State University of New York

Initial Report:

Provost's Mathematics Education Task Force

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Vicky Kouba, University at Albany, Co-Chair
Alan Tucker, University at Stony Brook, Co-Chair

Executive Summary

Preparing teachers for the K-12 schools is a long-standing component of the mission of the State University of New York, with a number of institutions in the System having been founded with teacher education as their central mission. Today SUNY's graduates constitute a major segment of New York State's K-12 educators. Recognizing this historical mission and a responsibility for continuing excellence, the Chancellor and Provost adopted an action plan, *A New Vision in Teacher Education,* to guide the future of teacher education in the System. The SUNY Provost's Mathematics Education Task Force (METF) is an outgrowth of the action plan's charge to engage faculty in seeking enhancements in the preparation of teachers and, ultimately, in the improvement of instruction in the K-12 schools.

The METF, formed by campus's recommendations of more than 100 mathematics and mathematics education faculty and administrators from across the System, was organized into three working groups: (1) pre-service teacher education; (2) professional development and in-service teacher education, including graduate programs; and (3) articulation issues between K-12 and post-secondary education. The task force set the goal to interact extensively with the State Education Department on its work and invited SED staff to participate as full members of the group. Initial work was carried out by a steering committee and three small core-working groups which identified four focus areas and prepared an interim report. The focus areas form the headings for the recommendations in this report. The interim report was circulated to the full task force membership. The results of a plenary session of the task force led to drafting and revision of the report, the recommendations of which follow.

Focus A: Bachelor's Degree Programs

Recommendation A: Increase the number of mathematics credits in the Bachelor's degree coursework of future early childhood and childhood teachers. Added coursework should be directly connected to how that mathematics should be taught and learned in school classrooms.

Recommendation A-1: Students entering their first course in a teacher preparation program should be given a placement examination or competency test.

Recommendation A-2: Mathematics courses should be taken in Associate Degree programs for transfer to baccalaureate teacher education programs. Such courses should be carefully planned to facilitate acceptance at senior colleges.

Recommendation A-3: To allow for increases in specific required content and content-related pedagogy courses in early childhood and childhood education programs, consideration must be given to reducing the number of education courses of a general (non-content-specific) nature, such as curriculum development.

Focus B: Master's Degree Programs

Recommendation B: Mathematics and/or mathematics pedagogy courses should be required in the Master's Degree programs of in-service early childhood and childhood teachers as well as in Master's programs for in-service teachers of middle childhood and adolescence education.

Recommendation B-1: Master's Degree programs for in-service early childhood and childhood teachers should require a minimum of three credit hours of mathematics and three credit hours of mathematics integrated with appropriate pedagogy in addition to requirements for initial certification.

Recommendation B-2: Master's Degree programs for middle childhood and adolescence education should require a minimum of 12 credit hours of mathematics and at least 3 credit hours of mathematics integrated with appropriate pedagogy. Generalist Master's Degree programs for middle childhood and adolescence teachers of mathematics should be prohibited.

Recommendation B-3: Master's Degree programs in Education/Mathematics Education should contain a research project that focuses on standards -based practice in a classroom setting, and that examines the role of student and teacher in the meaningful learning of mathematics.

Focus C: Teacher Certification Through Transcript Evaluation

Recommendation C: Specific mathematics courses, covering the areas that are essential for teaching mathematics in secondary schools, should be included among the 30 credits (under new proposed regulations) of mathematics required for alternative adolescence certification through transcript evaluation.

Focus D: Professional Development for In-service Teachers

Recommendation D: Guidelines should be formulated for professional development opportunities for teachers of mathematics to assist them in teaching to the state's standards in grades K-12.

Recommendation D-1: SUNY should encourage research on what constitutes effective professional development and should provide funding for innovative professional development programs such as SUNY Fredonia's Professional Resources in Mathematics Education (Project PRIME). "Conversations in the Disciplines" is one potential source of funds.

Recommendation D-2: SUNY faculty and administrators should work cooperatively with professional organizations such as the Mathematical Association of America (MAA), the New York State Mathematical Association of Two-Year Colleges (NYSMATYC), the National Council of Teachers of Mathematics (NCTM), the Association of Mathematics Teachers of New York State (AMTNYS), and other affiliated organizations to actively support faculty who organize professional **development programs for K-12 teachers.**

Recommendation D-3: Faculty who participate in professional development of teachers should receive recognition, commensurate with their contributions, for professional service and scholarly activity.

Recommendation D-4: Teachers at the childhood, middle childhood, and adolescence levels who are specialists in mathematics should be required to have a minimum of 100 Continuing Education Units (of the 175 required over a five-year period) in mathematics and mathematics pedagogy. Early childhood and childhood generalist classroom teachers should be required to have a minimum of 20% of the 175 required Continuing Education Units (CEUs) in mathematics and/or mathematics pedagogy.

Recommendation D-5: Individual professional development plans for teachers should consist of at least three different acceptable activities at least one of which should include a more in-depth professional development experience.

