UNITED STATES DEPARTMENT OF EDUCATION

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NATIONAL MATHEMATICS ADVISORY PANEL

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Sunday, November 5, 2006
4:00 p.m.

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Stanford University
Schwab Residential Center
East Vidalakis Hall, 680 Serra Street
Stanford, CA

PANEL MEMBERS:
DR. LARRY FAULKNER, CHAIR
DR. CAMILLA PERSSON BENBOW, VICE CHAIR
DR. DEBORAH LOEWENBERG BALL
DR. DANIEL BERCH (PRESENT VIA CONFERENCE PHONE)
DR. A. WADE BOYKIN (NOT PRESENT)
DR. FRANCIS (SKIP) FENNELL
DR. DAVID C. GEARY
DR. RUSSELL M. GERSTEN
MS. NANCY ICHINAGA
DR. DIANE JONES (PRESENT VIA CONFERENCE PHONE)
DR. TOM LOVELESS
DR. LIPING MA
DR. VALERIE F. REYNA
DR. WILFRIED SCHMID (NOT PRESENT)
DR. ROBERT S. SIEGLER
DR. JAMES SIMONS (NOT PRESENT)
DR. SANDRA STOTSKY
MR. VERN WILLIAMS
DR. HUNG-HSI WU

EX OFFICIO MEMBERS:

DR. KATHIE OLSEN (NOT PRESENT)
MR. RAY SIMON
DR. GROVER J. (RUSS) WHITEHURST

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MS. TYRRELL FLAWN, EXECUTIVE DIRECTOR
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MR. KENNETH THOMSON
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C-O-N-T-E-N-T-S

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

7:04 p.m.

DR. FAULKNER: (presiding) All right, good afternoon, everyone. Let me welcome all participants to this fourth meeting of the National Math Panel.

We are delighted to be here at Stanford University, and we are most grateful to Stanford for helping us to stage this meeting on the West Coast. We look forward to progress in the next couple of days.

I would like to welcome all who are here in the public audience and welcome you to this occasion.

We have a signing service, and we are happy to continue it, but we will not continue it if no one is using it. So I would like to ask if there is a need for us to continue the signing service. If not, then we will discontinue the signing service. If someone comes in at a subsequent stage, we can pick it up. Thank you.

Let me introduce the first session now, which is on American student readiness for college-level mathematics. The panel will be able to find information on this under Tab 7 in the notebook. Bios for the presenters are under Tab 6 of the notebook.

This session was set up by Skip Fennell and Deputy Secretary Ray Simon. I would like to thank both of them for the work in getting this organized.

We have presentations that will be made, two 15-minute presentations and 25 minutes for questions and answers. The two 15-minute presentations will be carried out by Arthur VanderVeen, Executive Director, College Readiness, for the College Board (including two colleagues that he will introduce) and Cyndie Schmeiser, the President of the Education Division of the ACT.

So, with that, let me welcome our presenters and begin with Arthur VanderVeen of the College Board.

Turn on your microphone, please.

MR. VANDERVEEN: Chairman Faulkner and panel members thank you very much for this opportunity to speak to you and to Stanford University for hosting this session.

I am here with Professor Alfred Manaster from the University of California, San Diego, and Professor William Speer from the University Nevada, Las Vegas.

I am going to run rather quickly through an overly long presentation that I'm committed to doing in 15 minutes. So I hope you will keep up with me. Then we look forward to your further questions during the question and answer.

My objective for this presentation is really to share with you some of the empirical research that we have done to support the design and development of our mathematics and statistics standards for college success, as well as share with you the kind of purposes and objectives that led the College Board to develop these standards.

I am not going to spend a lot of time, but I am sure you are all familiar with these data on remediation rates of entering freshmen taking non-credit-bearing or remedial courses in college, and that we know that remediation is not an effective solution to preparing students for college-ready work. Only, of those students who take remedial mathematics courses, 27 percent will earn a bachelor's degree. By comparison, 58 who take no remedial courses will earn a bachelor's degree.

The College Board launched its effort to develop these standards in 2003, and we had two primary objectives. Our membership was struggling under these very high remediation rates and they were looking for a framework that they could use to try to coordinate the conversations between K-12 systems and higher education systems to better articulate learning objectives across the two systems to reduce remediation. Our other primary objective was advanced placement courses. Participation in advanced placement courses has expanded dramatically over the last five years. We, ourselves, needed a framework to increase the number and diversity of students who were prepared and ready with the skills they would need to succeed in Advanced Placement (AP). So those were our two primary objectives for launching this initiative in 2003 to develop these standards.

Our goal, once finished, which we are just close to finishing now, was then to provide these model course frameworks for states and districts, so that they could prepare their students for college-level work by the time they graduated high school or to take an Advanced Placement course.

