Position Papers

NCSM POSITION PAPERS

- Improving Student Achievement Through Designated District and School Mathematics Program Leaders (March, 1998)
- NCSM Position Paper on Basic Mathematical Skills (January, 1977)

NCSM POSITION PAPER:
IMPROVING STUDENT ACHIEVEMENT THROUGH DESIGNATED DISTRICT AND SCHOOL MATHEMATICS PROGRAM LEADERS

March, 1998

The National Council of Supervisors of Mathematics (NCSM) believes that strong, programmatic leadership is essential to the improvement of mathematics instruction and achievement for all students. Therefore, we urge the designation and support of leaders of mathematics programs at the school district and school building levels. These designated leaders should be responsible for coordinating the planning, implementation and evaluation of mathematics programs. They should serve as informed resources in the areas of curriculum design, professional development, instructional strategies, student and program assessment, and the development of partnerships with the broader community.

Improvement of mathematics programs and increases in student achievement in mathematics result from carefully designed changes in curriculum and instructional strategies, and in assessment practices that support both curricular expectations and pedagogical practices - all in alignment with the vision of national standards. There are no magic bullets or simple formulas to accomplish this. There is, however, the recognized strategy of designating and supporting mathematics program leaders to help meet the challenges we face.

The case for designated mathematics program leaders

It is clear that the demands upon teachers of mathematics have never been greater:

- Society in general and a changing workplace demand broader mathematical literacy for every student;
- Technology forces reconsideration of what mathematics is essential and how best to teach this mathematics; and
- National standards and the higher expectations they represent have heightened the need for updating the knowledge and skills of teachers of mathematics as these standards are translated into the district, school and classroom levels.

These demands and the changes in classroom practice that they imply require different and more effective forms of leadership to help shape and direct improvement.

When we want a job done we designate an individual to get it done. We assign responsibility, we establish expectations, and we provide necessary support. This applies to an endeavor as simple as the PTA Bake Sale or as complex as the purchase of a new fleet of school buses. It applies to how we designate coordinators for programs like special education or directors to oversee district athletics programs. Likewise, it applies to district and school mathematics programs where the effectiveness of such programs increasingly depends on designated and supported mathematics program leaders.

NCSM takes this position in the belief that high-quality, well-informed district and school level leadership in mathematics is an indispensable component of world-class mathematics programs for students.

The role of designated mathematics program leaders

To meet these challenges, there is a range of essential responsibilities that district and school mathematics program leaders can be expected to assume:

In the area of curriculum design:

- coordinate the development and implementation of a standards-based curriculum;
- ensure curricular alignment and coordination between grades, levels and courses;
- assist teachers in integrating mathematics into other disciplines and the content of other disciplines into mathematics;
- guide the ongoing review and revision of the curriculum.

In the area of instructional strategies and materials:

- recommend programs and materials, and oversee their piloting, adoption, and the evaluation of their effectiveness;
- share knowledge about successful and innovative strategies with teachers;
- assist teachers in incorporating technology into daily instruction;
- assist teachers by modeling effective instructional strategies.

In the area of assessment:

- assist teachers in designing and implementing a broad range of assessment tools;
- ensure the alignment of assessment instruments with the curriculum;
- use assessment results to improve curriculum and instruction;
- interpret the results of assessment for parents and the community at large.

In the area of professional development:

- assess needs for professional development;
- conduct or facilitate professional development activities, and motivate colleagues to engage in ongoing professional growth and development;
- encourage involvement in professional organizations;
- design and encourage opportunities for professional sharing and interaction between and among colleagues, and advance other effective professional development strategies;
- promote professional visits among teachers between classrooms, schools, and districts.

In the area of forging partnerships:

- communicate with committees, school boards, administrators, teachers, parents and students about the importance of mathematics and the need for high quality mathematics programs;
- cultivate connections with the post-secondary mathematics and mathematics

education communities, and with local business and industry personnel;
- establish and support forums and encourage dialogue among groups that influence the shape and direction of school mathematics programs.

