UNITED STATES DEPARTMENT OF EDUCATION
NATIONAL MATHEMATICS ADVISORY PANEL MEETING

Friday, June 6, 2007

SUMMARY

The National Mathematics Advisory Panel met in open session at the Miami Dade College, Wolfson Campus, Building 3, Chapman Conference Center, Room 3210, 300 N.E. 2nd Avenue, Miami, Florida 33132 2296 on Friday June 6th, 2007 at 8:50 a.m.

PANEL AND EX OFFICIO MEMBERS PRESENT:

LARRY FAULKNER	Chair
CAMILLA PERSSON BENBOW,	Vice Chair
DEBORAH LOEWENBERG BALL	Member
A. WADE BOYKIN	Member
DOUG CLEMENTS	Member
FRANCIS (SKIP) FENNELL	Member
BERT FRISTEDT	Member
RUSSELL M. GERSTEN	Member
TOM LOVELESS	Member
WILFRIED SCHMID	Member
ROBERT S. SIEGLER	Member
SANDRA STOTSKY	Member
VERN WILLIAMS	Member
HUNG-HSI WU	Member
IRMA ARISPE	Ex Officio
DAN BERCH	Ex Officio
JOAN FERRINI-MUNDY	Ex Officio
RAY SIMON	Ex Officio

PANEL AND EX OFFICIO MEMBERS NOT PRESENT:

SUSAN EMBRETSON	Member
DAVID C. GEARY	Member
NANCY ICHINAGA	Member
LIPING MA	Member
VALERIE F. REYNA	Member
JAMES SIMONS	Member
GROVER J. (RUSS) WHITEHURST	Ex Officio

STAFF MEMBERS PRESENT:

TYRRELL FLAWN	Executive Director
IDA EBLINGER KELLEY	
MARIAN BANFIELD	
JENNIFER GRABAN	
KENNETH THOMSON	
ROBERT GOMEZ	

CALL TO ORDER:

Chair Faulkner opened the session at 8:50 a.m. and welcomed the audience to the seventh National Mathematics Advisory Panel meeting. He expressed that Miami Dade College (MDC) holds a very high standing among the community colleges of this nation and that it was a privilege for the Panel to be there. He also acknowledged the hospitality that Dr. Padron and his colleagues have granted them at Miami Dade.

Chair Faulkner then advised the audience that sign language services were available for those who required it, but with no one stating a need, the signing services were discontinued.

Chair Faulkner then introduced Dr. Eduardo Padron, President of Miami Dade College, who is chief administrative and academic officer responsible for the affairs of six campuses and several outreach centers, enrolling 165,000 students.

Dr. Padron came to this country at the age of fifteen, speaking little English, but he transformed his life through dedication to learning. Education gave him the keys, and he has made tremendous use of the opportunities that have come his way. Under Dr. Padron's leadership, MDC welcomes the largest enrollment of Hispanic students and second largest enrollment of black non-Hispanic students in the United States.

Dr. Padron thanked Chair Faulkner and welcomed the audience to the session. He stated that MDC has known for quite some time that mathematics is the most critical obstacle in the path to success of their students. He introduced MDC's Quality Enhancement Program, which deals with math education and was created to address the severe lack of preparation that many of their students bring with them. About 80 percent of the entering students of MDC show deficiency in basic skills in at least one area.

He closed by thanking the Panel for their work and stated that he looks forward to their deliberations as well as their conclusions as they will help MDC set and refine their agenda for the future.

OPEN SESSION

Chair Faulkner then proceeded with the open session where the Panel received testimony on an open basis from the public.

PUBLIC COMMENT:
PATRICK BIBBY, MATHEMATICS PROFESSOR, MIAMI DADE COLLEGE, KENDALL CAMPUS

Dr. Bibby has been a mathematics educator for 44 years and spent the last 33 of those years at Miami Dade College. Three years ago MDC successfully completed the process of re-accreditation by the Southern Association of Colleges and Schools. The Southern Association now requires its member institutions to submit a Quality Enhancement Plan, or QEP, to be re–accredited. The QEP is a plan to enhance student learning. MDC took the bold step of choosing mathematics as its QEP topic.

Dr. Bibby explained that in its two-year math program, MDC offers a wide range of courses from basic arithmetic and basic algebra through such courses as multivariable calculus, differential equations and linear algebra. At MDC, 64 percent of entering students test into college prep level math--by Florida standards--in which students earn no college credits. 21 percent of entering students test into intermediate algebra, for which they earn three credits not counted towards graduation. Only 15 percent of the entering students are able to start with a college level mathematics course. MDC data show that the college prep math courses, intermediate algebra and college algebra, are serious obstacles to graduation and program completion. For this reason their QEP focuses on these courses.

Dr. Bibby walked through the strategies of their QEP, which involve initiatives in curriculum, instruction, assessment, advisement and support. These strategies include the following:

- Frequent assessment, about which coincidentally, there is an article in the current issue of the *Chronicle of Higher Education*;
- Establishing a mathematics testing center on each campus to allow instructors to test their students outside of class;
- E-mailing interim progress reports;
- Providing students with learning prescriptions that refer them to support labs with directions to receive help with specific topics;
- Creating advisement procedures to encourage students to take their first math course during their first semester and subsequent math courses in consecutive semesters;
- Providing supplemental instruction for college prep repeaters to help them with their study skills, as well as course content;
- Incorporating mathematics into other disciplines;
- Upgrading math support labs; and
- Establishing a training program for math lab tutors.

As part of the QEP development process, MDC conducted an extensive review of literature and best practices that demonstrated that these strategies either enhanced student learning or improved student attitudes toward the learning of mathematics. They conducted an in-house experiment, which demonstrated the positive effect of frequent testing.

Miami Dade has offered its math students support outside of class and beyond faculty office hours for the past 25 years. Their mathematics support labs offer one-on-one and small group tutoring, drill and practice software, DVDs, videotapes, and practice problems. The support labs are open days, evenings and weekends. Math lab directors are salaried employees, and the tutors are paid hourly. The College Learning and Reading Association recently certified their new tutor training program. All of their tutors now receive seven hours of training to become more effective.

Dr. Bibby expressed concern that the effective practices of academic support for K-12 students, such as tutoring, are only available to those with the resources to seek it out. He suggested that on-site math support labs, as well as labs that might support reading and writing, be made available at the K-12 level, or at least at the 6-12 level. He feels it is important that students who are struggling to keep up with their studies be offered this type of intervention. Without it, he says, they are more likely to fail, drop out of school, make bad choices and become societal problems.