Our strategy was rather simple, theoretically: to identify the mathematics and statistics content that first-year college faculty expect of entering freshmen, and once having set those benchmarks, to map back from these expectations to articulate a coherent framework of college preparatory courses beginning in grade six that would lead to these benchmarks for college readiness.

Our first step was to convene our Mathematics and Statistics Standards Advisory

Committee. Members of the Committee were comprised of middle school and high school teachers, college mathematics faculty, teacher education faculty, research mathematicians, curriculum and assessment specialists, and specialists especially with experience in developing standards frameworks, both national and state standards frameworks.

The Committee met for more than a dozen working sessions of two to three days and spent hundreds of hours over the course of three years drafting and reviewing information and surveys, reviewer comments, and revising these standards. So it has been a long, lengthy process to get to where we are today.

We also sent out drafts of the standards to the following national professional organizations and individuals who reviewed and commented on drafts of the standards that we then responded to. Here's also a list of the College Board staff that worked on the project.

The Standards for College Success, which you should have in your book, are organized as a traditional sequence of courses building to college readiness listed here: middle school math 1 and 2, algebra I, geometry, algebra II, pre-calculus.

Having completed the frameworks for each of those courses, we then also essentially permuted the performance expectations within those course frameworks to align with an integrated approach. We also offer an alternative framework of six integrated courses to support those states and districts that are using an integrated approach to math education.

If you have had any time to look through the standards, you will, no doubt, notice that we have integrated statistics and data analysis into all of the courses. Our decision on this, to give this level of emphasis to statistics, was twofold. One, as I said earlier, we needed to provide a preparation track for our Advanced Placement statistics course. I think, more importantly, our feeling at the College Board is that increasingly courses outside of the traditional math major, courses in business, science, health science, and finance are increasingly dependent on both mathematics and statistics. So that is certainly a salient feature of the standards framework.

Also, one of the contributions of the framework is a careful consideration of the sequencing of content to be covered in the middle school courses with an eye toward coherence across middle school math 1 and 2, with coherence and focus and a decrease in repetition from what is seen in traditional sequences.

That enables us to prepare students for algebra I in grade eight, and for the great majority of districts, where the high percentage of students are not taking algebra I in grade eight, we also provide a three-year sequence for the middle school courses that will support those students as well.

You will also note that the standards are generally more specific than many standards frameworks that are out there. This was also intentional. Our purpose was to provide sufficient guidance to curriculum and assessment supervisors and teachers to design instructions and assessments in middle school and high school that lead toward Advanced Placement college readiness.

The validity of the standards in our mind is based on multiple alignments. Again, our objective was to anchor our framework in advanced placement and clear definitions of college readiness while aligning to other national frameworks and strong state standards frameworks.

So you see at the top there Advanced Placement, also the Scholastic Aptitude Test (SAT) and the pre-Scholastic Aptitude Test (PSAT). Underneath the foundation were a number of curriculum surveys and course content analyses that I am going to tell you about, but also looking to align to national and state content standards as well as the NSF integrated curriculum.

Again, organizationally, one of our top objectives was to prepare the pathway to Advanced Placement Calculus and Advanced Placement Statistics as well as to the SAT. Our Committee members have worked on the test development committees for Advanced Placement Calculus, Statistics and the SAT.

Also, during the drafting of the frameworks, we looked closely at the specifications for those assessments and actual test items, to look at the competencies measured by those assessments.

Then to support our ability of our framework to, quote/unquote, "communicate" with other frameworks, we also reviewed these national standards and curricula.

Now I want to get to what is really the focus of my talk, which is to share with you the empirical research that we conducted to inform the design of the standards. We conducted two surveys, one of postsecondary faculty and one of high school faculty. In the postsecondary survey, 1,099 college faculty at 312 postsecondary institutions responded to a survey to determine the mathematics knowledge and skills critical to success in their courses.

I won't go into the details, but the

sampling plan is described here. Fairly representative, though we over sampled at Master's levels and under sampled at Associate's levels institutions. Most of the responses came from faculty teaching algebra and calculus. There were some also from statistics, discrete math, and finite math.

They were given drafts of the Standards for College Success and asked to rate them in terms of the level of student mastery expected for those performance expectations. One of our most interesting findings is that they taught most of the performance expectations written for high school mathematics courses as new due to students' lack of strong mathematical foundations.

We also posed an open-ended question. “What content or process, knowledge would you suggest students have mastered prior to entering your course to be successful?” I am going to share with you some of those findings.

Across courses, 29 percent indicated that students need greater mastery of algebra and functions. This need was reported most frequently by instructors of high college algebra courses.

In the process of the survey and the course content analyses, we rated the courses from the faculty who are responding, looking at their syllabi, assessments, student work, and rated them as low, medium, and high. So this response was strongest from faculty teaching high college algebra courses, medium calculus courses, and low statistics.

Another finding we found interesting was that 18 percent of calculus instructors reported a need for greater student mastery in geometry and measurement. This was much higher, as would be expected, for calculus faculty rather than faculty of college algebra or statistics.

