U.S. DEPARTMENT OF EDUCATION

NATIONAL MATH PANEL MEETING

Arizona State University
Memorial Union Alumni Lounge
Room 202
Tempe, Arizona

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Dr. Camilla Persson Benbow, Vice-Chair
Dr. Deborah Loewenberg Ball
Dr. A. Wade Boykin
Dr. Douglas Clements
Dr. Susan Embretson
Dr. Francis (Skip) Fennell
Dr. Bert Fristedt
Dr. David Geary
Dr. Russell Gersten
Dr. Tom Loveless
Dr. Liping Ma
Dr. Valerie F. Reyna
Dr. Wilfried Schmid
Dr. Robert S. Siegler
Dr. James Simons (Not Present)
Dr. Sandra Stotsky
Mr. Vern Williams
Dr. Hung-Hsi Wu

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Dr. Dan Berch (Not Present)
Dr. Joan Ferrini-Mundy
Mr. Raymond Simon (Not Present)
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Ms. Jennifer Graban
Ms. Holly Clark
Mr. Jim Yun
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Adjourn
DR. FAULKNER: Okay, I think we're ready to go. Let me call this meeting of the National Mathematics Advisory Panel to order. I'm Larry Faulkner. I'm chairman of the National Math Panel. To my left is Camilla Benbow, who's vice chair of the panel.

We are in the, I think, ninth meeting of the National Math Panel. And this is the first open session of the ninth meeting, and I want to welcome everyone who is in the audience to this session. It will be an important session in many ways in that -- this will be the time in which we start public work on the drafting of the Final Report of this Panel. And I'll talk to you more about how that has come to pass.

But let me ask right now about signing services. We have a signer here, and we are glad to continue those services if there is anyone in the audience who requires them. If there is not, then we will discontinue the signing services with the understanding that we can re-continue them if the need develops. So let me ask if there is a need for continuation of the signing services? If not, then we'll go on.

I would also like to express appreciation
to Arizona State University for hosting this Panel. With our visit here to Arizona State, this university joins a constellation of eight other institutions around the country where the panel has met to receive testimony and conduct business. From the National Academies in Washington where the panel started its work to Fermi National Accelerator Laboratory near Chicago, from MIT on the east coast to Stanford on the west coast, from Miami-Dade College at the southern tip of Florida to Arizona State, the Panel has traveled across the country to places with strong reputations for educational excellence, and we're glad to be here in Arizona.

This university is a leading metropolitan research university in a region of extraordinary growth. I'm not using the word extraordinary casually. What's going on in Arizona is remarkable. And the way in which Arizona State University has coupled its future with the future of this region is unique, I think, in the American spectrum of higher education, and we're glad to be in that milieu for a period of time here. Arizona State has become very widely recognized for its willingness to address the future in inventive new ways with civic and social engagement as a hallmark.

Tomorrow morning at 8:15 we'll be, I
think, back in this room. And Dr. Michael Crowe, President of Arizona State University, will welcome the Panel and make brief remarks.

Let me give a little background on the Panel. The Math Panel was established in April 2006 by Executive Order of the President to review the best scientific evidence and to make recommendations to the President and Secretary of Education on ways to improve mathematics learning, with a particular emphasis on algebra readiness and algebra success. After almost 18 months of reviewing research and listening to testimony, the Panel is wrapping up the work of its specialized Task Groups and has begun the synthesis process for the Final Report.

After the public comments, which will be our first order of business, the Panel will discuss the outline of the Final Report, which has been developed in draft form through the work of three teams that have worked largely by telephone and email for the past three weeks. Each team was asked to assemble a concept for the Final Report in the form of an elaborated outline, giving the most important findings and recommendations and suggesting an order of presentation.

The chairs of the synthesis teams worked the three concepts into a final -- or excuse me, into
a single first common concept, a Panel-wide concept, which was taken back to the synthesis teams for separate discussions and reactions earlier today. Over the lunch period, the chairs revised the first common concept into a second common concept on the basis of reactions in the morning session. After lunch the synthesis teams were able to -- were supposed to discuss the second common concept but they didn't actually have time for it.

We're going to open the Panel-wide public discussion with this second common concept and you will be able to see it projected on the screen. Now I want to hasten to add that as you look at this, this is a kind of catalog of items suggested to be included in the Final Report. It is not the language of the Final Report. The language of the Final Report will be drafted -- pardon me, in the next couple or three weeks on the basis of this catalog, this concept document that we're talking about here today. So there's a lot that's tentative about what you'll be looking at -- looking at in this document, and we will be having a discussion here among the Panel about what to include, what not to include, and what to change. Pardon me. Something about dry heat, I guess.

Now before we start that discussion, let me welcome the speakers who've registered to speak
this afternoon. At each meeting of the National Math Panel, we've taken time to hear from interested individuals and organizations who have been following the National Math Panel's work and who want to offer comments for the consideration of the Panel. This testimony has been quite valuable.

Our first speaker is Bill McCallum, and I ask him to come forward and to sit at the testimony table. For Panel members, you'll find public commentators listed under Tab 6 in your notebook. Each speaker is limited to five minutes. Panelists will have the opportunity to ask questions of the speaker after their remarks are concluded. So let's go ahead and begin with Dr. McCallum.

DR. MCCALLUM: Thank you. As I think you've been viewing I've been walking around the Panel making my comments this afternoon --

DR. FAULKNER: Yes. Dr. McCallum, could I ask you to turn the microphone on.

DR. MCCALLUM: Is that better? I'm a mathematics professor at the University of Arizona and I direct the Institute for Mathematics and Education there. In addition, I chair the committee on education of the American Mathematical Society. Next year I will start a two-year term as chair of the conference board of the Mathematical Sciences.
I'd like to start by thanking the Panel for its work in trying to create clarity and consensus around the problems facing mathematics education in this country. The charge to the Panel covered an enormous amount of territory, almost an unmanageable amount. The Panel has researched and discussed teacher knowledge, instructional practice, student learning and core knowledge of school mathematics. It has navigated significant controversies on these issues and has discovered some areas of consensus and others where more knowledge and evidence is needed.

Effective next steps will require the energy of many stakeholders: mathematicians, educators, teachers, administrators, policy makers and business people. I'm not here today to tell you to add anything more to your report. My comments here today are really about how to awaken and harness and direct the necessary energy.

The Panel's report will join a series of reports by distinguished groups going back over the last 25 years at least, starting with a Nation at Risk in 1983, through the Glenn Commission report that came out in the waning days of the previous administration, to the recent National Academies report "Rising Above the Gathering Storm," which I recently discovered on another trip to Washington to hear your presentation.
to organizations is affectionately known as RAGS.

The Panel's recommendations might be different from those in these reports, but their fate might be the same. Although there is some movement on turning RAGS to riches for education, the general record of follow-up on these reports is a sorry one. As the panel winds up its work, it must be wondering how to beat that record.

Fran Leibowitz said that the opposite of talking isn't listening; the opposite of talking is waiting to talk. Right now there are plenty of people in the national education arena, especially in Washington, who are waiting for their turn to talk. Those of us spread throughout the rest of the country who care about mathematics education are obliged to start thinking now about how to turn your report into a process of listening that leads to action, not more talk. Too many reports have burst upon us like the summer monsoon, only to sink into the desert sands. It's time for us to start making use of the water when it comes.

The immediate purpose of the Panel's report is to inform the legislative agenda at the federal level. However, we can't wait for whatever legislation might materialize. Turning the Panel's words into action also requires an urgent national
deliberation, conducted in school districts, state houses, state boards of education, and national organizations.

On that front, I have a proposal for your Final Report. I would like to suggest that you enjoin a coalition of institutes, centers, and programs to organize a series of follow-up meetings around the nation. These meetings would mine your work and extract nuggets around which to build their own agendas for action and programs for research. An important resource would be not only your report, but also the rich set of documents that you have accumulated during these periods of public comment, especially in areas where the panel has not yet found common ground.

Some meetings would have a focus on influencing policy, taking recommendations from the Panel's report that can be turned into immediate action. For example, there is much that institutions for higher education can do right now in teacher preparation and professional development. Other meetings would pick up the ball in areas where more research is needed and develop research agendas of their own to fill in these gaps.

Should the Panel take up my suggestion, the Institute for Mathematics in Education stands
ready to step up. We have the capacity not only to run some of the meetings envisioned in my proposal, but also to collate and orchestrate the efforts of other centers. Collaboration is the hallmark of the institute. We specialize in bringing together communities that are sometimes worlds apart: mathematics departments, colleges of education, school systems, government agencies, business and commercial and non-profit education organizations.

I have made preliminary contact with some of the organizations that might help carry out this work, such as the Mathematical Sciences Research Institute in Berkley, the Focus on Mathematics Project at Boston University, the Center for Science, Mathematics and Computer Education at the University of Nebraska, the Center for Mathematics Education at the University of Maryland, and CRESMET, the Center for Research on Education in Science, Mathematics, Engineering and Technology here at Arizona State University.

There are many more centers I have not had time to contact but which I am sure are ready to join such an effort. As A Nation at Risk memorably put it, if an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act
of war. That was almost 25 years ago and we are not much better off now than then.

We ourselves are the unfriendly power. And we are also, therefore, the solution. I urge the Panel to draw on the resources of local and national centers and catalyze the formation of a network for positive climate change in education.

DR. FAULKNER: Thank you, Dr. McCallum. That was a useful set of comments and we appreciate your sharing your views with us.

Are there comments from the panel? One thing I can say is that I think that the question of what follow-up will happen is always a question for a group that undertakes a study like this. And we don't know the answer.

One thing that is true in this situation as opposed to others in which I've been engaged is that the responsibility for follow-up is actually diffused in this country over many agencies, organizations and authorities. And that actually gives us some hope that somebody, somewhere, may actually act. And we aren't quite as dependent on the idea that a single power or a single authority will act.

Any other comments that you wish to make?

Thank you.
All right. Second in the group of testifiers is Janie Zimmer, National Council of Supervisors of Mathematics (NCSM), board member.

MS. ZIMMER: Honorable members -- is this on? Honorable members of the National Mathematics Advisory Panel, thank you for the opportunity to speak to you today. I am Janie Zimmer from Research Base Education, and I am speaking on behalf of the National Council of Supervisors of Mathematics, or NCSM, a group of leaders in mathematics education. I serve on their board.

First of all, we would like to tell you that the National Council of Supervisors of Mathematics (NCSM) greatly appreciates your work throughout the past year and a half. We realize how important your task is and we are hopeful that your final report will have an impact on the children in our nation. NCSM appreciates the opportunity today to provide further input prior to your final report. We sent written input to the panel about a week ago and that input is most likely in your binders.

The input that we sent touched upon several issues, some issues addressed to the entire panel and some to different task groups. Today, however, I would like again to highlight one of those issues, what we see to be the most critical issue in
the work of the Panel, and that is equity, the opportunity for every student to achieve a high level of mathematics.

As we examine the total work of the Panel, we currently see few references to equity and the opportunity for every student to achieve high level of mathematics in order to be prepared to be successful in algebra. There are some references to students with learning disabilities and a reference to gifted and talented students, but at this time, or prior to this meeting, we did see not addressing the needs of those from poor families, those with -- those whose native language is other than English, those who have diverse learning styles, those students of color, and those who have strong and different cultural backgrounds.

We realize that you are still in the early stages of your report, yet emphasize that the needs of these students must be woven into the report in a more robust way. In his most recent book, The Art and Science of Teaching, Robert Manzano references many affirmed research studies that highlight the importance of planning for instruction that can significantly impact student achievement. He emphasizes percentile gains based on teacher actions and commitments.
In the third annual Brown Lecture in Education Research, Linda Darling-Hammond presented “The Flat Earth and Education, How America’s Commitment to Equity Will Determine our Future.” Our poorest, most needy students often have the least access to the best teachers and proper resources, she states. Study after study documents that there are significant differences in factors such as class size, school size, teacher quality, curriculum quality, and availability of resources and equipment in what is found in our affluent, suburban schools compared with what is found in our center city schools that are the homes of our African-American and Latino students. Much of the difference in school achievement between minority students and others is due to the effect of the unequal school opportunities, and in particular, greatly diverse access to high quality teachers and teaching.

In addition, tracking persists in the face of growing evidence that it does not substantially benefit high achievers and tends to put low achievers at a serious disadvantage, in part because good teaching is a scarce resource and thus must be allocated.

Today the world is flat. And in this flat world the United States is dramatically losing ground
educationally. We set standards yet we continue to struggle as a nation. Most of the top achieving countries now graduate virtually all of their students from high school, while the graduation rate in the United States is about 70 percent. And for cities such as Baltimore, Denver and New York City, the graduation rate is much less than 50 percent.

Possibly more than any other recommendation, the recommendations of equal access and equal opportunity, the recommendations of equity are the ones that need to be made by you, and need to be made very strongly, so that students who are now truly left out will be given a strong education.

Once again, the National Council of Supervisors of Mathematics (NCSM) thanks the Panel for the tremendous amount of work and time that you have put into this project, and again invites you to call upon us to inform your work and to provide support in any way that we can. Thank you for this opportunity.

DR. FAULKNER: Thank you, Ms. Zimmer.

Questions or comments from the Panel? Vern?

MR. WILLIAMS: You mentioned that there were some differences between quality of services offered lower income students and middle class students, and you mentioned quality of curriculum.
Could you answer two questions? What do you think the differences in curricula are? And my second question would be have you heard of Project Follow Through and what's your opinion of it?

MS. ZIMMER: When I look at curriculum -- and I've had the opportunity, and I truly say opportunity, to work in Baltimore City and also to work in Howard County. One is a rather affluent school district; one is a struggling city school district. The quality of curriculum is not at all to be compared.

Curriculum is designed by the school district in which the teachers are teaching, and the teachers design it for the most part. The curriculum in Howard County is very tight. It is seamless. It is presented in a way that a teacher can look at that student's grade level and see what was done in the previous two or three years and what will be coming in the next few years. In Howard County the curriculum is -- I mean in Baltimore City the curriculum is much older. It is not seamless, and it is not very tight.

I cannot comment very specifically on Project Follow Through, and I would be remiss in pretending to be an expert in that, but I can speak very, very intimately from those two school districts. Also, I can say in Philadelphia, where I've worked
closely, I do not see a strong curriculum. In Redding, where I've worked closely, I do not see a strong curriculum. In the Gettysburg School District, where I have done some services, I do not see a strong school curriculum.

