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AUTHOR	Osborne, Alan R.; And Others
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ABSTRACT

Results of a national survey to determine preferences and priorities for school mathematics in the 1980's are reported. Responses were obtained from samples of nine populations, including teachers, supervisors, and other professionals in mathematics education, plus principals, school board members, and PTA presidents. First-round surveys concerned curricular preferences about fractions and decimals; algebra; whole numbers; geometry; probability and statistics; ratio, proportion, and percent; problem solving; measurement; and computer literacy. Results from these areas were reported in terms of goals, content, methods, resources, appropriate times and students, and calculators. Data were also analyzed to yield information on such topics as applications and individualization. Second-round surveys sought to determine curricular priorities. These items were grouped according to focus; for example, development of new materials for specific content or use of additional time. The report provides vast amounts of specific information relevant to mathematics curriculum in the 1980's. Similarities and differences between samples in the perceived desirability of different curricular alternatives for the 1980's are indicated. This contains the body of the report plus Appendices A and B containing the survey items. Item data in Appendices C and D are contained in SE 030 578. (MK)

PRiorities In School Mathematics

FINAL REPORT

on data from the

PRISM Project

funded by the

National Science Foundation

March 1980

Prepared by the PRISM Project Staff at The Ohio State University

for the

National Council of Teachers of Mathematics

FOREWORD

This Report was developed by:

Alan R. Osborne, Director

F. Joe Crosswhite

Jon L. Higgins

Margaret L. Kasten

Patricia Newcomb

Marilyn N. Suydam

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The PRISM Project

PRiorities In School Mathematics:
A Study of Actual and Desired Curricular Practices

Introduction

The PRISM Project of the National Council of Teachers of Mathematics (NCTM) was designed to collect information about desired curricular practices in mathematics as a basis for comparison with actual practices in the schools. The NCTM, through the action of its Board of Directors in 1976, adopted as its top priority, five-year goal the development of specific curriculum recommendations suitable for the decade of the 1980's. The PRISM Project is one of the sources of information used by the NCTM in formulating their curriculum recommendations for the 1980's.

Curricular decision making in the United States appears to have been characterized by change for the sake of change, by failure to consolidate productive practices, and by a propensity for ignoring the findings of research. The previous two decades of curriculum development is characterized by rapid change. We have moved without pause from one area of curriculum development to another--from modern mathematics to mathematics for the disadvantaged to career education mathematics, from metrication to consumer mathematics to basic skills to handheld calculator applications.

There has been an almost suicidal concentration of vital resources and energy on the newest change. Each new fad means that more and more energy and resources must be expended to get the revision underway and accepted in the schools. Neither the teachers nor the public appear to be satisfied with the present curriculum. The dissatisfaction is not unrelated to the rapidity of change. The NCTM was of the firm belief that the fad-like character of curriculum change could be reduced by the development of a blueprint for change based on research findings and the wisdom of concerned groups. Such a basis is needed for determining the priorities for the investment of time, money, energy, and other resources. Planned, controlled change--with the object of that change kept clearly in mind--is needed.

Formulation of curricular plans in the past have demonstrated little cognizance of the desires and opinions held by the different populations that have a stake in the effectiveness of school mathematics programs. The development of new curricula has been primarily the prerogative and domain of experts in mathematics and mathematics education and has not reflected adequately the concerns and values of such groups as parents, teachers, and school board members. The NCTM PRISM Project was designed to sample and contrast the opinions of samples of several different populations about curricular preferences and priorities for school mathematics.

The NCTM PRISM Project collected information to be used by the NCTM pursuant its goal of formulating and implementing a blueprint for planned curricular change for the 1980's. In particular, the PRISM Project is a primary source of information concerning what samples of concerned populations believe are the curricular preferences and priorities for the coming decade.

This section of the report describes the general design of the Project, the instrument development and sampling plans, and provides information concerning characteristics of the samples. Subsequent sections report on the curricular preferences of samples within curricular strands, considers the responses across strands about practices that are represented in more than one strand, examine priorities across strands for development and research, and, finally, consider some of the preferences and priorities in terms of the evidence of current practices.

Design of the PRISM Project

The PRISM Project was designed to collect information about preferences and priorities concerning the mathematics curriculum of the future from samples of several populations. Curriculum was defined broadly to include topical content in mathematics, the tools and modes of instruction, and levels of student need. Survey instruments were to be constructed that gave an opportunity to react to items reflecting choices among curricular alternatives.

Curricular alternatives were considered to be on two different levels. The first level concerns thinking or decision-making specific to a given factor in curricular planning. Examples of such factors are goals, the nature of the subject matter, the materials environment, the instructional practices, and the psycho-social climate of the school. The second level of curricular thinking or decision-making respects the interactive character of these factors and is of a more global nature. Thus, the decision was made to have two rounds of surveys.

The first-round surveys were the preferences surveys. They inquired about curricular alternatives at a specific level. The items were designed in sets that concerned a specific major topical area or strand of the mathematics curriculum such as computer literacy or measurement. Within each strand, items were nested in a cluster for each factor such as goals or instructional methods. Respondents could indicate within each cluster the strength of their preferences for given alternatives. Respondents were asked to consider alternatives in a cluster with the proviso that the effects of other factors were relatively equal. Thus, alternatives for the preference survey were "small" and specific. Examination of the professional literature in mathematics education that concerned theory, research, and practice indicated a rich variety of curricular alternatives for the basis of the preferences surveys.

The second-round surveys were called the priorities surveys. Initially they were conceived of in terms of identifying the most popular alternatives for strands found in the data of the preferences surveys and, then, asking individuals to reflect their priorities for development and research across these popular choices. For example, a response might have concerned whether it was more important to invest resources in developing an alternative curricular practice in geometry or one in statistics and probability. However, the decision was made that it would be more realistic to represent the decision-making for curriculum in more global terms that would allow decisions about priorities in terms of the interactive nature of all the factors. Thus, respondents indicated priorities not only in terms of the topical areas or strands such as algebra or geometry but also in terms of whether development was of higher priority for content than for teaching methods, or of mathematics for special categories of students than for investing in new resources for the mathematics program.

Surveying Curricular Preferences

The rich and varied selection of curricular alternatives indicated by sources such as the three recent status studies commissioned by the National Science Foundation (Suydam and Osborne, 1977; Weiss, 1977; Stake and Easley, 1978), as well as the evidence of professional literature in mathematics education, indicated the wisdom of using techniques of item sampling in order to keep survey instruments at a reasonable length for the preference surveys. It also indicated that a major portion of the time of the project had to be given to the preparation of the survey instruments. That is, the forces and issues affecting curricular decisions are of such a nature that many items were required to reflect the full range of choices of alternatives.

The initial concept for representing curricular alternatives was in terms of some choices representing past practices, some representing alternatives that are currently popular, and some that looked to the future to describe practices that might be anticipated. Although this orientation was kept in mind during the process of instrument construction, it was exceptionally difficult to describe hypothesized future practices in terms that were consistent with many individuals' understanding, knowledge, and vocabulary. Consequently, the information about curricular preferences and priorities found in the PRISM date are relatively middle-of-the-road or conservative since the items more often describe alternatives in current practice then extreme futuristic alternatives.

The initial plan identified three categories of population to be sampled:

--users of curriculum, including teachers and student

--makers of curriculum, including mathematics educators and mathematicians

--buyers of curriculum, including supervisors, administrators, and school board members.

The past twenty years of curriculum development and recommendations have represented the opinions of the second category of populations to a much greater extent than the other two. Discrepancies between the preferences and priorities of the makers of curriculum and of the users and buyers of curriculum may account in part for the mixed successes of previous efforts in revising the mathematics curriculum. Therefore, one of the major goals of the PRISM Project was to identify discrepancies between populations in terms of their curricular preferences and priorities.

The identification of the preferences and priorities of populations is particularly important in the larger NCTM effort of preparing a curricular blueprint for mathematics in the 1980's. The formulation of the curriculum recommendations per se is not at stake; the recommendations are not being determined by ballot or through the PRISM survey processes. However, implementation strategies are part of the curriculum blueprint. Information about the level and nature of support for a recommended practice affects the choice of implementation strategies. Suppose the data reveal the following situations:

--All samples demonstrate strong support for increasing the attention given to a particular type of goal in the teaching of the mathematics of several different strands. If this fits with a recommendation of the NCTM for mathematics in the 1980's, then the implementation strategies of lobbying congress and federal and state agencies for the development of materials and in-service education for teachers and of encouraging producers of instructional materials to stress the goal would be facilitated.

--Parents and school board members exhibit little support for a practice that requires a new investment in electronic technology to accomplish an NCTM recommendation. An alternative for an implementation strategy might be the launching of an educational awareness campaign for these populations.

--Teachers and teacher educators value such different practices in the teaching of algebra that it is questionable whether NCTM recommendations about the teaching of algebra would be understood by the majority of teachers. An implementation strategy might be to make certain that teacher educators are fully aware of the differences in opinions between themselves and their intended in-service audiences.

The hypothetical examples given above provide an elaboration of the intent of the PRISM Project and specify what is critical in the preparation of items for the preference and priorities surveys. The success or failure of the PRISM Project depended upon the quality of instruments developed. Consequently, the first year of the two-and-one-half-year project was invested primarily in the development of instruments. Particular care was taken to identify practices that would represent accurately current topics and forces that are at issue in the teaching of school mathematics for the target populations of the surveys. In order for the NCTM to utilize the information effectively in designing implementation strategies, the descriptions of alternative practices in the instruments had to provide evidence that would help in making the judgment of what was acceptable and what was not.

Teachers are a key element in the curriculum change process. If a teacher finds a curriculum recommendation acceptable, then the likelihood of successful implementation is significantly greater. If a recommendation is not viewed as significant or to be in conflict with what the teacher holds to be important, then the teacher will either not implement the recommendation or will do so with a significant lack of enthusiasm and commitment. No other population has quite as critical a role in determining the success or failure of a set of curriculum recommendations. For this reason, the PRISM Project began the construction of the item pool for the preference surveys by focusing on the teacher populations.

The preference item pool for the teacher populations was considered to be the base for the development of items for other populations. The initial intent was to have as many items as possible in common for the teacher populations and the other populations. The greater the commonality, the smaller the risk of error in analyzing and interpreting discrepancies between the sets of data from different populations. This required the use of ordinary language in-so-far as possible in stating the technical aspects of mathematics and mathematics teaching in the items. This proved to be somewhat unrealistic since it imposed too many restrictions on the range of alternatives in describing the practices that should be included in the item pool.

The practical result of coping with the language and technical content of mathematics education during the item writing was a restructuring of the population categories. Using familiarity with the technical aspects of mathematics and mathematics education in the schools as the basis, the populations were categorized in two groups, professional and lay. The item pools for the preference and priority surveys were designed and organized for these two groups.

The professional groups that we wanted to sample were the following: elementary school teachers, secondary school mathematics teachers, junior college mathematics teachers, mathematicians, supervisors of school mathematics programs, and teacher educators who work with preservice and inservice teachers of mathematics. Each of these groups has a unique function and/or commitment in implementing curriculum or in dealing with the products of that curriculum. Each group has a stake in how issues are resolved and the direction that the curriculum takes in the future. More precise descriptions of how the samples were selected and characteristics of the samples will be given later in this chapter.

Two comments about the sample of teachers to be selected are important. First, it was considered important to select individuals possessing judgment concerning the curriculum and its effectiveness. The perspectives of leaders in the cohort of teachers were deemed important in order to reflect thoughtful consideration of the issues and forces attendant to selecting preferences and priorities among alternative curricular practices. The decision was made to select samples using the membership rosters of the NCTM, since membership in the organization is evidence of the desired level of professionalism. Second, some of the issues about curriculum and some forces impinging on curricular decisions are unique to the middle school or junior high school level. We preferred sampling a population of teachers uniquely concerned with and having responsibilities for instruction of this level of student. We found no adequate and efficient means of sampling teachers of mathematics at this level of schooling. Consequently, some item clusters concerned primarily with elementary school curriculum alternatives and some clusters concerned with the secondary school curriculum alternatives contain items specific to the issues and forces affecting the middle or junior high school curriculum since junior high or middle school teachers are represented in each sample.

Two item-pools were constructed for the preference surveys of teachers; one concerned primarily with the elementary school curriculum and the other focused on secondary school curriculum. The item-pools had many clusters of items in common. The clusters concerned with the selection of content alternatives provided the primary differences in the two item pools. The secondary school teacher item-pool was used in surveying the preferences of the samples of mathematicians and of teachers of two-year college mathematics.

Teacher educators and supervisors typically have responsibilities spanning both the elementary and the secondary school programs. Therefore, it was important to give them an opportunity to respond to items at both levels. Based on the common features of some of the clusters concerned with the same factor, such as instructional resources, that occurred in several of the strands, the decision was made to collapse these clusters into generic clusters that were to apply to all curricular strands in mathematics. This decision was forced by the fact that for both the supervisors and the teacher educators the number to be sampled was too small to assure a sufficient number of responses to a question even if a large response rate were realized. Specific details concerning the characteristics of items and of the item sampling will be given in the next section of this chapter.