In terms of process skills, we found a need for greater mastery in problem solving and communication with the other process skills really finding less representation.

We also conducted eight case studies to gain greater insight into the findings of the surveys. We, of course, got a broad range of opinion from the faculty at these eight institutions. A number emphasized computational fluency and dismissed the need for conceptual understanding in K-12 preparation while others emphasized the ability to reason conceptually and solve problems.

All eight institutions noted that students lack a deep theoretically understanding -- and this was the phrase -- "of math as a language," which inhibits their ability to think critically and apply mathematics to solve problems.

Quickly shifting now to our survey of high school/college teachers, we had 1,539 high school teachers respond to the same performance expectations that were given to the postsecondary college faculty, so that we could make comparisons between the findings.

Here is the sampling plan. In this sampling plan we intentionally over sampled highly qualified teachers. The majority of them had more than 20 years teaching experience. They were asked to rate whether they taught the material in their course as new, if they taught it in their course, if they don't teach it in their course, or if they expected it to be taught in a later course.

Typically, for the performance expectations listed in our standards for algebra I, geometry, and algebra II, most of the teachers responded that, in fact, they do teach this material as new in their course, which confirmed for us the sequencing of the coverage of the content knowledge that we have articulated.

Pre-calculus, for the standards in algebra and measurement, again, teachers tended to teach this material as new in their course. However, in pre-calculus for the standards covering geometry and data analysis, statistics, and probability the answer was, "No, I typically assume that the students will learn this later."

Recently, we have developed a number of algebra II questions based on our standards and done some field-testing. I am going to give you some very preliminary data of what we have seen in terms of student response to those questions.

We developed 19 forms that were tested at high schools around the country with the 200 students taking each of the 10 forms. We included three SAT items as linking items to judge the level of effort and difficulty.

Generally, these were algebra II students. They performed well on operations with real numbers and polynomial expressions, linear and quadratic equations and functions, systems of equations, and exponential functions.

They had difficulty with matrices, complex numbers, though they could plot them, but other operations they had difficulty with. In data, they had difficulty with permutations and the normal distribution.

Our conclusions are as follows: We found there is fairly common agreement among highly qualified high school mathematics teachers about the scope of these courses. High school mathematics teachers are not generally accustomed to integrating data analysis and statistics into their mathematics courses, and there seems to be a real disconnect between college calculus faculty and high school pre-calculus teachers regarding the importance of geometry and pre-calculus courses.

We have also found that college mathematics instructors and faculty teachers knew much of the same material that high school mathematics teachers knew. This leads us to recommend that measures of reteaching should be part of any {K-16} mathematics curriculum conversation.

Our final conclusion, which won't be probably new to any of you is as follows: A coherent, articulated framework defining expectations across middle school, high school, first-year college mathematics courses would really help structure the curriculum conversation, potentially resulting in a reduction of reteaching and remediation at the college level.

Thank you very much.

DR. FAULKNER: Thank you very much.

Let us proceed then to Cyndie Schmeiser.

MS. SCHMEISER: Thank you, Mr. Chairman and members of the National Math Panel. I am pleased to be invited to share some thoughts with you today about our data, focusing on the readiness of students who take our programs throughout high school for college-level mathematics.

In the next few minutes, I would really like to focus on three aspects of our data. First of all, what do we know about college readiness in mathematics, what factors increase college readiness in mathematics, and what is the relationship between college readiness and college success in mathematics?

Our primary data source that I will be citing in the next few minutes is our 2006 ACT-tested high school graduates. The composition is about 54 percent female, 43 percent male, 63 percent white, 12 percent African American, 7 percent Hispanic, 3 percent Asian, and 1 percent American Indian.

Before I do that, I would like to share some statistics with you. So many people have different definitions of college readiness and what it really means. I would like to spend just a minute and talk about how we define college readiness at ACT.

We actually have gone through and based our definition of college readiness on a nationally representative sample of postsecondary institutions. We have gone in, looked at their course placement data, and we looked at the ACT scores of students who went into those college courses and had at least a 50/50 chance of getting a "B" or better in those college-entry credit-bearing college courses or a 75 percent chance or greater of getting a "C" or better.

We then looked at the ACT score that those students obtained, and we have labeled those benchmarks, which are median values. So, obviously, in any particular campus those values might be higher or lower, but they represent, if you will, a median college-readiness benchmark.

In mathematics, the median ACT score is 22 on the ACT mathematics, which is on a scale from 1 to 36, and that represents the point at which the median value where students have at least a 75 percent chance of getting a "C" or better in a credit-bearing college algebra course. We have other benchmarks for higher-level mathematics courses, but today I would like to just focus on the college algebra benchmark, if I could.

Each of these ACT scores are based on our college readiness standards that are empirically-based and describe what it is that a score of 22 means in terms of what students actually know and can do in mathematics.