MR. WILLIAMS: But can you identify some characteristics that you have in mind when you talk about a strong curriculum?

MS. ZIMMER: A strong curriculum needs to identify to the teacher exactly what it is at this grade level that your students are responsible to master. You need to look at what are the things that you will be introducing, what are the things that students should master at this grade level, and what are the things that you should maintain at this grade level.

Also, a strong curriculum should place the content of this grade level in context of what comes before it and what comes after it. When we look at a teacher teaching a grade level, I think that at the St. Louis meeting we looked at the slide presented by the Teachers Task Group that said teachers should know at least what they are teaching or what their grade level's teaching.

I have a problem with that and we did address that in the -- what the National Council of
Supervisors of Mathematics (NCSM) sent in, because we firmly believe a teacher needs to know far beyond what they're teaching. Because if you're teaching a third grade class and you know what you're teaching, and a child comes out with a question that is beyond that, how do you then respond to that? How do you prepare your third grade students to be successful in fourth and fifth grade mathematics? You can't do that just by knowing what you are teaching at that grade level.

Your curriculum needs to be able to extend beyond, or a teacher needs to be able to extend beyond what the curriculum is, but to focus on and to be able to test what it is that you're responsible for students to master at that grade level. And as teachers are teaching, they need to take responsibility for having students master at that grade level so that they will be prepared as they go on to the next grade level.

DR. FAULKNER: Tom?

Dr. LOVELESS: Thank you for your presentation. The two states that I heard you mention and focus on are Pennsylvania and Maryland. Both of those states have math standards and frameworks.

MS. ZIMMER: That's correct.

DR. LOVELESS: And in fact both of them have had them for some time. They're not new to
that --

MS. ZIMMER: That's correct.

DR. LOVELESS: -- to that ballgame. To what extent is what you have just laid out to us and the heterogeneity of districts within both those states, to what extent do you blame the state standards, or should the state standards be focused more so that this kind of thing doesn't happen?

MS. ZIMMER: I'm not so sure that I blame the state standards. As you know, Maryland has changed their standards from the more integrated program, or problem solving based program, to a more rigid, discrete type standard program. I'm not so sure that I blame the standards as much as I blame the curriculum in the school districts and their preparation of the teachers, and the resources that are available to school districts, and especially large school districts, large urban school districts, and poor school districts, and the ability of school districts to really look at what do we do with children with learning disabilities. This is a real, real problem. This is a real problem.

This is where our urban school districts are really falling back in my estimation. And I'm speaking as Janie here. I can't -- haven't polled the National Council of Supervisors of Mathematics (NCSM),
so I'm speaking as Janie. Students with learning disabilities are not students who are dumb. I think in one of the sessions I shared with you that there are 13 or 14 different categories of learning disabilities. Only one of those is low IQ. And yet when a student is in a class and has an Individual Education Program (IEP), teachers have an attitude that this child is not up to par with everyone else. That child can be up to par if the teacher believes they can be up to par, and if the teacher takes the time to do the things that will meet the needs of that child.

Now, do I know all of the things that they can do? No, I don't. Do you have access to all of the research that's available? You have access to a lot more research than I do. But -- and I know it's a very difficult task, but we have to look at what are the things that our students who are not English speakers, what are the things that will get them to learn mathematics and be prepared for algebra? What are the things that will get our students who are from poor families, what will get the things -- have those students achieve mathematics, to be excited about mathematics?

There's a lot to do with technology. We're talking about the video game generation.
There's a lot out on that. Marc Prensky talks about that. He talks about the digital natives and the digital immigrants. There's a lot that will turn those children on and get them excited about school and about mathematics, which will get them learning the mathematics. But we have to have an open mind, number one, and our teachers have to be invested, they have to believe, they have to have the training. And in our urban districts they're not getting that training.

In Howard County, where I was a coordinator of mathematics, they have very rich training. In Fairfax County where Vern is a teacher, they have very good training. We coordinated a lot with Fairfax County. They have very good training, but that's your more affluent suburban district.

Well, what's happening in Washington, D.C.? What's happening in New York City? What's happening in Detroit? What's happening in Philadelphia? These are the large populations of the United States. We are looking at the world getting flatter and the United States is falling behind in education because of that. And this Panel has a real chance to look at how can we address equity. And I'm not sure what we're actually going to say, but it's something that you've got to do. It's got to be part
of that.

DR. FAULKNER: Liping, did you have a question?

DR. MA: Yes, I was wondering if the students with disability in math are the same group of students with disability in English or reading? Did I make sense, like is it the same group or -- if yes, so what does this mean to us?

MS. ZIMMER: A lot of times, especially in elementary school, children are grouped. And they're grouped according to ability in reading. And then they are in classes where their math just goes along with that ability in reading. Other times we see schools where students are pulled out for acceleration in math.

There's a lot of research, and in the paper that I just gave you I give you five or six references to research that is showing that classes where you have pullout of gifted and talented students are not really beneficial for low ability students. And they're also not that beneficial for your gifted and talented students or your high ability students. You have those references in the paper there, which you will be getting. I'm not sure if that answered your question. I'm not sure that I understood, you know --
DR. MA: Yes. Maybe --

MR. FAULKNER: -- your question.

DR. MA: My question is that aren't those children disabled to learn math same as children with disability learning English?

MS. ZIMMER: Oh.

DR. MA: Who they --

MS. ZIMMER: Okay. Children who are not speakers, not -- whose native language is not English, are not necessarily disabled. It's a different category of students. Students who are identified with learning disabilities are students who might be autistic, who might have Attention Deficit Hyperactivity Disorder (ADHD), who might be low IQ, who may have other disabilities. English language learners, students whose home language is not English are not considered to be learning disabled, but they're considered to be non-English speakers. And so as they're learning the mathematics, they're also learning the English.

We have a lot of students here from other countries that are learning the English language along with learning their mathematics. So the difficulty is that they don't always understand the language and the explanation in the classroom, and so they're having a difficult time learning the mathematics but that's not
necessarily a learning disability as one of the
classifications of learning disabilities.

DR. FAULKNER: Wade?

DR. BOYKIN: I also want to thank you for
your comments this morning -- this afternoon. But a
lot of your comments with respect to equity matters
focused on teachers and teaching quality. Given that
you represent the National Council of Supervisors of
Mathematics (NCSM), what role do you think supervisors
play in dealing with equity matters?

MS. ZIMMER: Supervisors play a humongous
role, but supervisors need to have access to the
teachers and they don't always have access to the
teachers. In large urban districts supervisors may
see the teachers once at the beginning of the year,
maybe a half-day or a full day in February, maybe one
other time during the year. They also have an
opportunity to go in with the teachers to visit them
in the classroom.

In say Baltimore City you may have 85
schools that a teacher -- that a supervisor is
responsible for, and you don't have that many
supervisors in the city district. Philadelphia's even
more. I think they have a hundred -- and don't quote
me on this, somewhere in the neighborhood of 165 or
175 schools in Philadelphia. And although they do
have a staff, their time is limited. They do offer workshops, but they're offered on a voluntary basis so all of the teachers are not required to come. They come if they want to come, but they -- the people who probably don't need to come as much are the ones who come; the people who really need to come don't come. So access to the teachers is not that -- there isn't that access to the teachers that need it.

On the other hand, I will say in many of the suburban districts with which I am familiar, I do see that there are two or three days in the summertime where they have access to all teachers. I do see that when a new program is implemented it's not a voluntary come and get training, it's you will be here to get training and that is time that is allocated to those teachers. I do see afternoons scheduled when teachers will come together for additional training and also for sharing sessions. And many times the sharing sessions will be monthly. They may be voluntary, but I see a much larger attendance. Again, that goes to the quality of the teachers.

I also see and I add one last comment on that, as a teacher, or as -- I was a teacher and then a supervisor in Baltimore City -- I would see many teachers begin teaching in Baltimore City because that's where they could get a job. And then after
two, three, four, five years they would move to a county system. Number one, the pay was higher; number two, the resources were much greater.

This is a big problem in our nation. And I'm not sure what this Panel can do about it. Maybe just state it, state it strongly. But it is a big problem in our nation and it makes a big impact on what kind of education our students get across the board.

DR. FAULKNER: Other questions or comments for the panel?

Thank you, Ms. Zimmer. We appreciate your being here.

The third testifier is Peggy Akins. Is she available? We have an indication she hasn't checked in, so that's why I'm asking. If that's -- if she's not here, then I think we're complete; right, on those who have signed up.

It's going to take the staff about five or so minutes to get the projection system set up. If the Panel wants to take a break briefly they may do so, but the projection system will be set up now. I'm going to ask everybody to turn off their microphones.

(Whereupon, the above-entitled matter went off the record at 3:34 p.m., and resumed at 3:43 p.m.)

DR. FAULKNER: Okay, let me ask everybody
to take the seat please. We're ready to re-start.

We're going to be talking about the second common concept. And I'd like to point out to the audience and to the Panel that we have two screens up. They're both carrying the same information. Those in the audience might find it actually somewhat more convenient to rotate your chair and look at the other screen. And we won't be offended if you turn your backs. But anyway, there are two screens. And as I said, as we talk -- they'll both be carrying the same information.

Now, let me emphasize again that we're talking only about major elements, findings, recommendations that are in the current concept, and what the panel thinks about those. What we need to find out in this session is the degree to which there is agreement or disagreement on a point so that we can build a catalog of items that are largely settled for inclusion in the report, and another set of items that will require more debate. We're really just trying to sort those things out.

This can be a time for suggesting other elements, but I'd say we ought to be careful about that. They need to be significant elements. We can start thinking about that, but we'll also have additional time tomorrow.
In general, this is not a time for wordsmithing. I would like to caution the Panel on that. The documents that you have here are cobbled together from documents that the synthesis groups cobbled together from their own language and the working papers of the various task groups and the subcommittee reports. These are really to be suggestive about what might be included in the report.

From this document once we settle it, we will build a draft. The draft will be largely made up of language taken from the working papers of the task groups. And that language and the language that is in the task group reports has already received quite a bit of attention from people. And that language is what will be brought into the draft final report once we have the concept settled. So there will be time for wordsmithing later, but it's mostly going to be at our Baltimore meeting in late November when that full text is available to you.

Today what we're going to do is take the current concept and we'll go through it section by section. You'll see where we are on the screen. There are also competent note takers and a transcriptionist making sure that everything gets recorded. So we're not going to edit right here on the spot. What we're going to do is receive people's
comments, and then from those comments we'll try to make the consequential changes that seem to be appropriate.

Let's get started. And we're going to be running until I think 6:00, so we've got about two hours here. That's the start.

The second common concept -- to the Panel, I'll remind the members; I spoke a little bit to you earlier -- differs from the first common concept in that you asked for a faster start getting to the more impactful language and getting away from the more operational stuff about how this Panel got charged, and who the members are and where we met, and all that. So let me show you how we have addressed that.

You'll see that there's room for an executive summary. That has to be done later. We're not going to worry about that right now. The introductory comments in the first paragraph or two will quickly indicate that this Panel arose from Presidential Executive Order. It'll talk -- it'll at least provide a reference as to where the membership list can be found and then it'll provide a reference on how the panel's work was carried out.

Let me ask Sara to scroll down now all the way to the end, control end. There you go. Now scroll up and we'll see that the appendices -- I see
that we've got an error already. But anyway, the appendices would be A, the Presidential Executive Order; B, the rosters of the Panel members and staff and consultants; and then C -- that should be a C -- is organization and operation of the Panel.

And you'll see all the stuff that we had previously laid out: the summary of the Panel's method for pursuing its work, the task groups and subcommittees, the synthesis and submission of this report, the standards of evidence. That's all laid out in Appendix C. And we haven't changed any of the details that are written there. It's simply just where it's arranged. Then D is still the locations and the meetings and dates, and E is the rosters of the task groups and subcommittees. So we moved all that stuff back into the back.

Now going back up to the top, we have the case. I think we believe that we need to begin this document with a strong discussion about the state of math education in the country and the need to address this issue, this set of issues. There are -- there's a whole body of material, I think, that we have to get organized into this kind of carefully written argument. The material that was identified up there in the front, the root in the President's charge, the policy behind -- concerns behind the Executive Order
having to do with college going rates and college
graduation rates and eligibility for the workforce,
Gathering Storm and so force, mathematical performance
on international competitions, those are things we've
already discussed.

What came out of one of the task -- or the
synthesis groups this morning was this discussion that
you'll see starting with point one there. Sara,
scroll that up a little more. And what we did was
agreed to put it in the case bin here. I think at
this stage we're not really composing this case. We're
really just collecting things that look like we ought
to think about for inclusion in it. But this argument
that begins "Mathematics education has been a major
concern for more than 50 years. Wave after wave of
improvement efforts have focused on math education,"
et cetera. This is stuff that we have put in this as
a result of its being developed in the discussion
group this morning, or the synthesis group. And
I want to open up any comments that people want to
make on the case section here relevant to whatever has
been put in today or whatever is already there or
whatever you think needs to be added into it. Sandra?

DR. STOTSKY: Let me just say that I think
that up until point four, it seems relatively okay to
me. I don't want to do the wordsmithing as you
suggested, but my sense is that from five down through the end of that section we've had an abrupt change in what the focus of the panel has actually produced as work. We're suddenly talking about resources, gaps in resources, and making investments, which is about -- and most of this is about research that needs to be done and investing in this research, which is really not what I have conceived the work of the Panel to be about.

I would say that what I thought we were trying to do was make sure that we had a focus on the content of mathematics, on content goals for K through seven teachers, on properly focused assessments that would address the content of mathematics, on the focus of instruction that would address the content of the classroom, and so on. Somehow that focus on restoring an emphasis on the content of mathematics has been lost, and we're talking about resources and gaps and investments for research. I don't really understand why we need to do this, and I think we need to recast the case that we're making.

DR. FAULKNER: Yes. Let me say again, we haven't actually made any decisions on the case. We're just collecting stuff into that box.

DR. STOTSKY: Okay.

DR. FAULKNER: But I think the comments
that you're making are relevant to where we go. And so I invite any comments, and those comments will be annotated into this document. But this doc -- this section differs from any other section in this document in that it's less digested in terms of what a formal presentation would be than the other sections. Yes, go ahead.