Other Recommendations

Recommendation E: The Mathematics Education Task Force should continue to address issues of K-16 articulation, including development with interested institutions of a mathematics placement test **that can be pilot-tested on participating campuses.**

Recommendation F: SUNY should collaborate with the New York State Education Department (SED) on issues of mutual concern, including compatibility between expectations of mathematics learning in K-12 schools and in SUNY

colleges and universities.

The Mathematics Education Task Force recognizes the complexity of curriculum change and innovation, especially given the diversity of institutions within the State University and competing demands in the preparation of teachers. The METF has endeavored to work through a collegial process with open invitation to membership and consultation among both mathematics educators and mathematicians. Considerable strength of consensus accompanies the recommendations of this report, and the task force believes that, if implemented, these recommendations can have positive impact on mathematics teaching and learning, not just within the State University, but across the state.

Mathematics Education Task Force Report

Introduction

Teacher Education is a mainstay of the State University of New York, several member institutions of which were founded in the nineteenth century specifically to educate teachers. SUNY's graduates constitute a major segment of New York State's K-12 educators. Acknowledging that highly qualified teachers are a prerequisite for quality in the education of the nation's children, and thus to its future, SUNY rededicated itself to continuing improvement of its programs for preparing the educators of tomorrow. An Advisory Council on Teacher Education (ACTE) was empanelled by the system's Provost, Peter D. Salins, as part of this high-priority initiative. The group's recommendations culminated in Chancellor Robert King's formulation in 2001 of an action plan, *A New Vision in Teacher Education: Agenda for Change in SUNY's Teacher Education Programs,* to guide the future directions of teacher education in the system. The SUNY Board of Trustees strongly endorsed the plan.

Background

The SUNY Provost's Mathematics Education Task Force is an outgrowth of the advisory council's recommendation that a series of forums be convened to address best practices in preparing teachers.

As a first step, the Provost called a meeting of mathematics and mathematics education faculty from across SUNY in April 2002. At that meeting, the Provost challenged the group to work collectively to improve the education of future teachers of mathematics, to ultimately help improve the mathematics instruction in New York's K-12 classrooms, and to consider steps leading to more effective articulation between high school and college level mathematics.

Discussion at the initial meeting led to the creation of a Mathematics Education Task Force and to the formulation of an agenda for such a group. Based on early discussions, the task force was organized into three working groups: one on pre-service teacher education, one on professional development and in-service teacher education, and one on articulation issues between K-12 education and post-secondary education. The task force's agenda is attached as Appendix I.

Following up on the initial meeting, Provost Salins forwarded to all SUNY campus Presidents and Chief Academic Officers a copy of the initial task force agenda and invited recommendation of faculty from their institutions to serve on the task force. Response to the call for participation was excellent, with more than 100 faculty and administrators recommended from almost every campus with basic mathematics instruction and a role in the preparation of teachers.

Special Assistant to the Provost, Dr. W. Hubert Keen, coordinated and oversaw follow-up efforts to organize the SUNY-wide task force of mathematicians and mathematics educators. Distinguished Teaching Professor Alan Tucker, of the University at Stony Brook's Applied Mathematics and Statistics Department, and Professor Vicky Kouba of the University at Albany's School of Education, were appointed co-chairs. Professor Tucker was the lead author of the 2001 report, *The Mathematical Education of Teachers* (the MET Report, 2001), issued by the Conference Board of the Mathematical Sciences, a consortium of professional mathematics organizations. The MET Report has been widely cited for setting high standards for the preparation of teachers of mathematics. Professor Kouba is recognized for her research on results of the National Assessment of Educational Progress reports.

Two co-chairs were named for each of the task force's working groups, one each from mathematics faculty and mathematics education faculty. Additionally, to facilitate the work of this broad group, approximately eight members

were enlisted to serve on core working groups to refine and focus the task force's work. Members of the core-working groups were convened in December 2002. The results of that meeting, along with subsequent work, led to formulation of an interim report that served as the basis for a plenary session in October 2003. This report incorporates the results of the task force's work to date.

Overview

After extensive discussion including during the December 2002 meeting of the task force leadership, the decision was made to focus initially on four areas:

A. Increasing the number of mathematics credits in the Bachelor's degree coursework of future early childhood and childhood teachers;

B. Requiring mathematics courses in the Master's degree coursework of early childhood, childhood and adolescence teachers;

C. Specifying particular mathematics courses in the 30 (under new proposed regulations) credits of mathematics that may be used for obtaining certification as a secondary teacher of mathematics through the state's transcript evaluation route; and

D. Developing guidelines for the professional development of in-service teachers of mathematics to assist them in teaching to the New York State Mathematics Learning Standards (Standard 3 – Math-Science-Technology Learning Standards).

While concentrating on these four areas, the task force planned from its inception to take up other issues as deemed appropriate by the group. It also set out to work closely with
the New York State Education Department, both to articulate its work with the needs of the K-12 schools and to aim for substantial impact of its recommendations.