Initially, four lay populations were considered for sampling: principals, school board members, parents, and businessmen. Principals were considered important to sample because their instructional leadership and support can be a significant factor in determining the success of new programs in schools. Although principals must be regarded as professionals with regard to educational processes, many--particularly at the secondary school level--do not have the background in mathematics to render professional judgments about the technical aspects of mathematics education. School board members were considered critical to sample since they control the use of funds that may be needed to implement some curricular modifications. Parents were included in the preferred sample since no other group has quite the same interest in the effectiveness of the school mathematics program. The desire to include businessmen was primarily from the consideration that they hire the products of the schools and have first-hand experience with the effectiveness of the schools in producing individuals who know mathematics well enough to function in job-related responsibilities.

The lay populations provided the most difficulty in locating samples with readily accessible addresses that could be selected randomly and be representative of the population. For example, initially we had hoped to sample parents through the national Parent-Teacher Association (PTA) and its mailing lists of members. The PTA was quite interested in the PRISM Project, but has had a policy for several decades that prohibited the release of mailing lists for such purposes. Nor could a mailing list for businessmen be located that was sufficiently representative of the different types of businesses in the United States. Consequently, the lay populations sampled were: principals, school board presidents, and parent-teacher organization presidents.

Five factors that determined characteristics of the item pools for the preference surveys are identified below:

1. The intent to describe a wide variety of alternatives in curricular practices that are indicative of current issues and forces affecting decision-making about the mathematics curriculum.
2. The decision to describe alternative practices within major curricular strands of the mathematics program of the schools in order to allow respondents to exhibit preferences specific to decisions about goals, content selection, methods and tools of instruction, and levels of student need for each of these strands.
3. The decision to use item-sampling techniques.
4. The decision to begin by constructing instruments for the samples of teachers.
5. The characteristics of the other populations to be sampled and the consequent modifications of the teacher item pools to fit these characteristics.

The major investment of effort during the first year of the project was in the preparation of the preference item pools for teachers. From October 1977 to April 1978, background information concerning alternative curricular practices was collected and synthesized for each of the strands to provide working papers for the use of the item-writing teams in the construction of items. From April through August, items were revised, piloted with teachers, and revised again in order to have the instruments constructed for mailing to teachers in September after the beginning of the school year.

Preference surveys were mailed to the samples of mathematicians and two-year college teachers during late fall 1978. The modifications of the item pool to fit the characteristics of the supervisors and teacher educators samples was also accomplished during the fall. Instruments were mailed to these two samples in December 1978.

The preference item pool for the lay populations was a drastic modification of the item pool used for the professional samples. Although some items are common to both pools, the effort to reduce further the reliance on technical language resulted in deletion of many items. For example, the clusters of items concerned with content selection alternatives within each of the strands were deleted. Other items were modified to preserve the intent of the preference survey item pool for professionals. However, the degree of commonality between the professional and lay preference item pools is not as great as might be desired. The preferences surveys were mailed to the lay populations in February 1979.

Surveying Curricular Priorities

It was initially anticipated that the results of the first-round surveys would be used as the basis for constructing the priorities survey. This was unrealistic. First, the timing of the preference surveys precluded having all of the data processed by the time it was needed for instrument development. Second, the nature of the instrument that evolved for the preference survey was somewhat different than initially imagined. The alternative practices that were described in the items were of a more specific nature than had been envisioned in the proposal. Examining small, particulave alternatives did not readily accommodate to the comparisons initially planned for the priorities survey. Third, the manner of data treatment encompassed some analyses that allowed inferring priorities from preferences. Finally, no logically defensible rationale could be found for combining the data across populations to identify specific practices as first choices. Who was to say how the preferences of teachers should be weighed in comparison to the opinions of parents or mathematicians?

Consequently, the priorities survey was constructed independent of the results of the preferences surveys.

The structure of the preferences surveys did serve as a guide for the design of the priority survey instruments. Forced-choice items were developed concerning the major, global factors affecting curricular practices that had been used as the basis for writing the clusters for the preference survey instruments. Each cluster of items in the preference survey had concerned a single setting of mathematics and a single major factor in curriculum planning. The items for the priorities survey respected the interactive character of these factors by being either independent of a content setting or requiring contrasts across content settings unlike the preference instruments.

The forced choice items presented five alternatives to the respondent to rank order from first to fifth in terms of the priorities for the decade of the 1980's. The professional samples were given a set of five reasons to use in indicating why they assigned priority one to a particular factor and five reasons to indicate why they had assigned priority five to another factor. The professional samples were the only populations that had this option of indicating the reasons for the assignment of priorities.

Two additional types of items were included on the priorities survey. One type of item concerned general factors affecting the performance of the schools in mathematics but which are not specific to mathematics teaching and learning. Discipline is one type of general factor that affects the quality of mathematics programs but is characteristic of the school-community that transcends mathematics teaching and learning. In particular, we considered it important to have some perception of whether the different samples considered the general problems facing schools to be more important and significant than those specific to the teaching and learning of mathematics. We were concerned that attention and resources invested in mathematics teaching and learning might be considered misplaced if the general problems were seen to be the dominant factors affecting the success of mathematics programs.

The other type of items on the priorities surveys concerned mechanisms for accomplishing changes in school mathematics. The items described different ways to approach the problems of mathematics education in the

1980's, such as preservice teacher education, in-service education, evaluation and assessment efforts, and different approaches to curriculum development. Items allowed an individual to indicate perceptions of the effectiveness and appropriateness of such mechanisms.

The PRISM Project was concerned with assessing the perceptions of different samples' opinions of what ought to be in the mathematics curriculum. It was part of a larger effort of the NCTM to make and implement recommendations of curricular change. Thus, it was particularly appropriate to collect some information concerning the perceptions of appropriateness and effectiveness of mechanisms for change.

The construction of the priorities surveys was completed in February 1979. The mailings of the priorities surveys was completed in March.

Instrument Development

Preference Surveys

The preference surveys were designed to represent curricular alternatives and issues encompassing mathematics content areas, tools and modes of instruction, and levels of student need. The intent was to anticipate the future as well to provide the respondent with an opportunity to react to alternatives perceived as important sources of dissatisfaction with current school mathematics programs. Consequently, throughout the preparation of the instruments, a variety of individuals and groups other than the PRISM staff contributed to and reacted to the design and content of the instruments in order to assure an adequate representation of alternatives.

The first decisions that served to determine the nature of the preference survey instruments were made at the stage of preparing the proposal. It was decided to organize the instrument around major topical areas in mathematics. The initial framework listed the following areas or strands: whole number operations; numeration, fractions, and decimals; ratio, proportion, and percent; measurement; applications and problem solving; algebra; geometry; statistics and probability; and analysis. A second critical decision was to use techniques of item sampling in which not everyone responds to the same survey instrument but an individual's responses are combined with other respondents in order to determine the response patterns of the total sample. This allowed the creation of a much larger item pool encompassing a broader scope of alternatives and issues than possible if a single instrument were used for all.

During Spring of 1977, informal surveys of the audiences at selected program sessions at the NCTM Annual Meeting were conducted to identify points at issue for the topical areas in mathematics that had been identified in preparing the proposal. This information was used by the Steering Committee of the PRISM Project to modify the set of content strands serving as the framework for designing the instruments at the November meeting early in the course of the project. The curricular strands identified by the Steering Committee were revised as follows:

Fractions/Decimals--FD
Algebra--AL
Whole Numbers--WN
Geometry--GM
Probability and Statistics--PS
Ratio/Proportion/Percent--RP
Problem Solving--PB
Measurement--MS
Computer Literacy--CL
Analysis--AN

The listing of curricular strands is a restructuring of the initial framework with one significant addition, computer literacy. The inclusion of computer literacy was in recognition of its potential impact on mathematics during the 1980's and the recognition of the issues that are being generated by the changes associated with the use of the computer in the schools.

The problem solving and applications strand was modified to provide a more precise delimitation of what should be stressed in the construction of the preference survey instrument. The Steering Committee urged that problem solving not be narrowly construed as being limited to verbal problem solving. The Steering Committee argued that techniques and heuristics of problem solving should be emphasized as the objects of teaching in the problem solving curricular strand.

The decision was also made not to tie applications with problem solving in a single strand. The decision was based on two primary arguments. First, applications were perceived as prevading all of mathematics. Thus, preference items about applications were seen as more appropriately imbedded within items in strands instead of being separated from the mathematical setting. Second, the Steering Committee held the strong opinion that problem solving is of sufficient importance in the curriculum and has been given such limited attention that it deserved undissipated attention as a major strand in the framework used for constructing the preference survey.

Subsequently, in the item-writing conferences the following April and May the analysis strand was deleted. The primary reason for deleting the analysis strand was a matter of definition. Topics in analysis are typically imbedded within other mathematical contexts in the school program. For example, the limit of a geometric series may be explored in grade eight general mathematics in the sense of discovery of a number pattern where the primary objective of instruction is not the analytic concept. The topics of analysis at the senior high school level are almost exclusively associated with the final courses taken by the college aspiring student who has talent and interest in mathematics and science, a small, relatively select set of students in most schools. The decision was made, therefore, to imbed the questions pertaining to analysis within other strands. This decision provides one limitation on the conclusions that are possible from the PRISM data: the curricular alternatives and issues for senior level mathematics courses for college-aspiring students are not broadly represented; thus, preferred practices for this curricular level cannot be identified.

The Steering Committee also suggested a categorization of item types to be applied in each of the curricular strands. The categories were:

1. Content: Which specific elements of mathematics within a curricular strand are preferred for inclusion in the curriculum? For example, which content for geometry is preferred at the secondary school level, vectors or transformations?
2. Goals: Which goals are preferred for a given curricular strand? For example, in teaching beginning algebra, are goals associated with applications to be preferred to those associated with understanding proof?
3. Resources: Which resources are to be preferred for a given curricular strand? For example, are demonstration devices or are

supplementary sets of applications problems preferred for teaching ratio and proportion.)

4. Methods: Are given methods preferred for instruction within a curricular area? (For example, Given two sets of materials for teaching probability and statistics each of which features a particular method, say individualized instruction versus long-term, group projects, which is preferred?)
5. Who: What content alternatives are preferred for special groups of students? What alternatives are preferred for all students?
6. Time: What is the preferred grade level placement for given content, techniques of instruction or expected competencies?
7. Calculator: What are preferred uses of the calculator for given types of mathematical content?

The act of creating items for each of these categories led to collapsing of the Who and Time categories to a single category. Preference questions about the timing of instruction were found to be inevitably interactive with the type of student being taught.

The final structure for the preference survey item pool that evolved from the Steering Committee's suggestions is shown below.

Categories of Items

Strands	CONTENT	GOALS	RESOURCES	METHODS	WHO/TIME	CALCULATOR
FD						
AL						
WN						
GM						
PS						
RP						
PB						
MS						
CL						

Strand-Category Matrix

The Steering Committee recognized that there were possible variations idiosyncratic to the issues associated with given curricular strands and recommended that the item writing not be bound by a rule that all cells in the structure must be filled.

The clusters of items in a cell became the basis for the design of the item sampling process that was used to create individual instruments. That is, clusters were sampled rather than individual items.

The Steering Committee also identified and elaborated further issues associated with each of the curricular strands. These issues, together with those generated by the informal surveys at the NCTM meetings the preceding Spring, were used by the PRISM staff to prepare a background paper for each of the strands for use by item-writing teams. The background papers were to identify and discuss major issues in terms of the research/knowledge base in the literature. Interestingly, the PRISM staff was surprised by the realization of the paucity of articles that are written to treat both sides of an issue. Most authors and researchers explore, argue, and collect information about only one side of an issue with the apparent, and frequently fallacious, assumption that a refined description of an alternative is to be found elsewhere in the literature. This resulted in the background papers being more difficult to prepare in terms of an extensively documented literature base than we had anticipated. The first item-writing conference was convened in late March. The item-writing team* had the task of preparing initial drafts of items and served as a pilot for the subsequent item-writing conference in early May. The five-day conferences were oriented to the production of item ideas and item types. Following the item-writing conference, the items were revised by the PRISM staff and this revision was circulated to the item-writers for reaction and comment. Indeed, each writing team reacted to two revisions of

*Members of the item-writing teams were:

1.	Frank Avenoso	Nassau Community College, New York
2.	Glenadine Gibb	University of Texas
3.	John C. Harvey	University of Wisconsin
4.	George Immerzeel	University of Northern Iowa
5.	David C. Johnson	University of Minnesota
6.	Robert Kansky	University of Wyoming
7.	Pat Koch	Berea Junior High, Ohio
8.	Betty Krist	West Seneca High School, New York
9.	Robert E. Reys	University of Missouri
10.	Les Steffe	University of Georgia
11.	Harry Tunis	NCTM Central Office
12.	Zal Usiskin	University of Chicago
13.	Joan Kirkpatrick Worth	University of Alberta

the items. The revisions were also circulated to the Steering Committee members.