In fact, let me also point out that the synthesis groups weren't actually asked to address this part of the document. I just indicated that there would have to be such a section when we came together the other day, and indicated that we would have to carefully develop it. But the synthesis groups were actually asked to address more of the content part of the document. And so this has not been developed on the basis of any extensive synthesis group interaction and it's just, as I said, a bin for collecting stuff right now. But I -- so I want to be sure everybody discusses it on that basis.

Yes, go ahead, Wilfried.

DR. SCHMID: It seems to me that if you look at the section that Sandy is referring to, lines 35 through lines 80, the two words that really bothered her are resources and investments. Now I find reading this section that resources is used in this case, in line 35, as a synonym for sources, and
investments, on line 76, is really used as a synonym for basis. And using the words resources and investments, respectively, suggests that in section -- in the section we are really talking about well, that there's a lot of money, and we're not.

So I think the choice of words, resources and investments in these two locations are really out of character with the whole section. This is not a matter of wordsmithing. Those words need to be changed.

MR. FAULKNER: Wade, yes.

MR. BOYKIN: A couple of comments. One is that, when our synthesis group offered up these particular points, we thought it was important to have them somewhere in the document to help frame the overall message, if you would, that we want to deliver. Where they are placed is up for grabs. It doesn't necessarily have to be in the section on the case to be made, just that this will help to frame some of the comments that we think should come out of this document as it is to be interpreted or processed by the readership.

The second thing, and I think more importantly, is that maybe the label is incorrect, but points 5-A, B, C and D are merely summaries of general findings from the body of the report. And the point
to be made is that, we sort of know these things, and then in 6 it's like then how do we get these things into the classroom where real kids can receive good instruction from real teachers. I think that's what's the message here. If it's part of the case or not, where you put it is, I think, less consequential than the fact that we think these matters here need to be in the document to help frame our overall statements.

DR. FAULKNER: Bert, then Valerie.

DR. FRISTEDT: I share Sandy's concerns and Wilfried's concerns. It is true that one wants to sort of catch the full story up front, but in some sense it's also a misleading story that gets represented here about where the main thrust of the document is concerned. I'm particularly concerned about items 5-C and 5-D unless later we have something very concrete to say that we are already making progress in these areas.

I think I'll just leave my comments at that, but I'm finding -- I'm essentially in agreement with Sandy.

DR. FAULKNER: Valerie?

DR. REYNA: The -- one of the tasks that this group had, I think from the beginning, is not only to speak to the content of mathematics that ought to be taught, and policy and practice, but also to
recommend research and areas for further research. So I think that's certainly within the purview. The question of the placement of these -- the recommendation section may be a bit odd. Again, I think it has to do with the fact that we were doing this very recently. So if we were to take the recommendations and place them in the context of the other recommendations of the panel, this might flow a bit more smoothly. But I do think that recommendations for research may be among our most valuable contributions of the Panel.

DR. FAULKNER: Okay. Anything else on this? Deborah?

DR. LOEWENBERG-BALL: What our task group was trying to do, just without respect to the particular words, is that, we worried about what we just heard in testimony. And we've worried about that since the beginning of the Panel's work, and that is how this report will have the impact that we all hoped it could have and how it could make some difference for policy and practice.

So what we were talking about today, as we went through these lists of things that we're about to talk about, was we noticed something very interesting, that there's astonishing agreement about one major thing that Sandra just referred to, which is amazing
amount of progress has been made and agreement about what kids should learn. There's a huge amount that's going to be in our report about that. There's also amazing progress in our knowledge about how kids learn. So the first section we're saying is that's really astonishing, and we can produce that for the public and for policy makers.

One big problem is that, like has happened many times before, what it will take for that to actually reach classrooms and be used by teachers and to be part of real, usable policy has historically always been left in the gap. And we notice that in the research from Instructional Practices and in the research from the Teacher group, for significant parts of what it takes to make these things happen, we still lack knowledge.

So we set up, whether it goes at the front or not, we thought we're proposing these -- in fact when we were asked about what are the big points, we're proposing these as the big points. This is what we feel we've learned. And on one hand, two of the task groups were able to collect astonishing progress in two key areas for the improvement of mathematics achievement. Two of the Panel groups, after a lot of work, discovered that we don't actually know all that it will take to make the knowledge about learning and
the knowledge about mathematical content reach real classrooms. So try to understand that whether you like the wording or not, that what we're attempting to do is to help our work we've done over the last 18 months actually have a punch.

I fear, and I think some of the colleagues in my group fear this report, unless we can figure out how to say what it is this group actually found, that we may be relegated to the same shelves that all the prior reports are. And we talked about this before.

So be sympathetic about the language, because as Larry said, it's not like it was written with great care. But it -- there is a point being made here about what the five task groups found, and I think it's worthy of our continued discussion, whether we agree that it's amazing the areas we know a lot and the areas where we don't, it's really a problem, and something that's really worth trying to continue to think about.

DR. FAULKNER: Wilfried, then Sandy.

DR. SCHMID: Just want to make it very clear that what I was talking about were two -- these two particular words, because they suggest a direction that I don't think was intended. And if those words are changed, then this is not -- I am not particularly objecting. I think, you know, I have some agreement
with Bert about his comments, but I am really concerned about two words.

   DR. FAULKNER: Sandy?

   DR. STOTSKY: I'd like to say that I also am very conscious of how the report will be received. And I would not want another report that seems to say we need more money for research. I don't think that is the way we want us to be seen. And that is what is now being conveyed by all of these four areas for research as the answer to our efforts in order to make more progress.

   I say that for another reason. Not only because I don't think that that correctly characterizes why the Panel was put into being and what we should be seen in public as saying is the outcome of the Panel, because this is a very common saying. Get a bunch of researchers together and, of course, they're going to say we need more money for more research. This has been known for decades as the common answer you get.

   There's another reason, and that is we had very poor yield from most of the research we looked at. We talked about this earlier, that most of the research we've looked at has been so poor that we haven't been able to use most of it for any reasons at all. Most of it doesn't even qualify as high quality.
Some of it is research that doesn't allow many conclusions to be drawn from it to begin with. So to then advocate more money for something that doesn't even necessarily come out of what we basically were -- was able -- what we were able to use sounds self-serving. And I think that we need to be very careful that we're not self-serving in this document and can somehow say that many of the things we found don't really require money.

It's beginning to sound like an old refrain, the best things in life are free. They're not free, but they require an intellectual effort. And they require a way of rethinking about what the purposes of the schools are, what the focus should be and so forth, but they don't necessarily require money. It's a way of changing the way people look at what the purpose of education is and what the purpose of mathematics education should be. And that message is being totally lost by saying we want more money for research.

DR. FAULKNER: Wu?

DR. WU: So I -- basically I want to compliment something that Deborah said a minute ago, but before saying that let me make one observation, which in part agrees with what Sandy just said. In the words of people other than myself, the impact of
mathematics education research or mathematics education itself has been uncertain. And so we -- I think this is something we should keep in mind.

But my main message is that, actually, it's amazing that I didn't think of it until Deborah mentioned it a minute ago. In our formulation of our recommendations and in the points of emphasis in our report thus far -- and I think I must confess to having been negligent and missed out on the point that Deborah was trying to make -- which is that the whole point of writing this report is to have an impact. And from that point of view, I mean all the things that we have found to be good, they're really of no use unless we put them into the classroom.

And what Deborah is pointing out is that it's the implementation part that maybe we have not been emphasizing enough. For example, because of various aspects of the report from the Teacher Task Group, there have been relatively few statements about teachers in both of our findings and our recommendations. But, in fact, in terms of a lot of what Deborah was saying, how do you carry this to the classroom? And the agent for carrying these out in the classroom is the teacher.

And I think we should go back and revamp our recommendations, and I think we need to put a lot
of emphasis on how to improve professional
development, how to devise better measurements for
teachers regarding knowledge, in particular how to
device better methods for preparing knowledgeable
teachers. And that, I feel, is -- has been neglected,
by myself included. But I think there should be a
slight -- maybe major change of direction in the
report.

DR. FAULKNER: Dave?

DR. GEARY: Yes, thank you. I think one
of the major reasons that mathematics education has
been a concern for the past 50 years is because of the
poor research base. In order for us to know what is
going to effectively work or not work and how to
implement that, we have to have systems in place to
evaluate and test out different types of approaches to
instruction or learning, whatever the case might be.
If we back away from a research base, we're backing
away from a scientific base that we're trying to put
the field on. And so that needs -- that can't be
lost. Otherwise we're back to where we started.

DR. FAULKNER: Yes. I might add, Dave,
that the President's Executive Order actually includes
item P, needs for research in support of mathematics
education. So we have an explicit charge to address
the research base. And in fact we do; there's a set
of recommendations that relate to that.

    Let me hasten to point out that this is
    the least digested and least developed part of this
    report. As long as everybody has thrown their
    reactions into the pot, that may be the best we can
    do. If there are some additional comments that people
    want to make we'll take them, but I'm going to cut off
    this debate here in a couple of minutes and move on.
    So we'll take Skip and we'll take Tom.

    DR. FENNELL: Thanks, Larry. Just a
    general comment. I appreciate what both Deborah and
    Wu said, because I do think this piece of the case has
    punch. I do think it sets up the report. I agree
    with Wilfried that we can change a couple words and
    not have it be read as more money for this, more money
    for that, even though I think that the notion of the
    need for research, like it or not, down the road will
    be suggestive of funding in one way or the other. I
    just value this particular aspect of the report
    setting up the full report.

    DR. FAULKNER: Tom?

    DR. LOVELESS: Thank you. I also agree
    with what Deborah said and I think there needs to be
    something in the case. However, the case has to be
    very punchy. You want to grab the reader. It's a
    statement of the problem. Why was this Panel created?
And so, some of what has been put in after number 4, to me -- for instance, the recommendation at the end has no place for recommendations. They'll come -- those should come later in the report. There's no basis yet.

But so what I would recommend is a number 5 that somehow makes the point that we've made progress on how kids learn math, we've made progress on the mathematics they need to learn, but there's this huge gap getting that kind of knowledge into the classroom. And I think a single statement like that hopefully would capture what Deborah's talking about.

DR. FAULKNER: Okay. Can we raise the flag of truce?

Okay. Now let's go to the content of school algebra and critical foundations for it. This actually, for the benefit of the audience, is actually the starting point for the place where the task -- the synthesis groups were asked to develop material. And so I think they've spent a lot of time thinking about this material and we can go ahead and talk.

Let me set the stage simply by mentioning for the Panel that earlier this morning in the first common concept, you'll remember that this started with the major topics of school algebra. The reaction we got back from the Siegler Group, right? Yes. Was
that it would be a good idea to bring forward the critical foundations to match up to the major topics of school algebra, and to also possibly bring the benchmarks forward.

As we talked about it at lunchtime, we developed a concept that was a little different from that. It was in agreement with the idea of bringing forward the critical foundations in a kind of foreshadowing way and let them be discussed more substantively in conjunction with learning in the learning section, but go ahead and present the package early. We actually left the benchmarks down in the learning section because they seemed better placed down there. But that's the way this has been shaped, and I think it's time for us to discuss it.

So let me suggest that we go ahead and discuss everything in this section called The Content of School Algebra and Critical Foundations for It, which goes down to the subhead "In acquiring knowledge" -- down to the major head "Acquiring Knowledge and Skills Needed to Learn Algebra," or lines 81 to 108. Bert, then Tom.

DR. FRISTEDT: I think this is good. And I want to call attention to the fact that, on line 97 and on line 107 both, we are actually thinking of a table, the table where the -- those tables might
actually be full-page tables, I think, when they're drawn out, or close to it. So that much I like.

One thing that I think we have to deal with somewhere, and I was hoping it would be right here, is what does the word algebra mean. Because of the fact that the National Assessment of Education Progress (NAEP), at least until recently, has algebra -- an algebra strand as low as fourth grade. And that's not what is being discussed here as algebra. And we do need some clarification there, and I think we can't keep talking about algebra when different people have vastly different interpretations of what the word means.

DR. FAULKNER: Well, we did discuss what is the identity of school algebra, but now you want to get to the etymology.

DR. FRISTEDT: I want to get to a little more -- and a good criterion in my mind is ratio and proportion, is that part of the material that precedes algebra or is it part of algebra? If we nail that, we will have done a pretty good job of saying what algebra is.

DR. FAULKNER: Okay. Thank you, Bert. Tom?

DR. LOVELESS: Thank you again. I want to press this case, bringing the benchmarks up to the top
and putting them right after the critical foundations.
And the reasoning -- and I apologize to my task group
members who have already heard this argument so
they're going to hear me repeat it again. The reason
is that one of the major flaws of math education in my
own view in the 20th century has been a confounding of
process and content. And --

DR. FAULKNER: Confounding of process --
DR. LOVELESS: Of process and content.
DR. FAULKNER: Content, thank you.
DR. LOVELESS: And I think a reader of our
document, first of all, they will see the question
answered, what is algebra. And that's very
specifically delineated with the bullets that you see
there and everyone can understand what algebra is.
The next paragraph, the critical
foundations of algebra, is just kind of a squishy
paragraph. It doesn't -- I'd rather see five bullets
or six bullets that lay out the content. Under that
it says there's going to be a table or a chart. And I
am sure that I'll be relieved once that's there, but I
won't be totally relieved because what the benchmarks
tell the public is in addition to -- this is the
content, here's why it's taught. At the end of third
grade, with a rough idea their kids should know this,
and at the end of fifth grade they should know this.
So the content stuff needs to be together, and it needs to be focused and it needs to be at the top.

Another problem is if the reader reads the phrase "Acquiring the knowledge and skills needed to learn algebra" and then thinks in this section I will find the critical skills needed to learn algebra, unfortunately they will find some other skills. For instance, estimation is talked about in this section, but it's not part of our critical skills and knowledge. And that's because the group that wrote this part talked about the broad base of learning mathematics. They talked about topics other than critical skills.

And that's quite right and I think it belongs in there, but we don't want the readers to think that we're contradicting ourselves. If we don't have estimation and rounding and other thing -- aspects of mathematics as the critical foundations of algebra, then why are we talking about it under the heading Acquiring Critical Knowledge and Skills?