Our ACT test is a part of a college readiness system. The reason I want to bring this up is that I'll also be citing some pipeline statistics this afternoon. Our ACT is also connected to a tenth grade program called PLAN and an eighth grade program that is given to eighth and ninth grade students called EXPLORE.

Because these programs are a single system for looking at college readiness from eighth grade to twelfth grade, they were also able to look at growth between and among those programs. We are also able to take our college readiness benchmark, which I mentioned was a 22 on the ACT, and look at what that benchmark is in terms of the tenth grade program. At tenth grade the benchmark is 19 and eighth grade is 17.

So when we look at students who take the EXPLORE mathematics test, we can see whether they are above or below a 17. If they are at or above a 17, we consider them to be on target to becoming college-ready. If they are below, they are probably struggling and will have a difficult time becoming college-ready.

What do we know in 2006? Only 42 percent of our ACT-tested students who graduate in the class of 2006 are on target to be ready for college-level math when they leave high school, 42 percent.

For some groups, there are substantially more sobering statistics. You'll see, and I know these numbers are hard to read, but to give you an idea, we have 11 percent of African American students meeting or exceeding the college readiness benchmark in twelfth grade, 25 percent Hispanics, and 22 percent of students with family incomes below $30,000.

What is the good news? We have seen a slight increase in college readiness over the past four years. In 2002, 39 percent had met or exceeded our college readiness benchmark. In 2006, that has increased to 42, modest increase, but, nevertheless, an increase.

But what I think is more startling and more troublesome is when we look at the pipeline. There are more eighth and tenth grade students nationally who are actually on target to becoming college-ready than actually are ready when they reach the 12th grade and take the ACT. Let me show you this chart.

This chart is based on a cohort of students from four years, from 2002 through 2005 cohort, who had taken our eighth grade program, our tenth grade program, and our twelfth grade program. Forty-seven percent of those students were on target to becoming college-ready in the tenth grade. That dropped to 44 percent of that same group with PLAN.

By the time they took the ACT, it had dropped to 42 percent.

What we do know is that students who take core courses in math are far better prepared for college than those who don't. You'll see in this visual a mean score of 19.4 on the ACT scale for those students who took less than core compared to 21.8 for those students who took the core courses, three years. Again, we use a Nation at Risk definition, which is three years of high school mathematics.

But the fact remains that those students who take upper-level math courses are two to five times more prepared for college than those who simply take algebra I, algebra II, and geometry. This chart shows when students take trig or advanced math and/or pre-calculus, their chances for becoming college-ready are dramatically improved.

What we also know is, when we look at grades, so many students say, "You know, I received an "A" in my algebra II class, but I took the ACT and I don't appear to be college-ready. How can that be? Why is there an apparent inconsistency?"

Well, when we looked at grades relative to college readiness, we find that 43 percent of students -- and this was a cohort of students in 2003 -- reported receiving an "A" or a "B" in algebra II. 43

percent did not meet the mathematics benchmark when they took the ACT.

But we also know the college-readiness, has a direct impact on college success. They are more likely to enroll in college, 77 percent versus 60 percent. Now, again, these statistics are based on students who have met the benchmark versus students who haven't. They are more likely to earn college course grades of "B" or better in college algebra, earn GPAs of 3.0 or higher, and return for the second year at the same college.

We are about 18 months short of being able to look at graduation, college graduation, relative to readiness. We will have those data in about a year and a half.

So why might students be losing momentum in high school? It is not a surprise to any of us that many students are not being asked to meet rigorous math standards in high school that are aligned with postsecondary education. They are not being exposed to high-level mathematics standards needed for college readiness.

And when we looked at the 49 sets of state standards, only 19 of 49 have fully defined course standards in math through high school.

I might also say, as a side note, when we looked at graduation requirements of the 50 states, only 25 states required students to take any math course in high school at all. Twenty-five required students just to take any math course. Twelve required algebra II, and four, only four, required any math beyond algebra II specifically.

So what have we done in our work, in our research, to try to get a better hold of this? We actually conducted a study two years ago with the Education Trust. We started very small. We started out with ten high-performing high schools that we identified through ACT data that were also high minority and high Title-I-funded high schools, but yet these high schools were producing high school graduates at greater than average proportions than we see nationally.

We've actually followed their students into college. We made sure their students were able to succeed in college through their grade point averages. They came back a second year. We traced those students back to those high schools and said, "What courses did they take? What teachers did they have? What was going on in those classrooms that helped those students achieve in greater than expected proportions?"

So we studied over 64 classrooms just in those ten schools. So I don't mean to imply that this was nationally-representative in any way. These were just 10 outstanding performing high schools.

What we found out would be, again, no surprises. Their courses were all aimed at high-level, college-oriented course content. There were well-qualified teachers in the classroom. They used flexible pedagogical styles, and they were available to their students after school, on the weekends, and whatever support that they could provide.