Areas of Focus and Recommendations

Focus A: Bachelors Degree Programs

Recommendation A: Increase the number of mathematics credits in the Bachelor's degree coursework of future early childhood and childhood teachers. Added coursework should be directly connected to how that mathematics should be taught and learned in school classrooms.

The task force recommends that students completing teacher preparation programs for early childhood (grades Pre-K - 2) or childhood (grades 1 - 6), including those seeking dual certification as special education teachers, take a minimum of nine credit hours in three separate courses. Implementation of this requirement will lead to the addition of a course in most programs and, in some cases, reorganization of topics. The recommended additional hours should be tied to the New York State Mathematics Learning Standards, the school mathematics curriculum, and the National Council of Teachers of Mathematics (NCTM) *Principles and Standards for School Mathematics (2000).*

The aim of additional instruction is to allow appropriate mathematical content to be taught for deeper levels of understanding. Additional content in advanced mathematics may not be necessary for most elementary classroom teachers. However, faculty and departments should make a concerted effort to recruit students to undertake a concentration in mathematics. The number of early childhood and childhood teachers in New York's schools with some specialization in mathematics is exceedingly small.

In addition to this overarching recommendation, following are other related recommendations:

Recommendation A-1: Students entering their first course in a teacher preparation program should be given a mathematics placement examination or competency test.

The results of this examination would be used to determine the course into which students are placed as they begin the program. Such a test could prevent classes from becoming bogged down in teaching basic skills and could enable a focus on the mathematics justifying the arithmetic algorithms. Some institutions already use the national placement test Acuplacer for this purpose.

Recommendation A-2: Mathematics courses should be taken in Associate Degree programs for transfer to baccalaureate teacher education programs. Such courses should be carefully planned to facilitate acceptance at senior colleges.

Courses accepted by senior colleges to fulfill program requirements should focus on the mathematics, although not necessarily the pedagogy, needed for students pursuing programs leading to elementary teacher certification. By taking appropriate courses, students can avoid additional requirements after transfer and can engage productively in mathematics pedagogy courses. For students not transferring directly from two-year programs, courses should have been taken not more than five years prior to entry to the program.

Recommendation A-3: To allow for increases in specific required content and content-related pedagogy courses in early childhood and childhood education programs, consideration must be given to reducing the number of education courses of a general (non-content-specific) nature, such as curriculum development.

The task force recognizes that requirements for students in teacher preparation programs already press the limits of baccalaureate program credits, and, in addition, that adding a course may be a resource issue on most campuses.

New York State Education Department regulations for teacher certification programs are relatively unspecific with respect to the mathematical preparation of early childhood and childhood teachers. Representatives of the SED have acknowledged the need for attention to this concern, and the task force hopes to gain broad support for attention to this issue.

A survey by the task force's working group on Pre-service Education for Teachers found that SUNY teacher preparation programs typically require two courses totaling six or eight credits for future teachers in the Pre-K-6 grade levels. Virtually all had a two-course mathematics sequence specifically designed for future childhood and early childhood teachers.

SUNY's requirements are more rigorous than those of public institutions in many states where taking generic mathematics courses—such as College Algebra—suffices for fulfilling degree requirements. College Algebra is not an essential prerequisite for students preparing to be teachers. The breadth of content, types of reasoning and skills of Math A in the state's high school curriculum provide a solid foundation for designing courses for prospective elementary teachers. The report *The Mathematical Education of Teachers* (CBMS, 2001), cited above in the Background section, recommends nine credits and gives guidance about content of the coursework.

Several other factors prompt the recommendation of additional coursework in mathematics. Future teachers develop reading and writing skills in almost all their college courses, while mathematics skills are typically developed only in mathematics courses. Today, mathematics proficiency in K-12 education is receiving increased attention along with the traditional concerns about reading and writing. Yet another major stumbling block for many future elementary teachers is the apprehension about—even aversion to— mathematics. Some have serious deficiencies in their mathematical skills and reasoning. More coursework in mathematics is essential in preparing early childhood and childhood teachers capable of meeting the heightened expectations for school mathematics instruction necessary to prepare students for adolescence mathematics courses.

A related issue is that SUNY Associate Degree granting institutions should offer mathematics courses designed for future early childhood and childhood teachers, because a large number of students who complete teacher preparation programs at senior campuses in New York State start their higher education in SUNY associate degree granting institutions. Offering such courses at two-year colleges requires careful planning to articulate smoothly with senior college program structure and practices, as well as to comply with state regulations. The task force strongly encourages ongoing dialogue between these sectors to facilitate student transfer to senior institution programs.

Focus B: Master's Degree Programs

Recommendation B: Mathematics and/or mathematics pedagogy courses should be required in the Master's Degree programs of in-service early childhood and childhood teachers as well as in Master's programs for in-service teachers of middle childhood and adolescence education.

Recommendation B-1: Master's Degree programs for in-service early childhood and childhood teachers should require a minimum of three credit hours of mathematics and three credit hours of mathematics integrated with appropriate pedagogy in addition to requirements for initial certification.