DR. FAULKNER: Tom, let me interject something here. I think you were talking about the squishy paragraph. What, since I'm going to end up constructing a lot of this document, the draft, from the working papers, I will tell you that what I would have in mind in presenting the critical foundations is
to present the three paragraph long subsection -- or sections, those three paragraphs that actually deal with whole numbers, fractions, and geometry and measurement. And they're pretty explicit about what's being sought. So there would be more substance than just this little descriptor that's been written for this catalog. Okay?

DR. LOVELESS: Okay. And again, the logic of the reader encountering this document for the first time, now that I know what it is kids should know to be prepared for algebra -- and it's been put on the same level of importance as what is algebra, on the same level of detail. My next question is when should -- when are they taught this in the school experience of K through eight.

DR. FAULKNER: Well, I --

DR. LOVELESS: That's why I --

DR. FAULKNER: No, I think your point that it goes immediately to the question of implementation is a good point. And that's one that I think is worth having a discussion about here today. Skip.

DR. FENNELL: Well, we discussed this a lot. And I agree with Tom, I think it sets it up. The target here -- here's the mathematics target, algebra, and here's how we're defining algebra, and here's the mathematics, the subset of what kinds of
mathematics to do prior to courses in algebra that
directly relates to algebra. And oh, by the way, this
is when they should learn it.

So I think it sets the stage nicely for
then the discussion of the learning content related
section that would follow.

DR. FAULKNER: Wilfried?

DR. SCHMID: The benchmarks, I think, were
purposely and advisedly kept extremely spare. They
were meant as really guideposts. And for that reason,
since it's really a rather short passage, I do agree
with Tom and Skip that it really makes sense to have
that right there. It is an integral part of talking
about the critical foundations.

I mean the critical foundations, the
substance cannot be entirely separated from the idea
of roughly when various things have to be done.
Certainly we have seen cases when things that should
be done at third grade are postponed until sixth
grade. And so to have a rough guidepost does make
sense, really as part of the critical foundations.
And especially because it is so compact, I think it
should go with the critical foundations.

DR. FAULKNER: I'm hearing a fair amount
of convergence on that. Does anybody have an opposite
view? I don't think anybody who was sitting around at
lunch would have a really strong opinion about keeping it down in the learning.

I -- my reason for putting it down in the learning was largely to get to the -- get through the early presentation of the most important elements, major topics and the critical foundations without cluttering this list, but I think -- but I buy your argument. So I think we'll go ahead and agree that that's done. All right? Liping?

DR. MA: I don't know if I'm repeating something or not, but we used to raise this point of two algebras that now we kind of have in math education. Are we going to address this?

DR. FAULKNER: Go ahead and address it.

DR. MA: It's just like we have -- what kind of algebra are we are talking here? But actually now in elementary schools they are teaching algebra, which is not this algebra, not formal algebra, not symbolic algebra. But they use the same words.

DR. FAULKNER: Well, that gets at what Bert was raising.

DR. MA: Yes.

DR. FAULKNER: Unless I'm mistaken that's --

DR. MA: Are we going to say --

DR. FAULKNER: -- the same question.
DR. MA: -- specifically, clearly saying that -- because I'm concerned that if we don't say it clearly then people will tend to confuse the two algebras, like replace that algebra with this algebra. I don't know if I make sense, clear or not. I --

DR. FAULKNER: All right. Well, there's a whole series of -- I mean these two questions that -- your question is very relatable to what Bert raised. Are there comments people want to make about what to do about that? Skip?

DR. FENNELL: I'll just respond to that a bit, that the -- we have discussed this opinion in a number of places. In the assessment of task group work we actually quote Hy Bass' definition and talk about the concerns with regard to, if you will, over emphasis of patterns in assessments, particularly national assessments, particularly the National Assessment of Education Progress (NAEP), and use a direct reference to his definition of algebra.

Within our work, a lot of elements of the critical foundations within fractions some people refer to as algebra. We have been very specific about talking about ratio and proportion in particular as fitting into that cluster of critical foundations and not calling that algebra, as just a for instance.

DR. MA: Yes. I understand we are very
clear about that, but if we don't make it clear that
this might be misunderstood. Then -- yes, I don't
know. I just want to point out my --

DR. FAULKNER: Okay.

DR. MA: -- concern.

DR. FAULKNER: Vern?

MR. WILLIAMS: I'd like to follow that up.

One thing that has happened is people will recall
pattern recognition studied in second grade algebra.
And since the world seems to be obsessed with algebra
at the moment, even though that's not real algebra
it's -- they get away with doing it because who could
be against algebra in second grade.

And maybe if we could get across what real
algebra is, not just in our definition of it starting
in I guess around grade eight or nine, but throughout
K-8. Maybe we need to make a strong definition,
period.

DR. FAULKNER: Bert?

DR. FRISTEDT: I think it is important to
deal with this issue quite explicitly, because we can
have internal agreement here, but there are so many
readers out there. Now I know one direction I would
like to go, but then Skip pointed out a difficulty
with that that I fully acknowledge. I'd like to bring
the word arithmetic back into use more. But Skip has
pointed out to me, and I think correctly so, that arithmetic when it's used by itself tends to just focus on calculation facility, not say on the number line and other aspects of number. So I agree, he's right on that.

But I think we have to handle the language issue. I mean we're talking about major issue here is preparation for algebra, and I think we just have to be quite clear and up front, and at least tell people where -- how we are using the words.

DR. FAULKNER: Wilfried?

DR. SCHMID: In the Conceptual Knowledge and Skills (CKS) report in fact there is at least some effort to do that. And some of the maybe not totally satisfactory mechanisms we use there can find their way into this. For example, there is, what may seem rather superficial, a capitalization of algebra. And in the Conceptual Knowledge and Skills (CKS) report there's a footnote that we use the word algebra with a capital in the sense of the material that is, you know, customarily taught in an algebra course. And so by that device alone we are setting up a certain separation. And I suggest, for example, at least that footnote, maybe more, should make it into this report.

DR. FAULKNER: Okay. Other items on this major subhead. I'm hearing a lot of agreement on
where we go, but some discussion on the definition.
But moving the benchmarks up is something that seems
to have been agreed upon.

Okay, that takes us into the next section.
The next section is acquiring knowledge and skills
needed to learn algebra. There are actually two
competing concepts of this. And I'd like to present
them, I think just lay them out is really probably the
right way to say it.

The one that you have here is essentially
the one that was in the first common concept, although
-- that's the one that's in your printed document -- ,
although the stand alone recommendations that came
from the Wu group got moved to the recommendations
section, the critical foundations got moved out of
this and moved up. The benchmarks are still in this
but will now depart. So there are a few changes, but
essentially it's the one you saw this morning. There
are not -- there's not a lot that has been changed
here, probably nothing substantive. Geometry and --
was changed to geometry and measurement in the fifth
header because that's what we've been using elsewhere.
And I think that's pretty much it.

So that's that layout. It begins with
readiness for learning and what children bring to
school, and a lot of that sort of thing that was
emphasized in the learning processes report. And we have an alternate concept for this that came out of Doug's synthesis group. And what I think I'll do is we're going to throw that one up on the screen and Doug can tell us what's different about it. Okay.

DR. CLEMENTS: What we looked at when we looked at the -- readiness for learning used to be the number one, right? That is the number one in the version you all have in your hands. And the -- two things struck us when we looked at that.

Number one was there were a couple of statements that were embedded in the readiness to learn on arithmetic facts and procedures and the like that were -- for instance, C there, the interplay of conceptual and procedural knowledge, that were very important, right on, but general. In other words, they didn't just apply to addition and subtraction; they didn't just apply to this. They're general psychological principles that apply to all mathematics learning. So we felt why not have that be up at the beginning.

Then there was -- there were other cases, such as -- if you would scroll down for us just a little bit here. Other cases such as -- right there is fine -- E, attitudes, beliefs, motivation and other things that were just not emphasized in the present
concept paper, in concept paper number one, stereotype threat and the like or others, that some people in our synthesis group thought were important points to be added. They were also general. Therefore, we came up with the idea that maybe before the readiness to learn we could make some of these general statements about learning. And then we edited down but did not eliminate the points as they were realized within the individual content areas.

So that's about it. It's a --

DR. FAULKNER: Well --

DR. CLEMENTS: -- additional section. Is there more to --

DR. FAULKNER: Well, I think it helps for you to page all the way through so people can look at the structure.

DR. CLEMENTS: Oh.

DR. FAULKNER: And they can see what's deleted --

DR. CLEMENTS: Fine, fine, fine.

DR. FAULKNER: -- and narrowed it down --

DR. CLEMENTS: Let's keep going down then.

DR. FAULKNER: -- and so on.

DR. CLEMENTS: So these are some general issues, including social, emotional, affective issues --
DR. FAULKNER: That's right, yes, you brought the social and motivational --

DR. CLEMENTS: And we moved that up here. That's not an addition. That's just something that was moved, and really was out of place where it was in that paper. This gives it a home here that it really didn't have because it was just kind of stuck on later in the paper.

If you keep scrolling down we can at least get to an example of --

DR. FAULKNER: Yes.

DR. CLEMENTS: -- for instance, B --

DR. FAULKNER: This is where you pick up the beginning of --

DR. CLEMENTS: Exactly. B is just moved up. That's it. It's -- not a word has been changed. It's just a move because this is really a general kind of learning process result. Keep going down. And I think I'll go down a little farther into whole number arithmetic.

And you'll see there B is a good -- A, first of all, is generally stated up above and it really isn't just for -- to prepare students for algebra. It's just -- the whole curriculum should do that so we've made it a general statement. We agree with it completely.
And then B gives you an example of how we kept the principle and just removed that material that was redundant with the general statement of the principle up in the proposed new section.

DR. FAULKNER: And then as you --

DR. CLEMENTS: Is that enough?

DR. FAULKNER: Keep going down. I think everybody should have a chance to just kind of survey it. So just keep paging down.

DR. CLEMENTS: I don't think --

DR. FAULKNER: And see less and less has changed.

DR. CLEMENTS: Yes, I don't think there were that many other changes actually --

DR. FAULKNER: Right.

DR. CLEMENTS: -- that were relevant to this particular point.

DR. FENNELL: Can we go all the way to the start and see how it sets up now that we get the sense of what's going on?

DR. FAULKNER: What do you want to do?

DR. FENNELL: Can we go all the way to the start of this insertion to see how it's set up?

MS. FLAWN: The principles.

DR. FAULKNER: The beginning.

DR. FENNELL: (Indiscernible) insertions,
right there.

DR. FAULKNER: Right there, okay.

DR. FENNEL: So that would replace --

DR. CLEMENTS: No.

DR. FAULKNER: No. It's an add-on.

DR. CLEMENTS: (Indiscernible).

DR. FENNEL: Where did you get this?

DR. CLEMENTS: From the general principles . . .

DR. REYNA: We took them out of subsections.

MR. WILLIAMS: This would come before line 110?

DR. REYNA: Yes.

DR. FAULKNER: Amazingly they picked these points, the general points up out of other sections and moved them up.

DR. CLEMENTS: Exactly.

DR. FAULKNER: Wilfried?

DR. SCHMID: I am really not happy with that suggestion. I mean I think that the way this existing document is structured, it really tries to get as quickly as possible to let's say the issues of content. And at least to me, there is great symbolic importance to the fact that the content comes very early and that it is separated from these issues.
I don't -- do not say that these issues are not important. They are, of course, very appropriate content for our report. But I would rather not dilute the focus on content and the separation of content issues from these issues. I think that Tom has made a very strong case that some of the -- quite a few of the troubles of American education in fact have come from too great an amalgamation of the issue of content and learning mechanisms.

DR. FAULKNER: Are there commentators on this? Tom?

DR. LOVELESS: I just wanted to ask Doug a question. What would -- what's the main benefit from doing it this way? What's -- what do we gain?

DR. CLEMENTS: I would defer to some of the others who weighed, I'd like -- and I'd like you to weigh in because this was primarily your notion. So -- although I typed them in.

But I think it was just that we kept seeing these things interspersed in the different areas but they made general points. And so part of it was just to make those general points. But I think almost more -- perhaps more importantly to people were the areas such as -- that I pointed out before that just weren't in the report.
So people were making a statement about essential learning principles, motivation and things like that that weren't present at all. And so if you don't put them in a general point, those things seemed to not have a home at all. It made the -- you show the principles --

DR. FAULKNER: Is it thinkable to take the approach that exists on paper here and go to those points and simply be explicit about the fact that when you reach those points, even though they're discussed in a local setting, to make the point that they are general? In other words, declare the generality but in context. That's an alternative that I can mention. Let's go to Wu and then to Wade.

DR. WU: I like to just add my -- not really objection. I guess it’s an objection. I prefer the original approach to this one. I think if you have an elaborate presentation of the general theory of learning and how mathematics, learning of algebra fits into this context, that would be the right way to do it. And so I think, for example, the learning group document if your notes can do it this way and double emphasize certain things that people want to emphasize.

But you'll have a short document that will try to be as impactful as possible, get to the heart
of the matter within the shortest time. And I think
the word that Wilfried uses is very good, but by doing
it this way you dilute the message. And so I just
want to add to my previous preference.

DR. FAULKNER: Wade, then Russ, then
Valerie.

DR. BOYKIN: Yes. If you look at the
three original synthesis documents, two of the three
have sections that essentially said how students
learn, how students learn mathematics, how do students
learn. And in those sections you did get issues
around learning and learning processes that
transcended any particular content area of
mathematics. And we felt -- and that got lost in the
end of the first concept paper and so we thought it
needed to have a life of its own.

Frankly, I think it's less important, to
me at least, whether it's up front before we go
through the content areas or after it. It just needs
to be here because when you get things like issues of
authenticity into one content area, or things around
conception and specific knowledge into one content
area it sort of misrepresents the reality that these
are generic processes that would enhance or be
involved in whether it's geometry or algebra, whatever
the case may be.
The other point that I think is critical is that when you get to some of the collateral processes of learning, such as the socio-emotional matters, or issues of equity as mentioned by testimony today, issues around, as the charge was given to us, how children from different backgrounds learn mathematics, issues around ethnic and racial differences in learning mathematics in the mix, those are also matters that transcend particular topics in math per se and deserve a home in the document, and simply are not in the version of document we have right now. And it seemed to make sense, those reasons alone, that somewhere in this document, before we get too far into it, that we address these general issues and issues of equity and issues around socio-emotional processes in the mix.

DR. FAULKNER: Russ?

DR. WHITEHURST: I probably agree with what's being suggested, but I'm frustrated --

DR. FAULKNER: Wait. What -- which one is what you are agreeing with?