In summary, designated district and school mathematics program leaders should be expected to:

- address concerns and promote excellence in mathematics education for all students;
- be visionary agents of positive change, knowledgeable about national standards, aware of current research, and able to translate these standards and this research into classroom practice;
- link stakeholders in education and enlist their support in improving the quality of the teaching and learning of mathematics.

NCSM believes that these responsibilities are core aspects of effective mathematics programs. Certainly, programs can survive without designated leaders. However, busy principals and full-time teachers cannot reasonably be expected to carry out more than a few of these responsibilities. Accordingly, the process of moving mathematics programs from fair to good to truly excellent demands designated mathematics program leaders.

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NCSM POSITION PAPER ON BASIC MATHEMATICAL SKILLS

January, 1977

Introduction

The currently popular slogan "Back to the Basics" has become a rallying cry of many who perceive a need for certain changes in education. The result is a trend that has gained considerable momentum and has initiated demands for programs and evaluations which emphasize narrowly defined skills.

Mathematics educators find themselves under considerable pressure from boards of education, legislatures, and citizens' groups who are demanding instructional programs which will guarantee acquisition of computational skills. Leaders in mathematics education have expressed a need for clarifying what are the basic skills needed by students who hope to participate successfully in adult society.

The narrow definition of basic skills which equates mathematical competence with computational ability has evolved as a result of several forces:

1. Declining scores on standardized achievement tests and college entrance examinations;
2. Reactions to the results of the National Assessment of Educational Progress;
3. Rising costs of education and increasing demands for accountability;
4. Shifting emphasis in mathematics education from curriculum content to instructional methods and alternatives;
5. Increased awareness of the need to provide remedial and compensatory programs;
6. The widespread publicity given to each of the above by the media.

This widespread publicity, in particular, has generated a call for action from governmental agencies, educational organizations, and community groups. In responding to these calls, the National Institute of Education adopted the area of basic skills as a major priority. This resulted in a Conference on Basic Mathematical Skills and Learning, held in Euclid, Ohio, in October, 1975.

The National Council of Supervisors of Mathematics (NCSM), during the 1976 Annual Meeting in Atlanta, Georgia, met in a special session to discuss the Euclid Conference Report. More than 100 members participating in that session expressed the need for a unified position on basic mathematical skills which would enable them to provide more effective leadership within their respective school systems, to give adequate rationale and direction in their tasks of implementing basic mathematics programs, and to appropriately expand the definition of basic skills. Hence, by an overwhelming majority, they mandated the NCSM to establish a task force to formulate a position on basic mathematical skills. This statement is the result of that effort.

Rationale for the Expanded Definition

There are many reasons why basic skills must include more than computation. The present technological society requires daily use of such skills as estimating, problem solving, interpreting data, organizing data, measuring, predicting, and applying mathematics to everyday situations. The changing needs of society, the explosion of the amount of quantitative data, and the availability of computers and calculators demand a redefining of the priorities for basic mathematics skills. In recognition of the inadequacy of computation alone, NCSM is going on record as providing both a general list of basic mathematical skills and a clarification of the need for such an expanded definition of basic skills.

Any list of basic skills must include computation. However, the role of computational skills in mathematics must be seen in the light of the contributions they make to one's ability to use mathematics in everyday living. In isolation, computational skills contribute little to one's ability to participate in mainstream society. Combined effectively with the other skill areas, they provide the learner with the basic mathematical ability needed by adults.

Defining Basic Skills

The NCSM views basic mathematical skills as falling under ten vital areas. The ten skill areas are interrelated and many overlap with each other and with other disciplines. All are basic to pupils' development of the ability to reason effectively in varied situations.

This expanded list is presented with the conviction that mathematics education must not emphasize computational skills to the neglect of other critical areas of mathematics. The ten components of basic mathematical skills are listed below, but the order of their listing should not be interpreted. as indicating either a priority of importance or a sequence for teaching and learning.

Furthermore, as society changes our ideas about which skills are basic also change. For example, today our students should learn to measure in both the customary and metric systems, but in the future the significance of the customary system will be mostly historical. There will also be increasing emphasis on when and how to use hand-held calculators and other electronic devices in mathematics.

