U.S. DEPARTMENT OF EDUCATION

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NATIONAL MATHEMATICS ADVISORY PANEL

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Wednesday
September 13, 2006
9:00 a.m.

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Auditorium
Broad Institute
7 Cambridge Center
Cambridge, Massachusetts

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PANEL:

DR. LARRY FAULKNER, Chairman
DR. CAMILLA PERSSON BENBOW, Vice Chair
DR. DEBORAH LOEWENBERG BALL
DR. A. WADE BOYKIN
DR. FRANCIS (SKIP) FENNELL
DR. DAVID C. GEARY
DR. RUSSELL GERSTEN
MS. NANCY ICHINAGA (NOT PRESENT)
DR. TOM LOVELESS
DR. LIPING MA (NOT PRESENT)
DR. VALERIE REYNA
DR. WILFRIED SCHMID
DR. ROBERT SIEGLER
DR. JAMES SIMONS
DR. SANDRA STOTSKY
MR. VERN WILLIAMS
DR. HUNG-HSI WU

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I-N-D-E-X

P-R-O-C-E-E-D-I-N-G-S

(9:07 a.m.)

MR. FAULKNER: I'm Larry Faulkner. I'm Chair of the National Math Panel, and Camilla Benbow is sitting on my right and she is vice chair, and we welcome everyone in this room to this third meeting of the National Math Panel, which is occurring here in Boston. We are very glad to be here in Boston, which has had such a long history of influence on universal education in the United States and in fact globally.

We also want to express our appreciation to Massachusetts Institute of Technology (MIT) for hosting this. I contacted President Hockfield's office some weeks ago about the possibility that MIT might host it, and MIT's folks have been entirely hospitable. We are very grateful for what they have done to facilitate this.

And we are about ready to go on with our agenda. I want to point out to everyone who is sitting around the conference table or people who will be making presentations that you need to push your green button on the microphone in order to have whatever it is you will say be recorded for posterity, and you may need to push it so that the people in this audience can hear you. So let me ask you to do that at the appropriate time. When you see a red light,

your microphone is on and when you don't want to be heard, then I suggest you turn it off.

(Laughter)

MR. FAULKNER: We begin our session today with a session on focal points. This is a particularly timely session because of the announcement that was made yesterday by the National Council of Teachers of Mathematics (NCTM), and we'll be going straight to that presentation. Several people have come to join us and be with us as presenters. I'm going to ask Skip Fennell to introduce them.

However, before we do that, I want to ask if there is anyone in the audience who requires the services of the signers. We do have signing services here and we are happy to continue them, but we will not continue them if no one is using them, so I would like to ask if there is anyone here who needs that service. If not, then we will discontinue and we can obviously recontinue at any time, if someone arrives.

The session on the focal points is our next item and Skip Fennell, who is President of the National Council of Teachers of Mathematics, is the obvious person to do the introductions.

Skip, please?

MR. FENNELL: Thank you, Mr. Chairman.

It's my privilege to introduce three of

the writers of the NCTM curriculum focal points that were released yesterday. You'll be hearing from Doug Clements who is a professor at the State University of New York in Buffalo. You'll be hearing as well from Sybilla Beckmann who is a professor of mathematics at the University of Georgia. And you will be hearing initially from Dr. Jane Schielack who is a professor and now Associate Dean at Texas A&M University in College Station.

So I'll turn this over to my three able colleagues and they'll tell you all about approximately two year's worth of work. Thank you.

MS. SCHIELACK: Good morning. We want to thank you for inviting us to this meeting of the National Math Panel, and we really appreciate the opportunity to share this new publication from NCTM released yesterday morning at 9:00. So, the Curriculum Focal Points for Pre-Kindergarten through Grade Eight Mathematics: A Quest for Coherence, and we have provided you with a copy. We got them yesterday so, if you haven't had a chance to look at it ahead of time, I'm sorry about that, but we hope you have a chance to look at it now.

The information in this publication provides possible solutions to two major ongoing issues, which confront today's mathematics teaching

and learning. First, in the attempt to address the improvement of mathematics teaching, state curriculum frameworks have evolved into long lists of learning expectations, lists that range in some states from 26 to 90, in others, and per grade level. They vary widely in terms of which grade contains particular content topics, so this new publication identifies three curriculum focal points at each grade level, pre-K through 8, as the most important mathematical topics for that grade level.

The focal points, as well as identifying the major components of the mathematics curriculum at each grade level, are also arranged across grade levels to consistently build student learning and preparation for further mathematics learning, particularly in algebra.

The second related issue is that math instruction in the United States is suffering from an emphasis on breadth with a resulting lack of depth, a characteristic that has caused our curriculum frequently to be described as a mile wide and an inch deep. A lot of you have heard that phrase.

In this publication, if you'll look on page 15 or somewhere in the middle there, you'll see the three curriculum focal points for a grade level, and they are accompanied by the sidebar on the right

where there are connections to create a cohesive cluster of related ideas, concepts and skills for that grade level. The structure provides a foundation for increasing depth of understanding in core mathematical areas, such as number and operations, geometry and spatial sense, within the context of important applications involving measurement and data.

The curriculum focal points represent a consensus of ideas for a cohesive math curriculum, as the writing team incorporated feedback from a very broad spectrum of experts. If you'll flip to the front of the document, you can see the lists of reviewers that were involved. They are on pages 9 and 10. The formal reviewers include the mathematicians, such as Jim Milgram from Stanford University, mathematics education researchers, such as Jeremy Kilpatrick from the University of Georgia and Joan Ferrini-Mundy from Michigan State University, and state supervisors, such as Norma Torrez-Martinez from the Texas Education Agency.

The result of all of this input for us is a practical guide for significantly improving the mathematics curriculum at pre-kindergarten through grade eight. We view it as the next step for implementation of the standards into the classroom. For students and parents, focal points provide clear

direction as to the importance of particular topics. From a teacher's perspective, they provide a focus that provides sufficient time for students to build understanding of concepts and develop and apply skills, and for schools and states, they allow for assessment to truly target what's being taught as the focus in the curriculum.

Doug Clements will now highlight some of the aspects of the focal points for pre-kindergarten through grade three, and he'll be followed by Sybilla Beckmann who will do the same for grades four through eight.

MR. CLEMENTS: Thank you.

The years from pre-K through the primary grades are essential to children's development in mathematical competence. Consider two findings from research -- one speaks to the mathematics as the core competent, a core competent of cognition, and the second to equity. First of all, mathematics is predictive of later mathematics achievement; early mathematics is predictive of later mathematics achievement but also later achievement in literacy in reading, whereas, for example, early literacy skills are only predictive of reading. In the equity sphere, gaps between income groups and between nations are as wide at ages three and four as they are in the

elementary years.

So there are significant gaps there, but the good news is the curriculum and programs using research-based developmental trajectories of mathematical concepts and skills close those gaps. In some cases, lower income children can outperform their middle class counterparts after experiencing those programs.

Regarding mathematical content, number is key, but important also is geometry and spatial skills. For example, research shows that early geometry work leads to higher mathematics achievement in second grade, but also higher literacy achievement and also higher IQ scores. So, upon these two domains, number and geometry, we build the foundation for mathematics.

Let's start looking at the curriculum focal points for pre-K on page 11. Development of whole number concepts and skills begins with two methods of quantification, recognizing the numerosity of small sets and counting, the first and most basic mathematical algorithm. Counting follows a developmental progression, for instance, from verbal counting, to correspondence in the counting of objects to understanding the Cardinality Principle. In geometry and spatial sense, children observe and

describe shapes in the environment and the relative position of objects and develop the initial foundations for measurement.

Skipping ahead over kindergarten to first grade for a minute, now on page 13, in number and operations, children develop strategies for adding and subtracting whole numbers based on their pre-K to kindergarten work with small numbers. For example, children use both more sophisticated counting strategies, such as counting on, and syllabatizing or quick recognition of small numerosities, which for example, encourages them to count on from a recognized addant, rather than the less sophisticated strategy of counting all items. They use properties of addition, such as commutativity and associativity, to move to increasingly sophisticated strategies, such as making tens.

Also, in number and operations, children compare and order whole numbers, at least to 100, thinking of whole numbers in terms of groups of tens and ones and representing numbers on a number line. In geometry, the growth from pre-K's naming and describing shapes in the environment to kindergarten's modeling and constructing a variety of shapes lead to first grade composing and decomposing plain and solid figures, thus building an understanding of part/whole

relationships that aids connections to the same notions in number as well as the knowledge of the properties of the original and the composite shapes.

Please turn to second grade. In number and operation, students use the understandings built in pre-K, K and 1, the understandings of addition, to develop quick recall of the basic addition facts and related subtraction facts. They use models, number relationships and properties, addition and subtraction to develop fluency with efficient procedures, including standard algorithms, to understand why the procedures work and solve problems.

In measurement, noting that geometric knowledge can synthesize numeric and geometric, or geometric measurement can synthesize numeric and geometric knowledge, children develop an understanding of the meaning and processes measurement, including underlying concepts such as partitioning and transitivity. They understand linear measure as an interaction of equal units and they use rulers and other measurement tools with that understanding.

Quickly summarizing grade three, on the next page, in number and operations in algebra, children develop understandings of multiplication and division and strategies for basic multiplication facts and related division facts, and they develop

understandings of fractions and fraction equivalents. In geometry, they describe and analyze properties of two-dimensional shapes. Now Sybilla will build on these ideas as she describes the curriculum focal points for grades four through eight.

Thank you.

MS. BECKMANN: Thank you.

Students leaving eighth grade should have all options open to them. To succeed in higher-level mathematics, students need a solid foundation in numbers and operations and in geometry and spatial sense. To succeed in algebra, students must be fluent with arithmetic, and they must be able to apply the properties of arithmetic, so the focal points emphasize algorithms of arithmetic, including the standard ones, and repeat the theme of developing the algorithms, understanding them in terms of place value and properties of operations, becoming fluent with them and using them to solve problems. This theme is consistent with the findings on whole number arithmetic of the National Research Council report, Adding it Up, as well as with the recommendations of the National Council of Teachers of Mathematics' Principles and Standards for School Mathematics and those of the Common Ground Group, among others.

Why emphasize spatial sense and geometric

measurement? A key skill in higher-level math and science is visualizing a situation and then analyzing it mathematically.

Please look at grade four on page 16.

The first focal point is on multiplication. Students develop quick recall of the basic multiplication and division facts. Extending grade three work, we repeat the theme of students developing algorithms, including the standard one, becoming fluent with them, understanding why they work in terms of place value and properties and using them to solve problems. The third focal point is on area, which connects to multiplication via areas of rectangles in two ways; first, the multiplication algorithms and their use of the distributive property can be viewed in terms of decomposing rectangles. Second, the use of multiplication in the area formula for rectangles can be justified by decomposition into unit squares.

Please look at grade five on page 17.

The first focal point is on division. We repeat the theme of students developing the algorithms, including the standard one, becoming fluent with them, understanding why they work in terms of place value and properties and using them to solve problems. In the second focal point, students develop

fluency with and understanding of addition and subtraction of fractions and decimals. The third focal point is about two and three-dimensional shapes, especially volume and surface area.

Please turn to grade six on page 18.

The first focal point concerns multiplication and division of fractions and decimals. As with addition and subtraction, students understand why the procedures make sense and they multiply and divide fractions and decimals to solve problems. The second focal point concerns ratio and rate, viewing ratio and rate as a direct extension of whole number multiplication and division work.

Please turn to grade seven on page 19.

The first focal point is about ratio and proportionality, including percent and similar figures, and extending sixth grade work. The second focal point concerns area and volume and extends fifth grade work. Students develop, justify and apply formulas for volumes of prisms and cylinders. Please turn to grade eight on page 20. In the first focal point, students extend their seventh grade study of proportionality to the study of linear equations. The second focal point is about analyzing two and three-dimensional space using distance and angles. It includes applications of parallel lines and explaining

and using the Pythagorean Theorem.

Students who have learned the material in these curriculum focal points for grades pre-K through 8 will be prepared to succeed in higher-level mathematics.

We are now ready for your questions.

MR. FAULKNER: Thank you all for making the presentation and for taking the time to be with us today. I open up to the panel the opportunity to ask questions of this group.

David?

MR. GEARY: My question is, so, for example, you have, on page 15, developing understanding of fractions and fraction equivalents, is the intention that fractions be introduced in third grade or that there be some preliminary introduction of that in earlier grades?

MS. SCHIELACK: The focal points are really designed to highlight the focus at a grade level, so certainly in grade three there would be a majority of instruction about fractions. This is an example of how a curriculum could be built, and I could certainly imagine that a district or a school would take this and say if we are going to focus on fractions at third grade. There might be some things we want to look at in second grade in terms of

dividing up into equal groups or something like that. But there are focal points for second grade that they have to make sure they don't take time away from as well.

MR. CLEMENTS: And, building on that, the work that I was mentioning in geometry for composing and decomposing shapes obviously lends itself in first and second grade, to a large part of establishing that kind of cognitive foundation for fraction work, at least in the area way. The composing and decomposing of numbers similarly lends itself to talking about, informally, those kinds of ideas leading to a focus on the fractions, per se, at third grade.

MR. SCHMID: I would like to ask you about how you reached these particular recommendations. Some countries reach these objectives more rapidly than you are recommending here, is this based on what's typical in the U.S. or is there some reason to think that this is a better way to do it? How did you get to your conclusions?