DR. WHITEHURST: I agree with -- is this on?

DR. FAULKNER: You're sure it's on?

DR. WHITEHURST: I believe I may -- can you hear me now?
DR. FAULKNER: Yes, much better.

DR. WHITEHURST: Okay. I believe I may agree with what's being suggested, but I'm frustrated at being asked to agree to something that I haven't read and can't read except by scrolling down the screen. Is there a paper version of this we might look at so that we can do a quick side by side and know exactly what's being proposed?

DR. FAULKNER: I think --

MS. FLAWN: We'll see if we can do that.

DR. FAULKNER: We don't have a paper version right at the moment.

Valerie, you want to go ahead.

DS. REYNA: Yes. I -- those three that, for example, are on the board, I agree with Wade that the -- I would say that the -- it's fine that the content be emphasized first for the reasons that people have mentioned, I think that's a fine thing to do.

I agree with Wade, however, that diluting them by -- these issues by putting them within different subheadings would be a mistake. The three that we're looking at right now, for example, and there are others, directly bare on important policy issues that are currently framing not only research, but practice. So the first one, A, is the sort of
motivation that motivated -- that created programs such as HeadStart. The fact that the preparation for algebra extends back into the preschool area is news in some quarters and will directly affect the way we make policy.

The interplay between conceptual and procedural knowledge is a theme that we've talked about that, again, bears on things where people have said there's a false dichotomy here and which they want to stress one over the other. This really influences practice, it influences research. And so to dilute it by putting it within subheadings I think would be a mistake.

DR. FAULKNER: Bob?

DR. SIEGLER: Yes. The original creation of the document that's on paper reflects an effort on the part of the synthesis group I to integrate the Conceptual Knowledge and Skills (CKS) and Learning Processes (LP) themes. And the reason for not having this learning material up front stemmed from the logic of trying to implement that. Now before we move away from that effort, we've decided to have the major part, not all of the part, but a lot of the part of the content of algebra up front and separate from the learning material.

And so at this point, I think that having
these learning themes up front actually makes a lot of sense. We're not talking about a lot of space here. We're talking about something that probably wouldn't be much longer in a written report than what we're seeing on the screen.

And what Vern and Wade and others have said is absolutely correct, that these are themes that logically transcend any particular content area. So that on a logical basis, I think there's a great deal to be said for this organization. And in the end, I actually found it decisive. I prefer this organization to the original one.

DR. FAULKNER: Let me suggest a path that I think actually is probably a better path than trying to just address this in this form. I don't think it would take all that much additional work to actually draft both the sections so that you could see what they would look like in real text and comparable text. And I think we could address the order on the basis of the real drafts rather than on the basis of these outlines. If you prefer, I think that's the path we can go ahead and take and just present you with two alternates. Bert?

DR. FRISTEDT: I agree to that, but I do want to point out that because of the different ways that different task groups sort of carried out their
responsibilities, we get a very different perception of how much space different things are taking. Learning Processes has these sort of short commands, one after the other. Actually I don't like that language so much; it's too commanding. But a lot of their things can be combined into one nice little paragraph. Actually, it wouldn't be a very long paragraph.

And so I think part of the trouble in deciding how things are organized is back here for critical foundations of algebra there's one line that says we're going to have a big figure. Over here when we come to learning processes every little sentence is practically there. And I -- it just makes it --

DR. FAULKNER: Well, that's just the way it is. And --

DR. FRISTEDT: But anyway, I want --

DR. FAULKNER: That's -- and I agree. I think that you can't always get a good picture of how long this would be and how oppressive it would be, and how much delay you're going to feel in getting to the algebra specific content.

And I think the only way to address that is simply to compare the two texts and see where we are. I don't think it will be that hard. I mean for the most part, this is a rearrangement. It's not a --
two completely different projects.

DR. FAULKNER: Okay, Vern.

MR. WILLIAMS: Wade, you had mentioned the thing about equity. And one problem in the past has been different learning styles, some of which I believe and some of which I don't as far as involving minorities. But one thing that we can all agree on is the content. I don't think we're ever going to agree on the learning processes and the equity issues, or we may as a Panel, but I don't think the general public will. So I think our number one effort should be content, because regardless of your beliefs about gender or race or anything else, there shouldn't be a problem with this as to the content that every kid should learn and every kid should prepare themselves for an algebra course.

DR. FAULKNER: Wade?

DR. BOYKIN: Yes, I certainly share you're sensitivity about trying to leave out of this issues of ideology or beliefs and whether there are or are not learning styles per se. What we did in this section certainly is to let the data speak for itself. And it wasn't so much that from the data it said that this learning style is present in Hispanic children, this one's in black kids per se.

It did point out that although there
really are a lot more similarities than differences, there are some areas where -- that if these are emphasized more, issues around mastery versus performance limitation, issues around focusing on effort, having kids to see effort as the driving force as opposed to ability, there is solid data -- I don't say that it's conclusive, but it's suggestive that these kinds of things are important places to look when you want to pursue matters of equity. And again, it's the research findings that drive these comments as opposed to beliefs or ideologies.

DR. FAULKNER: Wilfried?

DR. SCHMID: Well, first of all, I should say that of course, you know, after this presentation I do agree that it makes sense to have all of these issues together. So that I -- what I said before should not be seen as arguing against that. That makes a lot of sense.

But then I would say that let's say the way you described what you just did, that there is, you know, there is evidence, you say. But I think you did agree in effect with Vern, that while there is agreement, it is not on the same level as the kind of agreement we have on content. And so therefore, perhaps let the content speak for itself and then we talk about these other issues, which are important and
they need to be addressed. And they need to be addressed together. But I would rather not have, let's say, the focus on content interrupted by this particular section.

DR. BOYKIN: I concur.

DR. FAULKNER: Skip, did you have your hand up earlier?

DR. FENNELL: Yes, I did, because I thought Val and Bob made a really good suggestion to use these general principles to -- of learning -- to frame. And I was struck by if it's only A, B and C that would ease this pretty nicely into the further discussion. I then asked Doug to scroll down and let me look at the rest of it and it's a heck of a lot more.

So we -- I think, Larry, your thought of let's look at two side by side and we see -- we can see how it lays out. And we could also -- there's always the option of sort of preserving parts of the general principles, but perhaps not all of them, because in fact they did exist somewhere else until a couple hours ago. But I -- but the cases for particularly A, B and C there I think were very well presented by Val.

DR. BENBOW: One version, we could just take these general principles and put them at the end
instead of at the beginning. So it's a summing up, rather than a framing it could be a summing up. And then we could talk about there are these general principles that cut across these topics that we had. So that could be another version that we could look at to see which one makes the most sense to us.

DR. REYNA: Put it at the end.

DR. BENBOW: At the end of the content things, not at the end of the document?

DR. REYNA: Yes, right. End of -- yes.

DR. BENBOW: Yes.

DR. CLEMENTS: And that's how they were in the original --

DR. REYNA: Yes.

DR. CLEMENTS: -- concept paper.

DR. BENBOW: Oh, okay.

DR. CLEMENTS: -- of our group.

DR. BENBOW: We're back to where we started.

DR. CLEMENTS: Exactly.

DR. FAULKNER: Tom, Wilfried.

DR. LOVELESS: You know, maybe what we should do -- this is just a suggestion, would be to table this. I think everybody agrees this is the right content, it's where to place it. And I don't think I can make a decision about that unless I see it
on paper. I have a hard time with --

DR. FAULKNER: Old guys.

DR. LOVELESS: -- with track changing. So maybe we can discuss this tomorrow. Is that possible?

And move on to other things and --

DR. FAULKNER: I'm not sure we're going to get any further on this until people can actually see the text.

DR. LOVELESS: Well, what I'm saying is tomorrow we could have -- I'm assuming we could copy it, and we could have the two versions.

DR. FAULKNER: Well, you can have these two outlines.

DR. LOVELESS: Well, even that would be helpful for me.

DR. FAULKNER: Okay. Well, Tyrrell says you'll have that in a few minutes.

DR. SCHMID: Well, but I -- it seems to me though that we do have some degree of convergence, don't we? I mean I think that Wade felt it was very important to, let's say, preserve the integrity of these particular issues. And I fully agree with that.

It seems to me Wade agreed also that it makes sense to have that not interrupt the discussion of content and I see then no conflict.

DR. BOYKIN: From my standpoint,
extracting these principles into its own section is what I'm arguing for. A, B; B, A. You pay your money, take your choice.

DR. CLEMENTS: That's what I'm saying.

There seems to be a consensus to just move this section to the end of the contents section and let's -- we could move on without having to compare versions.

DR. FAULKNER: You aren't going to get any representational saving doing that, Doug. You're going to end up having to treat, oh, let's say the automaticity thing, practice, into long-term memory. That item you're going to end up treating in specific context --

MR. WILLIAMS: That's exactly right.

DR. FAULKNER: And then you're going to treat it again --

UNIDENTIFIED SPEAKER: But that's okay --

UNIDENTIFIED SPEAKER: That's okay.

DR. FAULKNER: -- later.

UNIDENTIFIED SPEAKER: That's okay.

(Simultaneous conversation.)

DR. SIEGLER: But you have to admit automaticity -- automaticity is a huge issue when it comes to whole number operations. It's not a huge issue when it comes to fractions or geometry. So that it's not altogether bad to arrange it that way.
DR. FAULKNER: Right, but the efficiency of this paper is going to matter.

DR. SCHMID: I mean I think that this whole -- I mean I think that Bob had it exactly right. I mean I think that yes, when we talk about automaticity in particular, there is an issue that cuts across subjects.

But with automaticity of number facts, there is a really qualitatively different weight to that. And to have let's say that particular issue mentioned twice, first in the context of memorizing number facts, let's use the word automaticity, and then again as a general principle, I see absolutely no problem with that. That makes perfect sense to me.

DR. FAULKNER: Okay. So what I'm hearing you say is that you want to move -- if we take the version of this paper that Doug's group has put there, you're talking about taking that first section and moving it to the end of --

DR. REYNA: The content area.

DR. CLEMENTS: Of the content -- right after benchmarks.

DR. FAULKNER: Right after benchmarks?

DR. REYNA: Right after the old benchmarks.
DR. FAULKNER: And then leaving social, motivational and affective where -- after that?

(Simultaneous conversation.)

DR. BENBOW: That's already up there.

DR. FAULKNER: No, but in the Clements' version it's moved way up. It's --

(Simultaneous conversation)

DR. FAULKNER: It goes back to its old position, okay. All right. So your --

DR. FENNELL: But I think the suggestion is to move it there, Larry, for now and then allow for some of the more aged readers -- that would include myself -- the opportunity to look at it, because I think that that section, while I agree very much with many of the principles, general principles there, once we read it we may decide that -- to move them elsewhere. But for right now, I would like to see that done and take a look at it.

DR. FAULKNER: Okay.

DR. FENNELL: My opinion only.

DR. FAULKNER: Okay. All right. If we have a deal, I think I'm going to --

All right. Then let's go ahead. What we're going to do now is actually start talking -- let's go back to the version we've got here. Well, actually let's go back to the version there.
What we're going to need to do now is to talk about the actual content of what is in each of these sections. So I'm going to take them section-by-section. And let me take this proposed general principles section -- which will not appear here, it'll appear further down. But this is the most coherent representation of it, so I'd like to get you to go ahead and react to that.

Let's -- let me take a moment and allow people to read it.

MS. FLAWN: We could work on that until we get the copies of it.

MR. FAULKNER: Okay. All right. Tyrrell's made a good point. Tyrrell says the copies are actually going to be here momentarily and wait until they get here. So let's go to whole number arithmetic. That section -- go back to the other version. There you go, go down to -- no, let's not do that. Let's go to readiness. Yes. There you go.

Okay. Let's take the readiness section here, the mathematics that children learn from preschool through the middle grades, et cetera. Go on down, Sarah. Let's -- let me just remind you what's here.

DR. WU: But much of this is --

DR. FAULKNER: Some of it has been moved,
yes. You want to review that in the new version?

DR. FAULKNER: Okay. You want to move --
they want to review that one in the new version.
Okay, let's go to two then, whole number arithmetic.
Okay, Tom?

DR. LOVELESS: This was an edit that we
made in our group. And it didn't show up in this
particular version, but the -- under F --

DR. FAULKNER: We could not get to all --

DR. LOVELESS: I understand, understand.

DR. FAULKNER: We didn't have enough time.

DR. LOVELESS: But I want to be sure to
raise it so that it gets --

DR. FAULKNER: There's no plot
necessarily.

DR. LOVELESS: I understand.

DR. FAULKNER: There may be a plot.

DR. LOVELESS: Under F, letter F, China is
not a good example to be using there. China's only
participated, to my knowledge, in one international
assessment, and there were sampling problems. So I
recommend substituting Singapore to use as the example
of a high achieving country.

DR. FAULKNER: Is there any agree -- any
disagreement in that?

DR. REYNA: No.
DR. FAULKNER: Okay. Okay, then let's go ahead and take -- let's continue other discussion in the section on whole number arithmetic. Bert?

DR. FRISTEDT: I tend to agree with most everything that's in here, but I'm wondering if we really know some of these things. I mean I read it and I say that sounds good, but for example do we really know that the elementary school textbooks in this country don't have enough double and triple digit addition and multiplication problems? I know it's not getting emphasized, at least that's my understanding, but if we -- if it just sits there it just looks like we're throwing out a strong statement without really knowing that it's accurate.

DR. FAULKNER: Well, Tom just brought up Singapore. I presume he knew what he was talking about.

DR. LOVELESS: I was referring to whether or not China was high achieving versus Singapore.

DR. FAULKNER: No, but we're -- I think the implication here is that Singapore's books are different than our books.

DR. LOVELESS: No, I raised that also as problematic. I don't -- with Singapore, I do know that the statement is true, in terms of the Singapore text. Yes, that's true.
DR. CLEMENTS: And Susan’s research, for instance, looks specifically at other textbooks from other countries and textbooks from the United States, counted the number of times. We do a lot more of two plus two and two plus three, they are right into eight plus seven, so -- at the same point in the child's development. So I think there's adequate empirical research that has compared those.

DR. STOTSKY: This is a question that relates to a lot of the statements here, not just that one. Should this be like a research paper in which you're referencing at least a study. There have been an awful lot of declarative statements throughout here.

