ralph Cicerone might want to read us. We're on our way out of here, right?

MR. LUCE: Yes. That's fine. You can go ahead and adjourn. He just wanted to welcome everybody. I'll pass on each welcome. He wouldn't want to hold everybody up.

CHAIRMAN FAULKNER: I'm sensing that we have reached the natural adjournment point.

(Whereupon, at 2:34 p.m., the National Mathematics Advisory Panel Meeting was adjourned.)