Ten Basic Skill Areas

Problem Solving

Learning to solve problems is the principal reason for studying mathematics. Problem solving is the process of applying previously acquired knowledge to new and unfamiliar situations. Solving word problems in texts is one form of problem solving, but students also should be faced with non-textbook problems. Problem-solving strategies involve posing questions, analyzing situations, translating results, illustrating results, drawing diagrams, and using trial and error. In solving problems, students need to be able to apply the rules of logic necessary to arrive at valid conclusions. They must be able to determine which facts are relevant. They should be unfearful of arriving at tentative conclusions and they must be willing to subject these conclusions to scrutiny.

Applying Mathematics to Everyday Situations

The use of mathematics is interrelated with all computation activities. Students should be encouraged to take everyday situations, translate them into mathematical expressions, solve the mathematics, and interpret the results in light of the initial situation.

Alertness to the Reasonableness of Results

Due to arithmetic errors or other mistakes, results of mathematical work are sometimes wrong. Students should learn to inspect all results and to check for reasonableness in terms of the original problem. With the increase in the use of calculating devices in society, this skill is essential.

Estimation and Approximation

Students should be able to carry out rapid approximate calculations by first rounding off numbers. They should acquire some simple techniques for estimating quantity, length, distance, weight, etc. It is also necessary to decide when a particular result is precise enough for the purpose at hand.

Appropriate Computational Skills

Students should gain facility with addition, subtraction, multiplication, and division with whole numbers and decimals. Today it must be recognized that long, complicated computations will usually be done with a calculator. knowledge of single-digit number facts is essential and mental arithmetic is a valuable skill. Moreover, there are everyday situations which demand recognition of, and simple computation with, common fractions.

Because consumers continually deal with many situations that involve percentage, the ability to recognize and use percents should be developed and maintained.

Geometry

Students should learn the geometric concepts they will need to function effectively in the 3-dimensional world. They should have knowledge of concepts such as point, line, plane, parallel, and perpendicular. They should know basic properties of simple geometric figures, particularly those properties which relate to measurement and problem-solving skills. They also must be able to recognize similarities and differences among objects.

Measurement

As a minimum skill, students should be able to measure distance, weight, time, capacity, and temperature. Measurement of angles and calculations of simple areas and volumes are also essential. Students should be able to perform measurement in both metric and customary systems using the appropriate tools.

Reading, Interpreting, and Constructing Tables, Charts, and Graphs

Students should know how to read and draw conclusions from simple tables, maps, charts, and graphs. They should be able to condense numerical information into more manageable or meaningful terms by setting up simple tables, charts, and graphs.

Using Mathematics to Predict

Students should learn how elementary notions of probability are used to determine the likelihood of future events. They should learn to identify situations where immediate past experience does not affect the likelihood of future events. They should become familiar with how mathematics is used to help make predictions such as election forecasts.

Computer Literacy

It is important for all citizens to understand what computers can and cannot do. Students should be aware of the many uses of computers in society, such as their use in teaching/learning, financial transactions, and information storage and retrieval. The "mystique" surrounding computers is disturbing and can put persons with no understanding of computers at a disadvantage. The increasing use of computers by government, industry, and business demands an awareness of computer uses and limitations.

Basic Skills and the Student's Future

Anyone adopting a definition of basic skills should consider the "door-opening/door-closing" implications of the list. The following diagram illustrates expected outcomes associated with various amounts of skill development.

Scope of Skill Development		Expected Outcomes
Expanded Skills Mathematical skills beyond those described here plus a desire to learn more.	--->	**Potential Leaders** Employment and the educational opportunities will continue to increase as mathematical skills continue to grow.
Basic Skills The skills described here.	--->	**Employment Very Likely** Employment opportunities are predictable. Doors to further education opportunities are open.
Minimal Skills Limited skills, primarily computation. Little exposure to the other skill areas described here.	--->	**Limited Opportunities** Unemployment likely. Potential generally limited to low-level jobs.