Recommendation B-2: Master's Degree programs for middle childhood and adolescence education should require a minimum of 12 credit hours of mathematics and at least 3 credit hours of mathematics integrated with appropriate pedagogy. Generalist Master's Degree programs for middle childhood and adolescence teachers of mathematics should be prohibited.

This recommendation is in accord with the report *The Mathematical Education of Teachers* (CBMS, 2001, p.11). Ideally, many of these courses would be "linking" courses that integrate mathematical content with pedagogical strategies.

Mathematics in the middle grades (grades 5-8) should be taught by mathematics specialists. Current attention in New York State to deficiencies in the preparedness for Math A in high schools is focusing on the fact that a substantial proportion of students were taught in the middle grades by teachers with minimal preparation to teach mathematics.

Recommendation B-3: Master's Degree programs in Education/Mathematics Education should contain a research project that focuses on standards -based practice in a classroom setting, and that examines the role of student and teacher in the meaningful learning of mathematics.

Currently, there is no mathematics content requirement for coursework in the Master's degree programs for early childhood and childhood teachers leading to the professional teaching credential. States across the U.S. vary on whether a Master's Degree is required at all for teachers, and thus national standards are lacking. The working group on In-service Education and Professional Development for K-12 Teachers surveyed the requirements across SUNY campuses for Master's Degree programs in early childhood, childhood, middle childhood and adolescence education. There seems to be a growing trend away from content-specific programs to generalist programs, perhaps due in part to the SED requirement that programs contain a minimum of 12 credit hours that link content and pedagogy. Because of current resource limitations, it appears that the generalist approach discourages the offering of content-specific mathematics courses and mathematics education degree programs. In particular, this requirement is being interpreted in a way that programs <u>need not</u> require content courses.

The task force believes this trend is a serious mistake, and it recommends at least one mathematics course in the Master's Degree program for early childhood and childhood teachers. This course would develop more deeply the core mathematics topics, such as operations on numbers, measurement, and algebraic thinking that are the focus of undergraduate mathematics courses for future elementary teachers. A conceptual framework and rationale for such courses are convincingly presented in the National Research Council's report *Adding It Up* (2001). Master's Degree programs for middle childhood and adolescence teachers of mathematics should contain a minimum of 12 credit hours of mathematics. In future work, the task force will develop more specific recommendations about the content in these 12 credits, building on the middle school recommendations in the MET Report.

Recommendation B-3 aims to inculcate in teachers an orientation toward research. Teachers should be comfortable with reading and analyzing the results of research on the teaching and learning of their subjects, as well as being able to develop and carry out research projects. Introspective, action research projects are valuable for classroom teachers as the profession seeks to base teaching on research-verified methodology.

Focus C: Teacher Certification Through Transcript Evaluation

Recommendation C: Specific mathematics courses, covering the areas that are essential for teaching mathematics in secondary schools, should be included among the 30 credits (under new proposed regulations) of mathematics required for alternative adolescence certification through transcript evaluation.

The Mathematical Association of America's Committee on the Undergraduate Program in Mathematics recommends the following (recommendation 4.2 in the MAA's report):

"In addition to the skills developed in programs for K-8 teachers, departments should ensure that mathematical sciences majors preparing to teach secondary mathematics:

Learn to make appropriate connections between the advanced mathematics they are learning and the secondary mathematics they will be teaching, including a senior-level experience that makes these connections explicit;

Fulfill their requirements for a mathematics major by including topics from abstract algebra, analysis (advanced calculus or real analysis), geometry, probability and statistics with an emphasis on data analysis, discrete mathematics, and number theory;

Experience many forms of mathematical modeling and a variety of technological tools, including graphing calculators and geometry software;

Learn about the history of mathematics and its applications, including recent work."

The Mathematics Education Task Force recommends that the minimum requirements, derived from the common courses across all SUNY adolescence mathematics education programs, should be:

1 Single-Variable and Multivariable Calculus
2 Linear Algebra
3 Probability and Statistics
4 Geometry
5 Abstract Algebra or Applied Algebra

Additional courses discussed for inclusion in the list were Discrete Mathematics, Logic and Real Analysis, but there was no clear consensus on these. Courses numbered 3, 4 and 5 above, with the possible exception of probability and statistics, should be at the junior or senior undergraduate level. Additional hours, to complete the 30 required, should also be above the introductory college mathematics level. In addition, the task force considers a capstone course addressing the mathematics curriculum of the secondary schools to be highly desirable. Such courses are the most essential component of some undergraduate programs, bridging the gap between the content of the mathematics major and its relationship to the school curriculum. Capstone courses are not widely available, however, and if required at present may be an insurmountable obstacle to candidates.

The task force recognizes that certification through transcript evaluation is an issue that reaches beyond SUNY and affects all college graduates who seek certificates through this route in New York State. Currently, a college graduate with 30 credits of college-level mathematics and appropriate pedagogy coursework and experience, may seek provisional certification to be a secondary school mathematics teacher. The Regents' earlier decision to eliminate this 'backdoor' route to teacher certification has been reversed because the state is confronted with critical shortages of certified teachers in high demand areas, such as mathematics, and the discontinuation of the alternative route would exacerbate the problem.