DR. FAULKNER: Yes.

DR. STOTSKY: And I'm worried about --

DR. FAULKNER: Well, I think that's exactly right. And I think we're going to have to be careful when we go through this document and actually check all that out. I think that we will have to decide whether we want to try to carry citations in the final report of the Panel or whether we want to leave the citation record in the task group reports.

The Panel's by and large -- the Panel’s report is by and large derived from what was done in the task groups. There's a lot of citation in the
task group reports. And as long as it's adequately supported at that point, my inclination is to feel that we don't have to cover up the panel report with citations. But we may change our views about that. I think we're just going to have to feel our way through that.

I think, Sandy, you're absolutely right, and Bert. We have to be certain that there's adequate authority for what we claim. As to where that authority is cited, I think we have a little bit of latitude, and we can talk about that later. And I've got Bert, I've got Valerie. Go ahead, Bert.

No, not yet. You're after Valerie.

DR. FRISTEDT: My little follow-up to that is I noticed, for example, in 1-B where a very controversial topic is being discussed. This is on page 3 at the bottom. We got quite a long paragraph there. So I'm advocating a middle ground on this issue of justifying statements. When we know they're going to be controversial then we should do a little more to indicate on what basis we know we're making it, whereas when it's something that we have a basis for that we think more or less people will agree with then we can be briefer.

DR. FAULKNER: Okay. Well, we're going to have to come to terms with whatever it is we choose to
do.

DR. FAULKNER: Or no, I think it's Valerie, then Bob.

DR. REYNA: Mine's brief. I was going to say -- I was going to make a recommendation at some point that we have an annotation that would be flush right that would reference the pages or line numbers of the original task group reports. And it would not interfere with the prose flow because it would be flush right.

DR. BENBOW: Bob?

DR. SIEGLER: Point J under the whole number section, which is on page 5 of the written document, I think would be better stated in the general principles of learning section because it applies to all the sections equally.

MR. BENBOW: All right. Wade?

MR. BOYKIN: This comes up for me several times and maybe I need to be put at ease about it, but when you look at points -- whoops, F and G on page 5, for example, it wasn't clear to me why those are going in this section rather than in the instructional materials and practices section when you're talking about textbooks and curriculum. That comes up at other times through the teacher references in a similar vein.
I'm wondering just about that from a structural standpoint. Should we keep the apples with the apples, oranges with oranges, or should it matter? I'm saying this out loud to the whole group. And these are just two cases in point. F and G, 2-F and G.

DR. BENBOW: So what are you saying? I'm sorry, I didn't --

DR. BENBOW: Are they instructional materials?

DR. BOYKIN: Yes. They're about textbooks, about curriculum. And there's a section called instructional materials and practices. I'm wondering if those kinds of statements, should we put those in the same section rather than have them interspersed. And it seems this is a little structurally problematic.

MR. BENBOW: Wilfried?

MR. SCHMID: Well, I mean obviously you have a good point. I would say that sometimes there is -- it's a gray area. And so here yes, there's learning materials, but I think much of it is really based on substance of what are the prerequisites. And in this particular case I would say that this should probably stay, but in many other cases I'm sure I would go with you.
DR. BENBOW: Liping?

DR. MA: Under the whole number arithmetic, the item F. I -- is this F? Yes. I have an observation, which is not mentioned here but related to this item is F. In U.S. elementary schools, we do much more column computation versus horizontal computation in comparison with other countries. That, I think, even contributes more to the learning of algebra, because children in other countries get familiar with the computation in horizontal expressions much more than children in U.S. I would like to mention this and -- if we put this in, we can maybe add a very parallel thing.

DR. MA: And it's very obvious if you -- we compare textbooks from other countries --

DR. BENVOW: Skip?

DR. FENNEL: That's a good point. And Liping's right. And I'm just trying to figure out how to consider amending the statement that's there. I think, Liping, it's probably appropriate there to sort of connect it back to textual kinds of materials, but there's also instructional. I mean if you just -- and I'm sure you know when you visit classrooms we see American teachers vertically doing practice far more, multiple times more than any kind of a horizontal thing. I was just looking at --
DR. GEARY: Single digit numbers.

DR. FENNELL: Yes. I was looking at Dave. I know in their learning analysis when they listed algebra, they do make some reference to that in terms of equation solving. So there's an opportunity here that maybe we should take advantage of.

DR. BENBOW: Do you think it should be a separate recommendation rather than trying to build it in?

DR. GEARY: I have a question.

DR. FENNELL: Go ahead, Dave.

DR. BENBOW: Okay, I don't know who raised their hand first.

DR. GEARY: It was a tie.

DR. BENBOW: Okay, Dave.

DR. LOVELESS: It was a tie.

DR. BENBOW: Okay.

DR. GEARY: Yes. The particular statement there in this section is trying to reference it to the fact that practice isn't well built into -- practice of difficult problems isn't well built into the curricula. But I think the point about the horizontal presentation is a very big point. And U.S. kids in processing algebraic linear equations, they -- they're not doing it horizontally. They're not processing it the same way somebody who's skilled at it would do it.
It's not coming -- it's not something that comes automatically without math equations.

DR. BENBOW: So you're basically saying separate recommendation?

DR. GEARY: I'm saying separate, but a great point that needs to be somewhere.

DR. BENBOW: Yes, okay. Tom?

DR. LOVELESS: I'm concerned about two -- I have two questions. Liping's point is a good one, but my two questions would be A, do we have any empirical evidence that indeed this is true, that other countries do these computations horizontally more than the United States. And then B, do we know that that has some impact on later learning or what's the effect?

DR. BENBOW: Liping?

DR. MA: Yes. In China, they introduce the column computation when children learn two digit, adding two digits, addition of two digit numbers. For Russia, they start even later, when they do -- children do three digits, addition with three digit numbers. So before that, children are not exposed to columns at all. That is the facts. You can -- it's in textbooks. Anyone can see. But we start with one digit number.

DR. LOVELESS: And the causal evidence
that that then enhances learning?

DR. MA: I don't have data about that, but -- yes, I don't have data, but the achievement of students, I think it's obvious for laypeople, maybe not for scientists.

DR. BENBOW: Very nice.

DR. LOVELESS: I have never been called a scientist in my life.

DR. BENBOW: Wilfried?

DR. SCHMID: Well, it seems to me that this point at least should be addressed in one of the task group reports, which I assume is not the case at the moment. And for one thing, I believe that to get this point across it takes a little space; right? I mean you need, you know, two or three paragraphs. And if there is to be a recommendation in the report itself, and I'm not taking a position on that, there must be a basis, a basis for advancement.

DR. BENBOW: Deborah?

DR. LOEWENBERG-BALL: One way to get around what we've just been discussing for the basis is to argue this logically. If you know that in algebra things are represented horizontally, then you can make a claim directly from the mathematics that it's important for students to have experiences with that format. I'm not sure that we have to go through
the international comparisons to say this, because that's actually what's now coming, do we have analyses of these textbooks. We probably don't have ones that are sufficient for the claim, but one can make the claim from the math.

DR. BENBOW: Well, it may have to just label it professional judgment and logic, I guess. And --

DR. LOEWENBERG-BALL: Right, the content also could dictate this --

DR. BENBOW: Yes.

DR. LOEWENBERG-BALL: That's another way we could approach it.

DR. SIEGLER: Yes. I share the widespread impression that what Liping says is very likely true. And I think it would bear mentioning someplace either in the Learning Processes or Instructional Practices group.

However, I also share Tom's reluctance to put it in the summary report because we don't have -- you know, there are many things that are very plausible that you could say are logical and they don't turn out to be true. And so I'd be a little reluctant to promote this to the status of something that should be in this 30-page report.

DR. BENBOW: Vern?
MR. WILLIAMS: But have we looked for research to support or go against what she said?

DR. BENBOW: Dave?

DR. GEARY: The only work I'm aware of that came up in our -- in the Learning Process reviews were those for the processing of linear equations in algebra. And what comes up there is that students aren't processing it the way somebody who's skilled in mathematics would process it in terms of expressions and horizontally. The factors that contribute to that we don't know.

It seems like one potential contributing factor is inexperience in processing mathematical expressions or information horizontally, or they don't have much experience. But whether it would be in this re -- in a summary report, I agree, it's a stretch. But I think it's a really good idea and a good point that needs to be somewhere.

DR. BENBOW: Could we put it as a research question at the bottom? I'm just asking -- if this might be a viable approach that we would -- I'm just -- - I'm -- yes, but this is a viable approach but it needs to be researched. I'm just trying to compromise here, find a compromise.

DR. LOVELESS: I think that's possible, but we have to know more about what the existing
research base is on this. There may be some research on it. We don't know. We have not looked, so that point is very good. There is research on the question of what do kids do when they confront an equal sign. And we do know that they often think now you need to do something when they encounter an equal sign. And that's related to this topic.

DR. BENBOW: So are you going to put it into your task group report? And should we leave it there, and maybe have it as a recommendation for research? How would you like to go forward here?

DR. GEARY: Well, I'm not sure. We could certainly find a place for it as kind of a speculative statement in our report. Our report is awful long and dense.

DR. GEARY: And overly referenced with -- I think we've broken 600 references. So I think it would get lost.

DR. BENBOW: Okay. Joan?

DR. FERRINI-MUNDY: I was struck by what Tom said. And there is a nice section in the report about -- a short paragraph about the research around the equal sign, which seems like it would possibly be a place without a lot of additional work that this point could be brought up. It seems to fit.

DR. GEARY: Yes. The difference -- yes,
it could be done. And I would be happy to do it and it would be there. Whether it would come to the front -- it'll be there if you guys want it.

DR. BENBOW: Okay.

DR. GEARY: It will happen.

DR. BENBOW: Solve this for us --

DR. GEARY: How's that?

DR. BENBOW: -- and put it there.

DR. GEARY: All right, we'll do that.

DR. BENBOW: Okay. All right, so I am understanding now that this topic was going to be put into your task group report. All right. Then I open it up for another topic and turn it over to you again.

DR. FAULKNER: Where we are is still on whole number arithmetic. Is there anything else anybody wants to bring up in whole number arithmetic? Bert?

DR. FRISTEDT: I could bring that up any number of places, but I might as well bring it up here. It's this interplay between research and professional judgment that comes up a lot. And in some ways it bothers me a lot because if one focuses too much on what has been researched, one might not be dealing with what the most important issues are. Because if one focuses on what's been researched, it's what those people thought was important.
DR. FAULKNER: Or what was accessible.

DR. FRISTEDT: Or -- yes. And some of these things -- and of course the Conceptual Knowledge and Skills group mostly, they can't -- they're not going to have research that says well, this is a particularly important part of algebra. They're using their professional judgment. There's another way that professional judgment is coming in that I don't think we acknowledge enough. And that is in going from the research to the actual statements we make in the document, that there often is professional judgment there. And so if we have this dichotomy that there's either professional judgment or research, I think that's probably not fully accurate.

And I, in this general section, do we really have research that supports each of the statements, or is it these are natural statements that come out of the research, sort of combining common sense with the research? And I've had that concern throughout the document in lots of places, but maybe I just don't know the research well enough. There's a possibility --

DR. FAULKNER: Well, there's a lot of research that does exist in -- on many of these points, but I think we'll have to go through and, when we prepare this document, and satisfy ourselves that
we have a basis for making the statements we make.

I think as we've done the task group reports we've been pretty faithful to that rule. I mean we've been pretty clear about why we've made whatever statements we've made.

Sandra?

DR. STOTSKY: Sorry, put my light on first before raising my hand. I'm getting this backwards.

There's a concern that this raises about the statements not having many of the necessary qualifications that they actually have back in the original documents. Many of them somehow emerge here, sort of stripped of the necessary claims or qualifications that would be made when you actually look at the body of research. And --

DR. FAULKNER: Well, again, the text that's going to be transported and put together is the language in the working papers. If those qualifications are in the working papers, they'll show up in the report.

DR. STOTSKY: If they're in the working papers.

DR. FAULKNER: Yes.

DR. STOTSKY: But if they are not even in the working papers --

DR. FAULKNER: If they're not in the
working papers then we've got --

   DR. STOTSKY: We've got a problem.

   DR. FAULKNER: -- an issue. I'm going to
work with the working papers.

   DR. STOTSKY: Okay.

   DR. FAULKNER: The working papers --

   DR. STOTSKY: I worry about a lot of the
statements here with a lot of the qualifying remarks
that --

   DR. FAULKNER: Well, we're going to have a
problem, of course, in that we're trying to produce a
compact report. Now we're not going to be able to put
every amplification and every point in that compact
report. Wade?

   DR. BOYKIN: Yes, just a comment. I was
under the impression that we brought Abt Associates
into this vetting process to try to determine the
empirical veracity of claims made in the task group
reports. So there is at least that element that's
there as sort of a safeguard for, you know, claims
that aren't specifically backed up data. I mean I
think that maybe needs to be mentioned somewhere in
the report perhaps, I don't know.

   DR. FAULKNER: Well, I don't think that's
quite accurate. I mean I think Abt has checked things
we've asked them to check. I'm not sure that they've
been -- they've taken the position that they're the insurer of everything we've written. I think we're supposed to be the insurer of what we wrote. Yes.

DR. REYNA: The issue of this qualification would also be partially addressed by the suggestion to indicate the places in the original task group reports where these points are discussed in more detail.

DR. FAULKNER: Yes. I think we need to move onto whole number arithmetic here, or do you see problems that you think need to be brought up? I think why don't we go down below D to E and beyond. Wait, wait, wait, wait. E and beyond. We're satisfied with whole number arithmetic aside from the buttressing of claims? Yes. Who said something?

Oh, okay. All right, Bert.

DR. FRISTEDT: I don't have a comment in connection with estimation. There's several comments connected with it. This precedes fractions, so are we there?

DR. FAULKNER: No.

DR. FRISTEDT: Oh, we're not that far yet?

DR. FAULKNER: No. We're in whole number arithmetic.

DR. FRISTEDT: Okay.

DR. FAULKNER: What I want to do is --
DR. FRISTEDT: I'll pass up.

DR. FAULKNER: Okay. Now what I want to do is go back and take this new document that has just arrived, Acquiring Knowledge and Skills Needed to Learn Algebra. It's just the first part of it there. Take Section 1, and I'd like you to look at the content of Section 1, the general principles of learning, which will not be Section 1. It will be something like 6 or 7 or 8.