PUBLIC COMMENTS QUESTION AND ANSWER PERIOD:

Dr. Fristedt asked how MDC encouraged other courses to incorporate mathematics into the curriculum. Dr. Bibby stated that they do this through a process of linking courses. While he stated there is a limit to how much this can be done, he noted that MDC is part of a grant called Mathematics Across the Community College Curriculum. Within this project, the process for incorporating mathematics into other courses is to have a math instructor team up with an instructor in the other discipline and link their courses. The joint effort could culminate in a full-fledged learning community or could consist of a lesson or two. Dr. Fennell asked, relative to the large numbers of students who are enrolling in non-credit mathematics, if there are particular areas of weakness that immediately rise to the top. Dr. Bibby stated that to be well prepared for basic algebra, students need to be able to add, subtract, multiply and divide positive rational numbers.

Dr. Loveless asked about the high schools that feed MDC students and whether Dr. Bibby has had any contact with them to express his concern about the preparation of incoming students. Dr. Bibby said that their chair is part of the Bridges Program, which is establishing communication lines between MDC and the Miami Dade County public schools.

Mr. Williams asked about outside testing centers, and whether they were staffed by assessment specialists and what the advantages of such experts might be for students. Dr. Bibby responded that they are in the middle of the implementation of the QEP, but the plan is to staff testing centers with proctors and to have students report there to take tests, either on the local network or with paper and pencil. But they are going to be allowed to take their test outside of class where an instructor can do frequent assessment and not use an inordinate amount of class time for test administration.

Chair Faulkner stated that there were a couple of cancellations; number two, Superintendent Crew, and number three, Alberto Carvahlo.

PUBLIC COMMENT:
STEVE BLUMSACK, EMERITUS PROFESSOR OF MATHEMATICS, FLORIDA STATE UNIVERSITY

Dr. Blumsack made his comments representing the new Florida Center for Research in Science Technology, Engineering and Mathematics (FCRSTEM) of Florida State University (FSU). He stated that his participation in the session was, first, to describe the nature and the priorities of FCRSTEM, and, second, to understand the priorities and progress reports of the Panel to assist the center in establishing its long-term priorities.

FCRSTEM was formed in February 2007 as a result of a solicitation from the Florida Department of Education (FDOE). The Center acts, in some sense, as an academic arm of the FDOE. It is a collaborative enterprise with participation from FSU's Colleges of Arts and Sciences, Education and the Learning Systems Institute. Its long-term plan will be established later this month by an International Advisory Board, including Panel member Dr. Benbow.

Dr. Blumsack described the four priorities for the center's research. The first is to look at instructional models used and:

- To compare the effectiveness of three elementary school mathematics curricula in one district in the State of Florida;
- To evaluate the Texas Instruments Model Districts Program, an intervention to close the achievement gap in grades 6-12;
- To use an expert performance approach to relate teachers' knowledge to students' success in AP courses; and
- To collect information regarding the current use of technology in middle and high schools in the State of Florida.

Second, Dr. Blumsack stated that the Center would look at teacher preparation and retention, and plans to adapt the UTeach model of Texas to recruit math majors into teaching, as well as science majors into science teaching. This approach is supported by the nationwide success of National Science Foundation's Scholarship Program.

The Center's third priority is to assist the FDOE in its revision of its K-12 mathematics standards, which are modeled after the *Focal Points* of the National Council of Teachers of Mathematics. Some specific activities to assist FDOE are:

- To rate the new mathematics standards, using Webb's Depth of Knowledge categories;
- To develop an interactive standards database to align math courses with the new standards;

- To review progress monitoring instruments for the assessment of student learning, to develop specifications for a progress monitoring reporting network to track student progress and to measure the effectiveness of various instructional strategies; and
- To develop a plan with FDOE to increase the success of minorities and females in the STEM disciplines.

The fourth priority involves dissemination. They have established a web site, and plan to conduct regional symposia for both teachers and administrators, and to host conferences in the future.

PUBLIC COMMENTS QUESTION AND ANSWER PERIOD:

Dr. Loveless asked whether they planned to do a study of elementary textbooks. Dr. Blumsack responded that they planned to look at curricula. Dr. Loveless asked if he could name the curricula. Dr. Blumsack responded that they have identified a school district, but he does not know the names of the curricula at this point.

Dr. Boykin asked about their initiative to close the achievement gap and if he could share more about it. Dr. Blumsack responded that they are just starting some conversations with the FDOE about how to do that, so he does not have anything specific to talk about right now. It is one of the objectives for the first year.

Dr. Fristedt asked, since Florida is revising its standards now, whether they plan to put on their web site a series of sample problems designed to illustrate what is really meant by the standards. Dr. Blumsack responded that, yes, the current status is that they have gone through a public discussion to refine what the standards are. They offered for that discussion very specific examples, and they consist of three focal points per grade level.

Dr. Fennell stated that he is aware of what they have done with the *Focal Points*, but he wanted to clarify Dr. Fristedt's question, and that he may be asking whether the revised Florida Comprehensive Achievement Test (FCAT) items are reflective of new standards. Dr. Blumsack responded that they are looking at that and during the next three years, the FCAT is going to be modified to align with the new standards. He is not clear on how the transition will work, when they will have new standards, old courses and an old exam. But he has done a study of how the old exam aligns with the new standards and the results are not too disappointing, but the standards still need a lot of work

PUBLIC COMMENT:
ALCIDES MARIN, STUDENT, MIAMI DADE NORTH CAMPUS

Mr. Marin began by stating that he has listened to what has been said so far that morning and it struck him that people talk about math as a way to accomplish a career. He thought back to when he graduated from a Cuban high school in 1989--he was just glad that math was over and he did not want to know anything more about it. After high school, he went to technical school and became a welder, and that was the end of his studies, probably because of math.

When he moved to South Florida, he came to Miami Dade North Campus initially for English. He wanted to learn English because it was important for his job. When he completed his English through Second Language (ESL) courses, he was encouraged by his English teacher to take a College Placement Test, on which he scored really well for English. His math score was really low. He started wondering if this institution had done so well for him in English, maybe it could do the same thing in math. Thinking back now, he said that he does not think he could have made a better decision.

Mr. Marin enrolled at the very bottom level of math and took part in math classes, and used all the facilities, labs and tutors. He really benefited from the one-on-one math instruction and noted that the professors were always available for him with their open door policy.

Mr. Marin is now in calculus, which he finds amazing because he was never good in math. But he knows he has done the best he could have with the help of the teachers and the school. He stated that the most important thing in a classroom is the ability of a teacher to inspire a student. He has been inspired to think about math beyond the numbers, and more about the doors it opens for a person. In his second year at MDC, he has moved up in his job because management saw the math skills he was gaining. His goal in a year and half or two is to become a civil engineer.