Given this reality, the task force proposes that specific courses be required among the 30 credits of college-level mathematics. Because of the shortage of mathematics teachers, applicants for alternative certification may be temporarily certified for one or two years during which time they complete specified courses to remove deficiencies.

This recommendation will require extensive discussions with SED and other interested parties before it is ready to be publicly announced. Note that SED, rather than SUNY, would be implementing this recommendation.

Focus D: Professional Development for In-Service Teachers

Recommendation D: Guidelines should be formulated for professional development opportunities for teachers of mathematics to assist them in teaching to the state's standards in grades K-12.

Recommendation D-1: SUNY should encourage research on what constitutes effective professional development and should provide funding for innovative professional development programs such as SUNY

Fredonia's Professional Resources in Mathematics Education (Project PRIME). "Conversations in the Disciplines" is one potential source of funds.

Recommendation D-2: SUNY faculty and administrators should work cooperatively with professional organizations such as the Mathematical Association of America (MAA), the New York State Mathematical Association of Two-Year Colleges (NYSMATYC), the National Council of Teachers of Mathematics (NCTM), the Association of Mathematics Teachers of New York State (AMTNYS), and other affiliated organizations to actively support faculty who organize professional development programs for K-12 teachers.

Recommendation D-3: Faculty who participate in professional development of teachers should receive recognition, commensurate with their contributions, for professional service and scholarly activity.

Recommendation D-4: Teachers at the childhood, middle childhood, and adolescence levels who are specialists in mathematics should be required to have a minimum of 100 Continuing Education Units (of the 175 required over a five-year period) in mathematics and mathematics pedagogy. Early childhood and childhood generalist classroom teachers should be required to have a minimum of 20% of the 175 required Continuing Education Units (CEUs) in mathematics and/or mathematics pedagogy.

Recommendation D-5: Individual professional development plans for teachers should consist of at least three different acceptable activities (see below), at least one of which should include a more in-depth professional development experience.

To place in perspective the importance of high quality professional development for in-service teachers, consider the question posed by a task force member: "What percent of a teacher's career is post-baccalaureate?" Because the answer to this question is "A very large percent," and because of the ever-greater impetus in New York State to teach to higher standards, SUNY institutions should take an active role in the continuing professional development of teachers. The MET report (CBMS, 2001, p.9) states: "Teacher education must be recognized as an important part of mathematics departments' mission at institutions that educate teachers." SUNY Fredonia's Project PRIME (Professional Resources in Mathematics Education) is an example of such a program.

High quality professional development is essential for both new and continuing teachers. SED recently mandated that all K-12 teachers receiving initial certification after 2004 "complete 175 clock-hours of acceptable professional development" every five years after attaining professional certification. In addition to this requirement, other factors providing strong motivation for professional development are new standards for learning in the K-12 schools, followed by statewide mathematics assessments, and generally poor mathematics achievement in most U.S. schools. The weight of these factors has however not led to a surge of professional development activity in mathematics. Unfortunately, there still are very few professional development opportunities for teachers in mathematics, sponsored either by local school districts or by statewide organizations. Anecdotal evidence indicates that many local school administrators prefer general professional development that encompasses all teachers and not subject-specific programs.

SUNY System Academic Affairs and individual institutions should urge the State Education Department to establish Continuing Education Units (CEU) as a means to judge teachers' involvement in professional development activities. Such activity is normally measured in Continuing Education Units (CEUs), and these units should be equated with the state's requirement—to be phased in beginning in 2004—of 175 hours of professional development every five years for in-service teachers.

Local determinations of number of CEUs assigned to each activity should be based on the individual teacher's

professional development needs and plan, and should be in accord with the teacher's time, effort and quality of each type of experience. Following is a list of activities that would qualify for professional development credit.

a. Graduate courses in mathematics, mathematics pedagogy and related areas. Appropriate undergraduate courses, such as a computer science course that expands the candidate's scope of knowledge, may also qualify
b. Supervision of student teachers and hosting of pre-student teaching field experiences
c. Professional membership in appropriate organizations
d. Engaged attendance at national, state, and local professional meetings
e. Speaking at national, state, and local professional meetings
f. Participation in introspective research
g. Authoring an article published in a professional journal
h. Participation in officially organized mathematics study
i. Working with university faculty on classroom research projects related to the teaching of mathematics. By giving teachers a reward for working cooperatively with university faculty, such activities would support research in schools. This also supports integration of ongoing research into best practices in mathematics teaching.
j. Presenting or co-presenting an in-service workshop of at least an hour's duration to other teachers

The more challenging content and Regents tests associated with the new Math A and Math B courses are putting pressure on many secondary mathematics teachers to strengthen their own mathematical knowledge and instructional skills to teach more demanding mathematics to all their students. Thus, in the professional development arena, the task force has chosen to focus initially on helping secondary school mathematics teachers with the new Regents Math A and Math B courses. The task force's working group on In-service Education and Professional Development for K-12 Teachers has been discussing a variety of activities to help these teachers. This professional development planning will draw in representatives of interested parties such as teacher organizations and the state associations of boards of education and administrators.