But I would like to spend a minute, if I could, to talk about the high-level course content. We were able to derive a high degree of consistency in these high schools and what they were teaching in 11 courses, and in mathematics in particular, algebra I, algebra II, geometry, pre-calculus. An amazing amount of agreement on what was important and what they were teaching their students to be prepared for college.

So then after we finished that study with these 10 high schools, we went out to 300 additional high-performing high schools, irrespective of student population, representation, or Title I funding. We asked those additional schools, "Are these the sorts of things you're teaching? What else are you focused on?" Again, an amazing amount of consistency in these high-performing high schools of what was important, what they were focusing on, and what students need to know in order to become college-ready.

So as a result from that, we do have model course syllabi, and we are basing a new program on those rigorous course objectives to help identify what needs to be done and what is actually having an effect when these students go to college.

So, quickly, our data suggests a few recommendations. We need to begin monitoring college-readiness early and identify students who are not on target to become college-ready in math way before high school. Maybe middle school is too late. We are not sure. But our data right now on middle school readiness is startling.

Our state standards need more work. Good effort is underway to align them with college-readiness standards and to detail the college-readiness standards in ways the teacher can implement them and teach to them in the high schools. We've got to find a level of detail that helps teachers and define the type of math skills that need to be incorporated into each course. So we are taking state standards down to the course level as well because there is terrific ambiguity, at least from our data, at the course level.

We need to align state assessments with

state standards, and we need end-of-course assessments to evaluate the quality of our core courses. We can't forget that the alignment process needs to come all the way down to the course level to align with college-level expectations.

Our focus certainly at ACT is to improve the quality and intensity of high school core courses, and we will be using formative and end-of-course assessments, that type of information, to help teachers identify students who need help, to improve instruction and learning in the classroom.

So, with that, I thank you very much for the opportunity to share our data with you this afternoon.

DR. FAULKNER: Thank you. Thanks to both of our main presenters here.

We are now ready to go to questions and answers. So let me open to the panel the opportunity to query.

Turn on your microphone, please.

DR. SIEGLER: I would like to ask Dr. Schmeiser a couple of questions about this very interesting longitudinal dataset you have with the EXPLORE and PLAN and ACT study. This is a wonderful opportunity to find out all kinds of things.

So, for example, you talked about how the overall percentage of children who are on target goes down by 5 percent between when the EXPLORE test is given and the ACT. But there must be people who are going into the set. That is a sum of the number of people who weren't on target in the EXPLORE dataset and were in the ACT, and people who were in the EXPLORE and weren't in the ACT.

I was wondering if you could give us a sense of how many or what percentage of kids who are ready by the time they take the ACT who weren't earlier, and if you have done any studies of what characterizes those children who weren't on target but somehow, through their own efforts and that of the school system, became on target?

MS. SCHMEISER: Well, that is a critical question. Yes, we have looked at that. Unfortunately, I don't have the data right in front of me to respond specifically. I would very much be pleased to respond after the meeting to that question.

We find, in general -- and I'm speaking in generalities here -- we find that there may be as many as 30 to 35 percent of students who take EXPLORE -- and, again, that is not a nationally-representative sample; it numbers this last year around 700,000 eighth grade students -- who are not on target. When we in previous years followed those students all the way through high school, they never do get on target. So that number is staggering in and of itself. Somewhere between 30 and 35 percent of eighth-graders never do get on target, either at the tenth grade or twelfth grade level.

I would be pleased to respond specifically to you, if I could, in a follow-up with regards to the other statistics, in terms of who might have been on target in tenth grade and what happened in twelfth. I don't have that data right off the top of my head this afternoon.

DR. FAULKNER: Tom?

DR. LOVELESS: I wanted to probe a little bit about the College Board's decision to integrate statistics, to the extent that it did, into its standards. If I understand your poll of high school teachers correctly, the results show that high school teachers don't integrate statistics into their courses. From my own knowledge of state standards, I know that states don't integrate statistics into those courses, at least to the extent that you have.

So I guess my question is, why are you integrating statistics into those courses? Have you thought maybe that is a decision you might want to revisit?

MR. VANDERVEEN: It's not a decision that we are intending to revisit. We recognize that the current state of statistics education in K-12 generally does not have a lot of emphasis on that. We feel it is growing.

We feel the need is growing because the number of courses, postsecondary courses as well, that demand both the computational mathematical skills as well as the probabilistic reasoning skills that come with data and experimental design. In addition, statistics is important for just being prepared for civic life and the ability to analyze data, which are more and more a part of how we understand our lives, It is also critical for success more broadly in college.

So we recognize it is a commitment beyond what the current practice in high school would support. There are states, and certainly districts, going beyond state standards in terms of incorporation of statistics education in their instructional programs.