MS. SCHIELACK: I'll start with just some general things and then let Sybilla and Doug put in more ideas, as they think of them.

We started with a lot of information, as most groups do like that, we looked at curricula from the 49 states that already have it, we looked at

curriculum from other countries that are doing well in the mathematics achievement area. We looked at the research that's out there about what's happening at what grades, in terms of students developing understanding. And we had, as you see, input from the reviewers from a wide perspective to get their reactions and many of them suggested those kinds of areas as well, and by fitting all that together, that's how we came up with the placements for them.

There are always going to be differences between what's out there and what was proposed, but one of the things we had in mind was that we wanted this to be a doable step for a lot of people and so we did look at what is in existence, but we didn't let that drive our selections totally.

MR. FAULKNER: I would like to actually follow that up with a question about a little history. I would like to hear you say why this group was formed, when it was formed, the motivations and then the mechanics. You are listed here in the book as members of the writing team and, in particular, I'm interested in the question of does that mean that you decided on the recommendations and the content or was that done by some other or larger group. So could you cover this whole series of questions--

MS. SCHIELACK: Certainly.

MR. FAULKNER: --about origin, motivation and mechanics?

MS. SCHIELACK: Certainly. I think one of the goals of the NCTM, as a group, is always to support what's happening in the classroom and so when the standards in 2000 were presented, of course the next question is how do we make these things happen well? And in my work with curriculum in Texas, one of the main questions that's always asked is which things are most important, which I spend the most time on, how do I fit things together to make it make sense. Because I don't have time to spend the same amount of time on my 60 objectives during the year or whatever it happens to be? So that, coming from a lot of states, was I think the impetus for this.

I know that I worked with Kathy Sealey for a long time and when she was in Texas that was one of our goals in Texas. We have these kinds of statements at the beginning of our state curriculum, and it was brought into the national arena and then followed up by NCTM with this, so that was the impetus, how do we make the standards that people have for states more doable in the classroom and more coherent across the curriculum for everyone, in terms of making decisions?

NCTM put the writing group together. I think Kathy was president at that time, but it has to

be approved by the board, so they looked for representation and I was asked to chair the group. So I wasn't involved in the selection of the members, so I'm not sure all the details about that, but I do know that in the group that we had, we were able to organize into grade level groups that contained a mathematician or mathematics educator from a university level and a teacher type person who was in a supervisory position or had been in the classroom, so we tried to have sort of a dyad of that experience for each writing group at pre-K through two, three through five and six through eight.

So, with those groups, we worked together with the input that we had from the Center for Study in Mathematics Curriculum that Barbara Reyes leads up in Missouri. We started with some of their research about the curriculum that exists and what the issues are, and we put together a first draft and sent it to the list of formal reviewers that you see. And that list was crafted very carefully to include a variety of groups of people, mathematicians, mathematics education researchers, state curriculum directors, policy makers, people involved in assessment and classroom practitioners, and so we worked very hard to get input from them.

I was the follow up person so I can show

you how many e-mails I sent saying please respond, please respond, and most of them did with wonderful sets of input.

Our second meeting had tables full of their input, we worked on incorporating those to come to a consensus that supported what they provided to us and we sent out a second draft to a separate --. I guess we didn't send it out formally, we had people that we had been talking to about that and that's the informal list of reviewers that you see that had another chance to look and see how things were going, and then it was approved by the Board of NCTM.

MR. FAULKNER: But what I'm hearing you say is you weren't just a writing group; you were also the deciding group.

MS. SCHIELACK: Oh, definitely.

MR. FAULKNER: I mean you were really, lock, stock and barrel, the panel that was put together by NCTM to do this.

MS. SCHIELACK: Yes, and we were the deciding group of what went to the board and then the Board of NCTM was the final deciding group of it going forward from NCTM, yes.

MR. FAULKNER: Okay.

Please, Diane?

MS. JONES: I want to congratulate you on

this effort. I think bringing focus to this laundry list of lessons is a really important step forward. I haven't had time to read it, obviously, but I'm wondering if, in the focal points, if you comment on where calculators might be introduced? I notice that, in third grade, you talk about multiplication, division, let's see, basic multiplication facts. So I'm wondering, you know, do you recommend in here where calculator use might be appropriate, where it may not be appropriate, or did you not touch on that issue in these focal points?

MS. SCHIELACK: We did not touch on that for a specific reason. One of the things that we tried to do, because we were trying to provide something different, was make this as concise as possible, so we made a conscious decision, much to our pain sometimes, not to address instructional pedagogy at all, and so the decisions about what tools to use, the decisions about what materials to use. The decisions about what instructional strategies to use are not addressed at all.

MR. CLEMENTS: With the one caveat that of course any document that lays out a vision of the content like this has implications with it that any approach or strategy should be at least consistent with. For instance, connections between various

mathematical ideas to establish solid foundations of understanding and skills would be important, but that's, we left it at that, we didn't really specify anything about technology, or curricula or other kind of means to the end.

MR. FAULKNER: Sandra?

MS. STOTSKY: To the extent that you are aware of state assessments in mathematics, I wondered if you would comment on any implications that might come from in terms of the organization and the shape of state assessments based upon this?

MS. SCHIELACK: Well I can start, I've been involved in the Texas one and I don't know, Sybilla, if you've been involved in Georgia or not. I see it as being the same process that's going on right now. As a state refines their curriculum, which many of them have done since they put their state testing in place, they look back at their curriculum, say, well, maybe there are some things that we need to do differently. And then the assessment group gets together and says, okay, what do we need to change about the assessment to make it match again? And we've gone through that process I think three times now in Texas.

I see that being the same thing, that this is a document to generate more discussion about the

curriculum that exists out there and if a group is making changes in their curriculum, then they will be working with their state assessment group to make comparable changes in their assessment as they go.

MS. BECKMANN: Well and I think of course it would make sense for the assessment to focus on these focal points.

MR. LOVELESS: My question actually is very similar and it's a follow up.

The 1989 NCTM standards were very influential, more than 40 states used them to create their own standards, the National Assessment of Educational Progress (NAEP) framework is based on the 1989 standards. Can I take it from the focal points and did you discuss as a group that we should draw from this document that all of those standards documents need to be more focused and that they should be looking to this document to clarify what that focus should be?

MS. SCHIELACK: And all the state documents should be more focused?

MR. LOVELESS: Both the state standards and the NAEP framework.

MS. SCHIELACK: I think that's a reasonable conclusion, yes.

MR. BOYKIN: A question to Professor

Clements. Can you provide the references to the studies that report on programs and activities that lead to the gap closing outcomes that you mentioned?

MR. CLEMENTS: Sure, I would be glad to do that, I'll just e-mail to Skip and he can disseminate it to you.

MR. BOYKIN: Thank you.

MR. FAULKNER: Valerie?

MS. RENYA: And just to revisit Professor Siegler's earlier comment, I don't know if we, I heard quite the answer, in terms, and let me broaden it just a bit. Any empirical evidence regarding critical skill progressions or sequentiality here, whether it's comparisons with other countries or studies here within our curriculum context? So, in other words, why did we decide at these ages these competencies compared to other countries that might have different standards?

MR. CLEMENTS: I think Jane addressed that as much as I can, other than I think that there are empirical studies of these developmental progressions or what ages, but the ages are tricky, any time you find ages, especially if it's longitudinal studies, it's based on things as they exist now. We would like things to be better in mathematics education, so there is always the potential for those ages to move down a

little bit. But the emphasis on this was in following, I think, a coherent developmental progression from grade to grade, more than it was about finding if five and a half or six was a better age to do this.

Nevertheless, we did look at the kind of studies, many of the people represented in this room have conducted such studies, that gave us an indication about these ages, the ability of the kids to learn various ideas at various ages but, like I say, the most important thing is how these ideas play out over several years of mathematics education.

MS. BECKMANN: And I would say also that these do follow a natural mathematical progression and I believe they are not so far off from what is done in some of the high performing countries. I mean of course there is always going to be a little bit of variation here and there.

MR. FAULKNER: Let me follow up on that briefly. Professor Schmidt has published extensively on the outcome of the Trends in International Mathematics and Science Study (TIMSS) and has put together this sort of A-plus kind of set of what amount to focal points, a kind of composite of top performing countries, and makes a point of the coherence that exists within that set. Could you

comment on the degree to which you see this matching up to, differing from, looking the same as, looking different from what he calls out in that A-plus profile?

MS. SCHIELACK: I actually did a correlation to some materials that came out of an Achieve group that I think used that. We didn't --. Did we have that directly in--

MR. CLEMENTS: I don't think we did a correlation--

MS. SCHIELACK: No, I don't think we did a correlation to that one, we certainly looked at the document. We did look at the Achieve list and matched it up and there was, I would say, an 85 percent match to things and the differences were maybe one grade level different. So we really tried to go to the sources of the, we had the Singapore curriculum and the Japanese curriculum and those were the two that we looked at.

Does that answer your question?

MR. FAULKNER: Camilla?

MS. BENBOW: When I was listening to you, you talked about something that was very doable, and what about if you wanted to add challenge to it or you wanted to push up achievement, do you have recommendations of how you might want to proceed a

little faster and so that the interpretation isn't of the person in the school necessarily but what kind of recommendations do you have or are you thinking about in the ahead, if you like to think about maybe we can accomplish this a year earlier for all students or is that possible? How do you think about individual differences and adding a little bit of challenge, more challenge, to these focal points?

MS. SCHIELACK: There is actually a formal comment in here about that. There are of course a lot of places that recommend eighth grade algebra, and this is a pre-K through 8 document and that was done on purpose because there are also a lot of places that teach eighth grade mathematics and we want it to be a good course as well.

It's appropriate to think about eighth grade algebra with the caveat that the main important ideas that are brought out in the focal points for eighth grade would then need to be compressed into sixth and seventh, that they are not throw away things, they are things that need to be connected, so it would require some time management and some curriculum adjustment for that.

MS. BECKMANN: Can I make a comment also? I think, in mathematics, it's always the case that in any given topic you can go deeper, you can go more

deeply into it. You can give more challenging word problems, for example, so that is certainly one way, always, in mathematics, to make things more challenging.

MS. BENBOW: I think that acceleration and enrichment always have to work together or else they don't work but, as I think about it, a lot of schools do have, as you said, eight grade math. A lot of schools also offer, I mean algebra, eighth grade algebra, also offer it in seventh grade and I personally, from my perspective, don't think that eighth grade is very accelerative. I think seventh grade is.

And I think it would be very helpful, as you think about the future, and I think this is excellent, you know, this is just trying to make something even better, to think about how you would do it if your plan is for a certain group of individuals in your school or whatever to get to the seventh grade, to get to the eighth grade, so that it continues in a logical way so that the deep principles of this plan actually get carried out.

And it may not be a very good idea to perhaps, in fifth or sixth grade, to say this is where we compress. Maybe we begin earlier. Have you thought about how you might, how this thing could stretch or

compress?

MS. SCHIELACK: I mean I think those are good points because one of the issues that I've seen in acceleration in particular in schools is that they skip things rather than compressing them, and it's easier to skip little pieces. So, if you do have the focal points, it might prove to be a better way to look at what you are addressing, if you are going to accelerate.

MR. CLEMENTS: And when they skip, as you know probably better than most, they often skip and do routine, mundane mathematics of a later grade, rather than as you were, I think, implying, both enrichment and acceleration for those children for whom that's appropriate.

MS. BALL: I want to join my colleagues in applauding you for this work, I think it brings clarity to what has been an often chaotic specification of curriculum, but I have a question that goes a little different, has a little different focus than, excuse the use of the word focus--

(Laughter)

MS. BALL: --than the other questions that you've been posed, and that has to do with the unusual way in which curriculum has guided us in this country and I wondered about whether this is something that

you had considered. NCTM is clearly not a governmental agency or a curriculum writing group, you are an important professional organization that unusually brings together people from a variety of professional disciplines that form together the mathematics education enterprise.

However, I wondered about your thoughts about the direction, whether this country, in its comparison to other countries, differs in the sense that everything is done locally, and your document continues to suggest, and I'm following up on my colleague's comment, as though states should continue and even localities should continue to set curriculum. And I wondered about your thoughts about that, it strikes me that as long as we continue to think of curriculum as something that's somehow idiosyncratic and developed locally, we aren't likely to make the focus, make the gains on the kind of focus that your document represents, and I'm curious about that and your comments about that.

MS. SCHIELACK: Well I'll speak for the writing group in that we think this is a really good idea and so we are hoping that it's acceptable to more people and will lead us into the direction of more cohesiveness. But as you said, we are not the body that can change the way the curriculum decision

is being made, so--

MS. BALL: Can I ask, just push on this a little bit? What are the reasons not to move to a national curriculum? Can I ask it backwards?

MS. SCHIELACK: I can't provide any reasons, Deborah, for not doing that, but I don't think that that was NCTM's purpose for this.

MS. BALL: It just seems like you are coming rather close to it but yet silent on that question. Not that you should mandate it, but I'm curious about it as a professional organization concerned with the lack of curriculum focus, what about that as an avenue, in addition to the specification of topics?

MR. CLEMENTS: The lack of consistency and coherency across the states and across locales hurts kids, it's hurting kids in the United States, that's my own personal view.

MS. SCHIELACK: And I think you are asking me to say why doesn't NCTM say that and I am not in the position to respond to that.