The process of writing items that evolved was for a small group to prepare a set of items for each of the cells of a curricular strand. Then another team reacted to and rewrote the item sets. Periodically, the groups would convene to examine and discuss the entire item pool to help assure that no major issues were ignored.

Items written for a given cell, for example, goal items for geometry, tended to be quite similar. The item format that evolved was to construct a general stem and to associate a cluster of items with that stem. The geometry goals cluster, GM 2, is given as an example:

GM 2

STEM

Imagine that there are available several sets of instructional materials for geometry. The materials differ in that each emphasizes one of the curricular goals listed below even at the expense of other goals. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which emphasis on the stated goal should be a positive influence on the decision to use or to buy these curricular materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

ITEM

Geometry is taught:

21. To motivate students who dislike computation.
22. To develop job-oriented skills.
23. To appreciate historical and cultural development.
24. To learn to make proofs.
25. To develop spatial intuitions about the real world.
26. To learn to read and interpret mathematical arguments.
27. To practice arithmetic and algebraic skills.
28. To develop logical thinking abilities.
29. To develop skills and knowledge needed by the consumer.
30. To acquire the knowledge needed for study of more mathematics.

Cluster Stems

In the data reporting and discussion sections in other parts of this report, the word cluster is used frequently. It refers to the set of items built on a single stem in a given cell in the strand-category matrix. Discussion about individual items in this report is frequently presented without repeating (reprinting) the statement of the stem in order to save space.

The reader should be aware of the content of the stem while considering analyses of individual items.

Many of the stems for a given category of items are common from strand to strand. The stems that were used primarily are given below. Under each stem statement, the curricular strands for which the stem was used are identified and exceptions are listed. Parentheses are placed around the words that are replaced to indicate a different curricular strand. The largest number of stems is for the content clusters. Consequently, content cluster stems are listed last.

Goals Cluster Stem

> Imagine that there are available several sets of instructional materials for (whole number concepts and skills.) The materials differ in that each emphasizes one of the curricular goals listed below even at the expense of other goals. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which emphasis on the stated goal should be a positive influence on the decision to use or to buy these curricular materials.
>
> a. Strong positive influence
> b. Somewhat positive influence
> c. No influence or undecided
> d. Somewhat negative influence
> e. Strong negative influence

(Whole number concepts and skills) are taught:

AL, WN, GM, PS, RP, PB, MS, CL
Exception: FD

Resource Cluster Stem

> During the 1980's it may be possible to add to each classroom several different resources for teaching (measurement). To what extent would you want to have each of the following?
>
> a. I would definitely want this
> b. This might be nice to have
> c. Undecided
> d. I'd rather not be bothered by this
> e. I definitely would not want this

All Strands

Methods Cluster Stem

Imagine that there are available several sets of instructional materials for (probability and statistics.) Each set of materials emphasizes one of the teaching strategies listed below. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which the incorporation of this particular teaching strategy would be a positive or negative influence in your decision to purchase or use the materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

All Strands

Who/Time Cluster Stem

The mathematics curriculum committee of your school system is considering the possibility of placing topics from (algebra) at different points in the curriculum. Please react to their following suggestions.

a. I agree completely
b. I tend to agree
c. Undecided
d. I tend to disagree
e. I strongly disagree

AL, GM, PS, MS
Exceptions: FD, WN, RP, PB, CL.
Note: If the item set listed in Appendix A.3 is examined, you can observe that the intent of the stems for the exceptions is the same but that the wording of the stems is not parallel.

Calculator Cluster Stem

How appropriate is it for students to use hand-held calculators when doing each of the following types of (ratio, proportion and/or percent) activities?

a. Very appropriate
b. Only in special circumstances
c. Undecided
d. Almost never appropriate
e. Should not be allowed

WN, GM, PS, RP, MS
Exceptions: FD and AL had the same wording except that the qualifying modifier of the word activities was not given. No calculator cluster was written for either the CL or the PB strands.

Content: Cluster Stems

The largest variation in type for stems is found in the content clusters. For the content clusters, stems were written to differentiate between content for specific levels of schooling (elementary and secondary) and to identify preferred content alternatives for particular categories of students.

Elementary Content Cluster

> A parent-teacher committee in your school has suggested topics in (probability and statistics) that could be taught in the mathematics program for grades K-6 during the 1980's. React to the suggestions of the committee by indicating which topics should be included in elementary school mathematics.
>
> a. Definitely should be included
> b. Probably should be included
> c. Undecided
> d. Probably should not be included
> e. Definitely should not be included

AL, GM, PS

Variants of this stem were used for the strands FD, WN, PB, and MS. None of those specified that a parent-teacher committee had created the list of topics. There were two versions of the FD content cluster; for version A, the level of instruction was pre-grade 7 and for B, the level was specified as after grade 6.

Two types of clusters were used for both the algebra and geometry strand content clusters for secondary school. One was concerned with content for all graduating students, the other for those college-bound students who will not be science or mathematics majors.

Content Cluster Stem: Every graduating student (AL)

> Your school system has decided that every graduating student should have some experiences in (algebra.) Specialized (algebraic) skills necessary for work in higher mathematics will be available in courses offered to college-bound students. Which of the following (algebraic) topics should be taught to all students?
>
> a. Definitely should be taught to all students
> b. Probably should be taught to all students

c. Undecided
d. Probably should not be taught to all students
e. Definitely should not be taught to all students

AL, GM
Note: The geometry stem had a different wording in that the topics of geometry were specified as being listed by a parent-teacher committee.

Content Cluster Stem: College-bound, not intending science or mathematics majors (AL)

The majority of college-bound students will not be science or mathematics majors. Which of the following advanced (algebraic) topics should be included in the secondary school curriculum for these students?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

The issue of what content is appropriate for different types of students was handled differently for the probability and statistics strand. Although the cluster format provides information about more types of students due to the nature of the choices in the response alternatives, the advantage gained by not needing as many clusters is offset by the fact that different statistical interpretations must be used to analyze the response patterns.

Content Cluster Stem: Probability and Statistics (PS)

Listed below are topics in probability and statistics which could be included in the secondary school mathematics curriculum. Identify the most inclusive group for whom you feel instruction on the topic is appropriate.

a. Noncollege-bound secondary school students
b. College-bound secondary school students
c. All secondary school students
d. Not appropriate for secondary school students
e. Undecided

The secondary content clusters for measurement and for problem solving were similar and did not differentiate content alternatives on the basis of types of students. The stems were of parallel construction but not identical wording.

Content Cluster Stem: Secondary School (MS)

> Listed below are topics concerning (measurement) that could be taught at some point in the secondary school (grades 7-12) mathematics program. Which are of sufficient significance to include for <u>all</u> students during the 1980's?
>
> a. Definitely should be included for all students
> b. Probably should be included for all students
> c. Undecided
> d. Probably should not be included for all students
> e. Definitely should not be included for all students

Content Cluster Stem: Secondary School (PB)

> Listed below are several problem solving techniques that might be taught to all secondary students. Which specific techniques should be included in the mathematics curriculum of the secondary school?
>
> a. Definitely should be included for all secondary students
> b. Probably should be included for all secondary students
> c. Undecided
> d. Probably should not be included for all secondary students
> e. Definitely should not be included for all secondary students

Content clusters for the RP (ratio/proportion/percent) and CL (computer literacy) did not specify the level of schooling. The stems are listed below.

Content Cluster Stem: (CL)

> As citizens of the 21st century, today's students will live in a world heavily influenced by computers and calculators. Which of the following topics should be included in the mathematics curriculum of the <u>1980</u>'s?
>
> a. Definitely should be included
> b. Probably should be included
> c. Undecided
> d. Probably should not be included
> e. Definitely should not be included

Content Cluster Stem: (RP)

Listed below are several ways that ratio, proportion, and/or percent could be treated in the curriculum. Which of the following treatments should be included in the school mathematics program?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

Each individual item of a cluster describes an alternative practice for a cell in the strands-category matrix. Since many items in the same category of cluster but in different curricular strands share either common wording or, if not worded identically, share a common intent, it is possible to infer the comparative strengths of preference for a practice in several different mathematical contexts. For example, in each of four methods clusters for AL, RP, FS, and MS, there appears an item that inquires about the teaching technique of using problem solving activities as the means to develop new concepts. Such a common item allows one to note whether a practice is preferred in a variety of mathematical settings or if there are differences in preference corresponding to the types of mathematics.

Comparable comparisons can be made within a given strand, usually in the content clusters, when a mathematical topic appears in clusters for different student populations. For example, in the algebra strand respondents indicated the content preference for the topic of graphing number sentences in two clusters, one concerned with the elementary school curriculum and the other specifying that the topic should be taught to all graduating students. This allows inferences about the perceived appropriateness of the content at a given student level.

A large number of comparisons in the senses described above are made in the data reporting sections of this report. It is appropriate to consider carefully the wording of both items and cluster stems for the given comparisons. The smaller the disparity in wordings of items and stems, the more credence can be given to the inferred comparison. Because of the large number of comparisons that are made, we have not elected to remind readers of this caution in reading the results each instance for which a warning is appropriate.

The modifier inferred is used with the word comparison. This is an artifact of both the item-sampling process employed in this study and the fact that the responses to one item are independent of the responses to comparison items. The item-sampling process means that for a pair of items being compared, they may have been responded to by different sets of individuals. However, the process used in assigning the different forms of the survey to sub-samples of a population assure that respondents to a particular cluster (item) are spread uniformily across the entire set of respondents. Consequently, the response pattern of the subset of all respondents that answered a particular item is inferred to be characteristic of the response pattern for the entire set of respondents to the survey. Nevertheless, it is an inferred sample characteristic.

The second factor, the independence of the responses for pairs of items, means that if a respondent ranked one practice highly, then there was no forced comparison that required that an alternative practice be ranked low. For example, in the methods cluster for FD, one item describes the practice of using more than half of the instructional time for drill and practice. Another item in the same cluster describes the practice of using more than half of the instructional time to develop and extend fraction and decimal concepts. It is possible for individuals to indicate a strong preference for both practices in spite of the apparent ambiguity. Thus, the responses to items are independent. A forced choice between the practices would have provided a direct measure of the comparative strength of preference for the practices. In the data analyses that follow, the comparative strength of preferences are inferred by comparison of the mean response levels for items.

The item pool could have been designed to allow more comparisons. The strengths and weaknesses of requiring identical items for each of the categories of clusters was discussed thoroughly at the item-writing conferences. It was argued, for example, that each of the goal clusters should have contained, precisely the same, identical items. The conclusion was reached that this was too restrictive since there were issues that are unique to some curricular strands.

It was noted that this would restrict the number of alternative goals that could be represented in the goals clusters. Parallel arguments were made and accepted for each category of clusters.

The commonality of items within common clusters across strands did allow a modification of the item pool necessitated by the smaller samples, a variable for some populations. The initial item pool was designed in terms of population samples of 1000 with an item-sampling process designed to assure that, with a modest return rate, for each cluster there would be responses from about 100 individuals. Populations, such as the supervisors of mathematics, provided definite problems since the sample frame was less than 800 individuals. Given the nature of supervisor's responsibilities, it was desirable that responses were obtained for both elementary and secondary forms. Recognizing the high degree of common item content in the methods clusters, the resources clusters, and the calculator clusters, it was decided to create a generic, across-strand cluster for each of the three cluster categories. Two versions of the generic clusters for methods and resources differed only in the wording of the stem were written; one was for the elementary school and the other for the secondary school program. This decision provided an item pool of 468 items rather than 666, allowing an item-sampling process to be used for smaller samples, such as the supervisors and teacher educators, that have interests, responsibilities, and expertise spanning both the elementary and secondary programs. The generic item clusters are exhibited in Appendix A.3.

Each individual encountered fifteen general information items before responding to items from the preference survey pool. One subset of the fifteen items was selected from a pool of thirty demographic items. For each population sample, a set of five to seven items was selected to reflect the respondents' current responsibilities, background, and relation to mathematics education or the schools. Each respondent encountered one item that requested an appraisal of the current state of the way schools are organized and children are taught.

The remaining eight to ten general information items were designed to provide a mind set or advance organizer for thinking about issues in terms of the preference item pool. These introductory items were organized around a single stem.

Introductory Issues Stem

> Consider the mathematics program from kindergarten through twelfth grade. Below are several phrases indicating areas of the program that could receive more or less emphasis during the coming decade. Mark each with the response that best describes your feeling concerning what should be the trend.
>
> a. Should receive much more emphasis
> b. Should receive somewhat more emphasis
> c. Should receive about the same emphasis as now
> d. Should receive somewhat less emphasis
> e. Should receive much less emphasis

The set of items for this stem was selected from a pool of 45 phrases indicating problems or issues. The listing of this pool of items is in Appendix A.2.