PUBLIC COMMENTS QUESTION AND ANSWER PERIOD:

Dr. Arispe congratulated Mr. Marin twice, first for meeting the language challenge and second for conquering the math challenge. She asked him how he would encourage other students to connect with teachers for inspiration. Mr. Marin responded that one of the things that teachers appreciate is when students put in effort. Even if students are not doing well, they will be recognized and be told not to give up. That hard work is encouraged and it gives students the strength to keep trying. Mr. Williams stated that Mr. Marin inspires him, and he added that after 34 years of teaching, he finds that it is students like Mr. Marin who will keep him teaching another few years.

Dr. Wu stated that many people want to learn math, but not everybody wants to work hard. He asked Mr. Marin if he had any advice to encourage his students to work hard. Mr. Marin said that asking for help is important. It is also important to make it an adventure and have fun with learning. Solving a hard problem can give students so much pleasure. It is a game, and once students complete the task, they will feel satisfaction and that will inspire them to keep trying harder. Dr. Wu followed up by asking what he would do if he had friends who just do not want to put in the effort. Mr. Marin stated that if he has a friend who is having trouble, they look to him to see what he is doing. They want to see how he does well.

CLOSE OF PUBLIC COMMENT SESSION

Chair Faulkner closed the public testimony session. He announced that one of the Panel members, Nancy Ichinaga from California, had found it necessary to resign. He also announced that there is a new Panel member, Dr. Irma Arispe, who will replace Diane Jones as the Panel's ex officio representative from the White House Office of Science and Technology Policy. He acknowledged the contribution that Diane Jones made in the months of Panel work over the last year. She will serve as a new, high-level appointee in the U.S. Department of Education.

Dr. Arispe currently serves as assistant director of life sciences and acting assistant director for social and behavioral sciences at the White House Office of Science and Technology Policy. She has a B.A. from Trinity University in San Antonio, TX, an M.A. from Catholic University of America in Washington, DC and a Ph.D. in behavioral sciences health policy and management from Johns Hopkins Bloomberg School of Public Health, MD.

Chair Faulkner thanked the public for participating in the testimony up to this point. He stated that it has been valuable for the Panel to hear testimony of the type they heard this morning, and the Panel appreciates the personal effort that today's speakers have given to be present.

TASK GROUP REPORTS:
TASK GROUP ON CONCEPTUAL KNOWLEDGE AND SKILLS

Francis "Skip" Fennell, Chair; Larry Faulkner; Liping Ma; Wilfried Schmid; and Sandra Stotsky; with contributions from Hung-Hsi Wu.

Dr. Fennell began the Task Group report with an overview of the methodology they are using and the work completed to date on a literature review, an analysis of state curricular frameworks, other standards—international and/or from local school districts—and a textbook analysis. They also are carrying out a survey of approximately 1,000 Algebra I teachers around the country, which will also inform their work as the data is received. Several of the members of the Task Group were involved with the creation of the questionnaire for that survey.

In addition, the Task Group is conducting an analysis of math content from a variety of respected sources, including international groups and people who have spent time looking at content from the perspective of mathematics, as well as mathematics education. They also are compiling a synthesis of algebra topics, skills and concepts that lead to what they call algebra at the secondary school level.

The Task Group is addressing three questions. The first question is, "What are the major topics of school algebra?" Dr. Schmid gave an overview of that question's findings. He stated that the Panel has been asked to make recommendations on the critical skills and skill progressions necessary for students to succeed in algebra and topics beyond algebra. But before that they needed some understanding of what actually constitutes school algebra. There is an element of professional judgment involved in defining the critical ingredients of algebra. That judgment is then validated by looking at various pieces of evidence, a survey of curricula of high-achieving countries, state frameworks and textbooks.

Their findings show that the major topics in school algebra are symbols and expressions, linear relations, quadratic relations, functions, the algebra of polynomials, and combinatorics and finite probability. When validating the professional judgment of the definition of algebra, there is broad agreement when looking at high-achieving countries where these skills make up school algebra. When observing state frameworks, almost all of these topics appear. In textbooks, all of these topics appear for Algebra I and Algebra II. The Task Group will also comment on the particular items that do not show up in state frameworks, textbooks and the other places reviewed.

The Fundamental Theorem of Algebra is typically not found in state frameworks, because it cannot be discussed in depth in school mathematics. It should be included in Algebra II. Textbooks almost uniformly address this topic.

Almost all the other topics are found in state frameworks. There is a fairly large number of topics that are covered by textbooks that are not on the Task Group's list, mainly because, while they are labeled Algebra I and Algebra II, they are primarily dedicated to an integrated curriculum—or a mixing of algebra and geometry, probability, data analysis and other non-algebra topics.

Looking at the Task Group's list of topics, some items that are not algebra are listed—for example, trigonometric functions, logarithms and exponents. The reason for including these subjects as topics relevant to algebra is because of the substantial discussion of functions, especially in Algebra II. While probability and data analysis are a large focus of algebra textbooks, the Task Group feels that those topics are mainly relevant as an appropriate source for applications of algebra and problems.

Chair Faulkner followed up by saying that when the Task Group has tried to put together the major topics list of school algebra, they did not distinguish between Algebra I and Algebra II, but instead focused on a whole package of what is traditionally taught as two courses.

Dr. Fennell stated that the second question their Task Group is dealing with is, "What are the essential mathematics concepts and skills that lead to success in algebra, and should they be mastered prior to formal algebra course work?" The Task Group refers to these concepts and skills as the critical foundations that lead to algebra or the priorities for the prerequisite background. Elaboration on each skill will be provided in later documentation. A clear understanding of the important aspects of working with whole number operations, place value, positive exponents, rational numbers, fractions, and positive and negative integers are fundamental to algebra. They also include the critical aspects of geometry that lead to algebra.

The list of these skills is not intended to convey a full curriculum, but contains the building blocks that would lead to success in algebra. Dr. Schmid added that the list is not an end in itself, and it is necessary to also address how these topics fit together. The Task Group's final report will provide such discussion.

Dr. Fennell presented the Task Group's third question, which is, "Does the sequence of topics at targeted grade levels prior to algebra course work affect achievement in algebra?" One consideration is the issue of consistency across curriculum and what implications coherence creates for learning algebra or the critical foundations for algebra. Another consideration is the actual placement of algebra course work. The United States typically introduces algebra curriculum at grade nine, but more and more schools offer algebra at grade eight. The Task Group will look at whether students have the background at this grade level to be successful in such course work.