MS. BALL: No, I think I'm asking you, as professionals who have thought a great deal about curricula coherence, is there an argument against a national curriculum that you can think of?

MR. CLEMENTS: Not that I've ever come up

with.

MS. BALL: You people have thought a great deal about this.

MS. SCHIELACK: Personally, no.

DR. SCHMID: Yes, I also want to congratulate you on this achievement, I think it certainly changed my opinion about NCTM, I must confess.

But then perhaps I should ask Deborah's question, get the same substance, slightly differently. Do you expect that NCTM will be as aggressive in promoting this document as a basis for rewrite of state curriculum guidelines as was the case with the 1989 and 2000 documents?

MS. SCHIELACK: I think so and I, at this point, we have gotten very positive responses from states about it being a helpful view and a helpful document and we are already being invited to come to their curriculum revision meetings to present this information.

MS. JONES: I do believe that the documents that come out of NCTM are quite influential, both on state standards but also on textbooks, and so I'm wondering what interactions you've had with textbook publishers at this point because clearly those of us who have watched children carry 80 pounds

worth of books to school sort of applaud this idea, that maybe we would get away from the mile wide and inch deep and actually focus. So have you had discussions with textbook publishers and what are your thoughts on moving the textbooks to actually meet these standards?

MS. SCHIELACK: I think that kind of fits into the assessment question as well, that it's something that will follow the implementation of the curriculum because certainly the textbook publishers want to match what people are wanting to teach, so I can see it as being a direct influence on what they are able to produce and to have a more cohesive set of materials at each grade level I think would be beneficial to them.

MS. JONES: I mean because, in some sense, this is how you drive toward a national curriculum is through the textbooks that are used across the country. I mean there is the issue of the Constitution. I think that begs the question about a national curriculum.

(Laughter)

MS. JONES: But I do think textbooks are the way that we, in some ways, achieve a national curriculum with some degree of variability and so I think it will be important to continue working with

those publishers, and writers and editors.

MR. FAULKNER: We are going to need to come to a close here, but we have two more questions, Dan Berch and then Wade Boykin.

MR. BERCH: Thank you.

Well I do understand that you are looking at content here and not pedagogy, but one question is whether you would agree that the likelihood of implementing these focal points successfully will depend in large part on the nature of the instructional procedures? And two, while you don't speak to those very extensively which, again, I understand the reason for that, I find it interesting that your focal points are developed in a manner to be developmentally sensitive, if not appropriate, developmentally appropriate, but yet on every page and for every grade you use the same statement that these focal points should be addressed in contexts that promote problem solving, reasoning, communication, making connections and designing and analyzing representations.

So I guess my second question is would you agree that those procedures, which you haven't explicated, would also have to be developmentally sensitive? And third, would you -- now that I've used up the rest of the time -- would you think that that's

part of your purview in the future or NCTM's, to deal with those issues as well? Not to take away from this document.

MS. SCHIELACK: No, I mean I actually think that's a continuation of NCTM's interest and responsibilities. You did point out to me that that is where we addressed pedagogy, if anyplace, was in that original statement of what we considered the environment that this content needed to be approached in, in terms of problem solving and reasoning.

MR. CLEMENTS: It was always said that those processes are goals too. They are not just pedagogical approaches to the content goals. The processes themselves, the reasoning that lies behind mathematics, and communication of mathematical understanding is as important an end goal as are these content goals. They are very hard to -- we don't have enough research knowledge, they are very hard to lay out. We found it impossible to consider laying those out in a grade-by-grade basis or something like that at the present time and maybe it's never possible.

But like I said before, I think instruction has to be consistent with these goals if it's going to be consistent with the CFP and that includes reasoning and communication and representation, but those should be seen as end goals

as well and important end goals, not just a means but an end as well.

MS. BECKMANN: And I think we should be clear that this can be done in a number of --. This is consistent with different pedagogical approaches. There is no pedagogical approach that's dictated here.

MR. FAULKNER: Wade?

MR. BOYKIN: You touched on this already a little, but I just want a little more clarity on it though. As you go from elementary to middle school, the structure of schooling changes. Could you say a little bit more about how these curricula focal points map into conventional course offerings at the middle school level where you have self-contained math classes, pre-algebra, algebra, whatever the case might be? How do these map into conventional course offerings or does this imply a different way of structuring how we offer math at the middle school level?

MS. BECKMANN: I think these would work wonderfully for self-contained math instruction at the middle grades. I'm not completely sure I understood your question but this is, and certainly it would require a teacher who really does know a lot of math to be able to teach, especially at the middle grades level, that material. I think probably very few

teachers who are generally certified would be able to teach this kind of material proficiently.

MR. CLEMENTS: This is just me, not the organization, again, speaking, but I think the implications are more for the lower grades and the elementary grades, that we have to start taking seriously recommendations to look at mathematics specialists or whatever, as well as upgrading professional development and expectations for teachers at those grades.

MR. FAULKNER: I think we are going to need to break off this session. I do want to thank, on behalf of the panel, all the representatives from the National Council of Teachers of Mathematics who put all the work they did into the focal points and have taken the time to be with us today.

We will move now to a session that relates to the National Science Foundation (NSF) and its interests. This topic session will be led by Kathie Olsen, Deputy Director of the National Science Foundation and an ex-officio member of the National Math Panel.

Kathie is a former chief scientist at NASA, a former associate director for science at the White House Office of Science and Technology Policy, and she has Rosemary Haggett joining her and at least

one other person.

DR. OLSEN: That's right, also Dr. John (Spud) Bradley who is the lead program director in the Division of Elementary, Secondary and Formal Education and Dr. Joan Ferrini-Mundy who is from Michigan State, and she was commenting that she was part of the group for the curriculum in the previous session and she is serving as a consultant to the EASE, which is in the process of being combined with the Division of Research Evaluation and Communication. And the new division will be called the Division of Research on Learning in Formal and Informal Settings, DRL, since we are all acronyms.

Before I start, I want to say that we believe at the National Science Foundation that the work of the National Math Panel is extremely important to our nation and to NSF and, for that reason, Arden Bement thought that it was very important that me, as the deputy, actually provide the remarks. And I do want to note that I am a scientist and so I do speak from overheads and I also change constantly my presentations, so you got the latest update. I think we put it in your packets. All the slides are the same but it's in a different order and if I could have changed it this morning, I would have done that as well.

What I want to do is provide a very brief overview and then I will turn for questions with my team that I have here. If you look at the first slide and it says I really can't talk about the NSF education research without putting it into the context of NSF as an organization. We have a unique mission among the federal agencies for several reasons. Number one, we are the only federal agency charged with funding or supporting research across the entire spectrum of fundamental science and engineering disciplines, so we go from biology, social science, engineering, math, physics, astronomy, etcetera.

We also have a special role in ensuring the nation's research capability, capacity and potential. And finally, we have a special charge to support mathematics, science, and engineering educations at all levels. This is K through graduation.

We turn to the next slide, we are one of the smallest federal agencies with, and we are very proud now because we hit a milestone in the president's fiscal year 2007 budget, we are just at $6 billion. To put it in comparison, NASA, the world's chief scientists, is at $16.8 billion and the Department of Education is $54.4 billion, and we are very proud that we made that $6 billion this year.

The other thing to point out is NSF does not perform our own research as an agency, nor do we implement or directly benefit from the projects we spun. We are also very proud that 94 percent of our $6 billion goes directly into the hands of the research and education community and no other federal agency can actually say that, in terms of really streamlining the production.

Our role is to be a catalyst for progress and new insights into research. We listen to the research and education communities in setting priorities in programs initiatives. We are really a bottoms-up organization. The National Institute of Health (NIH) and NSF are pretty bottoms-up, where the other more mission orientation is more top-down, sort of meeting the bottom. We oversee the merit review process, and it's considered the gold standard in the federal government, by which we ensure that the highest quality of ideas are funded. And we sustain the integrity, efficiency and impact of our programs through a variety of both internal and external evaluation mechanisms and community feedback.

I want to add that the Office of Management and Budget has a part where they actually look at all of the programs in the federal government and the National Science Foundation is the only agency

to get the perfect score, and almost all of the education programs which I'll be talking about today have already been parted and scored at the top.

The next slide, I also need to put the NSF Education and Human Resources, EHR, is a separate line item in the congressional appropriations and it's about $830 million in the fiscal year 2007 appropriations bill that's under consideration for Congress.

Before I get into what we do with our money, I want to put it in perspective. According to the National Center for Educational Statistics, the total amount that we spend annually as a nation on education is $850 billion. State and local governments supply about $600 billion of that and that's in the big box that you see in terms of the slide. The federal government only provides about 10 percent of the nation's total education expenditures or about $85 billion per year, and that's the green box. And in K through 12 education, the number is even lower for the entire federal government and that's 8.3 percent.

The National Science Foundation is only one percent of the federal number or only 0.1 percent of the total national expenditure, or the size of the red box in the slide, in comparison. And with that

little fraction, I said we are expected to do a lot and I believe that we do.

And I also want to point out that the amount that we focus on K through 12, within that box of our EHR, is approximately $260 million, so when you see that it's $260 million, I think we do have a major impact. If we look at the next slide, NSF's $830 million in EHR covers programs in K through 12 and undergraduate education, graduate education and life long education. As I say, we go from K through gray.

Of that, the K through 12 education research programs comprise about $250 million and the K-12 programs specifically geared towards mathematics is only a part of that number. These broad programs consist of investigator initiative research projects targeted towards four broad areas of research and development. Number one is innovative curriculum models and related instructional materials. Number two, models for teacher preparation and professional development. We actually -- Arden Bement says that one of our responsibilities is no teachers left behind as well. Three is education research to fundamentally advance teaching and teacher preparation, and fundamental research on learning.

We know a lot about how children learn language and reading and we are building a similar

base of knowledge about math and science learning, particularly about the diversity of ways that children learn, since not everyone learns in the same way, and Camilla's question was sort of addressing that component in the previous panel. I want to point out that most projects start out at the very fundamental research level with small scale pilot testing followed by revisions based on what is learned.

Because what works in one or two classrooms might not scale up, and this is important, we support field-testing on a larger scale, after which there are usually further revisions before publication. NSF insists on a well thought out evaluation that includes a collection of student achievement data during the field tests. The National Science Foundation is not involved in broad implementation; dissemination is through the publishers, who are the professionals. NSF does not publish. Nevertheless, our relationship with school districts, state agencies, professional organizations, schools of education and the disciplinary programs and the U.S. Department of Education plays an important role in encouraging both.

In the next slide, what I'm going to do is briefly describe five primary programs in our Education and Human Research directorate that supports

K through 12 mathematics education. These are not the only activities that are relevant, as everything NSF funds has a broader impacts component. In fact it's part of our peer review that we use to evaluate proposals and often a part of that component relates to improving K through mathematics and science education, especially in our career grants from our, in our mathematics division at NSF. And I'm just going to talk about the main points because I have the experts that, if you have questions, we can provide details.

We have a program, which is called Research and Evaluation on Education in Science and Engineering (REESE). It's $42 million, our budget request in `07, and it's our fundamental program of basic applied research that will enable educators to investigate what works, why it works, and what contents and for whom. And research proposals address either fundamental questions about learning and education, our synthesis projects, so it's an analysis of findings and drawing conclusions from what is known about a particular issue, so that's the call for the research in those areas.

We also have a program called discovery research, K-12 (DRK-12), and it's a consolidation of our previous programs in the teacher professional

continuum (TPC) which focused on instructional materials development and centers for learning and teaching. And why we did this is we felt that those programs were being stovepiped and we wanted to have a larger program which doesn't say they have to fit into one spot to really increase the flexibility in developing projects of applied research, development of research resources and tools and then capacity building.

In the next slide, we talk about the math/science partnership and we also included to you an evaluation of the program, even though it's only in its beginning. This is a program that we share with the Department of Energy, Department of Education, we have too many E's here in the government but as I was told that E in energy stands for energy and not education. But it's the Department of Education and it's an innovative partnership between institutions of higher education. We really focus on the disciplinary science for the NSF role, working with the department's research education departments in the university, but it's partnerships between higher education, state departments of education, local school systems, business, industry that seek to improve mathematics and science achievements for K through 12 students.

And we fund three types of programs, the NSF role, comprehensive and targeted partnerships, teacher/institution partnerships and research evaluation and technical assistance. And again, all of those involve the disciplinary scientists. I want to point out that that's $46 million in the `07 budget. And we also have MSP Net Organization, which is Electronics Showcase, a resource center and online learning community, serving our 72 supported projects, as well as the wider community.

Our next slide is sort of focusing on, as we say, no teachers left behind, and these are programs that we actually enhance the component of no child left behind of getting good, solid teachers within the classrooms. We have a program called the Royce Noyce Scholarship Program, this is only $10 million, and it's awarded to U.S. citizens who are juniors or seniors that are majoring in STEM and we give them a scholarship to actually take courses in education, get certified in education, and then they are required to work in targeted schools, rural schools or schools which are not meeting the high standards that we expect, and they are required to work at least two years within those schools. It's a relatively new program, so we don't have evaluations on that as yet.

And then we have a graduate teaching fellows in K through 12, and this is $47 million, and this is where graduate students actually work with the teachers into the classroom and it integrates the students and teachers to integrate classroom math and science learning with in depth knowledge and research experience of the graduate students. And we also think that it helps our scientists be able to express science in more lay people terms than sometimes happens within our community. Again, these fellowships are relatively new. The graduate teaching fellowship program in K-12 is $47 million.