The introductory items served a second purpose beyond that of establishing an orientation or mind-set for thinking in terms of the coming decade. The clusters in the remainder of the survey listed specific alternative practices as items within cells of the strand-category matrix. The introductory item cluster, by specifying more encompassing domains of issue or broader problem areas, provided a comparative base for considering the finer, more atomistic issues reflected in the alternative practices described in the items of the preference survey pool.

Item Sampling Processes

Item sampling was used for the first-round, preference surveys. The number of items precluded sending the total set to a respondent. There were 30 demographic items, 45 introductory items, and 660 items in the strand-category matrix describing alternative curricular practices for the teacher samples. Pilot administrations of individual strands to groups of professional and lay people in Ohio, Kentucky, Michigan, and Georgia indicated that it was reasonable to expect the typical respondent to deal with four to five items per minute. Thus, survey forms consisting of 15 items selected from the demographic and introductory item sets and between 100 and 120 items selected from the strand-category matrix of alternative curricular practices were constructed. It was assumed that one half hour was a reasonable expectation for the amount of time most individuals would be willing to commit to the task of completing this type of survey.

The item sampling from the introductory set was not as systematic as the item sampling from the preference item pool. The number of answer spaces left out of the 15-space response area on the answer forms set aside for general information items varied from population to population since different demographic item sets were designed for each population. Thus, we could not establish a rotated form item sampling process that would work for all populations without multiplying the number of forms to be produced for each population. We elected to let the preference item sampling dictate the process and compromised the sampling process for the introductory items to simplify the production and mailing processes for each population.

A second reason that the sampling of the introductory item set was not as systematic resulted from the shifting of items to be sampled from population to population. The initial item set was prepared for the teacher samples and contained 40 phrases descriptive of issues or problems understandable and recognizable by those samples. The elementary teacher sample imposed a limit on the types of issues we felt could be included in the phrase set. The set of preference items did not give a sufficient range of alternatives for the upper-level secondary school curriculum. Consequently, five items were added to these concerns for the samples of junior college mathematics faculty and mathematicians. The number of items that emphasized issues and problems concerned primarily with the lower school curriculum and which required some technical knowledge of educational vocabulary was reduced for the college mathematician samples. These two samples responded to a pool of 21 items.

The supervisors sample responded to samples from the entire pool of 45 introductory items. Because of a typographical error, one item was inadvertently omitted from the item pool for the teacher educator sample thereby reducing the pool for item sampling to 44 items.

The item sampling was designed to have the same size subset of a sample receive each cluster of preference items. The item sampling was designed on the basis of the strand-category matrix. A cluster of items was sampled rather than an individual item. Ten basic forms were designed, one for each strand and one miscellaneous form. Each cluster appeared on two of the ten basic forms. For nine of the forms a complete strand served as the basis for construction in that all of the clusters for a given level either elementary or secondary appeared on the form. The set of item clusters of the complete strand were in the interior of the form and were contiguous. The form was completed by placing on each end of the complete strand two or three clusters selected from other strands. Insofar as possible, these clusters were selected to maximize the number of categories of clusters represented and were placed so that two contiguous clusters did not represent the same category of cluster, such as methods. Having a cluster appear on one form along with other clusters from the same strand and on another apart from other clusters of the same strand allowed examination of whether such placement affected the response patterns; it did not.

Each of the ten basic forms was modified to produce an additional form by trading the position of the item clusters that preceded and followed the clusters of items representing the complete strand or, in the case of the miscellaneous form, switching the first half of the clusters with the last half. This allowed determination of whether the placement of a cluster made a significant difference in the response patterns; it did not.

One other factor produced four more forms in addition to the twenty described above. Recall that in the description of instrument development, two modifications had been made on basic clusters, goals and content, of the fractions/decimals strand. For one cluster, two versions were constructed one of which had the word decimal replaced by the word fraction, and vice versa. The other cluster also appeared in two versions. It concerned the level of instruction--one concerned learning concepts and skills with fractions and decimals after grade six and the other had the same item content except the learning was prior to grade nine. We elected to halve the size of the subsamples responding to this cluster rather than doubling the number receiving the other clusters of the fractions/decimals strand.

The design of each of the resulting 24 forms is indicated in the figure on the next two pages by the specification of the clusters appearing on each form. The column on the right indicates the size of the sub sample receiving this form for each 1000 people in a sample.

The instruments for determining curricular preferences for the secondary school mathematics program were made as similar to those for the elementary school as was possible. This was to allow comparisons across the school levels where the wording of items was identical or similar enough for the comparisons to be appropriate. Thus, to construct a secondary preference form, an elementary form was selected, and if a cluster was the same, its position in the form was not changed. If there were a minor change in wording, it was made and the position of the cluster was not changed. If there was a change in the cluster, the new cluster was substituted for the elementary alternatives cluster. A few clusters had more items on the secondary version. The algebra content cluster had an additional 5 items and the probability/statistics content cluster had an additional 5 items. The longer cluster was substituted for the shorter elementary version with a corresponding renumbering of items. An additional 20-item content cluster in algebra and a 15-item content cluster in geometry were needed for the secondary school forms. These were broken into three ten-item and one five-item subclusters in order to fit the 120-item limit to a form. For forms with geometry or algebra in the interior, 320, 321, 100, 110, 101, and 111, these clusters were placed with the other geometry or algebra clusters in the interior of the form. Otherwise, they were treated as the other beginning or ending clusters.

Priorities Surveys

The design of the instruments for the priorities surveys took place after the mailing of the preference surveys had begun. The priorities survey instruments were designed to reflect curricular decision making of a more global nature than was characteristic of the items of the preference surveys. The items allowed individuals to consider the interactive nature of the various factors contributing to curricular decision making.

Form Number	Clusters												Number of Items	Sample Size
000	CL4	MS1	FD1A	FD2A	FD2B	FD3	FD4	FD5	FD6	PS5	AL2		110	25
001	PS5	AL2	FD1A	FD2A	FD2B	FD3	FD4	FD5	FD6	CL4	MS1		110	25
010	CL4	MS1	FD1B	FD2A	FD2B	FD3	FD4	FD5	FD6	PS5	AL2		110	25
011	PS5	AL2	FD1B	FD2A	FD2B	FD3	FD4	FD5	FD6	CL4	MS1		110	25
100	WN3	FD1A	AL1	AL2	AL3	AL4	AL5	AL6	PS6	MS2	RP4		110	25
101	PS6	MS2	RP4	AL1	AL2	AL3	AL4	AL5	AL6	WN3	FD1A		110	25
110	WN3	FD1B	AL1	AL2	AL3	AL4	AL5	AL6	PS6	MS2	RP4		110	25
111	PS6	MS2	RP4	AL1	AL2	AL3	AL4	AL5	AL6	WN3	FD1B		110	25
220	FD3	PS1	WN1	WN2	WN3	WN4	WN5	WN6	GM6	CL2	PB5		110	50
221	GM6	CL2	PB5	WN1	WN2	WN3	WN4	WN5	WN6	FD3	PS1		110	50
320	RP5	PB3	GM1	GM2	GM3	GM4	GM5	GM6	WN4	PS2			120	50
321	WN2	PS2	GM1	GM2	GM3	GM4	GM5	GM6	RP5	PB3			120	50
420	PB1	CL5	PS1	PS2	PS3	PS4	PS5	PS6	GM4	RP2	AL3		110	50
421	GM4	RP2	AL3	PS1	PS2	PS3	PS4	PS5	PS6	PB1	CL5		110	50
520	AL1	WN1	AL6	RP1	RP2	RP3	RP4	RP5	RP6	PB2	MS5	GM3	120	50
521	PB2	MS5	GM3	RP1	RP2	RP3	RP4	RP5	RP6	WN1	AL6	AL1	120	50

Form Number	Clusters												Number of Items	Sample Size
620	RP1	PS4	PB1	PB2	PB3	PB4	PB5	MS3	WN5	FD6	AL1		120	50
621	AL1	MS3	WN5	FD6	PB1	PB2	PB3	PB4	PB5	RP1	PS4		120	50
720	AL1	CL1	RP6	MS1	MS2	MS3	MS4	MS5	MS6	AL5	[illegible]4	GM2	120	50
721	AL5	FD4	GM2	MS1	MS2	MS3	MS4	MS5	MS6	CL1	RP6	AL1	120	50
820	FD5	AL4	WN2	CL1	CL2	CL3	CL4	CL5	RP3	MS6	GM1	AL1	120	50
821	AL1	RP3	MS6	GM1	CL1	CL2	CL3	CL4	CL5	FD5	AL4	WN2	120	50
920	FD2A	AL1	WN6	GM5	PS3	PB4	MS4	CL3	GM1	FD2B			120	50
921	FD2B	GM1	CL3	MS4	PB4	PS3	GM5	WN6	AL1	FD2			120	50

Figure 1.
Cluster Sampling for Instrument Forms for
Samples Responding to Elementary Curriculum Item Pool

Item sampling was not used for the main portion of the instruments. With one exception, the only variation from form to form of the instrument was in terms of the demographic items that were specific to the populations being sampled. The single exception was that two lay populations, presidents of school boards and parent-teacher associations, were not asked to indicate their reasons for assigning priorities whereas the professional and lay samples were. The demographic item sets were identical to those used for the preference surveys. Eleven items from the forty-five item introductory set were selected to use to help respondents acquire a mind-set for thinking in terms of the priorities for mathematics curriculum during the next decade.

The main body of questions on the priorities instrument were of two types, those concerned with curricular priorities and those in which the intent of the item was concerned primarily with the means and processes for producing curricular and instructional change. The first type requested ordered priority decisions concerning the five primary factors that had been used to structure the design of clusters within each strand of the preference instrument item pool. The items were designed on a forced choice basis to provide contrasts in terms of goals, content selection, methods, resources, and attention to the needs of special categories of students. The use of the calculator, a sixth cluster type for the preference survey, was considered to be part of the resources factor for the purposes of the priorities survey. Following is an example of the type of item used for determining the content selection priorities.

> Imagine that you have a limited amount of money to spend for the development of new materials for grades 7-12 in the areas listed below. Please indicate the order in which you think the money should be spent by making the answer sheet in the following way:
>
> a = highest priority
> b = second highest priority
> c = middle-level priority
> d = second lowest priority
> e = lowest priority
>
> Be sure to use each letter only once for the next five items.
>
> 13. Algebra
> 14. Probability
> 15. Geometry
> 16. Computer literacy
> 17. Statistics

For all of the samples, except those representing the presidents of school boards and parent-teachers associations, an item of this type was followed by two parallel items inquiring as to the reasons for identification of the lowest and highest choices in making the ordered priority decision. For the item given above, two examples are give below:

18. Consider the content area (questions 13 thru 17) above that you ranked lowest (marked with an "e"). Of the following five ideas, which best describes the reason you gave it lowest priority?

   a = The materials we presently have in this area are more nearly adequate than the materials we have in the other four areas.

   b = This area does not present many problems for most teachers.

   c = It is not as important for students to develop skills in this area as it is in other areas in the list.

   d = Changes are needed in this area, but new materials would be an inefficient way to promote such changes.

   e = The importance of this area will diminish during the 1980s.

19. Consider the content area (questions 13 thru 17) above that you ranked highest (marked with an "a"). Of the following five ideas, which best describes the reason you gave it highest priority?

   a = We have fewer good materials to choose from in this area than in the other four areas.

   b = This is a major problem area for many, many teachers.

   c = It is absolutely crucial that more students develop skills in this area.

   d = New ideas have been developed in this area that are not reflected in present materials.

   e = The importance of this area will increase during the 1980s.

The priorities items that were specific to each of the five given factors were followed by items that requested the assignment of priorities across the factors. An example of one of these items follows:

In previous questions you have ranked priorities within the broad areas of mathematics content, students with special needs, and teacher education. To these areas might also be added the development of non-text teaching materials and the development of special teaching methods. In what order should these areas be studied or developed during the 1980s? Please indicate your priorities by marking the answer sheet in the following way:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

47. Improved mathematics content for textbooks

48. Development of special mathematics materials for students with special needs

49. Improved preservice and in-service education for teaching mathematics

50. Development of non-text materials for teaching mathematics

51. Improvement of methods and techniques for teaching mathematics

The items that inquired concerning curricular priorities concluded with questions about factors that are not specific to the teaching and learning of mathematics. Factors such as discipline, lack of motivation of students, class size, and mainstreaming have an impact on the teaching and learning of mathematics but affect performance in all areas of the school program. Respondents were asked to specify for fifteen such factors how serious a problem it was in the teaching and learning of mathematics and, finally, to indicate whether the general problems of this nature deserve priority attention over those that are unique to the teaching and learning of mathematics.

The second type of item on the priorities instruments asked for opinions about how research or development funds should be used during the coming decade to attack problems in mathematics education. Fifteen processes, such as supporting in-service education of teachers, creating many small basic research projects, and giving development grants to individual teachers, were compared in terms of general importance, practicality, and efficiency.