Another issue the Task Group is addressing is the mathematics background of middle-school teachers. In this country, the majority of people who teach middle school mathematics do not have a degree or certification in mathematics. As the nation thinks about more students having access to algebra at earlier levels, including the middle school, qualifications of teachers becomes a critical issue.

In addition, the Task Group is addressing the role and the use of the graphing calculator, particularly with regard to algebra.

TASK GROUP ON CONCEPTUAL KNOWLEDGE AND SKILLS: QUESTION AND ANSWER PERIOD

Dr. Ball asked that when they listed the building blocks, if they would also specify operations that would accompany these steps. Additionally, she asked for clarification on what fluency with whole numbers means. Dr. Fennell responded that yes, underneath that heading would be not only fluency with addition, subtraction, multiplication and division of whole numbers, but also the understanding relative to basic facts in those areas. Dr. Ball followed up by asking if that included properties as well, and Dr. Fennell responded yes. Dr. Ball also asked whether they are addressing the practices of mathematics that make a difference for algebra--such as representation, use of symbolic notation--which are not exactly topical but are more mathematic habits and skills. Dr. Schmid answered that the proper use of symbols is a topic of algebra itself. However, the Task Group does not think it will make a statement about whether algebra should appear in earlier grade levels.

Dr. Siegler stated that the goal of coherence strikes him as absolutely crucial, and he wondered if the Task Group will be able to provide guidance for educators in constructing a coherent sequencing of the topics within algebra courses. Dr. Schmidt responded that this is an issue both in algebra curriculum and in math courses beforehand. They will provide an elaboration on the connection between topics and a sketch of consistency for how the various topics fit together. He does not think it can be the task of the Panel to provide more than that. The Task Group can say that coherence will not happen unless there is a disciplined attempt to narrow the number of topics taught at any one grade level.

Dr. Wu made a comment about coherence and that this point is emphasized in the report. What they call coherence is a general term referring to how the various parts of mathematics are interconnected. The very grouping of all of algebra into four topics is in itself a statement of coherence. No matter how many things are carried out, they are under only four umbrellas.

Dr. Wu also spoke to the earlier comment on symbols, which he believes poses a problem. In the forthcoming write up on the critical foundations for algebra, one of the key issues about how to achieve algebra is the gradual use of symbols all through the early grades.

Dr. Loveless stated that there is a body of literature that shows a correlation between taking algebra and later success in college. He asked whether in their search of the research literature, if they have uncovered studies that show what the critical skills and knowledge are that students need to learn to be successful at algebra. Dr. Schmid responded that, no, they did not. Dr. Wu followed up by saying that their findings are not a response to the literature. By professional judgment, they see that the skills that are needed are predetermined--the coherence, the ability to reason and the precision. Dr. Fennell followed up by stating that there is reason to be concerned about whether algebra is needed earlier, but the first effort will be to make sure they are prepared to do that.

Dr. Loveless responded that absent scientific evidence, he is quite prepared to rely on professional judgment, but he would be more comforted if at some point they do have some research that demonstrates that their judgments are correct. He hopes the Panel can recommend further research in this area so they can try to demonstrate that.

Dr. Schmid stated that while some studies cannot be labeled research, they can provide valid evidence. When considering practices in various countries that do well in international comparisons, there is consensus that certain skills are absolutely necessary. This consensus agrees consistently with the professional judgment of mathematicians and mathematics educators.

Dr. Loveless agreed, but stated that when reviewing TIMSS data, there are countries at the bottom end of the distribution that are very low scoring that also have coherent curricula, matching the countries at the top. He warned against conclusions based on that correlation. Dr. Schmid stated that when some countries that have a coherent curriculum do not achieve at high levels, it does not invalidate the evidence.

Chair Faulkner followed up on that discussion by stating that the charge of the President's Executive Order is to examine the best available scientific evidence. What they have found is that there is a very limited availability of truly scientific studies bearing on the most important questions of this particular Task Group. He stated that one of the most important things that will come out of this Panel is to identify areas of future investigation that are well targeted to the most important questions.

TASK GROUP REPORTS:
TASK GROUP ON LEARNING PROCESSES

David Geary, Chair; Dan Berch; Wade Boykin; Susan Embretson; Valerie Reyna; and Robert Siegler.

Dr. Siegler reported that the Task Group had completed sections of their report titled, Principles of Learning and Cognition, Mathematic Knowledge Children Bring to School, Math Learning in Whole Number Arithmetic, and Social, Motivational and Affective Influences on Learning.

He began his summary with an overview of goals and beliefs about learning, which are related to their mathematics performance. Children who adopt mastery-oriented goals show better long-term academic development in mathematics than do their peers whose main goals are to get good grades or outperform other children. They also are more likely to pursue difficult academic tasks. Students who believe that learning mathematics is strongly related to innate

ability show less persistence on complex tasks than peers who believe that effort is more important. Experimental studies have demonstrated that children's beliefs about the relative importance of effort and ability can be changed, and that increased emphasis on the importance of effort is related to improved mathematics grades. The Task Group recommends an extension of these types of studies.

Dr. Siegler next covered intrinsic and extrinsic motivation. Young children's intrinsic motivation to learn, or desire to learn for its own sake, is positively correlated with academic outcomes in mathematics and other domains. However, intrinsic motivation declines across grades, especially in mathematics and the sciences, as material becomes increasingly complex and as instructional formats change. The complexity of the material being learned reflects demands of modern society that may not be fully reconcilable with intrinsic motivation. The latter should not be used as the sole gauge of what is appropriate academic content. At the same time, correlational evidence suggests that the educational environment can influence students' intrinsic motivation to learn in later grades. The Task Group recommends additional experimental studies that aim to more fully understand the relationship between intrinsic motivation and mathematics learning.

Dr. Siegler then addressed attributions, or students' belief about the causes of their success and failure. Attributions have been repeatedly linked to their engaging and persisting in learning activities. Self-efficacy has emerged as a significant correlate of academic outcomes. But the cause/effect relation between self-efficacy and math learning remains to be fully determined, as does the relative importance of self-efficacy beliefs and ability in moderating these outcomes. The Task Group again recommends more experimental and longitudinal studies to assess these factors.

Dr. Siegler then covered self-regulation, which is a mix of motivational and cognitive processes including setting goals, planning, monitoring, evaluating and making necessary adjustments in one's own learning processes, and choosing appropriate strategies. Self-regulation has emerged as a significant influence on math learning. Although the concept appears promising, research is needed to establish the relation for a wider range of math knowledge and skills.