Other Recommendations

Recommendation E: The Mathematics Education Task Force should continue to address issues of K-16 articulation, including development with interested institutions of a mathematics placement test that can be pilot-tested on participating campuses.

The task force has explored the concept of the development of a common SUNY-wide mathematics placement test. Such tests (Acuplacer is one example) are widely used throughout the country—and indeed on many SUNY campuses—to place entering college students in the appropriate first college course in mathematics, or to determine if students have met general education mathematics requirements. Placement tests are also valuable for determining level of preparedness in math of individuals re-entering teacher preparation programs after a period away from academics. Because many students transfer each year from one SUNY institution to another, largely from two-year to four-year institutions, they are subjected to different placement tests that give different assessments of what mathematics they know and what mathematics course is at the appropriate level. The SUNY Board of Trustees has mandated a general education mathematics requirement, although the content has been determined only within broad guidelines.

A common placement test has both positive and negative implications. Positive aspects of a SUNY-wide test are:

- Facilitating transfer of mathematics course credit among SUNY campuses. Institutions are more likely to give credit for, say, a college algebra course when there is confidence that all courses start at the same level.

- Providing an assessment of how well students are retaining mathematics taught in high school and, by pooling results from across SUNY, giving a basis for general feedback to high schools about the strengths and weaknesses in preparation of students for college mathematics. The prevalence of low-level remedial mathematics courses in American colleges and universities, covering topics like addition of fractions and basic algebra, is clear evidence of this problem.
- Accurately measuring the mathematical mastery of what is being taught in the state's high schools. Locally designed tests may, over time, cease to retain alignment with high school curriculum or to national standards set by the MAA, NCTM, or with tests designed for national use.

Concerns with a system-wide placement test are:

- The range of diagnostic testing across the system may be too great for a single instrument. Some institutions are concerned about skills or reasoning that students use subsequently in a broad range of academic disciplines, while others need to determine the level within the calculus sequence into which students should be placed.
- A single test might be inadequate to both determine level of placement in college courses and to measure high school learning.
- Faculty may resist relinquishing autonomy on an institutional curriculum matter and choose to design and administer its own placement test.
- While the focus of such a test might be for diagnostic and research purposes, once having been administered it provides a database that could be used for unintended purposes.

Related to these issues on placement tests is the concern over whether such a test should be designed to focus on skills, on reasoning or on a mix of the two. Two-year institutions are increasingly concerned with approaches that stress reasoning for students who would employ that facility in many contexts, perhaps in preference to high emphasis on skills, whereas university centers tend to be more concerned with level of skills.

The issue of reasoning versus skills highlights differences between the current high school Math A and B, which give greater attention to reasoning than the previous Math I, II and III, and the more traditional skills-oriented college algebra and pre-calculus courses in many colleges. Math A is considered by some to be much like the reform calculus which has not been universally accepted by college mathematics faculty.

Recommendation F: SUNY should collaborate with the State Education Department on issues of mutual concern, including compatibility between expectations of mathematics learning in K-12 schools and in SUNY colleges and universities.

Deliberations on issues of mathematics in the state's K-12 schools and in colleges and universities reveal considerable lack of consistency between expectations of SUNY mathematics departments and the content and instruction in secondary school mathematics courses. For this reason, it is desirable to continue to address questions of K-16 articulation. Thus, the task force should build on its working relationship with the State Education Department, including active participation by SED staff on the task force's working group and steering committee. SED invited the task force to have one of its members participate last summer in each of the four range-finding meetings for state-wide assessments. In these meetings, the detailed frameworks are established for giving full or partial credit to answers on the various state-wide mathematics tests, from 4^{tth}grade up to Regents Math B. The input of college mathematics and mathematics education faculty should help to develop grading standards for these important tests.

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Mathematics Education Task Force Co-Chairs

Task Force

Vicky L. Kouba Alan Tucker Professor, Department of Distinguished Teaching Professor
Educational Theory and Practice and Undergraduate Director School of Education Department of Applied
Mathematics University at Albany and Statistics University at Stony Brook

Pre-Service Teacher Education Working Group

Carol J. Bell Margaret W. Groman Associate Professor and Coordinator Associate Professor and Chair of
Adolescence Mathematics Education Department of Mathematics Department of Mathematics SUNY College
at Oswego SUNY College at Cortland

In-Service and Professional Development Working Group

Constance Feldt-Golden Stephen F. West Associate Professor and Chair Distinguished Teaching Professor
Department of Elementary Education and Chair and Reading Department of Mathematics SUNY College at Oneonta
SUNY College at Geneseo

K-16 Alignment Working Group

Douglas Clements Timothy Lance Professor, Learning and Instruction Distinguished Service Professor Graduate
School of Education and Chair University at Buffalo Mathematics and Statistics Department University at Albany

APPENDIX I

Provost's Mathematics Education Task Force Task Force Agenda (July 2002)

1. Alignment of K-12 mathematics in New York with teacher education and college mathematics generally

Sample Issues:

a. How does time spent on different topics in K-12 mathematics curriculum compare to time spent on these topics in college teacher preparation?
b. With what K-12 topics do teachers feel they need more preparation?
c. How can better alignment, if needed, be obtained?
d. How well does K-12 mathematics instruction prepare students to succeed in college mathematics courses? In particular, what factors in K-12 mathematics education are related to good performance on freshman mathematics placement tests?