We made estimates of time commitments for all of our frameworks. Our estimates for the time commitment to the statistics and data analysis for the high school courses is generally around 20 days out of 150 days of instruction available. So we are looking at just over 15 percent of the mathematics instructional calendar available. That does align with some of the districts that we feel are doing stronger emphasis than typical in statistics instruction.

DR. LOVELESS: Can I ask a follow-up?

DR. FAULKNER: Yes, sure. Go ahead.

DR. LOVELESS: There is an argument that many people make who study math curriculum that the American curriculum is -- the phrase that is often used -- it's a mile wide and an inch deep. The implication is that there are just too many topics and we don't focus enough.

Have you thought at all about adding more topics in, that this might just exacerbate that problem, and if you could defend statistics on those grounds for a second?

DR. SPEER: It's Bill Speer, University of Nevada, Las Vegas.

The statistics we try to incorporate in the high school and the middle school curriculum is related to the mathematics that is already there. There's a connection. There is a crossover benefit. It is not as if it is something new. It is looking at some of the things that we have done traditionally in perhaps a different way.

The other thing to mention is that these are College Board standards for college success, not exclusively in the realm of mathematics, but success in college. Statistics is certainly an important part of many majors beyond the mathematics area. So, again, we felt they needed to be incorporated.

DR. MANASTER: Another aspect of this is that part of the mile-wide, inch-deep curriculum came from early introduction of topics which were repeated for many, many years. So by reducing the amount of repetition, space is created in the curriculum.

DR. FAULKNER: Mr. Williams?

DR. WILLIAMS: Maybe one reason why students need more advanced courses to become successful in college is because so many things have been taken out of the basic courses because of the addition of topics like data analysis. I can't understand why data analysis would be a part of a geometry course.

American students are extremely weak in geometry. In many cases, that is the only proof-based course, or at least it used to be a proof-based course, that students get.

So, of all places, why would data analysis be included in geometry?

DR. MANASTER: That's a very hard question to answer. We share your concern about mathematical reasoning and proofs being more apparent in geometry than in any other subject. This is a major concern of mine and has been for at least 10 years.

I think that the only answer I can give here is that what we put into the geometry course was largely probability, for which there are geometric models. It still isn't traditional geometry by any means. But we tried to have a progression of treatments of data analysis throughout the curriculum.

DR. FAULKNER: Dr. Wu?

DR. WU: Yes, I have a question for the College Board and also one for ACT. But let me begin with one for the College Board.

My question pretty much echoes what Vern just said a minute ago. I am quite amazed that you have found that there are 15 days. Now I don't have statistics to back up what I say, but I've been around California a bit and I monitor the California Standards Test (CST).

The problem we run into is that there is never enough time to teach the things that would go into the CST, which means the basic curriculum. The California standards for high school, at least the Article I, Article II, et cetera, are highly competitive.

So my comment is that I don't know where those numbers come from, and I want to supplement that with the observation that the problem with mathematics education in this country at the moment is that we are not doing the basic things nearly well enough and pass onto the next topic as soon as possible. In mathematics that is fatal because everything is built on the previous step, and this is one of the reasons for the underachievement.

So all these are tied together: the fact that you think you have more time than they need, and also that you are going to spread out into statistics. To my knowledge, the basic problem is that the bread-and-butter topics are not taught well and not given enough time and attention.

So I guess this is relevant to what Tom said a minute ago. Why this decision to go into statistics?

One more, my colleagues at Berkeley wish that high schools wouldn’t teach statistics because, no matter how well-intentioned they are, if you teach someone, give them the wrong idea, and then they have to re-teach, it is kind of difficult.

At the moment we don't have the personnel in high school to teach statistics well. Statistics is extremely difficult, and it is not something I, myself, would want to touch. I can walk around and claim I know a little bit, and I can fool a lot of people, but I wouldn't want to teach it.

You are putting this into seventh grade, eighth grade, and ninth grade geometry without first inquiring whether you have the personnel to do it. One of your goals is to make them college-ready. This, in my opinion, is not the way to make students college-ready.

DR. FAULKNER: Do you have anything you want to say to that?

MR. VANDERVEEN: I would say that we recognize the issue of capacity in that we are aware that the expertise for teaching statistics in the lower grades needs to be improved. We are looking at a long-term vision here. By providing the level of specificity and what we think is a coherent program for statistics education in the country, we think we are laying out the long-term vision for how that capacity could be grown through professional development, through teacher training. So that is our reasoning behind that.

DR. WU: But I thought, if that is what you want to do, maybe you will have a phased-in plan. The first five years, learn this and the next five years, more. That is just a personal opinion.

But can I go on with the ACT question? I have two questions.

DR. FAULKNER: Okay, go ahead.

DR. WU: I want to know how much of the ACT test is, what you call, constructed response and what is free response. Are they all multiple-choice?

MS. SCHMEISER: Yes, the mathematics components of the ACT test are multiple-choice items.