Appendix B.2 contains a sample of the priorities survey form. The same form was sent to the AT, MT, SP, TE, and PR samples; it contained 92 items. The SB and PT samples were not asked to select reasons for their rankings; therefore, their form contained only 84 items.

Processes of Population Sampling

Surveys were mailed to samples of nine populations. Each sample was generated to be representative of the nation as a whole but since most of the samples were identified from membership rosters of professional organizations, representativeness is a function of the representativeness of the parent organization. Demographic data for each population are given in the following section that provide evidence of the representative nature of each sample.

The teacher samples were selected to represent leaders at the elementary and the secondary school levels. The initial intent was to select leaders because they would have better judgments concerning the trends and directions of curriculum development in terms of perspectives of needs for mathematics programs. The intent was to collect considered, thoughtful opinions of what-ought-to-be during the coming decade of the 1980's. The membership roster of the National Council of Teachers of Mathematics provided the base for identifying addresses. Two sample frames were identified, one that would be mostly elementary teachers and the other to be mostly secondary teachers, according to the following criteria:

AT--members of the NCTM who subscribe to the Arithmetic Teacher but do not subscribe to the Mathematics Teacher and who are not on NCTM's rosters of supervisors or teacher educators

MT--members of the NCTM who subscribe to the Mathematics Teacher but do not subscribe to the Arithmetic Teacher and who are not on NCTM's rosters of either supervisors or teacher educators.

It was hoped that the conditions specified for identifying sampling frames would serve to provide samples of teachers having primary teaching responsibility at either the elementary or the secondary school levels. For each frame, an n was selected to produce a sample of 1000 for the preference survey and a sample of 500 for the priorities survey. That is, if there were 12,372 subscribers to the Arithmetic Teacher, every twelfth name was selected to make a . ple of 1000. Every nth name was selected from the population address list which had been zip code ordered.

The process used has some deficiencies. First, there are some regional variations in terms of the portion of teachers belonging to NCTM. Second, the subscription lists do not allow the identification of teachers according to the level(s) at which they teach. Early in the course of the project we had regrets about not being able to prepare survey instruments that focused more specifically on the issues and problems of the middle or junior high school curriculum and the high school curriculum. The sampling process would not allow this type of tailoring of the instrumentation to specific grade levels. We were also not sure whether a subscription to the Arithmetic Teacher assured teaching at the elementary school level or to the Mathematics Teacher assured teaching at the secondary school level. The demographic data reported in the next section indicates this apprehension was justified. We were also quite aware of the fact that by excluding individuals who subscribed to both journals that we were excluding some of the more significant leadership in the NCTM from the sampling.

Two preference survey forms were mailed to each member of the AT and MT samples. The cover letter requested that the second survey form be given to a colleague in the same school system. The two forms of the instruments did not have a cluster in common. The purpose of sending two forms to the same school was to improve the representativeness of the sample by having non-NCTM members respond to the preference items.

Two samples were identified having primarily responsibilities for instruction of the products of the high school mathematics curriculum. Preference survey forms designed for the secondary school curriculum were sent to approximately 500 member samples selected from the following frames:

JC--membership roster of the Mathematics Associations of Two-Year Colleges.

MA--membership roster of the Mathematical Association of America.

Samples were selected for both the preference and priorities surveys from two populations concerned with preservice and in-service teacher education. Each sample for each survey was constituted of 500 names selected from:

TE--the roster of teacher educators maintained by NCTM.

SP--the roster of supervisors maintained by NCTM.

The former is a population of individuals who are employed primarily by institutions of higher education and have been identified by NCTM as having responsibilities for teacher education. A significant subset are researchers in mathematics education. The supervisor population not only has primary responsibility for in-service education in the schools but also often has responsibility for curriculum, instruction, and evaluation of school mathematics programs.

Each of the six populations identified for sampling in the previous part of this section were identified as professionals in the sense that they have the necessary background and understanding of mathematics teaching and mathematics to render informed judgments about curricular issues and problems in mathematics education. Three other samples were identified as lay samples based on this distinction:

PR--principals at the elementary and secondary school levels

SB--presidents of school boards

PT--presidents of local parent-teacher association groups

These samples provided problems in terms of identifying a sample list of the names of individuals with addresses. For each of the samples, we purchased randomly selected mailing lists of 1000 labels of school or school system addresses each with the appropriate title designated on the label. Using the title, such as President, School Board, was projected to affect the rate of return; consequently, a follow-up mailing was used for these populations. The address pool that was sampled contained addresses of all school systems arranged in zip code order.

The following table specifies the sample sizes and the return rates. The low rate of return for the SB and PT samples on the priorities surveys led to the pooling of the data for these two samples. Although this produces a larger number of respondents for a given question from these lay populations, the priorities results need to be examined with awareness of the dangers associated with low return rate. Since the overwhelming majority of comparisons of the responses to items on the preference surveys between NCTM and non-NCTM members did not produce statistically significant differences, the NCTM and non-NCTM responses were pooled in order to decrease the amount of data in this report.

TABLE 2

Sample Size and Return Rates

for Preference and Priority Surveys

	Preference Survey			Priorities Survey		
	Sample Size	Answer Forms Returned	Rate of Return	Sample Size	Answer Forms Returned	Rate of Return
AT-NCTM	1000	323	32.3%	500*	210	42.0%
Non-NCTM	1000	174	17.4%			
Combined	2000	497	24.8%			
MT-NCTM	1000	337	33.7%	500*	191	38.2%
Non-NCTM	1000	186	18.6%			
Combined	2000	523	26.2%			
JC	502	180	35.8%			
MA	493	167	33.9%			
SP	500	300	60.0%	490	255	52.0%
TE	500	232	46.4%	500	311	62.2%
PR	1989*	543	27.3%	999*	206	20.7%
SB	852*	185	21.7%	427*	65	15.2%
PT	657*	98	14.9%	334*	33	9.9%

*follow-up mailing

Characteristics of the Samples

Each survey form began with questions designed to provide information about the sample. The number of such demographic items varied from sample to sample since questions designed to reveal characteristics about one sample were inappropriate for other samples. For example, the request of teacher samples for an indication of the grade level at which they taught would not fit the responsibilities of a PTA member. The purpose of this section of the report is to describe general characteristics of the samples evident in the responses to the demographic items.

One question was common to all samples. The question was to provide an indication of whether a sample generally felt positive about the schools and how children are taught. It was felt that if a sample exhibited responses to preference or priority items that differed markedly from the responses of another sample that one possible way of accounting for the discrepancies might be in terms of the samples' differing perceptions of the effectiveness of the schools. Before examining the responses to other items of the surveys, responses to this demographic item will be discussed in order to provide an example of how the majority of responses to other items of the surveys will be displayed and discussed.

The question common to all surveys is the following:

DEMO5

With respect to the way schools are organized and children are taught, I am:

a. Very satisfied
b. Somewhat satisfied
c. Undecided
d. Somewhat dissatisfied
e. Very dissatisfied

For each item with five alternatives for responses that could be ordered, a coefficient of agreement was computed by assigning the five-point scale to the numbers 2, 1, 0, -1, and -2, with 2 assigned to the most positive alternative response and -2 assigned to the most negative response, and finding the weighted average for the sample's responses. In addition, the percent of the sample selecting one of the two positive responses and the percent of a sample selecting one of the two negative responses are given.

Table 2 displays these three statistics for DEMO5 for all nine samples and for the total pool of all respondents.

The format of this table is used for reporting data for most other items of the surveys. The left-hand column indicates the item number. Under the sample code for each item appear three statistics: first, the coefficient of agreement; next, the percent of positive responses; and, at the bottom, the percent of negative responses. The text accompanying most tables identifies the content of the items and the item code number in order that precise wording of the item may be found in an appendix.

The statistics for DEMO5 indicated that no sample was very positive in their satisfaction with the way schools are organized and children are taught. The relative sizes of the coefficients of agreement indicated the comparative satisfaction of the samples, with the SB sample appearing most satisfied and the MA sample least satisfied. The three samples constituted of members most likely to have post-secondary teaching responsibilities, JC, MA, and TE, exhibited the most dissatisfaction and were the only groups with predominantly negative responses. None of the samples was strongly positive. Each samples' response pattern was bi-modal, with the neutral response being selected by few individuals.

Most items have five response levels that range across strong agreement, moderate agreement, neutral, moderate disagreement, and strong disagreement. The majority of discussion of items is in terms of the percent of agree and percent of disagree responses with the coefficients of agreement used if secondary interpretations were necessary. Percents of agreement are interpreted as follows:

Strong agreement	80%
Moderate agreement	60%-79%
Minimal agreement	54%-59%
Very little (weak) agreement	25%-53%

It is important to note the percent of a sample selecting a neutral response if minimal or very little agreement is observed for an item; a lack of agreement should not be assumed the equivalent of disagreement.

Thus, for the DEMO5 item, the SP, PR, and SB samples indicated moderately strong satisfaction with the way schools are organized and children

TABLE 2

Satisfaction with the schools and the way children are taught

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
DEMO5	0.189	0.218	0.117	-0.471	-0.506	0.298	-0.194	0.623	0.782	0.359
	56.0%	57.5%	52.4%	28.2%	25.0%	61.6%	40.9%	75.6%	78.7%	59.8%
	38.0%	37.2%	40.0%	62.6%	61.0%	34.8%	51.4%	22.1%	20.1%	30.4%

AT--a sample selected from the subscribers to the Arithmetic Teacher
MT--a sample selected from the subscribers to the Mathematics Teacher
JC--a sample selected from the members of the Mathematical Association of Two-Year Colleges
MA--a sample selected from the members of the Mathematical Association of America
SP--a sample selected from the NCTM list of supervisors
TE--a sample selected from the NCTM list of teacher educators
PR--a sample of school principals
SB--a sample of presidents of school boards
PT--a sample of presidents of local PTAs

are taught. The AT and PT samples exhibited minimal satisfaction and the MT, JC, MA, and TE samples showed very little agreement.

AT and MT Sample Characteristics

Teachers responded to four additional demographic items concerned with years of teaching experience, type of community, grade level of their teaching, and the number of mathematics courses taken for college credit. Responses are not exhibited in terms of the three statistics discussed in the previous section, since the response alternatives do not fit those statistics meaningfully.

The AT sample fits the characteristics that were sought for the group of teachers responding to the elementary curriculum questions. They have sufficient experience to have perspective and judgment about the issues and problems in curriculum. In terms of the number of courses in mathematics, the sample was somewhat above average and could be considered sufficiently knowledgeable in mathematics for the judgments required by the instruments. They are broadly representative of schools serving all sizes of communities. The only disconcerting demographic characteristic is the relatively high portion in the upper grade levels for the AT sample; a larger portion of the group teaching at the elementary school levels, kindergarten through sixth grade, would be preferable, along with a corresponding reduction in the size of the group teaching grades 9 to 12. This would have rendered the judgments about items concerning the elementary school issues and problems of curriculum more trustworthy in the sense that the sample would have a more representative base of experience.

The MT sample fits the desired characteristics of leadership for the responding group of teachers for issues and problems concerned with the secondary school mathematics curriculum somewhat better than the AT sample fits the characteristics desired for the elementary school curriculum. The MT sample as a group is more experienced than the AT sample, is uniformly spread across schools representing different sizes of community settings, and has considerable background in course work in mathematics.

DEMO1 I have taught

	AT	MT
< 3 years	6.1%	3.9%
3-8 years	24.9%	19.0%
9-14 years	36.0%	25.9%
15-20 years	15.9%	22.5%
> 20 years	17.2%	28.6%

DEMO2 The majority of students in my school are residents of

	AT	MT
Urban/Metro pop > 50,000	22.7%	20.9%
Urban fringe/Sub	21.0%	23.9%
Small-city 25,000-150,000	20.1%	20.3%
Town < 25,000	22.7%	20.7%
Rural	13.6%	14.2%

DEMO3 I teach students who are in grades

	AT	MT
K-3	10.9%	1.2%
4-6	21.0%	0.7%
7-8	40.9%	7.2%
9-12	18.7%	72.8%
Other	8.6%	19.1%

DEMO4 I have taken the following number of mathematics content courses for college credit

	AT	MT
0-1	4.6%	1.1%
2-4	18.1%	0.9%
5-9	19.4%	7.2%
10-15	20.6%	18.0%
> 15	37.3%	72.8%

JC and MA Sample Characteristics

The JC and MA samples responded to many of the same demographic items. Since both samples are constituted of teachers primarily, and tend to work with the same levels of students, the data for the two populations are presented together.