2. Improving pre-service education of teachers

Sample Issues:

a. Assess the readiness of new teachers to assume responsibility of teaching math. Include assessment of effectiveness of programs leading to different teacher certification levels (i.e., grades K-2, 1-6, 5-9, 7-12, the New York State certification "bands.") in preparing teachers for their specific teaching levels.
b. Work to increase the amount of college mathematics required for elementary teachers to 9 credit hours.
c. Work to bring close alignment between pre-service mathematics instruction and effective K-12 mathematics teaching. As an example, design special sections of introductory mathematics courses, like college algebra, that both cover the traditional scope of such courses and articulate with the mathematical concepts that underlie elementary school curriculum in the state. As another example, design a "capstone course" for pre-service secondary mathematics teachers that articulate with the mathematical concepts that underlie the secondary school curriculum in the state.

3. Improving in-service education and professional development for K-12 teachers. Sample Issues:

a. Assess the effectiveness of master's degree programs (as required by New York State Education Department regulations for professional certification) in advancing the effectiveness of novice teachers' skills toward master-teacher levels at each of the certification levels in the state.
b. Develop models for courses that will serve different levels of K-12 teachers in their master's programs.
c. Assess the effectiveness of specific course or content requirements, in both pre-service and master's degree programs, in bringing K-12 students to higher levels of mathematics competency.
d. In collaboration with partner school districts, develop guidelines and materials for the mathematics components of the required 175 hours every five years of professional development for professionally certified teachers. Guidelines should establish minimum hour requirements for mathematics as teachers fulfill the in-service requirement.

APENDIX II

Mathematics Education Task Force
Membership by Campus

State University at Albany
Professor Lindsay N. Childs Department of Mathematics and Statistics

Professor Abbe H. Herzig Educational Theory and Practice

Professor Vicky Kouba Educational Theory and Practice

Dr. Tim Lance Distinguished Service Professor Chair, Mathematics and Statistics Department

State University at Binghamton
Professor Ben Brewster Chair, Math Sciences Department

Professor Patricia McAuley Mathematics Department

Professor Jean Schmittau Mathematics Department

State University at Buffalo
Professor Douglas Clements Learning and Instruction Graduate School of Education

Mr. Mark Marino Mathematics Education: Adolescence

Dr. Bruce Pitman Vice Provost for Educational Technology and Math

Professor Julie Sarama Mathematics Education Department

Professor Samuel Schack Chair, Mathematics Department

State University at Stony Brook
Dr. Thomas Liao Distinguished Teaching Professor Department of Technology and Society

Professor Bernard Maskit Mathematics Department

Professor Anthony Phillips Undergraduate Teacher Preparation

Dr. Alan Tucker Distinguished Teaching Professor Applied Mathematics and Statistics Department

College at Brockport
Professor Dawn Jones Mathematics Department

Professor Lynae Sakshaug Department of Education and Human Development

Professor Conrad Van Voorst Education and Human Development

Professor Osman Yasar Chair, Computer Sciences Department

College at Buffalo
Professor Daniel Cunningham Mathematics Department

Professor Betty Krist School of Education

Professor Sue McMillan Mathematics Department

Professor Fred Reiner Mathematics Department

Professor Robin Sanders Chair, Mathematics Department

College at Cortland
Professor Carol J. Bell Coordinator of Adolescence Mathematics Education Mathematics Department

Professor Susana Davidenko Childhood and Early Childhood Education

Professor Andrea LaChance School of Education

College at Fredonia
Professor Jamar Pickreign School of Education

Professor Robert Rogers School of Education

Professor Joseph Straight Chair, Mathematics Department

College at Geneseo
Professor Mary Ellen Schmidt School of Education

Professor Stephen F. West Distinguished Teaching Professor Chair, Mathematics Department

College at New Paltz
Dr. David Clark Distinguished Professor Associate Dean of Science, Engineering and Mathematics

Professor Kees Degroot Department of Elementary Education

Professor Maria Shavalier Department of Elementary Education

College at Old Westbury
Professor Arlene Blasius Chair, Mathematics Department

Professor Velta Clarke Department of Education

Professor Myong-Hi Kim Mathematics Department

Dr. Jong Pil Lee Distinguished Service Professor Mathematics Department

Professor Kathleen Miranda Mathematics Department

Professor Sharon O'Connor Department of Education

College at Oneonta
Professor Deborah Farro-Lynd Mathematics, Computer Sciences and Statistics