So those are sort of the programs that we are highlighting and I think I actually skipped one, which is, no, I didn't, okay, good.

I just want to talk about curriculum development time line, and I want to emphasize that instructional materials development is a lengthy process. The National Science Foundation works primarily in the top part of this chart and that's in the funding decisions, research on curriculum materials, pilot testing, and that we look at as approximately five years.

We do devote a limited amount of funding, about $2 million per year, to research proposals for the downstream investigation of the effectiveness and

impact of products that have been shown to be effective on a small scale. Again, it's very little money, but this downstream evaluation is possible only after there have been publication, a dissemination of the products and acceptance in the market on a scale large enough to provide reasonable sample sizes. It's important to note that the impacts and evaluation after large-scale implementation can be a decade or more down the road.

So, in summary, NSF education, we provide support for investigator initiated research and development in science, technology, engineering and math education, focused on fundamental understanding to build a long-term conceptual foundation for learning, teaching, evaluation and to address important and timely problems in STEM research education. We seek to stimulate the development of a wide range of innovative and imaginative strategies and tools, to understand and evaluate how these tools work in the classroom and to encourage the dissemination and implementation of proven techniques.

To ensure it, again, we depend upon our merit review and we have actually looked it up, 10 of the 17 panel members have served as reviewers for us and in fact, in the last three years, we have had nearly 7,000 panelists who evaluated EHR proposals,

and if you would like the list of the names, we can provide that for the record. NSF is held accountable by our board, the National Science Board, of which Dr. Benbow serves on, and we are very happy that you have now been signed off and I guess are going to be sworn-in in September, but we also look at our advisory committees and our committee of visitors as well as external mechanisms.

In the next slide, I just want to emphasize that our merit review process has two criteria, which the board has developed and the panels evaluate. The proposals are based on peer reviews, outside experts in the field from the diverse backgrounds with a variety of perspectives. They are accountable to evaluate the proposals based upon the merit. We also have other specific things in terms of the use of that.

The next slide, very briefly, is our committee of visitors. This is very important because the committee of visitors actually has two primary responsibilities. They look at the integrity and the efficiency of the processes related to the proposals review, so they actually look at that, do we make the right decisions, are they substantiated, etcetera, and they also look at the quality of the results of the National Science Foundation investments that appear

over time. All of their reviews are on our web and how we respond to the web, it's very public.

And then, finally, I just want to add, in terms of the evaluations of the programs, we have the National Science Board that provides an overview, we have advisory committees, we conduct formal reviews in response to GPRA (the Governance Performance and Results Act). As I already mentioned, OMB has reviewed our education programs and they all got the highest possibly rating. Also, we have a more formal third party evaluation of programs. For example, Abt Associates, in 2005, is assessing our teachers, our continuing program, and every one of our education programs has to have an evaluation component part of that that's also peer reviewed, so it's very, very labored consensus.

So, finally, we do, as I say, do a series of evaluations that all of our projects, much collect data through surveys and other processes. Many of our investigators are awarded funding for proposals to evaluate previous K through 12 education investments to better evaluate instrumentation and methodologies. And we also contract out for external evaluations of many of our education programs to get further assessments of program efficiencies.

We have three programs. I don't have time

to talk about them. They are on your slides. We have the mathematic specialists and this is a slide working with elementary schools to improve math knowledge and teaching. We are evaluating that and we expect results in 2008. We have a program in achievement in algebra, and actually Professor Wu is a member of the panel, is an active member of the advisory committee, and again, we are looking back at connected math in terms of how they are incorporating student testing results in that.

We have programs in terms of integrating biology computational mathematics, basically this is something very important, especially in college because science isn't in stovepipes and disciplines that are asked for questions and we are really looking closely on how we have to change our curriculum to really keep up with, and this is at university levels, to keep up with how we approach science.

And finally, I just want to end up by saying what NSF does and what NSF doesn't. NSF sponsored research projects and experimentation towards the development of tools and instrumental materials in the determination of their effectiveness. NSF requires that every Education and Human Resources (EHR) proposal we fund have an evaluation component, and that component is evaluated by peers for quality

and appropriateness during the merit review process, just like every other part of the proposal, and factors into whether the proposal is selected for funding. NSF does not recommend or endorse math and science instrumental materials or programs, but we do encourage and sometimes fund broad dissemination of results of funded projects and their evaluations. For example, the NSFP Net Organization.

We do not conduct the evaluations of individual project's results itself, but we do make recommendations and decisions on high quality information in terms of the evaluation of the proposals. When we talk about evaluations and assessment that NSF conducts of our mathematical education programs, we are talking about evaluations of programs consisting of multiple projects to make sure that our solicitation and merit review are broadly inclusive, that we are allowing the best ideas to come forward and that our portfolio is balanced, and taken together, our investigators are producing quality results.

And the final slide is that with only 0.1 percent of all funding for education that we wield, we have to have a strategic plan for our impact and our focus is on building strong conceptual foundations, fostering innovation in education and education

assessment through research, dissemination of results and best practices and strong partnerships. And we are really looking forward to the results and conclusions of the National Math Panel because, again, that's one of our bottoms-up approach to help us guide our programs and to help us redefine our focus and make our greater leveraging of our funding.

And so, with that point, I apologize for going over, but I really thought it was important to really provide a view of what the National Science Foundation is, what it's not and the focus that we have on evaluation. Thank you very much.

MR. FAULKNER: Thank you, Kathie.

Questions? Tom?

MR. LOVELESS: There have been a number of criticisms of NSF over the last decade or so with its funding in mathematics and I wonder if you could address two issues for me--

MR. SCHMID: Mathematics or mathematics education?

MR. LOVELESS: Mathematics education. I wonder if you could address two issues. We just heard from NCTM that the focal points don't have a pedagogical bias or they don't take a stance on pedagogy. The critics of NSF believe and have stated that NSF does have a pedagogical bias, that the

programs it has funded are mostly inquiry-based and constructivist. I'm wondering if you could point to a major project that you have funded that supports direct instruction or takes a more direct instructional approach in terms of pedagogy?

And then the second question I have is, in terms of the evaluation of the textbooks that have been funded, have any of those been subjected to a randomized field trial in terms of the evaluations?

MR. BRADLEY: So, in terms of the randomized field trial, as Kathie pointed out, it's difficult to do that until the materials have been used fairly widely. The other study that she alluded to and the one for which Professor Wu is on the advisory committee is looking at algebra achievement for students in the connected mathematics program and they are using a randomized control trial design in that study. There have been other smaller studies. There was a smaller project that looked at interventions, mostly at the fifth grade level, on teaching fractions and that's also being evaluated with a randomized control trial, with a fairly small one. So, those are some examples of efforts that are underway. They are not complete yet.

The other, I guess another example, and this is not an instructional materials evaluation, but

it's another one that was on Kathie's slide, and that's the math specialist effort in the State of Virginia. There is an evaluation of that that is also using a randomized control design, looking both at teacher knowledge as well as student achievement in the classrooms of those teachers. So we are doing those kinds of studies that are underway.

MS. OLSEN: And I saw Dr. Wu's face and so it was the connected mathematics projects that is, in 2005, a funded research proposal to determine the extent of the student achievement, the study using the randomized control design, a longitudinal study incorporated student testing results from the Spring of 2006, 2007 and 2008 and they said that you were a member of the advisory committee on this project. This is something very important. Yeah, Jim Fochi is the PI of that project.

MR. WU: I see, it's one of the things you funded, though I was an advisory member.

MR. BRADLEY: Of the study itself, yes.

MR. WU: The study itself.

MR. BRADLEY: Right.

MR. WU: It's a minor project.

MR. LOVELESS: I just wonder if you could get to my question though about pedagogical bias in terms of inquiry-based and constructivist-based

programs. The charge has been that everything that you fund in math education has that bias and so I'm wondering what have you funded in terms of a program that takes a different approach, that takes a direct instruction approach or takes a neutral approach?

MR. BRADLEY: So, again, we, the projects that we fund are investigator initiated, the proposals come from the field. They are evaluated by the peer review process. In terms of, you asked for specific examples, yeah, I don't, I can't tell you, I can't give you a specific example of something that has a specific emphasis on direct instruction, but we have funded, there is a high school project underway now that I would certainly say has a neutral stance. This is being developed at the Education Development Center. Certainly the way that the materials are used is up to the teachers themselves.

Certainly many of the programs of the curriculum materials are written in such a way that there is an emphasis on students working together in groups, instead of sitting in rows. But again, there are a wide variety of approaches, even in those situations. Teachers actually do get involved and do provide direct instruction, so I would say, in general, there is a mix of those kinds of approaches in the materials.

MS. OLSEN: And I just want to add, in terms of NSF, we are a research organization. We actually have a call for proposals. We are not accountable in terms of who actually submits or does not submit proposals. We try to encourage all ideas, all activities. We have a very robust peer review process, the peer review process, as I've said, we have had over 3,000 panelists, many on this panel have served on, have reviewed for the National Science Foundation and we can provide you those names.

We have a committee of visitors that actually looks specifically in terms of how the selections are made and if they represent different types of institutions and different types of disciplines. We try to have mathematic discipline, people within the mathematics disciplines, as well as educators on our panels, in terms of breadth. We look at these things very, very seriously. One of the issues is that, you know, we are open for all ideas, all activities, but we can't control who is submitting, who is not submitting.

We also have programs, which are very exciting, called small grants for exploratory research. These don't even go out for peer review. It's sort of crazy ideas to get out there in terms of support, so we have a lot of mechanisms. But again,

we are a research agency dependent upon the ideas that come forward and then the peer review process, in terms of the evaluation of that.

MR. WU: A criticism of long standing of the Education and Human Resources (EHR) has been that it does not pay enough attention to the mathematical component of mathematics education. And I quite agree that the EHR has done a lot but, because of this tradition of slighting mathematics, it has been argued that maybe all that you have done may not be positive. And so I wonder, in the new leadership, what has been done to effect some changes in this direction.

And at the same time, it has been proposed, for example, in the portfolio review panel, that EHR should make better use of the Division of Mathematical Sciences in all phases, not just one or two places, in terms of writing the request for proposal, for example. Using the Division of Mathematical Sciences could make it clear that mathematics is important in terms of evaluation of proposals and in terms of the committee of visitors, to invite a few people who are critical of her. I wonder what has been done in this direction.

MS. OLSEN: I'm going to say something and then I'll turn it to Rosemary.

Two things. In terms of, as I say, the K

through 12 curriculum, we don't have any programs focusing in EHR that's specifically math or science, we have it open. And so, of the $260 million, it doesn't even say in terms of what we are doing in math, and so I have to agree with you completely.

I used to be actually a program officer at NSF and the change that has evolved in the last 12 years has been extraordinarily exciting. When I was there, as the Deputy Division Director, there really wasn't that much communication between the disciplinary programs and EHR.

Things have really changed in the last two years and on almost all of the activities, people within the division for math, Bill, the division director, is unfortunately leaving on Friday. We have a new person coming in from Ohio State who is outstanding, but they have actually been involved in terms of our science and technology centers. Again, that whole integration of research and education, we are really trying to bring the disciplines and the education together because, again, we don't want to be able to stovepipe things and it shouldn't be stovepiped. So that is a direction that Dr. Bement and I really endorse, but it's something that I think that, within the foundation, you are seeing that as well. I'll turn it to Rosemary.

MS. HAGGETT: I was just going to say the same thing. I've been there since the Fall of 2003, and we have worked hard to build strong and positive relationships with the directorate for math and physical sciences and engaging them by working with their investigators and our investigators. We see the development of these programs as interdisciplinary, if I may use that term, in terms of needing to have people who identify, we would all identify as mathematicians and math educators and others involved in these processes.

Whether we are talking about curriculum development in mathematics, which, as Dr. Olsen just pointed, is a small slice, or if we were talking about what we support in EHR. But, back to your comment about working together with Math and Science Partnerships (MSP), we have done that both by engaging them and talking about how we do our committee of visitors, working together with their advisory committee with our advisory committee. We have had joint meetings for the last two years of our advisory committee, at least an overlapping session to discuss important issues, and so we have taken those recommendations seriously and have moved in that direction.

MS. OLSEN: And I just want to add one

other thing too. You know, we are talking about EHR, which is a line item part of our budget, but in terms of the National Science Foundation, our value is integration research and education so, within our disciplinary programs, we also do activities, about a billion dollars in terms of education. We just had an evaluation and our engineering directorate actually had a program for teachers, summer experiences for teachers. That came out of our disciplinary engineering program and they just had the evaluation, which I read this morning, which is very strong, so we have that going as well.

We also have a program called Career, and that is a research program for our disciplinary scientists and part of it is two components, they have to have a strong education component, and a strong research component, and that education component, in many of them, is looking at K through 12, and so you have that, and those are then funded by the math division as well. So we have that stovepipe of EHR, which we are trying not, you know, to get rid of it and integration of research or education, but all of our directorates really care about K through gray within their own disciplines. And we can give you a list, because we did this for the Hill in our hearing, of all the activities that we are doing in our

disciplinary programs that are education component as well.

MR. WU: So these are relatively new? The developments?

MS. OLSEN: This is, yes. It's been going on because we have been evaluating it, but it's something that has always looked at EHR as a separate budget and not of the National Science Foundation, which is the integration of research and education across all of our disciplines. I will provide that for the record because it's quite thick in terms of the activities and programs we are doing.