The JC and MA samples were expected to respond to two questions that asked their judgment concerning specific strengths (DEMO10) and weaknesses (DEMO9) of the students with whom they work. The response patterns to these items are notable in that there was relatively close agreement between samples concerning the strengths and the sources of difficulty for the students. Computational proficiency and skills were noted as a strength of the students by about as many individuals in both samples as noted it as the primary difficulty; similarly for the conceptual understanding of algebra and number. Geometric understanding and proficiency did not appear to be either a notable deficiency or strength of the students; does this mean that geometry is not used extensively in collegiate level mathematics? The study habits and motivation alternatives warrant comment in that study habits in mathematics was noted by few respondents in either sample as a strength of the students, and motivation was noted as a strength by close to 40% of both samples.

DEMO6 Have you taught mathematics at the secondary school level?

	JC	MA
Yes	72.4%	47.2%

DEMO7 The school at which I teach is best characterized as

	JC
Community College	75.9%
Technical School	12.1%
Branch Campus of 4-year School	5.2%
Independent 2-year College	1.7%
Other	5.2%

DEM12 The school at which I teach is best characterized as

	MA
College	28.7%
University	46.1%
Branch Campus of 4-Year School	1.7%
Two-Year College	15.7%
Other	7.8%

DEM08 The majority of the mathematics I am teaching this year is best described in terms of

	JC	MA
Technical Math for a Vocational Program	11.0%	57.1%
Remedial	20.3%	42.9%
General Education/Liberal Arts Requirement	19.8%	0.5%
Transfer Courses for 4-year Program	41.3%	0.0%
Other	7.6%	0.0%

DEM11 My professional responsibilities are best characterized as

	MA
Teaching Undergraduate Majors	29.9%
Teaching Undergraduate Courses	43.8%
Teaching Graduate Math	3.5%
Applied Math in Industry	16.0%
Research	6.9%

DEM09 If you consider only the background of students in your classes as a factor, would you conclude that among the following their primary source of difficulty is

	JC	MA
Computational Proficiency	41.5%	39.9%
Conceptual Understanding	21.7%	25.6%
Geometry	0.0%	3.3%
Study Habits	22.2%	24.0%
Motivation	15.2%	7.4%

DEM10 If you consider only the background of students in your classes as a factor, would you conclude that among the following their primary strength is

	JC	MA
Computational Proficiency	34.3%	34.0%
Conceptual Understanding	22.4%	14.0%
Geometry	2.2%	4.0%
Study Habits	3.7%	8.0%
Motivation	37.3%	40.0%

SP Sample Characteristics

The range and dispersal of the responses is typical of the population of supervisors generally. Note the percent supervising at both elementary and secondary school levels. One caution is in order: the word "supervising" was not defined. There may be considerable variation in the meaning applied to the word.

DEM16 My professional responsibilities include supervising teachers at

	SP
Elementary School Level	13.5%
Secondary School Level	20.8%
Both	60.4%
Other	5.0%

DEM17 The percent of time spent directly in supervising teachers

	SP
100%	16.3%
75%	19.7%
50%	22.0%
25%	29.0%
0%	13.0%

DEM18 My supervisory responsibilities are to teachers in a

	SP
Single Building	5.4%
Small Local School District	12.5%
Large Local School District	45.3%
Regional or County District	23.3%
State	13.5%

TE Sample Characteristics

It was expected that the TE sample would be constituted of mostly employees in institutions of higher education, either in departments of mathematics or in departments of education, who have a primary responsibility in teacher education for mathematics teaching at the elementary or secondary levels. The demographic questions inquired concerning the extent and nature of teacher education responsibilities.

Many of the respondents indicated that they did not like to characterize themselves in the ways required by this and the other demographic items. The items were criticized by forcing artificial, restrictive classifications that do not adequately describe the nature of teacher education responsibilities in higher education. Note that the final category specifies that an individual does not work in teacher education.

DEM13 Do you work most frequently with

	TE
Preservice Programs	38.7%
In-service Programs	5.2%
Both	42.4%
None	13.7%

DEM14 My responsibilities in teacher education are mostly in terms of

	TE
Methods and Field Experience	21.6%
Mathematics Content	33.2%
Both	42.1%
None: Responsibilities not Described	3.0%

DEM15 My work in teacher education is directed primarily toward teachers at the following levels

	TE
Elementary K-6	29.3%
Secondary 7-12	25.6%
Both K-12	42.4%
Neither	2.7%

PR Sample Characteristics

The PR sample responded to eight demographic items in addition to the question concerning satisfaction with the way schools are organized and children are taught. The PR sample appears to be relatively uniformly spread over different sizes of communities. It should be noted that significantly more students live in urban communities, the first two categories of responses, than is evident in the distribution of the PR sample.

The data from DEM29 (experience as principal) and DEM19 (age) indicate that more are experienced professionals. Thirty-eight percent indicated that they had been a teacher of secondary school mathematics, 78.3% indicated that they held a secondary school teaching certificate, and 38.5% indicated they held an elementary school teaching certificate. Just over 60% of the principals have academic work between a masters and a doctorate, 22.1% have a masters degree, and 8.5% have a doctorate. Only 9.1% hold only a bachelor's degree.

DEMO2 The majority of students in my school are residents of

	PR
Urban/Metro > 150,000	18.1%
Urban/Suburban	16.5%
Small City 25,000 to 150,000	13.4%
Town < 25,000	24.1%
Rural	27.8%

DEM19 I am

	PR
Under 25	0.4%
25 to 34	16.1%
35 to 44	34.1%
45 to 54	34.9%
55 or Over	14.5%

DEM20 I have

	PR
Children in Elementary School Only	25.0%
Children in High School Only	21.2%
Both	18.1%
No Children Currently in K-12	24.1%
No Children	11.7%

DEM29 I have been principal for

	PR
0-5 years	33.5%
5-10 years	28.7%
10-15 years	19.3%
> 15 years	17.3%

SB Sample Characteristics

The sample of school board presidents was representative of rural areas and towns, primarily. The ages of the SB sample is correlated with their having children in school. The SB sample was relatively well-educated as indicated by the responses. Interestingly, 57.5% were teachers in the past.

Prior to the year of the survey, 49.7% indicated they had been school board members, 20.9% indicated they had served as volunteer aides in the schools, and 0.6% indicated sérvice as paid aides, while 48.6% indicated prior membership in a PTA.

DEM02 I live in a community that is

	SB
Urban/Metro	1.7%
Urban/Suburban	10.1%
Small City	7.3%
Town	33.7%
Rural	47.2%

DEM19 Iam

	SB
Under 25	1.7%
25-34	15.6%
35-44	33.5%
45-54	39.1%
55 or Over	10.1%

DEM20 I have

	SB
Children in Elementary School Only	17.3%
Children in High School Only	24.6%
Children in Both	19.0%
No Children Currently in K-12	26.8%
No Children	12.3%

DEM21 Check the statement that best describes your formal educational experience.

	SB
High School Graduate	6.7%
Some School beyond High School	17.8%
College Graduate	30.0%
More than one College Degree	45.6%

PT Sample Characteristics

The sample of presidents of parent teacher associations was relatively uniformily spread across different sizes of communities. The ages are indicated by the responses. Most have children in school with 80.0% having a student in elementary school. The educational experience ranges from 2.2% having not completed high school, 17.2% with high school graduation, 29.0% with some college, 34.4% college graduates, and 17.2% having more than one college degree. Thirty-six percent indicated that they were teachers and 5.4% were school board members prior to the year of the survey. In response to the query of whether they had served as aides, 29.3% indicated on a volunteer basis, and 3.3% indicated on a paid basis. Eighty-eight percent indicated prior experience as a PTA member.

DEM02 I live in a community that is

	PT
Urban/Metro	22.2%
Urban/Suburban	20.0%
Small City	11.1%
Town	22.2%
Rural	24.4%

DEM19 I am

	PT
< 25	1.1%
25-34	43.0%
35-44	41.9%
45-54	9.7%
Over 55	4.3%

DEM20 I have

	PT
Children in Elementary School Only	46.2%
Children in High School Only	8.6%
Both	34.4%
No Children Currently in School K-12	5.4%
No Children	5.4%

Introductory Items

The data from the introductory items provide evidence about the samples' perceptions of priorities for curricular emphasis during the decade of the 1980's. Although the item sampling procedure was not uniform across the samples, the data provide a background for interpreting the more carefully collected information from the main body of the preference survey or the priorities survey. Data from the first-round and second-round surveys were pooled.

The introductory items follow this stem:

Consider the mathematics program from kindergarten through twelfth grade. Below are several phrases indicating areas of the program that could receive more or less emphasis during the coming decade. Mark each with the response that best describes your feeling concerning what should be the trend.

a. should receive much more emphasis
b. should receive somewhat more emphasis
c. should receive about the same emphasis as now
d. should receive somewhat less emphasis
e. should receive much less emphasis

The number of introductory items received depended on how many answer spaces were left in the general information section of the answer form after the demographic items were specified for a given population.

Twelve introductory items were responded to by all nine samples. Considering the response patterns to these items provides a basis for examining the responses to other introductory items. Ranked in order from highest level of support to lowest level, the items are shown in the following table that specifies the ranges of the percent of the samples indicating more emphasis is needed.

Problem solving was the most popular topic for increased emphasis during the coming decade. All samples had at least 76% of the respondents indicating that problem solving should receive more emphasis. It had the highest inferred rank for all samples except the MT sample, which ranked it number two following basic skills. Problem solving was followed closely by applications of mathematics as the second choice by most of the samples within this set of twelve topics. The applications topic was supported particularly strongly by the lay samples and had its weakest level of support by the MA sample.

Twelve Introductory Items Responded to by All Samples

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
UF12	1.367	1.407	1.318	1.371	1.250	1.428	1.506	1.213	1.225	1.080
	87.8%	90.4%	87.7%	92.0%	81.3%	88.2%	91.5%	84.1%	79.8%	76.0%
	1.3%	0.4%	0.3%	0.0%	0.0%	3.4%	1.7%	0.6%	0.0%	2.0%
UF8	1.118	1.131	1.123	1.323	0.792	1.113	1.034	1.219	1.125	1.140
	81.8%	80.2%	83.7%	95.2%	62.5%	82.5%	80.0%	83.3%	79.5%	86.0%
	1.9%	1.2%	1.1%	1.6%	0.0%	2.9%	3.6%	0.6%	2.3%	0.0%
UF24	1.069	1.018	0.991	0.750	1.143	1.020	1.060	1.509	1.108	1.067
	75.6%	70.4%	75.0%	60.0%	69.6%	74.6%	77.4%	89.2%	79.6%	75.6%
	2.7%	3.2%	2.6%	1.7%	0.0%	3.1%	2.8%	1.1%	4.3%	4.4%
UF1	0.996	1.199	1.294	1.317	1.042	0.379	0.556	1.429	1.258	1.280
	68.2%	76.9%	81.8%	86.7%	68.8%	37.4%	49.5%	88.1%	82.0%	86.0%
	5.3%	1.4%	1.1%	0.0%	2.1%	10.0%	13.7%	1.4%	2.2%	2.0%
UF2	0.968	1.008	0.924	1.204	0.804	0,959	0.890	1.113	0.854	0.837
	72.2%	73.3%	70.0%	85.7%	66.0%	69.6%	69.7%	79.6%	67.4%	67.3%
	2.7%	1.2%	2.5%	0.0%	5.4%	2.1%	4.4%	2.5%	4.5%	4.0%
UF36	0.879	0.593	0.966	1.229	1.273	0.600	0.574	0.790	0.591	0.653
	64.8%	55.5%	68.1%	82.4%	82.6%	55.0%	60.6%	57.7%	50.0%	51.1%
	3.4%	7.4%	2.5%	0.6%	1.9%	10.0%	13.1%	1.7%	3.4%	2.0%
UF40	0.778	0.935	0.807	0.810	0.297	0.783	0.525	0.966	0.935	1.182
	61.0%	72.2%	63.9%	67.8%	40.5%	55.0%	49.2%	64.6%	63.4%	77.3%
	6.8%	4.7%	7.6%	6.0%	16.4%	8.3%	8.2%	1.7%	4.3%	0.0%
UF30	0.681	0.596	0.790	0.698	0.832	0.923	0.918	0.509	0.363	0.683
	59.6%	55.3%	64.8%	62.8%	68.3%	73.1%	72.1%	50.3%	40.7%	53.6%
	5.5%	3.2%	1.9%	7.1%	3.1%	1.9%	1.6%	10.2%	11.0%	0.0%

Twelve introductory items responded to by all samples (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
UF7	0.640	0.603	0.436	0.510	0.089	0.789	0.853	0.766	0.636	0.796
	56.2%	61.6%	44.7%	51.0%	28.5%	64.5%	65.3%	59.9%	56.8%	65.3%
	10.6%	19.1%	12.3%	12.2%	21.5%	9.2%	4.0%	6.8%	9.1%	6.1%
UF29	0.408	0.383	0.343	0.150	0.509	0.404	0.483	0.544	0.258	0.537
	38.3%	36.2%	34.3%	33.3%	47.2%	36.5%	41.6%	42.7%	32.3%	41.5%
	7.6%	5.4%	8.6%	21.7%	9.1%	5.8%	6.7%	4.7%	7.5%	4.9%
UF5	0.289	0.340	0.464	0.426	0.319	1.088	1.000	0.224	-0.148	-0.500
	45.1%	51.3%	51.2%	47.5%	44.7%	85.3%	73.7%	40.2%	29.5%	16.0%
	19.0%	20.7%	13.6%	13.1%	17.1%	0.0%	0.0%	19.3%	33.0%	42.0%
UF37	0.077	0.144	0.017	-0.660	-0.491	0.050	-0.393	0.547	0.204	0.400
	30.7%	33.7%	26.1%	6.0%	17.6%	23.5%	18.1%	47.2%	34.4%	42.5%
	23.3%	22.1%	25.2%	56.0%	45.6%	16.7%	44.3%	6.9%	16.2%	7.5%

UF12 Problem solving
UF8 Applications
UF24 Gifted students
UF1 Basic skills
UF2 Diagnosis and remediation
UF36 Daily homework
UF40 Low achievers
UF30 Probability and statistics
UF7 Individualization
UF29 Geometry
UF5 Use of calculators
UF37 Calculus in high school

Basic skills provided a contrast with applications and problem solving. The level of support for basic skills was particularly strong by the MT and JC populations. For the MT sample it ranked first and for the JC sample it ranked third. Lay samples also gave it strong support, with 82% to 88% of the samples indicating more emphasis was needed. The weakest support was found with the TE and SP samples.