All right. But I want you to look at the content here and tell me whether you are satisfied with this content or whether there's discussion to be made. Go down to the social motivational and affective influences, all the way through those, everything in 1 down to readiness for learning. Russ?

DR. WHITEHURST: I have a concern, not about the organizational material, but one of the statements made. It's on the second page. It's the sentence just before letter H, "Gender differences are small and a focus on sex differences has distracted from the task of raising the scores of both boys and girls." Sex differences did not used to be small. They used to be a lot larger, and so to claim that focusing on them and seeing some progress over the last 20 years has been a distraction I think is an unnecessary claim.
One might also take the perspective that girls do substantially better than boys on other subjects, like reading. And so perhaps what has emerged as equality, at least in elementary and middle school, represents girls and women still undershooting what they would be capable of doing if they did not continue to have self-perceptions about math that are -- can be defeating in terms of aspirations. So I just don't see the necessity for this statement.

DR. FAULKNER: Dave?

DR. GEARY: Yes. This is quite a complicated topic. And in the Learning Processes report, we asked Abt and STPI to put together estimates of sex differences at the mean and at the extremes for multiple, many, many national databases.

The mean differences are very small. The mean differences have always been much smaller than they have been at the extremes. Girls have been getting better grades in mathematics at least as -- for the last two and a half, three years, which is -- I don't know any data prior to that, but it may well be the case that that's there.

Yes, the sex differences in writing and reading are very robust and have not changed much, possibly even gotten worse at the mean level. So I
think the mechanisms underlying those different
patterns of performance I think are different. And so
I think we either state something like the differences
are small -- and I have no problem stating that, you
know, on a -- the second -- the last sentence there,
be 4-H, deleting the cause there. But I mean we
either give in to this in extreme detail and really
unpack it, or we have to say, you know, the
differences are small and really we want to improve
both boys and girls. That's it.

DR. FAULKNER: Yes? Valerie's next.

DR. CLEMENTS: Real quick, to anyone who
does this kind of research, do you think that since
we're trying to say our major messages here, if
they're small do you think that saying that delivers
an implication that will change policy in constructive
ways? Or is it just not one of the major points we
have to make here?

DR. FAULKNER: Go ahead, Dave.

DR. GEARY: Well, the one potential point
is lots of resources are being focused on improving
the performance of girls. And that's fine, but it's
based on perception that there's a large intractable
gap. And that, if we look at mean differences, is not
the case. It is the case when we look at extremes.
And those differences have come down, and I'm sure for
a variety of reasons, including girls taking more high school higher-level mathematics courses. But, you know, so a lot of money is being targeted in ways that might be better spent to improve performance of both boys and girls.

DR. FAULKNER: Valerie?

DR. REYNA: Perhaps one way to separate these issues is to talk about the difference between ability, which this statement addresses, and attainment. And both of those are policy relevant, but they cut in somewhat different directions.

The ability issue I think Dave has summarized well. There are differences at the high end, at the high extreme. There are also differences at the low end, which we also deleted from our summary statement. So boys are over represented at the low end as well as being over represented at the high end. And what we wanted to convey here, I think, was that inherent ability, there's no evidence, you know, there -- or the evidence is getting weaker every day for any kind of -- that sort of difference.

There's also some recent work that shows that very limited practice and experiences will narrow this gender gap considerably. All of what I said so far speaks to the issue of inherent ability. So that's one policy relevant statement, and I think it's
an important policy relevant statement.

The other issue that Russ raises, however, has to do with attainment. And I don't know if we can cobble enough evidence from what we've already reviewed to address that. And that is despite what it -- what may be, you know, the equal capabilities, or roughly equal capabilities, you know, why is the attainment so different in terms of careers and science and mathematics. And there, there may be a significant gap. And again, that cuts in the opposite direction.

So perhaps making both of these statements, ability yes, attainment no, might have policy implications.

DR. FAULKNER: Okay. Anything else? Other items in these, the general principles of learning? Any other comments? Tom?

DR. LOVELESS: On items E and F. Item E begins "Other factors include attitudes," blah, blah, blah. I'm not sure what the other factors are related to, what those other factors are factors of.

The second part of that it says "And school based factors such as features of teaching and learning context." And I think that's very vague. I don't know what particular features of teaching and learning context are being referenced there.
And then in F there's a long list of things: stereotype threat. And I'm very much persuaded that the experimental evidence on stereotype threat needs to be emphasized here. But the other things I think the evidence is much weaker, cognitive load, strategy use, task engagement, self-efficacy, teacher involvement. That's very vague. And then we have this phrase, "And school based factors." And I don't know what school-based factors are being referred to.

So I think both E and F need to be cleaned up, and I would reduce the list of things and really let stereotype threat have its own place there.

DR. FAULKNER: Who's going to clean it up? DR. EMBRETSON: Could I make the opposite suggestion about stereotypic threat?

DR. FAULKNER: Yes.

DR. EMBRETSON: The procedures that were used to review the literature did not pick up technical reports from major test publishers, who in fact have looked at stereotypic --

DR. BOYKIN: Turn your microphone on.

DS. EMBRETSON: It is on, but it's not --

DR. BOYKIN: It's not working.

DR. EMBRETSON: It's not working?
DR. FAULKNER: You just may not have it pushed hard enough.

DR. EMBRETSON: Yes. What I want to say here is that the experimental evidence is different than studies that have been conducted by test publishers. These studies were not picked up in the review procedures. You'd have to go to different reports of ETS, ACT and so on. They have tried measures to counter stereotypic threat and they have led to little or no improvement. So we do have a different literature here.

So I wouldn't separate it out. I would just contextualize it, say the experimental studies show that, because if you don't say that you're not going to be accurate.

DR. LOVELESS: Well, those are really two different things. I'm referring to the evidence that stereotypic threat is a real thing and you're referring to interventions that tried to ameliorate it. And I'm -- I agree with you that that's weaker and we don't know a whole lot about that. But certainly the evidence on stereotype threat is pretty convincing.

DR. EMBRETSON: Well, the way they were mediating it was simply to have -- to do matching of examiners and examinees, and that was the mediation.
So that's not a real mediation, it's just saying that it didn't make much difference.

DR. FAULKNER: Val?

DR. REYNA: I think this is sort of a classic example of how you, you know, summarize literature. When people obtain null effects, as we said in our standards document, especially non-peer reviewed null effects; I don't think that counts either for or against a claim. Based on the published peer reviewed top journal type evidence, there have been interventions that have shown significant effects.

The Johnson et al. article in Psychological Science, as well as a number of others that we reviewed as part of our, you know, very systematic review of the literature, did show that if using interventions that were done in educational classroom settings there with, you know, experiments and tight controls, showed that in fact that -- and there's also -- not only is there evidence for the effectiveness of reducing stereotype threat, there's evidence for the mechanism by which this actually occurs. So the evidence is pretty good.

DR. EMBRETSON: Let me still counter it because everybody knows that null findings are not really well accepted by journals. And so the studies
that I'm referring to in fact are not published because they're not findings that are intriguing in that sense. And people -- in fact, the people who designed these studies had really hoped they would work, but they didn't.

DR. FAULKNER: Well, I noticed, Tom, that there are notations here, Learning Processes 26 to 79. It may be that the text that's being cited here is enough -- has enough detail to explicate the questions that you were raising.

DR. LOVELESS: I'd be fascinated to know what the school-based factors are.

DR. FAULKNER: Right. But I guess what I'm saying is we don't necessarily have to clean up E and F as long as the text that gets drawn in because of E and F is actually descriptive. Wade?

DR. BOYKIN: Let me just say that some of these points were stitched together rather hastily to make sure they got in here before you all met. And they can be cleaned up and they can be clarified. And we'll make sure that we do that.

DR. FAULKNER: Okay. Well --

DR. BOYKIN: If the broad points, you know, we agree to, we can make them, you know, more substantive and more clear.

DR. FAULKNER: Okay. Bert?
DR. FRISTEDT: Quick comment. If you end up having to trim down, two points that I don't want trimmed away are J and K.

DR. FAULKNER: Oh, I think you won't -- you'll find a lot of support for not getting those trimmed away. Are we okay with general principles, Section 1? Looks like it.

DR. FENNELL: Generally, I liked what Wade said because I think they do need to be trimmed down and read a little bit punchier, more concisely, if possible, but the intent I think is fine. Thanks.

DR. FAULKNER: All right. Let's go now to Section 2, if we may. Did you have something, Wade?

DR. BOYKIN: I just don't have a copy so I'm just giving them back.

DR. FAULKNER: Oh, okay. Well, after Section 2 you won't need it anymore. Section 2, readiness for learning, has been edited relative to the original second concept that you have here. So let's look at readiness for learning in this version here with Arial font. Yes?

DR. WU: What are we doing here? Are we saying let's go as low or as high as we can to see if we can decide this is better? Is that what we're trying to do?

DR. FAULKNER: I'm sorry, what --
DR. WU:  I mean this is the new -- I mean this is the version proposed by --

DR. FAULKNER:  No. What happened is that the -- you may recall that when we talked about a section called Acquiring Knowledge and Skills --

DR. WU:  Yes.

DR. FAULKNER:  -- Needed to Learn Algebra.

DR. WU:  Yes, yes.

DR. FAULKNER:  -- that what appeared to be the resolution to that is that the general section, the Section 1, we agreed to present as a general section, but later in the document.

DR. WU:  Yes.

DR. FAULKNER:  Okay? And then that caused the Section 1 that exists in this document and representative Section 2 in the Arial document, it causes it to be edited some. And so I'm asking us to review the version that's in the Arial document.

It will become Section 1 again, but it's not the same Section 1 that we had before. So I'm asking you to look at Section 2, Readiness for Learning, in the form of this Arial document.

DR. WU:  Okay.

DR. FAULKNER:  Okay?

DR. WU:  Oh, a different place. Okay.

Thanks.
DR. FAULKNER: Bob?

DR. SIEGLER: There was a point that came up in my synthesis group this morning that we didn't have a chance to work on, but that I think is a good change here to the Section 2. And that has to do with taking the -- let's see, the last two points, F and G, and changing the wording; the concern was that it might seem too self-serving where particulars of scaling up kinds of issues.

DR. FAULKNER: Is this E and F in the Arial document?

DR. SIEGLER: Oh, yes, I'm still on the old document.

DR. FAULKNER: Yes.

DR. SIEGLER: Yes, E and F. That's right, E and F in the Arial document.

DR. BENBOW: E and F of the Arial document.

MS. FLAWN: In the new one.

DR. BENBOW: The new document.

DR. SIEGLER: That's right. I think we want to change those two points into one and to say that a variety of instructional programs have been developed to include the mathematical knowledge of preschoolers and kindergarteners, especially those in at-risk backgrounds that have yielded encouraging
result. There is a need to invest in research on effective preschool interventions.

DR. FAULKNER: What is your -- what's that last sentence?

DR. FAULKNER: There is a need to invest in research on effective preschool interventions.

DR. REYNA: Is that research vital? And I'm wondering if all of the research should go at the end.

DR. FAULKNER: I think Tyrrell's reaction is we can figure that out later, which I think is accurate. Yes?

DR. FRISTEDT: I have a different point. In connection with E, a variety of instructional programs have been developed. Might be nice to mention some of them. If we're -- and the one I have in mind is the one that Cynthia Jones mentioned at the public session in Chicago, where the slow learners had a special seminar along with the -- but they go to the regular class. But, then the special class would try to, as I understood it, make sure that they kept up with the prerequisite material and skills, so just some examples anyway.

DR. FAULKNER: Yes, go ahead, Valerie.

DR. REYNA: There may be issues with endorsing that particular thing, especially since we
don't have peer-reviewed literature on it necessarily. I -- the -- but we do have some concrete evidence -- I was going to make a similar point.

I would mention here perhaps the number line training which -- that we have reviewed. We do have peer-reviewed evidence about. And we have various other things, like in -- and this doesn't pertain to the whole number section, but under fractions we have other interventions we could mention specifically that have to do with part-whole games and those kinds of things. So I would say a couple of examples would be helpful here.

DR. FAULKNER: Yes, I don't disagree. Bert?

DR. REYNA: The board game -- well, we can't name it, but board games that involve counting.

DR. FRISTEDT: In connection with the number line, I noticed that Learning Processes paid quite a bit of attention to understanding inequalities essentially on the number line and where numbers are. I didn't see much attention to using the number line to represent addition and subtraction, and that can carry over to fractions. But maybe there's no research, I don't know.

DR. REYNA: There is research and it does.

DR. FAULKNER: Okay, other items on the
readiness for learning section. All right. What I'm hearing us say is that we've now worked through Sections 1, 2 and 3. We've worked through the general, we've worked through readiness for learning, and we've worked through the whole number section. Now we can go back to the original second common concept, the one with the numbered lines. And we'll go to number sense, which is Section 3 in that document. And it's on page 5. So let me ask you if you have comments or questions about the number sense provisions. Wilfried?

DR. SCHMID: You've warned us that we should not engage in wordsmithing. Nonetheless, reading 3-A, that's something that I find really striking. So it starts out with number sense and proficiency at approximating numerical magnitudes. That is surely true. I am not quite sure whether this needs to be the first sentence here, but if it is then the next -- the start of the next sentence is really bothersome.

"Such proficiency," because now that refers to proficiency at approximating numerical magnitudes. There's then a huge list of components. And these components, of course, are very important on their own. They're not just important because they make it possible to approximate numerical magnitudes.
So I mean this is -- you know, this is garbled. And we should take note of the fact that this paragraph is garbled, and when it's rewritten that garbling has to be ungarbled.

DR. FENNELL: Okay, I could, let me -- I'm going to jump in here. I -- what hap -- this is Sandy referred to this. When we take work from other places and move it into these new positions we lose stuff. And boy did we lose stuff here.

This -- the issue of magnitude is an element of number sense. And we -- we're fine with that and then we launch into a discussion. Applying magnitude relates to all those other things. Yes, I totally agree and this needs to go back to work again. Maybe Bob, because you were in trouble doing this.

DR. SIEGLER: Just a quick suggestion. Is this --

DR. SCHMID: Yes, it's on now.

DR. SIEGLER: A quick suggested fix, because I agree with both of your points.

DR. FAULKNER: Where do I get the lines?

DR. SIEGLER: Okay, this is 189 in the old section.

DR. FAULKNER: Yes.