MR. WU: So I would like to just add a little something. When you say you consult with mathematicians, but mathematicians come in all stripes and many of them are very sympathetic to the old way of doing things at EHR and it's no good just getting them. I think EHR, at this juncture, needs to make a special effort to incorporate people who have been critical of its policies of the past and get their opinions too.

MS. BENBOW: We have here in our sheets some information about the Math-Science Partnerships. It looks like there is some evaluation data of outcomes and I was wondering if you would you like to comment on that before we close?

MS. OLSEN: Okay, Joan is going to. We are very proud of these data.

MS. FERRINI-MUNDY: This is very exciting. An example of a project, it's a project that I'm actually on with my colleague, Bill Schmidt, at Michigan State University. It's a Math and Science Partnership. It's one of the projects considered in these kinds of evaluative materials. We take a completely neutral stance about pedagogy in this project because our focus is on curricular coherence in the spirit of the International A Plus Curriculum. And so what we are doing in the 60 districts where we work is to work with teachers specifically around how to develop their mathematical competence in ways that would enable them to work toward curricular coherence.

And by necessity, we are neutral about pedagogy because it's 60 different districts, 60 times something different instructional materials involved and so forth, and we are starting to see some extremely promising results.

The Math and Science Partnerships (MSP) are also a place, in response to Professor Wu's comments, where, at least in my own experience and in those that I know about, there is very strong involvement of mathematicians and scientists. Certainly, in our project, that's the case as well as

with the design of the materials, and the design of the instruction. These kinds of results, which I have not studied carefully, are very promising because those projects are so accountable to being able to provide increases in student achievement. I think that's been an interesting innovation in the MSP. That's what we need to show in those projects, and therefore, people are working directly toward it. Others may want to say more about the insides of this.

MR. FAULKNER: We'll take one last question. Wilfried has something he wants to ask.

MR. SCHMID: Yes. So I mean this is, it's actually two related questions and this goes back to something that Wu asked. About four years ago, one of the program directors in mathematics told me privately that he, as a number of his colleagues, were quite critical of curricula being funded by the EHR directorate. It was clear to him that, first of all, his input on such matters was certainly not welcome, and that he also felt that he could not publicly voice such criticism. From what I've just heard, I gather that this has changed, that the program directors in mathematics would now feel welcome to offer their advice in decisions that are made about funding mathematics education curricula.

The second related issue is that some of

the curricula that were funded in the past that quite a few of us are highly critical of are touted on the ground as being NSF supported. Now of course NSF, I mean you say and I understand that NSF does not endorse curricula, but what can you do to counteract this seal of approval that is implicitly put on these curricula? Is there, I mean so the well-deserved positive reputation of the National Science Foundation is being used to, in effect, support these curricula that many of us are critical of.

MS. OLSEN: It's interesting, if they are funded by the National Science Foundation, then they are supported by NSF and they can use that in this incident. It was interesting and I'm just going to do it. A bunch of engineers went down and looked at the levees after Katrina last year and were very critical of the Corps of Engineers, and so all the newspapers said the National Science Foundation scientist is against the Corps of Engineers scientists and that's not true. It was we who gave the money to support, the engineers did it, they disseminated the data and we tried very, very carefully to say we don't endorse one thing or another We just provide the money, and we are trying to do that very strongly in terms of education as well, so I just want to point that out.

And NSF works where half of NSF are

permanent and half of NSF are visiting researchers from the universities or are teachers that come in and work, and we strongly encourage that because we are as good as our people. And so I would hope that we are getting the best to come to the National Science Foundation. I want to just say another one too is Arden Bement and I are incredibly open and, if that is still going on today, then I would hope that they would be willing to come and talk to us because I really do believe that there has been a change from the four years ago or five years ago when I used to actually hear the same thing as well and, if it's not, then I really do believe it should be brought to our attention.

MR. FAULKNER: Okay, I think we need to go on actually, and I want to thank Kathie and colleagues at the National Science Foundation for taking the time to be with us.

We have the next session on the Academic Competitiveness Council, which has been formed within the government to deal with issues related to things we are concerned with. Tom Luce will be speaking about this. Tom is well known to the panel, he is a senior consultant now to Secretary Spellings and is former Assistant Secretary in the U.S. Department of Education.

Tom?

MR. LUCE: Excuse me and I apologize for the unavailability of this handout until now, but Sarah Dillard and others are passing out a copy of this. There is a whole lot more material in the handout than I'm going to cover, but I felt it was important for you to have the background information.

The Deficit Reduction Act passed by Congress in February of this year created a cabinet level agency chaired by the secretary of education to identify all federal programs with a math and science focus and to identify the target populations intended to be served, determine the effectiveness of such programs, identify the areas of overlap or duplication and recommend ways to efficiently integrate and coordinate such programs.

A final report is due to Congress in February of next year. You have been supplied with a preliminary copy of the inventory that the Office of Management and Budget helped collect from all agencies to enable this work to be done. Thirteen agencies regularly participate in the work of the council and the White House has been involved through the Office of Management and Budget, through the Office of Science and Technology and the Domestic Policy Council.

If you direct your attention to page four, we have found so far that there are $3.2 billion being spent on programs in the Science, Technology, Engineering and Mathematics (STEM) area and there is an agency breakdown, which you will see regarding that funding.

On page five, I think it's important for the panel to know a breakdown of that by reference to informal and outreach K through 12 and post secondary. As you can see, quite a large percentage of the funding devoted to STEM is in the postsecondary area. The next page shows an attempt to break down the STEM funding into what shows is being spent that we know is being spent on math and on K through 8 math. As you can see, it hardly registers on the scale in the funding across the federal government. On page seven, we have listed the five largest math and science programs, these comprise about a third of the math and science funding that we have found.

The next page in the discussion of our goals of what we are trying to do in this council, we have really several objectives, the number one is to try to establish common goals in the K through 12 area, the post secondary area and in the outreach area that would apply across agency and come up with common metrics so that eventually Congress, Office of

Management and Budget, the public would be able to determine the effectiveness of programs conducted by various agencies. I would quickly point out that having duplicate programs isn't necessarily a good thing, or a bad thing because there are different approaches taken by different agencies. They have different missions.

However, I think, in a time of limited funding, it's important to know where there is duplication and some common metrics to determine if you have programs across agencies that are targeting the same population, trying to do the same thing, then what type of metrics should we use to determine which are most effective?

On page eight you will see that of the $3.2 billion, agencies have submitted to us 115 evaluations of those programs, they are being studied by OMB and by this entire council. We have tried to break down the types of evaluation in the second chart. You will see that only 26 of the 115 are random controlled trials and high quality impact evaluations. There are about 60 that are lower quality impact evaluations and 20 plus that are non-impact evaluations. By impact, which again is a breakdown of the 26, there are only five, to date, that show that there was a complete and meaningful random controlled

trial and there was a positive impact.

There is one that is yet unclear, that's what's hard to read in the blue and then, underneath that, complete, no meaningful positive impact and then still underway. So, of the 115 programs, we estimate that there are 26 that have high quality impact evaluations or randomized control trials.

The goal of this project, as I've said, if you'll turn to page ten, let me skip you to page ten, each agency, working with the Office of Management and Budget, has been given this graphic summary of, if you will, the types of evaluations and how each evaluation will be characterized. The goal of this exercise across agencies is to have every agency striving to reach the top level on the pyramid.

However, I must point out, often times it's not possible to reach the top level. If you are doing a million dollar project, you can't do a randomized control trial; there is not enough funding to do that, so there may be many instances in which the evaluation would be in the second level of the tier, but we would hope not many would remain in the third level. And the point of this exercise, again, is common goals, common metrics and to approve evaluations so that the money that is being spent across the government, we have accountability for that

money.

I think the fact of the allocation of that money is also an important thing for this committee to see. As you saw in the $3.2 billion, very little is devoted in the K through 12 arenas, let alone K through 8, but that is the state of STEM spending today. We have given you examples on page nine of three programs that appear to have positive impact and high quality evaluations that support that positive impact. On page 11, we give you the common goals that had been agreed to across agencies in K through 12, post secondary and informal and outreach. And importantly, on page 12, we have listed some of the common metrics that have been agreed upon.

This is simply a small percentage of the metrics, but there is a comprehensive list of common metrics that every agency will now have to say, will have to report on. As they report on their evaluations, they'll have to show these metrics. Now I want to be quick to point out a lot of agencies will say, well, you've asked us to report on if we have a program in the State of Texas, what's happening to the math scores on the National Assessment of Educational Progress (NAEP) sample or what's happened on the state assessment. Gee, we really couldn't impact that.

And I said, well, you know what? At the

Department of Education, as Ms. Olsen pointed out the federal government spends about eight percent of the money spent on education and yet we are all held accountable if national scores are not improving. So we have to keep in mind what's happening over time in metrics. If for no other reason then to say if metrics aren't moving over ten years, maybe we ought to reconsider what we are doing. So, no, you cannot necessarily say that there is a causal relationship but if an agency has continued to fund a series of programs and their metrics show no impact, then maybe they ought to consider consolidating their funding, maybe they ought to consider a different way of approaching it.

These are not mandated exercises but we believe, by requiring this accountability and this report, and all of this will be available on a website, it will eventually lead to more efficient and effective use of federal funding and that's the hope of this council. We have received cooperation from every agency, lots of disagreement, but we've reached agreement on common goals and common metrics, and attached to your material is a brief summary, in inventory form, of every federal program that has been catalogued to date.

I would caution you this is preliminary,

we are continuing to make sure we have a complete accounting of every item but, as you can see, this is the preliminary version and we thought it might be helpful to you to have this information.

I would be happy to respond to any of your questions that you might have.

MR. FAULKNER: Thank you, Tom.

MR. LUCE: Thank you.

MR. FAULKNER: It's quite interesting material.

(Laughter)

MR. LUCE: Thank you very much.

MR. FAULKNER: All right, are there questions?

Valerie?

Tom, don't go away. You said you would stay until 11:00.

MR. LUCE: Absolutely.

MR. FAULKNER: I'm watching the clock.

MR. LUCE: No problem.

(Laughter)

MS. RENYA: These are very interesting ideas and programs. Is there any, you talked about NAEP and these other more distal measures and you also mentioned randomized control trials. Is there any initiative to provide the means to perform more of

these randomized control trials in the future?

MR. LUCE: Yes. I think there is a new emphasis within the Office of Management and Budget (OMB). I think this exercise has caused the Office of Management and Budget, I think, to look at the evaluations that had previously been used in Program Assessment Rating Tool (PART) process, but also caused them to look at the whole evaluations spectrum. When we all developed this pyramid of evaluations and OMB discovered that only 26 of these met the high definition, I think there was a realization that we are not doing enough top quality impact evaluations. Now, again, it may not be possible to do randomized control trials in every instance, but there certainly is no reason we cannot continuously improve our methods of evaluation, and we've spent a lot of time defining and helping agencies say this is a way you could improve it where it's not biased. There is more evidence, so that's a large part of this endeavor.

MR. RENYA: And in particular, my question is focused at the resources to do these additional mandated--

MR. LUCE: You bet, and I think the Office of Management and Budget--

MS. RENYA: --but important things.

MR. LUCE: I think, having discovered

this, OMB will be more supportive of funding for evaluation.

MR. SIEGLER: These data on funding that you have presented are just stunning and they really tell the story. I'm wondering whether there are initiatives underway through the Academic Competitiveness Council or other means to change the state of affairs with regard to the funding of K through 8 math education, math learning?

MR. LUCE: Yes, we hope so. It takes two to tango. It takes Congress to go along with this. But in the delivery of our report in February, we hope, and we've already had preliminary meetings with House and Senate committees to let them know. We have met several times to give them progress reports, and I think it is eye opening to people to see the allocation of dollars and by agencies. I think and hope this will have impact. I know it's had impact within the administration, and I think it will impact budget submissions, and then we hope it will impact Congress as well. It certainly wouldn't hurt if this panel took a look at that and made some comment as well, if I could--

(Laughter)

MR. LUCE: --not that I could suggest that to anybody.

MR. FENNELL: I'm going to help you, Tom.

MR. LUCE: Thank you, Skip.

MR. FENNELL: It seems to me almost obvious that, given the emphasis of this panel, particularly K through 8 and the mathematics leading to algebra, and given the not relative paucity, how about no money, with regard to the initiative, that a push from this panel might make a lot of sense.

MR. LUCE: I would certainly leave that to the panel.

MR. FENNELL: But actually, and so I gave you that one.

(Laughter)

MR. FENNELL: I want to continue just for a minute.

MR. LUCE: Yeah, sure.

MR. FENNELL: The Math and Science Partnership (MSP) work at the Department of Education following or going along with that of NSF are both trying to work hard to deliver what Wu and some others have said with regard to a natural kind of connection between mathematics faculty, and math education faculty and teachers. Is there a chance, an opportunity, to get from perhaps some of the work that's going on within the Department of Education a summary, any kind of an analysis in terms of impact?

MR. LUCE: Yes, we are right now in the process of making sure we can deliver that to this body. We think and we were quick to say in this process the Department of Education has not done everything the way it should do as well and we are very focused now on the evaluations.

I think also there are some structural issues in the way that we do these things. There hasn't been a concentrated effort in any agency to make sure that whatever is funded is, number one, evaluated in the right way, and number two, there is proper dissemination of the lessons learned and what was found into the hands of everybody.