The data for gifted students and for low achievers provide an interesting contrast, particularly when the level of emphasis is compared to current investment of resources in the two areas. If the data across the samples is pooled, 75.6% of the respondents would increase the emphasis on gifted students, but only 61.0% would increase the emphasis for low achievers. The sample with least support for emphasis on low achievers is the MA sample. The JC sample exhibited the lowest level of support for more emphasis in working with the gifted.

The support for increased emphasis on topics concerned primarily with methods of teaching — UF 2, Diagnosis and remediation; UF36, Daily homework; and UF7, Individualization — were of moderate strength. The support for diagnosis and remediation was at about the same level across all samples, with higher support exhibited by the AT, MT, JC, TE, SP, and PR samples. Daily homework, interestingly, was not valued as highly by the lay samples as by other samples, and the JC and MA samples would increase the emphasis on daily homework markedly in contrast with other populations. Individualization, supported for increased emphasis by only 56.2% of the pooled respondents, had its weakest support from the professional samples.

Three items concerned with more typical curriculum topics were responded to by each sample. These were UF29, Geometry; UF30, Probability and statistics; and UF37, Calculus at the high school level. Calculus at the high school level was the only topic of the twelve common items that received more negative than positive support from three samples, the JC, MA, and SP samples. Only 30.7% of the pooled respondents were in favor of increasing the emphasis on this topic. Geometry was perceived as a more likely candidate for increased emphasis; however, 38.3% of all pooled respondents felt that the present level of emphasis was appropriate. Of the three curricular topics responded to by all samples, probability and statistics received the most support for additional emphasis.

The lay samples were less supportive than the professional samples. Even among the professional samples, support was weak: 48.3% of the pooled professional samples indicated that somewhat more emphasis should be given to this topic, whereas only 16.8% indicated it needed much more emphasis.

The use of calculators item (UF5) produced the greatest range in level of support of any of the items (16.0% to 85.3% across the samples). Only two samples were dramatically in favor of increasing the emphasis on the use of calculators, the SP and TE samples. None of the lay samples had a majority of respondents willing to have more emphasis on the use of calculators, and the PT sample was the most negative. The response levels of the AT, MT, JC, and MA samples fell midway between the lay samples and the SP and TE samples.

The remaining 33 items from the introductory item pool were not responded to by all samples. The discussion of these items that follows is organized around items that group together in terms of addressing a common factor or providing useful contrasts. The samples responding, unless stated otherwise for a given item, are AT, MT, SP, and TE.

Four items were concerned with technology: UF5, Use of calculators; UF6, Use of computers and other technology; UF16, Computer managed instruction; and UF39, Computer literacy. Computer literacy was intended to describe curricular content, whereas the other items specified the use of computer technology as a tool in teaching. Computer literacy enjoyed strong support from the MT, SP, and TE samples, but moderate from the AT and MA samples. The use of the calculator had strong support for increased emphasis from the SP sample and moderately strong support from the TE sample. Other professional groups and the lay samples gave very little support for increasing the emphasis on the use of calculators. Interestingly, the samples all gave stronger support for the use of the computer and other technology than of calculators. Computer managed instruction had only weak support from the four samples responding to the item.

Technology

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
UF5	0.492	0.340	0.484	0.426	0.319	1.088	1.000	0.224	-0.148	-0.500
	45.1%	51.3%	51.2%	47.5%	44.7%	85.3%	73.7%	40.2%	29.5%	16.0%
	19.0%	20.7%	13.6%	13.1%	17.2%	0.0%	0.0%	19.3%	33.0%	42.0%
UF6	0.960	0.897	1.101			0.829	0.882	1.149	0.957	0.976
	76.7%	71.9%	80.4%			67.1%	72.3%	85.6%	71.0%	78.0%
	4.2%	3.4%	3.9%			3.9%	2.6%	4.0%	4.3%	12.2%
UF16	0.295	0.137	0.397			0.466	0.186			
	44.6%	33.9%	51.3%			53.5%	40.7%			
	18.6%	19.4%	19.2%			12.0%	22.0%			
UF39	0.988	0.832	1.076	0.510	0.719	1.256	1.092			
	76.9%	67.3%	81.6%	59.1%	66.7%	87.2%	85.5%			
	3.6%	7.5%	4.2%	6.1%	3.5%	2.6%	2.3%			

Five items concerned special populations about which there are concerns and issues for the quality and quantity of treatment in the educational system:

UF22	Women in mathematics
UF23	Minorities and mathematics
UF24	Gifted students
UF25	Urban education
UF40	Low achievers

With the exception of the gifted, no single population was singled out for strong support for additional emphasis during the 1980's by any sample. Seven of the nine samples had more than 75% of the respondents favoring the increase of emphasis on the gifted with two samples, JC and MA, exhibiting 60.0% and 69.6% positive support, respectively. Support for more emphasis on the low achievers was moderate for the AT, MT, JC, PR, SB, and PT samples, but only marginal for the MA, SP, and TE samples. Special emphasis on urban education was supported by more than half the respondents of only one sample, TE, with only weak support by the other samples.

The women and minorities items could have been interpreted as curricular in that women or members of a minority could be treated in an historical contribution or sociological sense. They could also have been interpreted by respondents as pertaining to special programs or attention for those categories of students. Whatever the interpretation, neither item was supported strongly for additional emphasis, although the JC and SP samples exhibited moderate support for the women and mathematics item.

Special populations

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
UF22	0.574	0.664	0.481	0.617	0.065	0.788	0.767			
	52.5%	52.1%	44.3%	65.0%	47.8%	63.4%	56.6%			
	6.8%	4.3%	2.6%	15.0%	28.3%	1.9%	3.3%			
UF23	0.338	0.340	0.304	0.317	0.196	0.404	0.517			
	38.5%	38.3%	36.7%	40.0%	35.7%	40.4%	43.3%			
	11.0%	11.4%	9.5%	18.4%	17.9%	5.7%	6.7%			
UF24	1.069	1.143	1.113	0.750	1.143	1.037	1.053	1.509	1.108	1.067
	75.6%	75.7%	81.7%	60.0%	69.6%	75.3%	75.6%	89.2%	79.6%	75.6%
	2.7%	2.1%	1.9%	1.7%	0.0%	4.6%	3.8%	1.1%	4.3%	4.4%
UF25	0.506	0.532	0.413			0.538	0.656			
	43.2%	43.2%	42.6%			46.2%	54.1%			
	5.7%	5.7%	5.8%			5.7%	4.9%			
UF40	0.681	0.935	0.807	0.810	0.297	0.783	0.525	0.966	0.935	1.182
	61.0%	72.2%	65.9%	67.8%	40.5%	55.0%	49.2%	64.6%	63.4%	77.3%
	16.8%	4.7%	7.6%	6.0%	16.4%	8.3%	8.2%	1.7%	4.3%	0.0%

Four items refer specifically to testing or to curricular approaches that require special attention to testing:

UF3 Competency-based education

UF4 Minimal competency testing

UF11 Mastery learning curriculum

UF27 Norm-referenced testing

Competency-based education was moderately supported by only the AT sample, with almost as strong support by the MT sample and very minimal support by the TE and SP samples. Minimal competency testing also received weak support by the SP and TE samples, somewhat stronger support by the SB, AT, and MT samples, and strongest support from the lay samples PT and PR. Generally, minimal competency was not identified by most respondents as needing more emphasis. Norm-referenced testing had very weak support. Support for mastery learning curricula was mixed, with the strongest perceptions for inceased emphasis found in the AT sample.

Testing related

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
UF3	0.526	0.624	0.665			0.118	-0.105			
	55.4%	61.8%	59.3%			41.2%	26.0%			
	15.9%	16.1%	9.6%			32.4%	29.0%			
UF4	0.338	0.420	0.533			-0.206	-0.378	0.650	0.393	0.860
	54.0%	50.0%	56.8%			23.5%	27.0%	59.5%	48.3%	68.0%
	18.0%	21.3%	15.3%			35.3%	43.2%	14.3%	18.0%	12.0%
UF11	0.425	0.636	0.514			0.475	0.203			
	46.3%	52.6%	47.2%			49.3%	39.5%			
	14.6%	8.9%	9.2%			12.6%	22.9%			
UF27	-0.117	-0.032	0.038			-0.314	-0.344			
	23.3%	26.9%	28.8%			17.7%	13.1%			
	30.8%	29.0%	22.1%			39.3%	40.9%			

Seven items specified types of curricular orientations that were relatively general:

UF9	Interdisciplinary programs
UF10	Unified mathematics
UF17	National mathematics curriculum
UF18	Curricula based upon the psychology of learning mathematics
UF19	Curricula based on the logic of mathematics
UF35	Curricula based on teacher's experiences
UF38	Mathematics in history and culture

None of the samples exhibited more than very weak support for the national mathematics curriculum. There was moderately strong support for more emphasis on interdisciplinary programs, with stronger support in the AT and MT samples than in either the SP or TE sample. None of the other curricular orientations was accorded moderate support across all samples. Of particular note is the difference between the AT and TE samples and the SP and TE samples on UF18 and UF35. Constituted primarily of teachers at the school level, the AT and MT samples exhibited stronger support for more emphasis on curricula based on teacher experiences and weaker support for curricula based on the psychology of learning mathematics than the SP and TE samples.

__Curricular orientations__

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
UF9	0.660	0.804	0.753			0.316	0.513			
	60.3%	66.5%	63.5%			47.4%	54.0%			
	8.2%	7.0%	3.9%			15.8%	13.1%			
UF10	0.645	0.716	0.549			0.526	0.853			
	56.1%	59.6%	54.0%			48.7%	66.6%			
	8.0%	6.4%	9.2%			11.9%	4.0%			
UF17	0.200	0.198	0.282			0.136	0.051			
	38.3%	38.9%	43.6%			47.3%	23.7%			
	19.8%	19.0%	20.5%			23.8%	15.3%			
UF18	0.622	0.452	0.490			1.034	0.915			
	56.4%	49.2%	48.3%			76.3%	72.9%			
	13.3%	19.1%	13.5%			6.8%	6.8%			
UF19	0.421	0.424	0.494			0.610	0.034			
	44.9%	47.2%	46.2%			54.3%	27.1%			
	10.3%	10.4%	7.7%			6.8%	20.4%			
UF35	0.532	0.696	0.632			0.250	0.322			
	54.3%	58.8%	60.8%			38.3%	49.2%			
	10.4%	6.9%	8.0%			15.0%	17.0%			
UF38	0.552	0.426	0.689	0.400	0.526	0.550	0.656			
	53.8%	47.2%	60.5%	50.0%	52.6%	50.0%	60.6%			
	8.4%	9.3%	7.5%	14.0%	8.8%	5.0%	6.5%			

Three items concerned the uses of mathematics:

UF8 Applications of mathematics

UF28 Mathematics and careers

UF44 Mathematics for consumers

Strong support for giving more emphasis to applications during the 1980's was shown by eight of the nine samples, the single exception being the MA sample, which gave moderately strong support. Mathematics for consumers was given strong support by all three lay samples. Moderately strong support was given by all the remaining samples except TE. Mathematics and careers enjoyed stronger support from the JC and MA samples than from any of the remaining professional samples. Barely half of the TE and SP samples indicated positive emphasis to the topic of mathematics and careers.