The Task Group is also looking at math anxiety, an area where some fascinating new research is progressing. Anxiety about math performance is related to low math achievement, failure to enroll in advanced math courses, and poor scores on standardized tests and math achievement. It may also be related to failure to graduate from high school. At present, little is known about the factors responsible for this phenomenon. Among the risk factors for developing mathematics anxiety are the following: low math aptitude, low working memory capacity, vulnerability to embarrassment, and negative teacher and parent attitudes. Again, the Task Group recommends more research, as well as developing interventions for reducing mathematics anxiety.

The final topic the Task Group is reviewing is Vygotsky's social-cultural theory, which has been extremely influential in education where learners become increasingly able to function independently through the guidance of more knowledgeable peers and adults. While this approach has some promise, there is a shortage of controlled experiments that evaluate the importance of this in math learning.

The other projects the Task Group is working on include drafting new sections on fractions, estimation, geometry and algebra; completing the already drafted sections on race, ethnicity, and gender; finishing the section on neuroscience and a more substantial section on learning disabilities and giftedness. They are also adding to and revising the draft of overall recommendations.

TASK GROUP ON LEARNING PROCESSES:
QUESTION AND ANSWER PERIOD

Dr. Schmid asked from the issues just discussed what policy recommendations the Task Group would be able to make. Dr. Siegler responded that the priority would be to develop interventions aimed at reducing math anxiety as the research clearly shows that many students who possess the knowledge do not perform well in math when they become anxious, such as in testing situations or other pressure situations. Pinpointing the specific intervention would require more research.

There are a couple of small studies that were administered a number of years ago. One study by Hembree points out some initial thoughts. Dr. Siegler also stated that this body of research has gone on for more than two decades and has produced some fairly stable findings, but many of the findings have not found their way into classroom practices. The Task Group will try to address how to integrate them into practice, such as recommending actual classroom practices and teacher preparation programs.

Dr. Clements asked if the Task Group was looking at psychological coherence. Dr. Berch stated that they will be treating a narrow aspect of this subject matter with respect to cognitive coherence. It is an issue the Task Group has raised before to bridge what happens with Conceptual Knowledge and Skills, with the Instructional Practices and Teachers Task Groups. Further thought on this issue will rely on the sequences that students find easiest to follow as they are learning. Dr. Siegler agreed that this is a very important issue, and one that is already emphasized in the section on cognitive processes. He agreed that they may increase the emphasis on this constructive psychological coherence, and the relation between existing knowledge and learning.

Dr. Fristedt asked if the Task Group has any research concerning the effect of grading policies on motivation. He also asked if they have any data on the extent to which a heavy use of mathematics in other courses affects the motivation of students to learn more mathematics in their math courses. Dr. Siegler responded that the issue of grading is interesting and complex, and therefore a clear picture does not emerge in the realm of intrinsic motivation. There is a body of work that suggests a heavy emphasis upon grades can undermine a student's interest in a subject matter. He added that it is clear that grades can be a proper incentive in combination with other forms of incentives, particularly as students mature and get into more complex material.

TASK GROUP REPORTS:
TASK GROUP ON INSTRUCTIONAL PRACTICES

Russ Gersten, Chair; Camilla Benbow; Doug Clements; Bert Fristedt; Diane Jones; Tom Loveless; Joan Ferrini-Mundy and Vern Williams.

Dr. Gersten stated that his Task Group has made a lot of progress, and they are working on the refinement of all three of the papers presented at the Illinois meeting. They did not address learning disabilities, as the draft of that section is only one-third completed, but they found many more instructional studies on teaching students with learning disabilities than in teaching non-disabled students that met their criteria for rigorous experiments and quasi-experiments. Their presentation then covered the work done so far on technology, gifted students, and explicit instruction and child-centered methods.

Dr. Clements presented on the initial technology draft and stated that the findings should be taken very tentatively. The fundamental question they are addressing involves determining the role of technology, including computer software, calculators and graphing calculators in mathematics instruction and learning. They plan to have three sections in the final report: a description of the categories of the different software and hardware constellations; a synthesis of

existing reviews; and a meta-analysis. Technology is an area in which there are an overwhelming number of studies and reviews. They will also conduct their own meta-analysis of calculators and graphing calculators.

The Task Group is looking at the categories of different software, typical pedagogies of that kind of software, and the research-based features that should be present or could be present that enhance the value of that software for teaching and learning. For the synthesis of reviews, there is a caveat that many studies included in these reviews do not meet their criteria for studies. The effect sizes and the results of these reviews have been carefully considered. But because they are so extensive, there is hope that the studies would offer the Task Group some guidelines.

Findings from reviews of the role of technology that combine mathematics and other subjects together show a median effect size of 0.35. The pooled effect sizes were also presented in a table to the audience. For mathematics only, the median is very similar. For problem solving, there is an effect size of about 0.22, which is smaller but still significant in most of these studies.

Other findings of a meta-analysis that compared computer-based instruction (CBI) of all types to other interventions that are designed for individualization shows that CBI is less effective overall than individual tutoring, but more effective than most other interventions. In another review, CBI is less effective than different accommodations for the gifted, especially accelerated classes for the gifted, but more effective than other interventions. One other set of reviews by the same group compared CBI to other math interventions in general and found that it is less effective than learning processes, especially cooperative learning, but more effective than a change of mathematics curricula.

Other meta-analyses have looked at effects by goal. Separating out computation, the median effect size is 0.45. Concepts have the same result. Problem solving is about the same as in the previous study, between 0.2 and 0.23. The great variance between the meta-analyses suggests that other variables are very important. Therefore, the Task Group will be looking at contextual and implementation variables, such as sub-groups.

The Task Group saw no consistent pattern that CBI is more or less effective in particular grades. There is a slight tendency for children whose initial ability in mathematics is lower to receive more benefit from CBI than other children. There is a tendency for males to benefit more from computers and some hint that students from lower resource communities may benefit more from computers than others.

The Task Group found that implementation is also an important variable at which to look. For example, CBI used as a supplement to conventional instruction seems to be more effective than when it is used as a substitute. CBI use within classrooms seems to be more effective, especially in the elementary grades, but possibly in all grades when compared to CBI used in a computer laboratory. They also found that researcher- or teacher-developed software is somewhat more effective than that developed by commercial entities. Also, software developed to address a specific audience is more effective than software developed in general.

The Task Group stated that it is important to note that they are looking at relative comparisons for guidance of implementations. They found very few or no negative effects, and most of these effects are significantly positive.

There is not a lot of attention paid in the research to implementation fidelity. That type of information is not available in most of the research and could seriously affect the effect size of some of these interventions.

For general practice software that focused on computation, less effect was seen on concepts and application and a positive effect was found on attitude. The Task Group will look at these specific contextual and implementation variables for each of these tutorial tools.