Minimum Essentials for High School Graduation

Today some school boards and state legislatures are starting to mandate mastery of minimum essential skills in reading and mathematics as a requirement for high-school graduation. In the process, they should consider the potential pitfalls of doing this without an appropriate definition of "basic skills." If the mathematics requirements are set inordinately high, then a significant number of students may not be able to graduate. On the other hand, if the mathematics requirements are set too low and mathematical skills are too narrowly defined, the result could be a sterile mathematics program concentrating exclusively on learning of low-level mathematical skills. This position paper neither recommends nor condemns minimal competencies for high-school graduation. However, the ten components of basic skills stated here can serve as guidelines for state and local school systems that are considering the establishment of minimum essential graduation requirements.

Developing the Basic Skills

One individual difference among students is style or way of learning. In offering opportunities to learn the basic skills, options must be provided to meet these varying learning styles. The present "back-to-basics" movement may lead to an emphasis on drill and practice as a way to learn.

Certainly drill and practice is a viable option, but it is only one of many possible ways to bring about learning and to create interest and motivation in students. Learning centers, contracts, tutorial sessions, individual and small-group projects, games, simulations and community-based activities are some of the other options that can provide the opportunity to learn basic skills. Furthermore, to help students fully understand basic mathematical concepts, teachers should utilize the full range of activities and materials available, including objects the students can actually handle.

The learning of basic mathematical skills is a continuing process which extends through all of the years a student is in school. In particular, a tendency to emphasize computation while neglecting the other nine skill areas at the elementary level must be avoided.

Evaluating and Reporting Student Progress

Any systematic attempt to develop basic skills must necessarily be concerned with evaluating and reporting pupil progress.

In evaluation, test results are used to judge the effectiveness of the instructional process and to make needed adjustments in the curriculum and instruction for the individual student. In general, both educators and the public have accepted and emphasized an overuse of and overconfidence in the results of standardized tests. Standardized tests yield comparisons between students and can provide a rank ordering of individuals, schools, or districts. However, standardized tests have several limitations including the following:

a. Items are not necessarily generated to measure a specific objective or instructional aim.

b. The tests measure only a sample of the content that makes up a program; certain outcomes are not measured at all.

Because they do not supply sufficient information about how much mathematics a student knows, standardized tests are not the best instruments available for reporting individual pupil growth. Other alternatives such as criterion tests or competency tests must be considered. In criterion tests, items are generated which measure the specific objectives of the program and which establish the student's level of mastery of these objectives. Competency tests are designed to determine if the individual has mastered the skills necessary for a certain purpose such as entry into the job market. There is also need for open-ended assessments such as observations, interviews, and manipulative tasks to assess skills which paper and pencil tests do not measure adequately.

Reports of pupil progress will surely be made. But, while standardized tests will probably continue to dominate the testing scene for several years, there is an urgent need to begin reporting pupil progress in other terms, such as criterion tests and competency measures. This will also demand an immediate and extensive program of inservice education to instruct the general public on the meaning and interpretation of such data and to enable teachers to use testing as a vital part of the instructional process.

Large scale testing, whether involving all students or a random sample, can result in interpretations which have great influence on curriculum revisions and development. Test results can indicate, for example, that a particular mathematical topic is being taught at the wrong time in the student's development and that it might better be introduced later or earlier in the curriculum. Or, the results might indicate that students are confused about some topic as a result of inappropriate teaching procedures. In any case, test results should be carefully examined by educators with special skills in the area of curriculum development.

Conclusion

The present paper represents a preliminary attempt by the National Council of Supervisors of

Mathematics to clarify and communicate its position on basic mathematical skills. The NCSM position establishes a framework within which decisions on program planning and implementation can be made. It also sets forth the underlying rationale for identifying and developing basic skills and for evaluating pupils' acquisition of these competencies. The NCSM position underscores the fundamental belief of the National Council of Supervisors of Mathematics that any effective program of basic mathematical skills must be directed not "back" but forward to the essential needs of adults in the present and future.

You are encouraged to make and distribute copies of this paper.

The NCSM position paper was prepared pursuant to a contract with the National Institute of Education, U.S. Department of Health, Education and Welfare. Contractors undertaking such projects under government sponsorship are encouraged to express freely their judgment in professional and technical matters. Points of view or opinions do not, therefore, necessarily represent official National Institute of Education position or policy.

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