DR. WU: I would like ACT to be aware of the disconnect between the predictability of an ACT multiple-choice test and performance in college, because in a multiple-choice test, you don't need to know much of anything. You can do it by rote. In college we don't, as a rule, at least not at places like at Berkeley, give multiple-choice questions for calculus, for any test. When students are used to checking things off, they may give you the appearance of doing well. Maybe they don't know anything.

But I think your analysis ought to incorporate that, to take that into account.

MS. SCHMEISER: I certainly appreciate your perspective. I think for those of us in the measurement world that is a debate we have been having for 20-plus years.

I think there are ways in which multiple choice items can be constructed that focus on higher-level thinking and analysis. I would be pleased to share some of those with you and discuss those at a later time, if it makes sense to do that.

DR. FAULKNER: Dr. Benbow?

DR. BENBOW: I would like to have clarifications on the ACT study. It is so interesting. When you look at the people who took the EXPLORE and then took the PLAN and then took the ACT, are those comparable populations for groups?

MS. SCHMEISER: We looked at cohorts of students who had taken all three tests over a period of time. We took four different cohorts and combined them into one. The total sample size I believe is cited in the report.

We believe that the cohort is large enough to provide useful information, but it is not nationally representative. It is those students who had taken all three.

DR. BENBOW: There could be different students taking three different types of tests, right?

MS. SCHMEISER: It is the same students taking all three.

DR. BENBOW: So it is the same students across the three?

MS. SCHMEISER: Yes. Yes, Ma'am.

DR. BENBOW: So you're tracking them longitudinally and individually?

MS. SCHMEISER: Yes. Correct. Thank you.

DR. BENBOW: The second question is, when you looked at the course-taking data, and you looked at college preparedness by the number of courses taken in high school, did you adjust for previous achievement before that? So are those comparable groups going in?

MS. SCHMEISER: Very good question. The statistics that I cited in the slides today did not control for achievement. There is an analysis in the written report that I believe are part of your resource materials that did take into account previous achievement.

Even in those results, we are seeing a six-point difference in achievement between those students who took algebra I, algebra II, and geometry only compared to those students who then took two or more additional math courses above that. This is six points on a thirty-six-point scale. We did control for achievement in that study. So the results are reported in the written materials rather than in my presentation.

DR. FAULKNER: Dr. Fennell?

DR. FENNELL: Arthur, Bill, or Alfred, relative to the College Board standards, do you have any record of preliminary work by states beginning to take this work into consideration in terms of perhaps revising state frameworks?

MR. VANDERVEEN: We have been sharing drafts of the frameworks with a number of states. We have done an audit of the Florida Sunshine State Standards. We did an audit of the North Carolina English Language Arts Standards because we also have frameworks in English Language Arts. Most recently, we have spoken to Texas and their P-16 Council and Virginia’s P-16 Council.

In general, P-16 Councils are very interested in a framework that attempts to articulate between high school and definitions of college-readiness. We are in conversations with Virginia and Texas around conducting an audit, an analysis of their standards for increased rigor and alignment to college-readiness.

DR. FENNELL: And since the issue of data analysis has come up here, in your work with those jurisdictions, what kind of pushback did you get relative to the integration of data analysis and probability courses?

MR. VANDERVEEN: We have not received any pushback on that, but I can't say that that is kind of representative of their final opinion.

DR. FAULKNER: Further questions?

(No response.)

Let me follow up with one on the ACT longitudinal study. What I thought I heard you say, Ms. Schmeiser, is that students who are not college-ready at the earliest stage don't recover.

MS. SCHMEISER: That is correct. We are in the middle of a research study where we are, again, digging in as deeply as we can with the cohort of students who over time have, again, taken eighth, tenth, and our twelfth grade programs. The statistics that we are seeing for those students who are not on track or on target to become college-ready in eighth grade, somewhere between 30 and 35 percent never recover or become college-ready in high school.

DR. FAULKNER: This reinforces the role of this panel, which is basically about making sure that they are on track at that particular stage.

MS. SCHMEISER: Yes, sir.

DR. FAULKNER: Russell?

DR. GERSTEN: I have, I think, a relatively less controversial question. This is for the College Board group.

There are two points that I would just like a little expansion on. One point was the reteaching in college. You said that there is material that is taught in high school and retaught again in college. I personally experienced that as a math major a while back. I am just wondering what you think the pros and cons of doing that are.

You also said there was a disconnect about the importance of geometry from what high school teachers felt, including, I assume, the high school calculus teachers, and what university and college people felt. So I would just like to hear a little more about those two issues.

DR. MANASTER: Let me start with the second question. I think it is important to understand, and when I first saw this presentation, it went by too fast for me. So the disconnect on the importance of geometry refers specifically to the geometry that should be taught in a pre-calculus course.

So there isn't as much of a disconnect on the content of a traditional geometry course except, as you pointed out, for the treatment of proof, where many college mathematicians are concerned that students come in without an understanding of mathematics with regards to the notion of evidence and justification.