When the Task Group looked at a meta-analysis on calculators, they found a wide range of effect sizes averaging positive, which is about the same as the other CBI categories.

Dr. Clements gave an overview of the findings of K-12 calculator use. If the children receive instruction with the calculator but then are tested without access to that calculator, on operational skills, a combination of computational and conceptual knowledge, the effect is 0.17. For selectivity skills, a child selecting the right operation or strategy for solving a problem, the effect was 0.30. If students were tested and instructed with calculators, the effect on selectivity skills was insignificant, but in all other areas, including computational selectivity, problem solving and conceptual skills, the effects ranged from 0.33 to 0.44.

When reviewing graphing calculators, the results are not significant for students taught with calculators and tested without. A negative effect is found on procedural skills, but a positive effect is found on conceptual skills. If tested with calculators, the effects on both are fairly large compared to the rest of the literature, at 0.52 and 0.72.

Dr. Benbow reported on individual differences, and specifically within the gifted population. The Task Group have found so far that there is a wide range of achievement in any age group. One study showed that 10 percent of high school seniors know more than college seniors four years later. Another study showed gifted students who were able to cover two to three years of a regular course in just one year. The challenge in terms of instruction is how to be responsive to these individual differences so that all students make progress and can achieve their potential.

The literature states that there is a need to differentiate the curriculum by level, complexity, breadth and depth, and pacing. There are four ways to differentiate the curriculum—enrichment, acceleration, homogeneous grouping and individualization. The amount of adjustment required for any child depends on the level of giftedness. In most of the literature they have surveyed, the best combination is acceleration and enrichment working together.

Dr. Benbow stated that they only found seven to nine studies so far that met their methodological criteria. When grouped into categories, they have found three studies that met the criteria in acceleration, two in self-paced learning studies, two in enrichment and one that used a combination of methods.

The Task Group then reported the outcomes of studies of acceleration, which includes students who covered the full four years of the pre-calculus curriculum in about 14 months, took two years of mathematics in about 12 months, or accelerated in several other ways. The findings of two studies on acceleration and SAT math scores show no effect. When accelerated students are followed about ten years later in their education, studies show that these individuals took more elective math courses in college and more often majored in mathematics in college. It is important to note that these accelerated students had gained several years in their education and therefore were compared to equally-abled, non-accelerated, older students. With this in mind, the accelerants performed as well as or better on a host of these variables.

For self-paced learning, the investigators found effect sizes of about 0.45. Self-paced learning plus enrichment produces even greater results, yet there were few studies in that area. Enrichment by itself produced mixed results.

The Task Group provided some tentative conclusions, including that increasing the pace and level of instruction for gifted youth is beneficial and that acceleration is effective. While there is concern about acceleration because of social and emotional impacts, all the literature says that there is no impact on their social and emotional development. Enrichment might be a positive enhancement, but by itself it yields mixed results. The Task Group recommends more research in this area.

Dr. Loveless then reported on student-centered versus teacher-directed instruction practices. The Task Group has revised the cooperative and peer-assisted learning section of the report, taking into account input from fellow Task Group members and additional research since the last update.

The main finding is that the cooperative learning intervention called team-assisted individualization (TAI) has a large effect size. This applies only to computation skills and it was

based on six studies. All six studies had a positive effect, comparing TAI mostly to individualized learning but with a direct-instruction component.

The Task Group also identified three experimental or quasi-experimental studies that compared student-centered instruction to teacher-directed instruction. The Task Group only identified three rigorous studies that address this issue. The first, by Hopkins and DeLisi, studied third and fifth graders. It is important to note that it was only a single 30-minute intervention, where children were taught computation skills and were then retested in the two conditions. There were significant effects for the direct-instruction condition, but it was for girls only and it favored the didactic approach.

The second study was done by Muthukrishna and Borkowski in 1995. This study involved third graders and teaching problem solving strategies. This strategy is known as the "number family strategy for solving problems." There was a significant effect, 0.58, for far transfer of form only, i.e., that the students in the student-centered treatment were able to solve problems of a slightly different form after the intervention. It is important to note that when the pre-test was given in this study, only the children who could do the computations for the problems were included in the study and the problems were at the first grade level.

The third study, by Brenner, et al., was a test of pre-algebra students. The intervention involved teaching them a method of representing linear function problems, and there is a rather significant effect size. Important to note for this study is that the pre-test had four different points awarded to each item, and the correct answer only counted for one of the four points. Students were asked to make a table, draw a picture or write an equation that represents the problem. This study was carried out over 20 lessons.

Dr. Loveless reported some tentative conclusions. First, research in its current state will not settle the great debate between student-centered instruction and teacher-direct instruction. Second, effective practices that have been identified are situational. They depend on context and outcome sought. Finally, teacher-directed instruction is often assumed to be present in the control groups of these students, but it is not always clear. The Task Group would like to see more research on teacher-directed instruction as a treatment to find out what parts of it work.

TASK GROUP ON INSTRUCTIONAL PRACTICES:
QUESTION AND ANSWER PERIOD

Dr. Boykin asked if the Task Group looked at any of the work by Greenwood, out of Kansas, on classes conducted by peer tutoring and if it had any impact on math achievement. Dr. Loveless responded that he did not remember if that study was in the initial review. Dr. Boykin followed up to say that there are several studies that Greenwood has done over the last 15-20 years. Dr. Loveless stated that he would look for that work.

Dr. Fennell stated that if teacher- and student-directed instruction does not exist in pure form, how can the Task Group talk about a control group? Dr. Loveless responded that yes, that makes it difficult, and because of that, they do not pool any estimate of the effects because the interventions each look different.

Dr. Fennell followed up to ask about the work on computer based-instruction, and whether computer-based algebra systems will be subsumed under that work or if that is something they will look at separately. Dr. Gersten responded that the research tends to group graphing calculators with computer-based algebra systems, but the Task Group will conduct their own meta-analysis and will then determine if they can include that as a variable.

Chair Faulkner asked whether the studies address the question of the distribution of teacher skills that make up the control group and how they will address that question. Dr. Loveless responded that in the Brenner study, the same teacher taught both treatment and control to limit the teacher effects. But he stated that there is a problem because it might be the case that some teachers have a better skill set for direct-instruction and other teachers have a better skill set

for student-centered. Chair Faulkner stated that more teachers would help the results, and Dr. Loveless agreed. Chair Faulkner stated that it would be interesting to have a study that involved teachers on the direct-instruction side that were well-suited to direct-instruction, compared with teachers delivering student-centered methods who were well-suited to student-centered methods. Dr. Loveless followed up by adding that it would be good to randomly assign teachers to the two conditions.