Professor Constance Feldt-Golden Chair, Elementary Education and Reading

Professor Virginia Harder Secondary Education Department

Professor David Hildreth Secondary Math Education Department

College at Oswego
Professor Margaret Groman Mathematics Department

Professor Michel Helfgott Mathematics Department

Dr. Jack Narayan Distinguished Teaching Professor Dean of Graduate Studies

Professor Audrey Rule Mathematics Department

Dr. Suzanne Weber Associate Dean of Education

College at Plattsburgh
Professor Donald Blais Elementary Education

Professor David Kenoyer Chair, Mathematics Department

Professor Margaret Morrow Mathematics Department

College at Potsdam

Professor Peter Brouwer Department of Information and Communication Technology

Institute of Technology at Utica/Rome
Professor William Thistleton Department of Mathematics

College of Technology at Delhi
Professor Monica Gabriel Liddle Division of Arts and Sciences

College of Technology at Morrisville
Dr. Patricia Elko Interim Dean of Science and Technology

Cornell University
Professor Susan Piliero Department of Education

Professor Deborah Trumbull Department of Education

Adirondack Community College
Professor Diane Doyle Mathematics

Professor Maryann Faller Mathematics

Broome Community College
Professor Paul O'Heron Mathematics Department

Professor Mary Woestman Mathematics Department

Cayuga Community College
Professor Donald Fama Math/Computer Sciences **Cayuga (cont'd**) Professor Kathy Gross Mathematics Department

Professor Paul Richardson Mathematics Department

Corning Community College
Professor Lori Barrett Math/Physics/Technology Division

Professor Pat Keeler Math/Physics/Technology Division

Dutchess Community College
Professor Johanna Halsey Mathematics Physical & Computer Sciences

Professor Ellena Reda Mathematics Physical & Computer Sciences

Erie Community College
Professor Michael Delaney Mathematics Department

Professor Maryann Justinger Mathematics Department

Professor Mary Beth Orrange Mathematics Department

Professor Denise Prince Mathematics Department

Finger Lakes Community College
Professor Timothy Biehler Mathematics and Computer Sciences

Professor Leonard Malinowski Mathematics and Computer Sciences

Fulton-Montgomery Community College
Professor Marlene Glaser Mathematics Department

Professor Patrick Grande Mathematics Department

Genesee Community College

Professor May Knappen Mathematics Department

Herkimer County Community College

Professor Michael Oriolo Mathematics Department

Hudson Valley Community College

Dr. Ann Marie Murray Associate Dean, Academic Services

Dr. Dehlly Porras Dean of Liberal Arts

Jefferson Community College

Professor Donna Norman Mathematics Department

Professor Michael White Chair, Mathematics Department

Mohawk Valley Community College

Professor Julie Dewan Mathematics Department

Professor Norayne Rosero Mathematics Department

Monroe Community College

Professor Mark McKinzie Mathematics Department

Professor Tim McNamara Mathematics Department

Nassau Community College

Professor Ann Marie Pagnotta Math/Statistics/Computers

Professor Theresa Vecchiarelli Math/Statistics/Computers

Niagara County Community College
Professor Anne Jowsey Mathematics Department

Professor Salvatore Sciandra Mathematics Department

Onondaga Community College

Professor Michelle Gelsomin Mathematics Department

Rockland Community College
Professor Bill Baker Chair, Division of Math and Sciences

Schenectady County Community College
Professor Kathryn Tomaino Developmental Studies

Suffolk County Community College
Professor Dennis Reissig Mathematics Department

Professor Jane-Marie Wright Mathematics Department

Ulster County Community College
Professor Jennifer Davis Math and Physical Sciences

Professor Maureen Nicholson Math and Physical Sciences

Westchester Community College
Professor Mel Bienenfeld Mathematics Department

New York State Education Department
Ms. Teresa Calabrese-Gray Curriculum Instructiona l Support

Ms. Anne Schiano Assistant Director Curriculum, Instruction and Instructional Technology

Cambridge Central School District
Ms. Carmen Nelson-Parker Mathematics Department

SUNY System Administration

Office of the Provost and Vice Chancellor for Academic Affairs

Dr. W. Hubert Keen Special Assistant to the Provost

Ms. Penny LaRocque Technical Advisory Group (Provost's Applied Research Group)

Provost's Office of Academic Affairs

Mrs. Ginette F. Chambers Campus Liaison, Faculty Awards and Development

Dr. A. Jennifer Clarke Campus Liaison, Comprehensive Colleges

Dr. Anne Huot Campus Liaison, Doctoral Institutions

Dr. Patricia Pietropaolo Campus Liaison, Community Colleges

Ms. Kathryn Van Arnam Program Review and Assessment

Office of Vice Chancellor for Community Colleges

Dr. Preston Pulliams Vice Chancellor for Community Colleges

University Faculty Governance Organizations Faculty Council of Community Colleges

Professor Kimberley Reiser (Nassau) President

University Faculty Senate

Professor Joseph Hildreth (Potsdam) President