In other words, it's not being communicated. You may do a research project with the University of Texas at Austin and they may work with four school districts, but that doesn't necessarily mean the Texas Education Agency knows that that took place, knows what was learned and that that can be disseminated and communicated to schools, let alone to individuals classroom teachers.

MR. FAULKNER: Tom?

MR. LOVELESS: Tom, as you know, our basic focus here is on preparation for algebra, K through 8, let's call it mathematics. Now the three examples of positive impact programs that you provided, two of

them are higher education and one is in science. Can you give us an example of a K-8 math program with a positive impact? The federal government spent a lot of money in that area.

MR. LUCE: No, sir. It pains me to say that, but the answer is no.

MR. FAULKNER: Russell?

MR. GERSTEN: Tom, I want to react to one comment you made. You said that for a million dollars, you can't really do a randomized control trial, a high quality randomized trial. I think that probably is correct but if you go up a little bit to, let's say, $2 million for a four year study, I think then they can be done. So, in terms of shaping thinking in this initiative and our recommendations, I think that's an important issue and having fewer funded of so much higher quality, compared to the norm that, like you said, there is no example of acceptable research in math instruction from what you found so far, so it's something I think to think about.

MR. LUCE: Well certainly think, and Russ Whitehurst has been an integral part of this process and I think we are trying to make sure. I mean we want to. The whole effort is designed to improve the quality of evaluations and we want to do that. We realize that not every agency will get there

immediately. There are projects underway, but the bottom line is we have got to improve the evaluation of what we are doing and we've got to be able to learn enough to take some programs to scale. We continue to do pilot, after pilot, after pilot and we are not communicating the lessons learned, let alone taking anything to scale.

MR. FAULKNER: Russ, and then Kathie.

MR. WHITEHURST: I just want to get in on the conversation of the cost, with respect to the cost of randomized trials.

It costs no more, if you have ten schools available for research study, to flip a coin to decide which of those five schools get the intervention and which five do not than it costs to have five schools volunteer to be in the intervention group. It is the data collection that is expensive and not the design, and so I often, too often, hear people saying we can't do randomized trials because they cost too much and I think that's a red herring. I think it's a lack of will to do it because people don't have to do it.

There are certainly some circumstances in which it's impossible to do and then you do the best that's available, and certainly research at scale is quite expensive and we need more money for that, so I'm not claiming here we don't need more money for the

enterprise. But my point, if it's not obvious, is I think we should extend the reach of well-designed evaluations to small-scale implementations as well because they are not inherently more expensive than the weaker forms of evaluation.

MR. LUCE: I certainly agree with that and I would say that No Child Left Behind is gradually taking away the excuse that data is not available. Data is available.

MS. OLSEN: I just wanted to add that on every single National Institute of Health (NIH) grant, no matter the size, they must have an evaluation component which is also reviewed by the panel in terms of if this is appropriate. The National Science Foundation , will evaluate the programs, like the Math-Science Partnership. Every single proposal now has to have that as part of their evaluation before we go forward.

MR. FAULKNER: I promised Tom he would be out of here at 11:00. We have two minutes left.

Valerie?

MS. RENYA: I'll be brief.

Yes, just a coda to both of these remarks. Evaluation incorporates a whole range of things that range in quality, as we all know. Part of my remark was, though, about programs in which they are

delivering informal scientific instruction, or mathematics or whatever and they don't consider it a research enterprise, and therefore, the kind of scenario that Russ Whitehurst talked about is not thought about. But I think his remarks underline that we need to take a step back. If we think about the FDA, we don't disseminate the drugs and then do the research study to find out if they are safe and effective. So perhaps, as part of program delivery, research ought to be integrated into every aspect of that in the manner in which he indicated.

MR. LUCE: We will welcome your suggestions on this. This is an important endeavor.

MR. FAULKNER: Tom, you've been generous. We have another minute, but I think we'll just let you get out of here at 10:59.

(Laughter)

MR. LUCE: Thank you.

MR. FAULKNER: We are at a break. We will reassemble at 11:15.

(Whereupon, at 11:00 a.m., there was a brief recess until 11:17 a.m.)

MR. FAULKNER: We are now going into a session with large textbook publishers. We appreciate the representatives being with us, there are many people here, I see. Vern Williams, our colleague on

the panel, will be facilitating this session. The goal here is for us to find out from textbook publishers the constraints they face, the facts of life in the textbook publishing business.

And let me read the names I've got from the list here. We have Jim Reynolds, Vice President and Editor-in-Chief of the Math Division of Harcourt School Publishers. And Lila Nissen, Editorial Vice President, Mathematics, Holt, Rinehart and Winston.

We have Cindy Orrell, correctly pronounced, Editorial Director of Mathematics, Houghton Mifflin & Company and Doug Van Wassenhove, Supervising Editor of the Mathematics Department of McDougal Littell/Houghton Mifflin & Company.

We have Cathie Dillender, Marketing Director of Mathematics, and Science for Pearson, Scott, Foresman. Stewart Wood, Editorial Director of Mathematics, Pearson and Prentiss-Hall and we have Darlene Leshnock, Vice President, Pre-K to 12 Math, Editorial, McGraw-Hill Co. down on the end.

And with that, let me thank you all for taking the time to be with us.

Let me turn this over to Vern Williams. Vern is an algebra teacher with more than 30 years experience with textbooks and students.

(Laughter)

MR. FAULKNER: And he was 1990 Fairfax County Public School Teacher of the Year. Vern will actually moderate the whole session; he'll be taking you through your presentations and then will handle questioning at the end.

MR. WILLIAMS: Thank you. Thirty years of children and textbooks.

I submitted some questions to the publishers, some to be answered verbally and some written responses, and I would like to direct the panel to tab ten to see your written responses. And just to paraphrase a few of the questions, one question was what is the role of authors in your program? To what extent are they fully engaged in writing the majority of the lessons in the K through 8 programs that you publish?

The next question was, and this definitely has affected me, textbooks have seemingly grown, except strike the word seemingly. (Laughter)

MR. WILLIAMS: Textbooks have grown hundreds of pages in the last ten years, why is that? Why is it that a third grade math book now is close to 750 pages long and it is unique to the United States?

The third question was describe the importance of proficiency with basic facts and understanding of algorithms, including standard

algorithms, in your program.

And the last verbal response question was to what extent are you influenced by NCTM standards? Well how appropriate we would discuss this today.

(Laughter)

MR. WILLIAMS: State curricular frameworks, approaches used in older textbooks, programs such as Singapore Math, etcetera.

And we will start with a representative from Harcourt. You can appoint someone to respond.

MR. REYNOLDS: Good morning. My name is Jim Reynolds, I'm with Harcourt School Publishers, but I'll be representing Harcourt Education Group. The members who are here today from Harcourt Education Group are Lila Nissen, Lila is from Holt, Rinehart and Winston and they publish middle school and high school text materials, and then we also have with us Marilyn Trow, Marilyn is from Harcourt Achieve and they are the publisher of Saxon Mathematics.

So my answers will be on behalf of all of Harcourt Education Group represented here. We worked pretty hard on what we wrote up, so I hope you are not offended if I simply read our answers.

The first question about the role of authors in the program, our author teams are composed of professors of mathematics, professors of

mathematics education, professors of special education and mathematics educators, including supervisors and classroom teachers. Each author brings a particular strength to the program, which he or she focuses on throughout development. These foci include, for example, development of the scope and sequence, pedagogy of the lessons, integrity of the mathematics, development of the mathematical strands, work on problem solving, technology, differentiated instruction and professional development are some of the topics.

Harcourt Education publishes several types of programs and the nature of the author involvement might vary with the different programs we publish, but for all of our programs, the authors do write and/or review several drafts of lessons. They spend lots of time pouring over and commenting on the outlines, on the manuscript and on the drafts of the lesson, and then we look at the comments and act on them. We conduct meetings with supervisors and teachers across the country to discuss the needs of students taking specific courses and then, additionally, classroom teachers from across the country are involved in reviewing every grade level and they participate in field tests of our programs as well. It's a rigorous process and we take it seriously.

The second question about the increasing length of textbooks, I think one aspect of the answer to this question has to do with the depth of instruction we are trying to accomplish. When we have high quality teaching requirements like those in NCLB, what we try to provide is modeled, step by step instruction in the student editions, that we find sometimes requires lessons to become multiple pages, rather than just a couple of pages. We think that, although this lengthens the book, some of the step-by-step instruction does help prevent student misconceptions and also helps teachers who are not as confident about the mathematics behind a particular topic.

I think another issue though is that the states we publish for do ask us to publish and address all of their standards in the program that we are offering for adoption, as they do test the standards yearly. So the length of textbooks that is unique to the United States is in part also due to the need for us to address multiple state standards and also, within the state standards, as we work on a grade level book, often see quite a range of standards at a given grade level.

The third question has to do with the importance of proficiency with basic facts,

understanding of algorithms, including standard algorithms in our programs, has the position changed over the years and then a question on how would you define first year algebra. Mathematics is sequential in nature and fluency with basic facts, as well as the use of standard algorithms, is a key to student success in higher-level mathematics. It's equally important that students understand the concepts that underlie these algorithms and facts.

We recognize that students reach proficiency at different rates, and Harcourt Education offers programs that vary in their presentation and structure in order to build the foundation of mathematics. The textbooks written in the 1960s often provided examples and exercises, the textbooks written in the `90s might have led students to explore and discover basic algorithms. The goal of our programs today might be what we would call a blended approach. We are trying to focus on building students' conceptual understanding and follow that by helping them understand how algorithms were developed, how and when they work and why they are useful.

Regarding algebra, there is a general agreement among mathematicians and math educators that a first year algebra course is one in which students learn to reason symbolically, to understand writing,

and solving and graphing of a variety of equations and systems of equations. Function concepts, the dependence of one quantity on another, the relationship between equations and functions is another major or minor focus of Algebra I. The importance of a study of functions in algebra varies from state to state and district to district.

And then the final question, the influence of NCTM standards, state curricular frameworks, approaches used in older textbooks, programs such as Singapore Math and NSF projects. With the advent of No Child Left Behind and the corresponding focus on state assessments, state curricular frameworks, which the state tests are constructed to assess, have become very influential, we spend a lot of time graphing, and charting and staring at state frameworks. Then, given that most state standards were written to embody the NCTM standards, including a strong focus on process standards and problem solving, the NCTM standards have also had a significant influence on textbooks as well.

We often refer to older textbooks as we develop new ones. Also we conduct formal and informal research to receive input from users of our former textbooks on what worked in the classrooms and what did not. Regarding programs such as Singapore Math, you know, this has gained our attention, especially

following the Trends in International Mathematics and Science Study (TIMSS) report. I think what we've especially focused on--

MR. WILLIAMS: We'll need to finish up soon.

MR. REYNOLDS: --is the programs that have challenged us to look at the depth of our instruction and to be more strategic about the amount and focus of review from year to year. And then, finally, with regards to NSF programs, when we publish a textbook, we haven't tried to have it be an NSF program, but we've really tried to do a program that balances conceptual understanding, procedural fluency, and reasoning and problem solving.

Thank you.

MR. WILLIAMS: Thank you.

Now a representative from Houghton, Mifflin & Company?

MS. ORRELL: Good morning, thank you for the opportunity to present to this panel. I'm Cynthia Orrell, I'm the Editorial Director of Math for Houghton Mifflin School Division, and it's K-6. With me is Doug Van Wassenhove and he is a supervising Editor for Mathematics at McDougal Littell and they publish the middle and high school programs.

You asked about the role of authors in our

programs. Our authors are mathematicians and math educators from respected teaching and research universities. Some are supervisors for curriculum or assessment in high performing districts.

They guide the philosophy of the program, the pedagogy, the instructional sequence underlying the program and they are also fully engaged in writing the lessons, chapters, problems. Our authors, as this gentleman said, review stages of proof all through the whole development process. We involve other mathematicians as advisors, assessment advisors, English language learner advisors. Supervisors and teachers review book outlines, manuscript and some pilot free publication materials and then provide feedback for us before we got into final development.

In terms of textbook length, we agree, student books have grown larger and we see several factors. One factor, and I can't emphasize it enough, is the diversity of standards among the states. At every grade level, the content that we include is the full set of state standards for all the states for which we intend to sell the program and so it adds pages. We must address all those standards, many state guidelines require that we provide multiple exposures to those and that adds lengths. Also, the variety of student needs, as states are beginning to

understand that all students must master the standards. Then we provide materials for students with different levels of preparedness, different ability levels.

We provide back to school units, challenge features, extra pages for review, pages for extra practice and all this adds to the length of the book, and finally visual representations. Teachers ask for illustrations and photography to provide relevance to their students. Academic research says working with multiple representations, visual as well as verbal and symbolic, is important for learning and visuals take up a lot of space. There are probably a number of other reasons. I think that the issue of state standards and the diversity of the standards is probably the most important.

You asked about basic facts and algorithms. In our programs, the attention to proficiency with basic facts has remained relatively steady, the amount of attention we put to that over time, but what's changed is whether the facts are learned by rote, or through models of manipulatives, or through student reasoning. And similarly, attention to algorithms has changed in nature more than in the amount of attention we place. Since the National Council of Teachers of Mathematics standards

in 1989, teachers and state standards now are calling increasingly for students to understand how those algorithms work, both the standard and some alternate algorithms, why each step is important.