Dr. Ball stated that the treatments in the studies they are reviewing are completely under-specified. More explicitness around what is meant by the treatments would help make progress on what is a crucial variable and what the teacher does to help students learn. Dr. Loveless agreed and reemphasized that if the student-centered practice is always the intervention, they never hear very much in terms of specifics of how direct-instruction is operating beyond that it is the control or that it is traditional in its aspects. Dr. Ball followed up by stating that is it also important to look at what content is being taught in these different studies. Dr. Loveless agreed and added that also important are the tradeoffs of time and what gets lost if the time is devoted to these other activities.

Dr. Siegler asked about the research on the range of outcomes examined in these studies of gifted students, including the affective reactions of the students escaping the boredom of going at a slower pace, and also their long-term likelihood of going into math-intensive occupations. Dr. Benbow responded that there is a lot of research on that topic; some of lower quality and some longitudinal. The findings show that when students who were accelerated in secondary school are asked whether they are satisfied with their acceleration, they do not think it affected them socially or emotionally. When asked if they would change anything about their acceleration, the answer is, "I would accelerate more." And many of the students say that twelfth grade was a complete waste of time for them. Dr. Benbow also stated that there is a wealth of data on academic outcomes and acceleration. The Task Group only focused on the math achievement variables. But what they found is that overall, across various studies, students who participate in special programs are about twice as likely to enter career tracks that involve math and science.

Dr. Loveless went back to Dr. Boykin's question about Greenwood. They did screen that study and found it did not provide enough data to compute an effect size.

Dr. Stotsky asked about the intersection between real-world problem solving, and teacher-directed versus student-centered instruction, in addition to some of the parts of the Learning Process Task Group report on the support for peer-led small groups—and the time it takes to carry all of this out in the classroom. Dr. Loveless responded to the cooperative learning aspect, and noted that it was effective as TAI as well as with computation skills. There was not a loss of learning there because the students in both treatment and controls were learning the same skills. He noted that it is important to know this is more than simply placing students in groups, but instead, these groups of students are given a set of individual work sheets to practice skills on which they have been shown to be deficient in previous assessments.

Dr. Ferrini-Mundy responded that the interventions in the real-world problem studies have more in them than real-world problems. If a study involves more than one intervention, should they still use it? They are also looking at studies of cooperative groups, student writing, and a variety of other instructional strategies that will help them say a little bit about a range of content and types of performances.

Dr. Berch asked about some of the labels and terminology used in the field that might confuse teacher-directed and student-centered, and whether they would address this in the glossary or elsewhere in their report. He also shared concern about delving into further distinctions, such as virtual cooperative learning with a computer. Dr. Loveless agreed and stated that their new introduction contains some cautionary language about that issue.

TASK GROUP REPORTS:
TASK GROUP ON TEACHERS

Deborah Loewenberg Ball, Chair; James H. Simons; Hung-Hsi Wu; Raymond Simon; Grover "Russ" Whitehurst.

Dr. Ball reviewed the conceptual frame for organizing the Task Group's work and provided an update on two of their four questions. She stated that one premise of the work on teachers by the Panel is that teachers teaching in the grades prior to high school often seem to be lacking the mathematical knowledge and skills needed to teach effectively. That statement underlies the way in which the group has organized its work.

The Task Group will be looking to find the most current evidence about the nature and state of teachers' qualifications, and the best ways to address the shortfalls that exist. From their last report, they spoke about the issues related to teacher qualification, and the probability that a minority student or a student living in poverty would have a teacher who lacked a major or minor in mathematics or who was otherwise unqualified to teach the subject matter.

The 1999 data show 37 percent of middle school teachers who teach mathematics have a major or minor in mathematics, and three quarters of teachers who teach only mathematics at the secondary school level have a major or minor in mathematics. High school students living in poverty or minority students are twice as likely as their white and middle class counterparts to have teachers who are not qualified in mathematics.

The Task Group has found that while the empirical evidence is less than one might expect, all the signals in the research reviewed have pointed in the direction of the teachers' mathematical knowledge and their abilities to teach effectively. While they may say that teachers' mathematical knowledge matters, they cannot yet say exactly what or how much mathematics teachers need to know that makes that difference.

The Task group will also look at what teacher tests actually measure, including some of the commonly used teacher exams to investigate what kinds of mathematics are examined, how teachers do on these tests and what some of the difficult items look like. In addition, they will be looking at the certification requirements for teachers' mathematical training and the subsequent requirements in other countries.

The Task Group's questions include:

- What is known about effective pre-service teacher education that would equip teachers with the mathematical knowledge and skills that could positively effect students' learning capabilities?
- What is known about the effectiveness of professional development or professional structure, such as math coaches, and under what conditions they are effective for addressing this problem?
- What is known about incentives for performance, or incentives to actually produce student achievement gains?
- What are other incentives or mechanisms for attracting, retaining and distributing skilled teachers more effectively? This includes pay related to teachers' skills and location pay.
- What is known about math specialists at the elementary level?

The Task Group will start with these problems, provide the best evidence they can about the relationship of teacher knowledge to students' achievement gains, and then begin to look at what evidence exists that policy makers and others might draw upon to try to address the problem.

Dr. Ball then reviewed the progress on the first and second questions, on which they will give a full report at the next meeting.

On question three, research has shown that many things can be incentives for teachers. There are three kinds of financial incentives the Task Group has been investigating. They include pay for performance, skill pay and location pay. Research shows that entry level for teachers' salaries or for other technical careers to which these people might enter with equivalent levels of training is virtually the same. But over the first decade of employment, a huge gap develops. The exit rate of math and science teachers is greater than for other kinds of teachers, and salary is one of the principal reasons.

Skill-based pay is the term given to pay based on qualification and is often seen as the incentive to attract people with certain kinds of preparation to enter teaching as opposed to something else. Location pay is attracting teachers to work with populations in areas most in need of skillful teachers. The findings show that both of these kinds of pay plans have relatively weak results.

The Task Group is focusing on pay for performance plans or pay that directly is in concert with teachers' ability to produce achievement gains in students. There are many ways to carry this out, including compensation of individual teachers for the achievement gains of their students or at the school level. The second way is to focus on level of compensation, ranging from very small to very large amounts of differential salary for performance. The third way is continuity, which refers to plans that apply to the salary structure over a series of years.

The Task Group has identified 14 studies, 13 of which found distinct positive effects on student achievement. It is important to note that the studies looked at different types of treatments, but all the studies involved pay plans that, in one way or another, targeted or increased teachers' salaries as a function of their students learning. They will continue to look at more studies on the issue, particularly about skill-based pay and location-based pay, where they have not found many studies to date. The Task Group also will look at how other professions deal with this issue.