But the data on the survey dealt with solid geometry, analytic geometry of what was once a traditional kind, which now has pretty much been minimized. So that's your second question.

The issue of reteaching, Arthur, do you want to --

DR. SPEER: I can comment my perspective on reteaching. With regards to the revisiting of topics or concepts in subsequent courses, the real issue is, in what spirit are we revisiting? If it is something that needs anchoring, if it is something that needs further exploration and expansion, then certainly we want to revisit it. If it is repeating it as if it was new, then that is where I think we have a real difficulty.

Part of the material that was introduced in Course A and then is literally now reintroduced in Course B is something that we wanted to eliminate as much as possible. Certainly, extending it in Course B is a valued thing to do.

DR. GERSTEN: Yes, thanks.

DR. SIEGLER: I would like to follow up on Russ' point and on your answer just now. As a college teacher, if the students didn't learn it the first time, you might as well teach it as if it were new because they don't know it. As Dr. Wu said earlier, you have to build on the math as it goes along. So if a crucial building block is absent, even if it has been taught five times, you still have to get it right the sixth time.

DR. SPEER: I don't debate your premise, but that wasn't the premise that I was using in my statement. If I have evidence that you have not learned it, I'm certainly going to approach that material, but I might, in fact, approach it in a different manner than it was first approached because I have good, hard evidence that you didn't learn it the first time. So saying it louder in the same way is not going to necessarily make a difference. I agree completely with what you are saying, but that wasn't the premise off of which I was basing my statement.

DR. FAULKNER: Deborah?

DR. LOEWENBERG: My question follows on this last one, where we are getting a bit into teaching. I would like to direct my question to the ACT study.

I have a question about the connection between your analyses of why students are losing momentum in high school. How did you draw the conclusions that it was related to the lack of rigorous enough standards or the lack of exposure to rigorous topics?

MS. SCHMEISER: I did not have an opportunity this afternoon to mention we have also conducted national curriculum surveys. We have done that since 1976. The ACT is an achievement-based test.

We are about ready to publish our 2006 survey. When we do that, we do ask high school teachers, what they are focusing on in their mathematics courses, what amount of time are they spending teaching it, and so forth. We compare that to what faculty members of entry-level courses are telling us from the postsecondary side.

We look at loss of momentum between eighth grade and twelfth grade. We are basing this loss of momentum statement on the decrease in college-readiness. There is no question about that portion of kids that are college-ready.

Our analysis comes from comparing and looking at our survey data about what is really happening or at least reported to us from this nationally-representative curriculum survey.

DR. LOEWENBERG: So let me follow with that.

MS. SCHMEISER: Yes.

DR. LOEWENBERG: My question has to do with the importance of your analysis. That is, you draw the conclusion based on asking teachers what they are doing and what they are covering and the relationship of that and college curriculum. However, suppose the reason had to do with the quality of instruction or the quality of teacher preparedness to, as we were just discussing, teach things in alternative ways when students don't learn it. Would your surveys pick that up?

MS. SCHMEISER: No, because it is self-reported information from high school teachers. The type of research that we do to try to look at was the type that I describe that we did in our On Course for Success Study, where we actually went in and we studied practices in schools for an 18-month to two-year period of time.

DR. LOEWENBERG: And what did you learn from that?

MS. SCHMEISER: In those high-performing schools we learned that the teachers were teaching higher-level skills than what we are seeing in average schools. We had control schools in that study.

DR. LOEWENBERG: And you studied practices in those schools such as what teachers were doing and how they we teaching and reteaching?

MS. SCHMEISER: Yes. We analyzed assignments. We looked at student work. We made site visits to the classroom. We looked at pedagogical style that the teachers were using with their students.

We described that in that report. Yes, we studied that. Again this was a small sample so I'm not trying to suggest it is nationally representative.

DR. LOEWENBERG: I think it would be quite useful to elaborate that, because one concern that this panel will face is the ease with which it is possible in this country to draw conclusions about curriculum and not be able to make inferences or recommendations about teaching and teacher preparation.

So if you were able to provide us with more information about instruction and teacher preparedness or teacher skill that would be very useful to us.

MS. SCHMEISER: I would be happy to do that.

DR. FAULKNER: Is there a last question? We have to wrap this session up.

(No response.)

If there is no last question, then let me thank our presenters. We appreciate your taking the time to be with us today.

MS. SCHMEISER: Thank you.

DR. FAULKNER: Let me thank the public for attending today's open session. I would like to remind everyone that the open session will begin tomorrow at 8:15 a.m. Registration will open at 7:00. You don't have to be in line at that time.

I now invite the panelists to adjourn to their breakout sessions, where we will be doing work in task groups.

Thank you all for being here this afternoon.

(Whereupon, at 5:07 p.m., the meeting was adjourned.)