Algebra I, most students today study algebraic concepts in elementary and middle school courses, and our formal Algebra I course provides an opportunity to consolidate and extend knowledge by presenting it through the viewpoint of functions and the graphs. We include topics like data analysis and probability when you advance the study of algebra, for example, fitting points, data points, to a line. Our programs provide a balanced approach to theory, procedures and applications so that students develop mathematical reasoning and problem solving skills as they learn algebra concepts.

And finally, you asked about the influence of National Council of Teachers of Mathematics standards and state frameworks and other programs. As we develop a new program, we attend to all current information and points of view about teaching and learning. Academic research, the NCTM standards, international curricula, influences such as NAEP and TIMSS, and standardized tests, all this affect what content we teach, at what grades we teach it and how we suggest teaching it. State standards, which had

relatively little impact in the early 1990s, have increased in importance since that time and I would say now eclipse national influences in terms of program development.

Thank you.

MR. WILLIAMS: Thank you very much.

Next we'll have a representative from Pearson Education.

MS. SPIEGEL: Yes, thank you, Mr. Williams and fellow math panelists for inviting Pearson Education to participate in today's meeting. I'm Wendy Spiegel, Senior Vice President of Communications for Pearson Education. Joining me in this discussion are Cathie Dillender, our Mathematics and Science Marketing Director for our basal elementary division, Pearson, Scott, Foresman. Stewart Wood is our Mathematics Editorial Director for Pearson Prentice-Hall, our secondary education basal publisher, and behind me is Marcy Baughman who directs our Pearson School Group's Academic Research Department.

I'll try not to repeat everything that was said by my colleagues but, beginning with the first of the four questions, I would like to emphasize that we appreciate the opportunity to showcase the contributions of our highly regarded mathematics

authors and their engagement in the writing process. The role of our authors is central to the development of our programs. Our authors are either mathematicians or mathematics educators. Each author brings broad experience and specific expertise in areas critical to the creation of mathematically accurate, pedagogically sound and instructional effective materials.

Our authors are fully engaged in creating the vision, informing the instructional design and establishing the methodology in all of our programs. Our authors participate at every stage of program development, including outlining and writing manuscript for new programs and planning and carrying out the scope and nature of revisions of existing programs. Additionally, classroom teachers from across the country review the manuscript relative to their state and local standards.

Your second question asked about the forces that influence the page count of a textbook. Over the course of the last ten years, there have been three major sources of the growth in textbook size. First was the divergent and increasingly state-specific standards, which we've heard about this morning; second is continual review of topics from grade to grade; and third, expressed customer needs for increased support for diverse student populations,

such as students in need of intervention, English language learners and advanced learners.

The third question deals with the importance of proficiency with basic facts and the understanding of algorithms. Proficiency with basic facts and the understanding of algorithms, including standard algorithms, have always been at the heart of our basal programs. This position has not changed over the years. You asked also about first year algebra. As a publisher, we respond to what the market needs for first year algebra materials. Over the last 25 years or so, an increasing number of algebraic concepts have migrated to pre-algebra courses in grades six, seven and eight. These include such topics as solving one variable equations and inequalities, connecting two variable coordinate graphs, table and equations, and using variables not only as placeholders but to represent relationships among varying quantities.

But because state standards diverge, none of these pre-algebra materials can be omitted from a national Algebra I program, which must also include fluency with real numbers, exponents, polynomials, factoring linear equation and inequalities, linear systems, quadratic equations, functions, and depending upon the state, matrices, transformation of graphs,

exponential functions, radical expressions and equations and rational expressions and equations. It's also worth noting that many states expect topics, and data analysis and probability to be included also in the Algebra I course.

MR. WILLIAMS: You have about a minute.

MS. SPIEGEL: Question four asks about influences in textbook development. As a previous response indicated, state curricula frameworks are a significant influence in creating our textbook programs. Our programs also reflect NCTM standards. The market dictates the influencers of our products. While we maintain instructional approaches that have proven effective in previous programs, we are always striving to improve our products, so we looked at current research, emerging pedagogical approaches that have been shown to be effective, as well as programs developed outside the United States, such as Singapore Math.

As requested, we submitted written responses to the questions dedicated to our standards protocol of academic research and our commitment to professional development. Again, we thank you, Mr. Williams and the math panel members, for this invitation to participate in the work of the National Math Panel.

MR. WILLIAMS: Thank you.

And now we'll hear from the lone representative, Darlene Leshnock, from McGraw-Hill.

MS. LESHNOCK: Good morning, Chair Faulkner, Mr. Williams and members of the panel. I appreciate this opportunity to respond to the questions that were posed to us textbook publishers.

For the first question, the role of authors in the program, the McGraw-Hill mathematics authors play an integral role in the development of our programs from planning to execution. At face-to-face author meetings, the team of authors and editorial staff determine the philosophies of the programs, the tables of contents and the instructional designs.

The authors are responsible for writing the instructional content of the lessons and also for reviewing the edited manuscript. They work very closely throughout the process with our content editorial staff that also have mathematics education or mathematics degrees and experience. Our author teams are comprised of mathematicians and mathematics educators in pre-K to 12 classrooms and at universities. We also rely heavily on input from other mathematicians, consultants, teacher reviewers and teacher advisory boards throughout the planning

and development process.

The second question on the size of the textbooks, you are going to hear the same thing over and over again, I believe. In order to produce textbooks that address individual state standards to the depth and complexity required, it is necessary to include content at various grade levels. For example, several states may require that multiplication and division of decimals be introduced and mastered at fifth grade while other states require that this be done at sixth or even seventh grade. As a result, this concept is covered at several grade levels in a mathematics program designed for the entire United States.

In addition, we strive to publish materials that help our customers, students, teachers and administrators, meet the requirements of No Child Left Behind. Since each state has its own assessment standards, it is often necessary to include addressed concepts in more than one grade level to address these standards. The importance of proficiency with basic facts is the third question and also the definition of first year algebra course. Proficiency with basic facts and understanding of standard algorithms has always been important and will always be important. This has not changed over the years. Regardless of

how basic facts and algorithms are taught and learned, to become productive citizens, students must be adept at recalling basic facts and understanding and using algorithms.

A first year algebra course, which is defined as the student's first formal algebra course, is focused on understanding patterns, relations and functions. To generalize and represent these patterns, relations and functions, students learn to employ many different approaches, including models, both pictorial and physical, symbols, graphs, words and tables. Generally, first year algebra includes work with linear, quadratic and exponential functions.

The influence of various things on the textbooks is the fourth question. Our first priority is to meet state standards, which usually reflect the influence of the NCTM standards. In addition, it is important to take into account the diverse student needs and teacher qualifications in different school districts. Some prefer skill-based programs, which are designed for classrooms where skill development is the most important aspect of the mathematics program. Others prefer a more investigative problem solving approach, which is common in many NSF programs. Many prefer an approach somewhere in the middle, one that has a balance of skills, concepts and problem solving.

McGraw-Hill Education publishes a wide range of programs that are designed to reflect and meet our customers' wide range of needs.

Thank you very much.

MR. WILLIAMS: Thank you very much.

Now I'm sure the panel has questions, so I'll open it up to questions from the panel, starting with Professor Schmid.

MR. SCHMID: I have a question about the role of mathematics and mathematicians in the process. So I think all of you said that mathematicians, I think you mentioned mathematicians first when you talked about your authors. I cannot say that I have done a very wide study of K through 12 textbooks. I am a mathematician, a university mathematician. So you will pardon me if I take as an example a particular textbook that my daughter's school used last year. It's an Algebra I textbook. On pages two and three, the textbook gives a circular definition of real numbers.

In the teacher's edition, also I think on page three, under the heading of math background and professional development, there is the following sentence. Now I should say that this sentence may not sound outrageous to you if you are not a mathematician, as most of you are not, but to

mathematicians, it is just amazing. It says the continuum hypothesis asserts that every point on the number line corresponds to a real number. The continuum hypothesis asserts there are no wholes. This is the most complete nonsense that I've ever seen.

(Laughter)

MR. SCHMID: And so you tell me that a mathematician wrote this? I cannot believe it.

MR. WILLIAMS: Who would like to answer that?

(Laughter)

MR. SCHMID: Well this is a textbook that came out of Wendy Spiegel's empire.

MR. WILLIAMS: I take it there are no takers on this.

Robert?

MR. SIEGLER: My question concerns the role of research in shaping these textbooks. So, in the answer to question number five, there is a statement that pilot studies are done to look at student learning in response to the textbooks. What I'm wondering is do you do studies where you take the changes that are made from one edition to the next for very particular pieces of the curriculum, like, say you are teaching about decimal fractions, for example,

and you've changed the treatment from one edition to another, do you get data that allows you to say whether the new treatment is in fact superior to the old?

(No verbal response)

MR. WILLIAMS: Not all at once now.

(Laughter)

MS. BAUGHMAN: I think Bill and I are probably going to answer this together. Bill and I are from different organizations, but we are the researchers in our respective organizations. It's a very good question. What we deal with is trying to do multi-method research to support a lot of different programs. I know we are specifically talking about math here, you know, we may have a copyright revision every six years, depending on state requirements. We try to incorporate, within Pearson, some lower level questions as to if we are going from, for example, copyright 2002 to 2006 and we have made one significant change, we will examine that.

There is no possibility, and I don't want to say there is, of examining all of the different revisions that we have made and so we typically try to target just one significant change or even two. Our studies, overall, really focus on the effectiveness of the program. We do use randomized controlled trials,

and unfortunately we don't have a million dollars to do them for every program. We are typically working with much smaller budgets, but we do randomize at the teacher level within schools, and so I think they are very gold standard studies.

And I think that we do try to address whether revisions that we have made have actually changed student achievement. I don't think that we have achieved the goal of what you are asking in terms of tracking all of the changes and measures.

MR. SIEGLER: Well do you have a sense, of those changes that you do examine, what percentage of the changes are for the better?

MS. BAUGHMAN: That's a tough one, I don't. I can't say that I do because I think that would be very difficult, again, to track in the revision, there would be many different changes. What I focus on when I talk to our authorship team, I get to meet with our authors and our editors, is what do you think are the most significant changes and those changes will be addressed in my research study. I don't focus on that, and I almost think some of that would be addressed by smaller level maybe qualitative studies, instead of quantitative studies, which is what I am talking about right now.

Bill, I would kind of defer to you.

MR. WILKINSON: No, we approach things very similarly in that respect. The level of sensitivity required to drill down to some of those changes, given the range of products beyond mathematics that are, in my case, I've got a three person group, Marcy has got one, two. The range of projects requires us to look primarily at the program level and to get down to the level of distinction that Dr. Siegler is referring to. We just have not been able to do that. We can't get to that level of sensitivity is about as much as I can say.

MS. BAUGHMAN: It seems like that's maybe not even, that hasn't been asked of us as much. Like, for example, Bill and I, both of our programs, have been selected for the Department of Education study on early elementary math programs. Our sense from the first couple months of the study is that, again, they are focusing on large scale how well does this program work and how are we going to compare how your programs work for different groups of learners.

So it seems like the demand that is coming from our customers, even with the Department of Education, does tend to be a little more large scale, and again, it sounds flimsy but it is a limited budget that you are talking about, so we tend to address the bigger issues.

MR. WILLIAMS: We have a question from Larry and then Skip.

MR. FAULKNER: Actually, I would like to follow up on what you've been talking about here just briefly. When you say your evaluation is at the program level, what is the program level? Is that four grades in one school? Is that--

MS. BAUGHMAN: At the teacher level? Or do you mean the different programs that we are, we were referring to like, for example, Pearson has Scott Foresman, Addison, Wesley at the elementary level mathematics, as well as investigations, but we also have to do research on reading, science, music, social studies. I think earlier I referred to--

MR. FAULKNER: Well the program is the outcome of several grades of mathematics teaching using a unified set of--

MR. WILKINSON: Right, we would do multiple grades at multiple buildings through different districts, sure.

MR. FAULKNER: Okay, well, my real question is different from that. How many of you, are all of you issuing one edition aimed at all 50 states?

MR. WOOD: For some states, there are specific state editions, larger states with adoptions, state adoption policies.

MR. FAULKNER: Do you have a California edition?

MR. WOOD: We have a California, we have a Texas, we tend to have Florida and some others.

MR. FAULKNER: So you have multiple editions?

MR. WOOD: Many of those are built off the same base and a national edition is still going to have to cover major open territory states. I don't know if you are familiar with that distinction, but there are some states that do a state approval process in their call for textbooks and they come up periodically every six or seven years. And then there are roughly 30 states that are classified as open territory and a district can buy any program they want and, for that open territory, a national edition really has to cover all of those state standards. You don't have the opportunity to sell it completely in the state and so you are building a book that will fit in many different places.

MR. FAULKNER: But if this panel or let's say NCTM, any group, decided it wanted to sort of push the curriculum in some direction and it wanted to urge texts to evolve in a direction supportive of that. What I'm hearing all of you say is that the most important leverage point is state standards, that you

are all having to respond first to state standards. In fact, I think the last one of you who spoke, Ms. Leshnock, said the first priority is to meet state standards, so let's take NCTM who just released their focal points. So, if you want focal points to show up in textbooks or to manifest themselves in textbooks, they first have to get manifested in state standards, is that what you are saying?

MR. WILLIAMS: Skip?