Dr. Ball then summarized the Task Group's work on math specialists. Because there is a lack of agreement on what the term means, they will work to address the question while they look at it from the perspective of the qualifications necessary to teach middle school. Their findings to date on math specialists show that there are many in this country already, and there are two distinct models in use. These include a lead teacher model where teachers are equipped to work with students and teachers. The other model shows teachers directly teaching children, and having qualifications or demonstrated effectiveness at being particularly good at affecting students' achievement in mathematics. They found no evidence of effect, but they will continue to look at this issue by conducting searches that are better targeted and that look at high performing countries. They will also look at how much these models cost.

TASK GROUP ON TEACHERS:
QUESTION AND ANSWER PERIOD

Dr. Siegler asked if the studies examined by the Task Group make the distinction concerning teachers who leave between those who are effective but have other opportunities and those who know they will not be effective. Dr. Ball replied that it is not clear from the data.

Dr. Wu stated that anecdotally, there is a third kind, which is teachers who are quite capable but who become unhappy because of the demands on their time, and who did not have support from the school or district administration.

Dr. Clements asked if there was any information in the literature on pay for performance and cheating, or even just narrowing the curriculum. Dr. Ball replied that they are looking into that, but first need to find studies that show effects.

Dr. Stotsky asked if the Task Group had looked at school-leaving surveys. She believes that Paul Hill, University of Washington, has done some studies on them. She stated that there is

another category of teachers who leave due to marriage, pregnancy or other reasons, and they may resume teaching elsewhere.

Dr. Ferrini-Munday asked if the Teachers Task Group will work with the Conceptual Knowledge and Skills Task Group to match teachers' subject matter knowledge and its impact across the different knowledge and skill categories. Dr. Ball responded that they are looking into that but they do not know of random probability samples of teachers at the middle school that might allow them to make those inferences. Dr. Wu added that there are two major problems in this area. The first is that there is no way for them to define precisely what teachers ought to know, not only about the scope but also about the depth. The evidence there is lacking. Dr. Loveless asked if they plan to report some statistical properties in terms of the size of the positive effects and the competence level they found, and Dr. Ball responded that yes, they will do that in their report.

Mr. Williams asked if the Task Group looked into alternative forms of certification. He also stated that there is a philosophy in middle school that de-emphasizes content and emphasizes social aspects, which may account for the lack of certified middle school math teachers.

Dr. Wu added that one of the main points of their Task Group report is to emphasize the importance of teachers' common knowledge, and no matter which grade they teach, they have to know the mathematics involved.

Dr. Schmid asked for clarification about the lack of evidence about math coaches, and the evidence that teacher knowledge does raise student achievement. One argument for elementary math specialists is that they provide a mechanism for getting more teachers with mathematics subject knowledge into the elementary grades. The second clarification he requested was when they talked about the percentage of middle school teachers who have degrees in mathematics, and if that meant just mathematics or degrees in mathematics education. Dr. Ball responded that they have some discrepancy in the aggregation where teachers received their degree, but it addressed whether they have a major or minor in mathematics or are certified in math as their primary subject.

Mr. Simon stated that as Congress is debating both the Higher Education Act and No Child Left Behind, the issue of incentive pay for teachers is seeing more and more debate. He stated that the work of this Task Group is going to be very timely, both in informing the debate in Congress as well as informing actual practice by the schools. He added that the issue of distributing good teachers among all children is one of the biggest challenges, and anything to help inform that debate will be very useful.

Dr. Wu commented on the glaring gap in assessment of state teachers and having more capable teachers teaching the better students.

TASK GROUP REPORTS:
TASK GROUP ON ASSESSMENT

Camilla Benbow, Chair; Douglas Clements; Susan Embretson; Francis "Skip" Fennell; Bert Fristedt; Tom Loveless; Wilfried Schmid and Sandra Stotsky.

Dr. Benbow stated that the Task Group to date has been working on defining their charge. They are being informed by the NAEP validity studies to develop their research questions. The two main research questions are, 1) what are the mathematical knowledge and skills that are assessed on NAEP, TIMSS and state tests, and 2) how do these competencies align with the essential knowledge and skills required for eventual success in algebra as determined by the National Math Panel, specifically the Conceptual Knowledge and Skills Task Group.

The Task Group will further assess the content validity and the item types across the five NAEP strands at the fourth and eighth grades only. They will then supplement this main analysis with more of a case-based analysis that looks at the content strands of each of the six state tests

that were analyzed by the NAEP validity study. The NAEP validity study only looked at the fourth and eighth grades and they are looking at grades 3-8. They also will attempt to assess the content validity to item types and the complexity across the various strands for grades 3-8.

Once they have done that work, they will compare the content validity, the item types, the item difficulties of the NAEP and state tests with each other, with TIMSS and with the essential content to be learned as described by the Panel. The Task Group believes that they will be able to say a lot more about NAEP than they will about the states, and therefore, NAEP will be the focus.

Specifically, the Task Group will address how well the algebra or pre-algebra items, categorized by subtopics on the NAEP fourth and eighth grade tests and third through eighth grade on the six state tests, conform to the Panel's definition of algebra. The Task Group will also look at the policies that govern administration procedures. Are students able to use calculators or are formulas provided? They will look at the research to see to what extent these variations and procedures enhance validity and the value of the assessments. Another area of interest is whether test items that contain excessive language bias the assessment of mathematical competencies. In addition, the Task Group will look at how the NAEP and state proficiency levels were established.

TASK GROUP ON ASSESSMENT:
QUESTION AND ANSWER PERIOD

Dr. Schmid clarified that six of the state tests were looked at in the aggregate in the NAEP validity study, and not individually. He also suggested that the Task Group look at PISA, which is an international comparison in which the U.S. participates. Dr. Benbow replied that the group did talk about looking at that. Dr. Fennell followed up by saying that they decided not to use it because it is solely a problem-solving applications oriented test. It is also geared primarily to 15 year olds. Dr. Schmid followed up by saying that they should address it to ward off criticism. Dr. Loveless replied that they are going to refer to a study that NCES did comparing the content of TIMSS and NAEP, and in that same study PISA was part of the comparison as well.

Chair Faulkner announced the close of the Task Group reporting session and the public meeting. He thanked the public for attending, and announced that the next National Math Panel meeting will be hosted by Washington University in St. Louis, MO on September 7th, 2007. He thanked Miami Dade College for its hospitality and the excellent facilities that it provided.

The session adjourned at 12:15 p.m.

I certify the accuracy of these minutes.

Chair Signature_____Date_____

Vice Chair Signature_____Date_____

ADDENDUM: PUBLIC PARTICIPANTS

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