DR. SIEGLER: Among the key elements of number sense is understanding place value, how numbers
can be decomposed. Would that meet --

DR. FAULKNER: Where are you --

DR. SIEGLER: This is --

DR. FAULKNER: Where are you getting that?

DR. SIEGLER: It's --

MS. FLAWN: It's Learning Processes.

DR. FAULKNER: That's from Learning Processes?

MS. FLAWN: Yes.

DR. SIEGLER: Oh, I thought you wanted us to work from the section with number 11.

DR. SCHMID: This one. It's this one.

DR. SIEGLER: Oh.

DR. SCHMID: So it's 214.

DR. FAULKNER: Yes, we're in 214.

DR. SIEGLER: Right, 214. At the -- the second sentence could begin "Among the key elements of number sense are," and then continuing with understanding of place value, how numbers could be decomposed and recomposed.

DR. SCHMID: Well, the first sentence should really not be the first sentence. It should be in there, but not as the first sentence.

DR. FENNELL: It needs a rewrite, let’s just rewrite it.

DR. FAULKNER: Okay.
DR. FAULKNER: Skip is going to fix it.
Okay. All right, other questions about number sense?
Deborah and -- oh, Dave, Dave then Deborah. Dave then
Deborah then --

DR. GEARY: Yes, one point that came up in
our discussions this morning was whether we want to
separate number sense into those areas in which kids
seem to inherently and early on have knowledge. And
then which may be important for, but is very different
from the number sense that emerges as a result of good
mathematics education.

And so part of the mixing up of -- part of
what's going on is mixing up some of those different
features. So it's reading an A and B, or separating
those out in some way may clarify a lot in this area.

DR. FENNEL: Maybe you should help us.

DR. GEARY: I have the horizontal. I'm
sure it's right.

DR. FAULKNER: All right, guys, come on.
We only have to hang on for 15 more minutes now.
Deborah?

DR. LOEWENBERG-BALL: C, D and E in this
section seem a little bit misfitting. C, I don't
know, it just seems a little vague to me. There are
lots of things that are involved in improving kids
number sense. And then D and E seem like they're in
the spirit of what Sandra was commenting on a little
minute -- few minutes ago. These are now
recommendations about instruction and about textbooks.
They either don't belong here or something, but
they're not comments about what number sense involves
or what we know about it.

DR. FAULKNER: So what are you saying, you
would delete those?

DR. LOEWENBERG-BALL: Well, D and E are
recommendations that don't -- they're both
recommendations. That's one comment. And they're
also about instruction and about textbooks, so they
wouldn't belong in this section that's about what this
competence involves. And C just seems like a
throwaway to me. I'd delete it.

There are many things we might comment on.
I've already just said two items about what
estimation involves and suddenly there's this
additional statement that also involves skill of
computation. I don't think we need it.

DR. CLEMENTS: A question about E to
whoever's got that in there. Do we know the textbooks
don't do this and changing this in textbooks makes a
difference to kids learning, or is it really that that
should stay there but be reformulated as what the
research shows, which I assume was that children don't
over -- always understand the purpose and leave it at that? And I don't know, I'm honestly asking the question of how much we know about that.

DR. SCHMID: Well, I mean I think that the comment on E is -- really does not particularly apply to whole number arithmetic. I mean it is a much more general comment. It doesn't belong in this section. I mean I think that the purpose of estimation is really something that comes long after whole number arithmetic. In whole number arithmetic and in number sense, there should be some sense of order of magnitude and this is being said already. But we don't want to be advocating that in textbooks there be a formal discussion of the purpose of estimation in the context of whole number, of whole number arithmetic. This is just ludicrous.

DR. FAULKNER: Joan and then Liping, then Bert.

DR. FERRINI-MUNDY: I don't really have a solution to the problem I'm about to raise, but this sec -- you've got four content sections in this overall section and three of them map directly to your critical foundations. And this one doesn't, and I think that's confusing. I think it's powerful if you've got the three that map directly.

So we might want to contemplate some
solution to this if we want to keep -- and I think we should try to keep the emphasis on number sense. But maybe it's in a more general place or maybe the first part, the number sense part gets rolled in somehow to the whole number section and maybe the estimation. I mean it does mention fractions, although I don't think that connection's made strongly yet. But I just see a logical issue --

DR. FAULKNER: I think that's a good point.

DR. SCHMID: But I think that in fact the issue is sort of bare bones estimation in the context of whole number arithmetic is already in there in A. I mean it's --

DR. FERRINI-MUNDY: Yes.

DR. SCHMID: -- it's being mentioned. And I think this is exactly the right kind of emphasis to give on estimation at that grade level.

DR. FERRINI-MUNDY: Right. I'm not arguing with the content of it. I'm just saying I think I see a logical problem.

DR. SCHMID: Yes. Well, I mean I agree with you. I agree with you.

DR. FERRINI-MUNDY: Yes.

DR. SCHMID: I think that that is my point here.
DR. FERRINI-MUNDY: Sure.

DR. SCHMID: I agree with you, that what needs to be said about estimation is there. And then what else is being said about estimation really belongs into a different context.

DR. FAULKNER: Okay. It was Liping, then Bert.

DR. MA: Yes. Personally I don't like the term number sense because it's very vague, but that -- I know that will not count. But I was wondering if there is any scientific research saying that place value belongs to number sense. Because I think the place -- the concept of place value came very late, like only 800 years before we -- Europe adopted that number system -- Arabic number system so that we have number place value. But before that mathematics had already developed very advanced, so I don't know, this place value is it related to number sense.

But really I don't quite like the term number sense because it's too vague for teachers to follow, like to imply, to put in teaching. What should I do to promote number sense?

And on the other hand, when they do math well, number sense is kind of a byproduct of learning math.

DR. FAULKNER: Bob wants to speak to this
issue, Bert, so I'm going to let him go first.

DR. SIEGLER: Right. So I'd like to tell you about some of the research that supports the importance. This particular comes from understanding of fractions.

You ask children what's a bigger number, .43 or .367. Large majority of fourth, fifth, even sixth graders will say .367 because it has more numbers. You ask them where does .034 and .34 go in a number line. They put them at the identical location.

So the way in which number sense is understood, and place value is a key part of number sense, is that because the children don't understand the decimal system and place value, they make these very basic mistakes.

They also make similar mistakes in fractional arithmetic, because they come up with answers where you're adding two fractions and you come up with a number that's smaller than either of them. It just -- it's all over the place. But the lack of understanding of the place value system leads to this lack of number sense, certainly with fractions.

DR. FAULKNER: Are you on the same subject or a different subject?

DR. WU: Same subject, same subject.

DR. FAULKNER: Bert, are you on the same
subject or --

DR. FRISTEDT: Totally different. Let him go first.

DR. FAULKNER: Okay.

DR. WU: I don't know if I'm misinterpreting this, but I think the -- debate of the evening and that is quite different. What Liping is saying is that numbers -- now how do I express it. I carry your version and now I try to interpret it.

What Bob would like to see is number sense as in do we understand the Hindu-Arabic numeral system, which is a particular representation of numbers.

So it's a decision we can make whether we want to define what number sense is. If we define number sense to be understanding of the numeral system that we have, then of course number sense is correct. But Liping is saying that we have been handed numbers we -- with or without the Hindu-Arabic number system -- Therefore, what are you talking about? So that's the issue.

DR. FAULKNER: Okay, Bert. Or no, Vern. Are you talking on the --

MR. WILLIAMS: Same subject.

DR. FAULKNER: -- same subject? Okay.

MR. WILLIAMS: Prior to this Panel I'd
never heard of number sense, had no idea what it was, and still don't. And second of all, I think we should probably call it conceptual understanding instead of number sense. If you want teachers to pay any attention to this document, you have to put in terms they know. And number sense just is not going to make it.

DR. FRISTEDT: My comment's slightly different. Not that I disagree with what Vern said. Two things. One is estimation should come after people know what they're doing exactly. And so I worry if estimation is emphasized too early. Secondly, and I had this objection with Conceptual Knowledge and Skills as well as here, estimation fits so naturally with inequalities, but the connection doesn't seem to be anywhere in anything we've done.

DR. FAULKNER: Skip?

DR. FENNELL: Well, I disagree with Vern and I guess I disagree with Liping. I think number -- I think that the goal of kids, in particular in the learning of mathematics prior to algebra, ought to be a robust sense of number. And I would define that as being proficient in the kinds of algorithms and procedures we talked about in our critical foundations.

I would define that as having a sense of
where those numbers that Bob talked about fall in a
number line, be they decimal representation or mixed
fractions and decimal representations with common
percents, or whole numbers early on or what have you.
I would also define that as the ability to estimate,
whether it's the ability to estimate number of people
who happen to be in this room, magnitude, or use
particular procedures to get at something that's
close.

Now all those together, to me, gives kids
a sense of how to use number, whether I need to
accurately compute the thing or I -- or an estimate
will work, and so forth. There's a lot of things that
go into that. I would recognize sort of that this
sense of number is a culmination. And it doesn't
happen overnight, but I think it's critical for all
kids.

Dr. Faulkner: Wilfried?

Dr. Schmid: Well, I mean I completely
agree with what Skip said. And number sense includes
-- is not entirely a matter of the system, decimal
system of numerical expression. I mean the question
of -- is 7/8ths, I mean is -- how large is this number
approximately has nothing to do with decimal
expression. So Skip has it exactly right. Number
sense is a big package.
And then I would say, you know, I -- to Vern, I got involved in math education in 2000. Prior to 2000 I had no idea what people meant when they said number sense. But since I've been in this game, at least to me it seems that this is widely understood at this -- at the elementary school level and is terminology that exists. I mean whether or not I like it -- at this point becomes irrelevant. As Liping said, it is terminology that exists out in the schools, and it's not terminology that's harmful. It's maybe not the one I would choose, but it exists out there. It's being used, it's widely understood, and we certainly must use it in our report.

MR. WILLIAMS: I'm probably in my own little part of the universe, because I just disagree with that. I don't think it's understood. When I get a term number sense, I just get this bizarre something about numbers and they just sort of know more than maybe I think they know about what numbers mean. But I don't -- to come through that with knowing how to deal with compilations and understanding why those operations work and -- just a conceptual understanding of mathematics.

Number sense is just this vague weird thing, that if we don't write two pages on it it's just going to go in one ear and out the other in the teacher
world. Maybe it's just where I teach in Fairfax County, that we've never heard of it, but we just haven't.

MR. WILLIAMS: It's Virginia.

DR. FAULKNER: Have we more to discuss on number sense?

DR. REYNA: Yes. I would, please.

DR. FAULKNER: All right. Val?

DR. REYNA: As a possible way to reconcile these points of view, I agree number sense sometimes can seem vague to people. How about the following definition? "Number sense" -- we could put it right after that as the -- "has accurate intuitions about numerical magnitudes as exemplified by performance of the following tasks." And then you give examples of the place value, and so on and so forth, those operational ways to assess this accurate intuition about numerical magnitude. Would that help?

DR. WILLIAMS: That's one element. I mean that's not all of it.

DR. FAULKNER: I don't think we can work this here at the table.

(Simultaneous conversation.)

DR. FAULKNER: You all -- those of you who care, can work --

(Simultaneous conversation.)
DR. FAULKNER: I --

(Simultaneous conversation.)

DR. SCHMID: Could we have a word from the dean of a school of education that number sense is commonly understood terminology?

(Simultaneous conversation.)

DR. LOEWENBERG-BALL: Vern's claim is that teachers don't understand it, not whether schools of education understand it. So --

DR. WILLIAMS: Maybe you do want to teach it.

DR. LOEWENBERG-BALL: Yes. I don't know, I agree with Skip that it's broadly used. Whether it's broadly understood to mean the things that Skip and Wilfried want to say, I can't speak to that. But it's a very common term. So I think we're probably remiss in not trying to take it on. So --

DR. FAULKNER: What I've heard about this is that we ought to take the recommendations that are in D and E and move them to the recommendations section. And then we decide later whether they're important enough to try to keep in the recommendations section. We killed C. All right. We can't kill C?

(Simultaneous conversation.)

DR. FAULKNER: I thought Deborah's recommendation is we kill C. She said she thought it
Dr. Siegler: I disagree. I -- so I added the specifics, because someone, I forget who it was, who said they thought it was a throwaway, but I don't think it is at all. So this is Point C, improving young children's number sense. So here's the elaborated form. And I think it has a lot of content. "Improving young children's number sense improves a wide variety of other mathematical capabilities, including the ability to -- including estimation on number lines, magnitude comparison, counting, identification of numerals, and addition."

Unidentified speaker: That's a very good point though.

Dr. Faulkner: Yes.

Mr. Williams: But that's my exact point. You just said we could improve a student's number sense. How do you improve someone's sense? It makes no sense.

Dr. Siegler: No, no, this isn't a definition at all. This is an empirical finding that actually by playing numerical board games that are linear, so these are preschoolers, going from zero to 10, you get a sense after playing a game like this, we just go through moving a piece on a board, you learn
that six is bigger than four and eight is bigger than five and nine is bigger than three. You learn to recognize these numbers.

And after playing the game and you give kids novel addition problems that they don't know yet, the kids who played the game with the numbers learned more of the addition problems and their errors are closer in magnitude than kids who played the same game, except instead of five, six, seven you have red, blue, green. So that's how you -- that's one way to --

DR. FAULKNER: All right, all right. Well, we're going to close out here, but what we're going to do then is we're not going to kill C. We're going to move those recommendations and then we're going to leave it to Skip and Bob Siegler to --

And who?

DR. FENNELL: Wilfried and Dave and that works.

DR. FAULKNER: Okay. Well, that crew is going to work out something that actually has meaning.

DR. FENNELL: That's good.

DR. FAULKNER: Okay.

I'm going to move D and E, those two recommendations, to the recommendations. And then later we'll decide whether they have enough value to stand up to the other things that we're considering
here. Okay?

   All right. I have a deep number sense
that we have expired.

   DR. FAULKNER: Yes. So we're going to go
ahead and break out -- off now. And for the audience,
let me indicate that we're returning here tomorrow at
8:15. Those of you who have notebooks here may leave
your notebooks overnight. And we'll be back here in
the morning, so we're okay.

   But let me also point out to the Panel
that we need to get further down this chart quicker
than we're moving. And we have only gotten to three
in the first section.

   (Meeting concluded at 5:05 p.m.)