MR. FENNELL: So the obvious continuation, how would you feel about that?

MR. LOVELESS: How would you feel about it, Skip?

(Laughter)

MR. FENNELL: Tom has been holding me in check all morning, so, thank you.

(Laughter)

MR. FENNELL: A more serious question, kind of back to the research, just for a minute. And that is to what extent are the publishers engaged in working towards the What Works Clearinghouse work? I follow that. Russ, you would be impressed, I follow that regularly in terms of what has been acceptable in the name of research, particularly at the middle school level where I believe that the last thing I looked at was sixth, that met some level of

acceptance, and elementary is coming up as a topic to be engaged in. And as you alluded to, the issue of pot of money to do this, and yet the level of respect, the level of acceptance could potentially be tied to success through the What Works Clearinghouse.

And as I look at what has been submitted, it tends to be studies that are connected with particularly NSF projects, initially funded projects at the middle grade levels. So it's just sort of, I would like a sense of what you are doing about What Works Clearinghouse from a publisher perspective?

MS. BAUGHMAN: Well we now base all of our research designs on the standards that are recommended by the What Works Clearinghouse. As a publishing group, we formed a small group of researchers, within the publishers, that had the opportunity to meet Russ and Phoebe and they were kind enough to talk us through some of the rationale behind their design elements and how we can better achieve. Bill and I struggle through the small pot of money question, but also the idea of engaging our schools and wanting to participate in this type of research.

The gold standard design is always randomized. Sometimes it's difficult to get schools to agree to that. They feel like they are taking a risk by participating in a study that is not necessarily

with a proven product. But we all know that in a first year publication nothing is proven, right? So we deal with our customers that are nervous, they don't want the extra time. Obviously, you have to do some assessment. You have to do some observation.

That being said, for I think all of our major programs now, I'm speaking on behalf of Bill too, but we all have done at least one year of work of randomized control trials for our reading, math and science programs and they have been submitted to the What Works Clearinghouse.

We have our researchers submit them so that it is very clear that the data has been collected independently and will meet their standards. They have been reviewed and we have received feedback and, in recent months, for the elementary programs, we have been corresponding with them regarding their ratings. I think the report is to come out soon, and so we comply with full standards. I confidently can say that.

MR. WILLIAMS: A question from Wu, then Deborah, then Tom.

MR. WU: I would like to draw your attention to the deplorable state of the quality of mathematics in American publication textbooks. I think the basic requirement is that whatever we write

in the textbooks, you can say it's not effective, you can say that maybe it's not the best research, but at least it has to be minimally correct. And in one of the, I think in an e-mail exchange with one of the representatives, I forget which company here, I placed a bet with that person. I said you bet me that I can find, on average, one small mistake every five pages, one major mistake every 20 pages and see if you want to do it.

And I think I'm pleased there has been an open forum and to call attention to the state we are in, it just cannot go on. I have parents writing to me all the time asking for how to help their children and I wish I could say, well, just look closely at a book and you can learn something. Then I resort to saying, well, look at Singapore textbooks. It's not perfect, but at least it's correct most of the time, which is not what I can say about our American counterparts. So this is why I was very alarmed by the great emphasis and the great earnestness with which you promoted the role, the important role that your mathematical authors play in your publications.

One is left inescapably to draw one of two conclusions. One is that either you hired the wrong person or you are not serious about taking the mathematical advice you were given, and I don't know

how else to impress on you the fact that you have to clean house. Your publications are just riddled with errors and it cannot go on, and I think it's not news to you, I think, in another capacity, my despair over the state of affairs has been filtered up to at least some of you here. And I just want this fact to be really known that if you are talking about mathematics education and the mathematics is wrong, there is not much point going on.

I mean, for example, we talk about effectiveness, how to use research to determine effectiveness. Well, when you have several versions of a correct method of teaching something, research can be set in motion to say which is the best. When you have several versions of incorrect mathematics in front of you, I don't see the point of doing research. And we are at that stage now where we have different versions of doing the same thing in an incorrect way and I think this has to stop.

MR. WILLIAMS: I'm sure there was a question in there, but--

(Laughter)

MR. WILLIAMS: We need to move on.

Deborah, you're next.

MS. BALL: I have three questions and I guess you can pick which one. The first is what would

be the consequences for your work if we had a national curriculum that is not separate state standards? How would that effect what you've been describing this morning? So imagine a situation in which we have a set of national goals and standards that are specified that we no longer have a situation that every state has its own.

The second question is about research. I'm interested in what sorts of research you have done or exists about teachers' use of teacher manuals, so this goes to the question about the increasing length of the teacher guidance materials, they make very little difference if teachers can't read, or interpret or make use of them.

And I think implicit in the jokes about the length is the assumption that maybe they get so long that teachers can't use them. I'm curious about what sorts of research you do to learn about teachers' use of the material and how that shapes the development of the guidance materials, both the mathematical supports in the guidance materials but other things as well.

My third question is what sorts of research do you do to respond to a different sort of diversity and that is the vast range of linguistic and cultural diversity among our nation's students? How do

you do the developmental work and the research to build the supports for teachers to address important and significant linguistic issues that arise in the cultural diversity of our nation's school?

MR. WILLIAMS: You have about a minute to answer those questions.

(Laughter)

MS. DILLENDER: I can address the first question about what would happen if we had a national set of standards. Without a doubt, you would see smaller books. I think we all agree to that. A good example is, for California, we did write a specific book, just for California. It's a third grade book. It was 539 pages for California. For national, that same third grade book, to cover all the state standards, was 748 pages, so we needed over 200 pages in order to cover all of the other state standards that that book therefore addressed. I think that's a very clear example of what would happen if we had a very focused national curriculum. You would see smaller books.

MS. BAUGHMAN: And quickly, I think I can quickly do number two, what have we done about the teachers' use of teacher manuals? You would be shocked at how many teachers say we don't have enough information to support all of their needs. We require

that they use the teacher's manual every single day in our efficacy studies to ensure that there is a very rigorous implementation of our program. Inevitably, once a week, I get a question that actually goes to your second question, how do I support my ESL students? How do I support my struggling students? You should have methods in here for me that show me how to do it.

We get a lot of I need the follow up, I need additional information. You think you've covered it all and then you find out that they are looking for something extra, so I think they do use it. I don't think the teachers manuals are overwhelming to them because each one is seeking out something different from it. That being said, all we have is qualitative data from that.

MR. WILLIAMS: And a last question from Tom.

MR. LOVELESS: I just wanted to press on this issue of textbook size and the explanation. I don't really buy the state variation as being a source. For instance, the California example. I'm an old sixth grade teacher from California, I taught in the 1980s, and I'm familiar with the math elementary series of that era. And when I look at the ones today, for instance, you said the third grade text is

500 some odd pages. My sixth grade text, in the 1980s, was around 300 pages. They really have grown tremendously over the last twenty years, even if you control for state variation. Here is my theory, and let me just bounce this off of you and tell me if I'm wrong.

The one thing that I've noticed is there are topics in the current elementary books that weren't really covered in depth in the 1980s. For instance, and these are NCTM strands, data analysis, probability and geometry wasn't covered in the depth that it is now. So that's one source of the bloating of textbooks. The second source, I think, is that the books today have many more photos, pictures, non-mathematical content, stories, let's just call it non-mathematical content in them and that also leads to a bloating.

If you look at the textbooks from Asian nations and the high performing European nations, they are much slimmer books and they don't have a lot of photographs and sort of dressed up in their appearance. Could some of you comment on that? Am I wrong in my assumptions?

MS. TROW: Well I represent Saxon so, for those of you that know Saxon, the reason for the length of our books is not because of pictures but it

is because the competency and comfort level of teachers with mathematics. And so our student editions really contain that math background and explanation mathematics in the student books and do not leave it to chance that the teachers are going to read about math background in their teachers editions and somehow convey that to students. So it's a consistency issue from teacher to teacher comfort level.

So, yes, there are more topics. I also taught in the 1970s and 1980s, and we didn't have these standards to adhere to, so that is definitely an issue, but it's also the amount of support. We don't want to leave any teacher behind, and we have to provide more support for teachers now that we have to teach to mastery, and mastery teaching requires a certain set of skills and content knowledge.

MR. WILLIAMS: First of all, Tom, thanks for asking my question and one last, last question from Wade.

MR. BOYKIN: This piggybacks on Tom's question actually.

Given the expanded size of textbooks nowadays, what are your expectations to what a teacher is supposed to cover in that text in a given year? And if they can't cover all of it, do you offer

guidelines for what is to be prioritized in terms of content?

MS. NISSEN: We do provide guidelines but, most of the time, the teachers do teach to their own standards. We do not expect a teacher to cover the entire textbook in the course of a year. That would be too much. We basically provide the material. We do not prescribe the material. We do provide guidelines, if they don't have any from their state or their district, but they usually do.

MR. WILLIAMS: I would like to thank you all very much and I will turn it back over to our chairman.

MR. FAULKNER: Let me repeat the thanks for the appearance of all the representatives from the various publishers, we appreciate your having been here today. This has been I think a useful morning session. We have heard testimony in a lot of different areas by various people and I do want to provide just a moment here for any comment by panel members who might want to react to this morning's activity. Is there anything anybody wants to say?

Wade?

MR. BOYKIN: I'm just wondering, in light of the comments about the research, if any of the publishers have intentions in the near future of

expanding the budget that's devoted to your research arms?

MS. BAUGHMAN: Our budgets have increased every year. I think No Child Left Behind did us a service actually with research because they have helped us increase the budget. It becomes a customer need, and therefore it becomes a priority. So they have increased every year.

MR. BOYKIN: But you said you have a two-person research staff.

MS. BAUGHMAN: Oh, yes, internally, but we work with a team of 17 different research organizations because we don't do our own research. We contract and through our contracts, we give away the rights to the data so that it is independent, so 17 folks outside of the organization. It feels like a pretty good pool to us.

MR. FAULKNER: Skip, did you want to say something?

MR. FENNELL: This really isn't for the publishers, so you all can relax, but it is related to one of the sessions we had earlier and that is the session from NSF, which I thought was, like all of them, very interesting. I didn't sense that we were finished. I felt a little rushed in getting through some questions and I really think we would probably

benefit from some more time, particularly targeted on their K through 8 initiatives across the span. By that, I mean not just curriculum materials but also professional development, teacher development and the like.

MR. FAULKNER: Others?

Russ?

MR. WHITEHURST: I wanted to thank the publishers that have stepped up and increased their investment in research and evaluation on their products. I know it's not altruistic but, nevertheless, and perhaps it's a good thing that it's not altruistic, but I think it's a very positive trend and I think it's a sea change and so, again, thank you. I want to thank those of you who have done that, thanks very much.

MR. FAULKNER: Anything else? Okay, I would like to, in the vein of what works, I would like to point out that the great success of our vice chair, who has operated for some time in the world of trying to pick out and identify high achievers in mathematics, and one of her identifiees of some years ago won a Fields Medal this year, now that's working.

So, Camilla, we want to congratulate you on that success. Do you want to comment at all on the case?

MS. BENBOW: Well it's a very exceptional individual and we are very proud, we have worked with him since he was seven years old, so it's kind of great to see something like that happening, that you have opened some doors and wonderful things could happen, thank you.

MR. FAULKNER: And then, finally, I would like to just remind the panel that we are going into our task groups this afternoon. I see this meeting as a very critical meeting. This time is going to be the one where you also meet with our research contractor. You will be trying to identify the scope of, the principle scope of investigation with enough specificity to get things set up for you to complete your work. We all, in the task groups, are looking at a very large field of play, yet we have finite time.

I think that it's really important for us, every one, to try to focus on the things that are most critical to the policy discussions that will go on in the next year, or two years or five years, having to do with mathematics up to about the eighth grade, and try to focus on a relatively small set of questions that would make the most difference and that we have a chance to actually present information that is valuable about. That focus is going to be very important for us to achieve I think mostly today and

tomorrow and I think it's not easy, but I just want to highlight to everyone the importance of trying to get to those issues.

We simply do not have time to cover every interesting thing in this world and it is important for us to focus on the things that make the most difference, so that's my speech. There are a couple of follow-ons to the speech, I'll ask Kathie--

MS. OLSEN: I would just like you to clarify the role of the ex-officio member. Should we sort of go through different task forces? Because I'm assuming my role is to provide any kind of question or answers for the National Science Foundation or provide material back in order to follow up with what Skip had said, but what is our role in those task groups?

MR. FAULKNER: I think you are members of task groups, all of you are identified with task groups, and I think you have the role as regular members in those task groups.

Bob?

MR. SIEGLER: We are sort of pivoting right now from gathering testimony, and discussing with ourselves and organizing into actually starting to produce a written product, and one thing that I think is very important to get very soon is at least an outline, at the chapter level, of the kind of

report that we are thinking of making because it's very hard to know how long, how much detail to go into, what the place of each part that we write is going to be in the overall whole.

MR. FAULKNER: I don't disagree with that.

Wilfried?

MR. SCHMID: Well I think, to most of us, this is a complete mystery, how this is going to unfold.

(Laughter)

MR. FAULKNER: I think that's part of what this afternoon is about.

(Laughter)

MR. FAULKNER: I'm just trying to heighten the sense of urgency and to tighten your stomach muscles.

(Laughter)

MR. FAULKNER: Thank you all.

(Whereupon, at 12:14 p.m., the session was adjourned.)