Uses of mathematics

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
UF8	1.118	1.329	1.229	1.323	0.792	0.910	0.862	1.219	1.125	1.140
	81.8%	80.2%	83.7%	95.3%	62.5%	82.5%	80.0%	83.3%	79.5%	86.0%
	1.9%	1.2%	1.1%	1.6%	0.0%	2.9%	3.6%	0.6%	2.3%	0.0%
UF28	0.614	0.700	0.670	0.883	0.855	0.566	0.499			
	54.9%	56.6%	58.4%	76.6%	65.4%	50.4%	50.8%			
	5.5%	3.8%	3.8%	5.0%	3.6%	4.5%	8.8%			
UF44	0.803	0.797	0.681			0.830	0.337	1.349	1.204	1.465
	63.8%	60.9%	58.0%			68.8%	36.1%	88.5%	84.9%	86.1%
	4.1%	4.1%	3.2%			2.9%	5.7%	1.1%	2.2%	0.0%

Two comparisons were designed to examine two issues that have been of interest during the last few years. The first comparison concerns the relative emphasis given to fractions (UF31) and to decimals (UF20). The second comparison concerns the attention given to metric measurement. The latter comparison involves items UF32, Metric measure, and UF45, Measurement; note that some respondents might include metric measurement within measurement. Each sample gives more support to increasing the emphasis on decimals than on fractions and to metric measure than on measurement. The SP sample would decrease the emphasis on fractions, the only sample so inclined. Only the SB and SP samples are strongly supportive of increasing the emphasis on decimals; support from all remaining samples except MT was moderately strong for increasing the emphasis. Only the SB sample exhibited moderately strong support for increasing the emphasis on fractions; the rest of the samples gave at best marginal support for more emphasis. The metric measure item gained stronger support than did measurement for all samples. The level of support for metric measures was stronger by the professional samples than by the lay samples.

Comparisons: Fractions and decimals; metric measure and measurement

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
UF20	0.887	0.849	0.660			1.169	0.767	0.971	1.065	0.925
	66.0%	62.7%	53.2%			88.1%	60.0%	69.6%	75.3%	65.0%
	0.6%	1.6%	0.0%			0.0%	0.0%	0.6%	1.1%	0.0%
UF31	0.409	0.059	0.586			-0.424	0.000	0.636	0.806	0.667
	44.1%	33.3%	46.1%			17.0%	28.3%	52.0%	63.4%	50.0%
	19.9%	32.4%	13.3%			56.0%	33.3%	11.0%	6.5%	7.2%
UF32	0.951	1.311	1.094			1.200	0.951	0.829	0.674	0.900
	72.8%	87.4%	75.8%			83.4%	75.4%	68.3%	61.8%	70.0%
	6.1%	2.9%	3.1%			5.0%	4.9%	6.5%	13.5%	6.0%
UF45	0.705	0.551	0.426			0.948	0.547			
	58.8%	49.0%	42.5%			73.9%	52.0%			
	2.6%	4.0%	2.7%			0.7%	3.0%			

The "new math" was characterized by many as having significant emphasis on proof and axiomatics. Two items collected information about emphasis desired for the 1980's in the areas of proof and structure:

UF13 Proof

UF15 Formal axiomatic structures

No sample was inclined to more than weak support for increasing the emphasis on proof. Support was at a higher level by the MA, SP, and TE samples than by the AT, MT, and JC samples. UF15 earned the distinction of having the lowest level of support of any of the 45 items for the pooled samples.

Mathematical structure and proof

	Total	AT	MT	JC	MA	SP	TE	FR	SB	PT
UF13	0.281	0.000	0.125	-0.033	0.617	0.396	0.592			
	34.2%	22.5%	26.0%	18.1%	46.8%	44.5%	45.9%			
	15.6%	34.3%	15.4%	19.7%	4.3%	17.9%	8.1%			
UF15	-0.192	-0.275	-0.250			-0.080	-0.175			
	14.4%	12.5%	9.6%			17.0%	18.5%			
	31.7%	32.5%	33.8%			31.0%	33.0%			

Two items inquired concerning specialized personnel to provide service at the elementary or secondary school levels:

UF21 Elementary mathematics specialists

UF26 Secondary mathematics specialists

Each of the samples that responded to both questions regarded elementary specialists as more important for emphasis than secondary specialists. The AT and MT samples gave but weak support to emphasis on secondary specialists. No sample gave the secondary specialists more than minimal support, whereas every sample provided moderately strong support for the elementary mathematics specialist. The SB and PT samples were only weakly supportive, however, with the PR sample slightly more supportive.

Elementary and secondary mathematics specialists

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
UF21	0.943	0.898	0.982			1.213	1.074	0.678	0.477	0.489
	68.7%	67.9%	70.5%			78.7%	73.6%	58.5%	48.9%	51.0%
	8.0%	9.3%	9.1%			3.7%	5.8%	11.1%	11.6%	17.1%
UF26	0.466	0.359	0.371			0.667	0.623			
	47.2%	41.3%	47.6%			52.9%	50.8%			
	11.0%	16.3%	15.2%			0.0%	4.9%			

Mathematics laboratories (UF14) had moderately strong support by only one sample, TE. The AT, MT, and SP samples demonstrated very little support for increasing the emphasis on mathematics laboratories, with the lowest level of support accorded by the MT sample.

<u>Mathematics laboratories</u>

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
UF14	0.427	0.512	0.163			0.426	0.639			
	48.2%	53.6%	37.5%			45.5%	57.7%			
	17.6%	19.1%	27.0%			12.9%	11.3%			

Two items explored the emphases individuals would give to two major mechanisms the federal government has used for the study and development of curriculum. Research on mathematics learning (UF33) had a higher level of support as an emphasis for the 1980's than did large-scale curriculum development projects (UF34). The AT and MT samples gave only minimal support to the research emphasis, while the SP sample gave moderately strong support. All1 samples gave but weak support to the curriculum development emphasis.

Study of development process

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
UF33	0.683	0.591	0.606			1.000				
	56.2%	52.5%	53.5%			68.3%				
	7.6%	8.7%	8.7%			3.3%				
JF34	0.151	0.282	0.000			0.288	0.117			
	36.9%	32.8%	29.7%			40.7%	38.3%			
	26.0%	20.4%	29.5%			18.6%	33.4%			

Chapter II

Preference Survey: Strand by Cluster

In this section data are presented and discussed for each of the nine strands which comprised the preference (first) survey. The strands are whole numbers; fractions and decimals; ratio, proportion, and percent, measurement; algebra; geometry; probability and statistics; computer literacy; and problem solving. Within all but two strands, there are at least six common clusters: questions about goals, content, methods, and resources; an amalgam of questions about types of students for whom courses are appropriate and placement or level of courses (referred to as who/time); and questions about the appropriate use of calculators. The two exceptions are the computer literacy and problem-solving strands, where the cluster of questions on calculators is omitted. In some strands the content cluster is divided into two or three clusters reflecting elementary content or secondary content. The major organizing structure for this section is the strand. Clusters are discussed within each strand, and a summary is presented at the conclusion of each strand.

Data tables presented in this section are condensed from the complete data, which may be found in the appendix. Five possible responses were given for each question; in most cases, these involved an indication of strong agreement, moderate agreement, a neutral position, an indication of moderate disagreement, and strong disagreement. For the tables in this section the percentage responses for strong agreement and moderate agreement have been summed into a single "agree" percentage. Similarly, the moderate disagreement and strong disagreement percentages have been summed into a single "disagree" percentage. The reader should keep in mind, therefore, that the expected percentages for these pairs of "agree" and "disagree" responses are 40% each (rather than the 20% usually associated with five-choice items).

One more interpretive statistic appears in the tables. This is a "coefficient of agreement", a weighted average of responses, calculated from

$$C.A. = \frac{\sum_{i=1}^{5} n_i a_i}{N}$$

where i indicates the number of the response (1 = agree → 5 = strongly disagree), n_i

is the number of respondents choosing the i^{th} response, a_i is the weighting factor, and N is the total number of responses for the item. For the calculations made in this study, $a_1 = 2$, $a_2 = 1$, $a_3 = 0$, $a_4 = -1$, and $a_5 = -2$.

Within each table a row indicates responses of different samples for a single item. Columns indicate the populations sampled. Abbreviations for the samples are as follows:

AT -- subscribers to the Arithmetic Teacher plus non-subscribing teachers

MT -- subscribers to the Mathematics Teacher plus non-subscribing teachers

JC -- members of the Mathematics Associations of Two-Year Colleges

MA -- members of the Mathematical Association of America

SP -- supervisors on NCTM lists

TE -- teacher educators on NCTM lists

PR -- principals at the elementary and secondary school levels

SB -- presidents of school boards

PT -- presidents of local PTA groups.

Further information about sampling techniques and characteristics of samples can be found in chapter I of this report.

The AT, MT, JC, MA, SP, and TE samples are collectively referred to as the professional samples. The PR, SB, and PT samples are collectively referred to as the lay samples. Note that the use of the terms "professional" and "lay" refer to mathematics responsibility and not to general educational responsibility. Although principals are certainly professionals with respect to education, this report includes them in the lay sample with respect to mathematics.

Each entry in the table consists of three parts:

0.949 --coefficient of agreement

81.3% --agreement

5.1% --disagreement

The reader may easily interpret the percentage of the sample which gave a neutral response by subtracting the agreement and disagreement percentages from 100%. In the example, 13.6% chose the neutral response.

Additional information may be inferred by comparing two entries. For example, consider these two entries for item AL138:

	MT	TE
AL 138	0.785	0.775
	65.3%	66.2%
	9.1%	8.4%

Note that the coefficient of agreement is greater for the MT sample, but that the percentage of respondents choosing one of the "agree" choices is higher for the TE sample. This apparent discrepancy is clarified by considering the complete distribution of choice responses.

	MT	TE
strongly agree	25.6	21.1
agree	39.7	45.1
neutral	25.6	25.6
disagree	5.8	7.0
strongly disagree	3.3	1.4

Note the greater percentage on the "strongly agree" response for the MT sample, plus the distribution of the remainder. Since responses are weighted, this pattern leads to a slightly higher coefficient of agreement. Exact distributions of responses can be found by consulting the appendix.

In this section, discussions are based primarily upon the (combined) "agree" and (combined) "disagree" percentages. Coefficients of agreement are used only where secondary interpretations are necessary. In general, the percentages of agreement are interpreted as follows:

strong agreement	80%
moderately strong agreement	60% - 79%
minimal agreement	54% - 59%
very little (weak) agreement	25% - 53%

Note that when the interpretation for an item is "very little agreement", the dominant choice among the original five choices could have been the neutral choice or one of the disagreement choices.

Whole Numbers

Goals (WN2)

Five goals for teaching whole number concepts and skills received support from at least 80 percent of the total sample, and were ranked in the top five in every instance but one (the MA sample ranked item 201 sixth). These top five goals, with percentages of agreement indicated in parentheses, were:

207. To acquire the skills necessary for consumer decisions (94.7%)

208. To develop the fundamental understandings upon which other mathematics learning is built (91.6%)

204. To develop logical thinking ability (89.7%)

201. To acquire the qualifications necessary for obtaining many jobs (85.3%)

203. To understand the structure of mathematics (82.4%)

About 70 percent of the total sample supported two other goals:

210. To learn to read mathematics (70.4%)

206. To develop disciplined work habits (69.8%)

Two items received minimal support:

205. To gain an appreciation for the beauty of numbers (57.7%)

202. To be able to do well on standardized tests (42.0%)

Clearly rejected as a goal for whole numbers was:

209. To preserve a traditional emphasis in the curriculum (Only 15.1% supported the goal, while 43.5% rejected it.)

Goals

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN207	1.458	1.546	1.568	1.432	1.179	1.462	1.295			
	94.7%	96.3%	97.3%	91.9%	87.1%	98.1%	90.1%			
	1.2%	1.9%	0.9%	2.7%	2.6%	0.0%	0.0%			
WN208	1.466	1.509	1.333	1.432	1.538	1.654	1.443			
	91.6%	93.6%	87.4%	91.9%	97.4%	98.1%	86.9%			
	2.5%	1.9%	6.3%	0.0%	0.0%	0.0%	1.6%			
WN204	1.364	1.509	1.189	1.189	1.263	1.558	1.426			
	89.7%	94.4%	82.8%	86.5%	92.1%	92.3%	91.8%			
	3.0%	0.9%	6.3%	0.0%	2.6%	1.9%	3.2%			
WN201	1.192	1.194	1.333	1.139	1.128	1.269	0.934			
	85.3%	85.2%	89.1%	80.5%	82.1%	88.5%	80.3%			
	4.9%	7.4%	3.6%	8.4%	5.2%	0.0%	4.9%			
WN203	1.144	1.165	1.027	1.243	1.077	1.231	1.230			
	82.4%	81.7%	78.3%	83.7%	79.5%	86.5%	88.5%			
	4.9%	4.6%	9.0%	2.7%	5.1%	0.0%	3.3%			
WN210	0.837	0.869	0.836	0.730	0.658	0.865	0.934			
	70.4%	70.1%	70.9%	64.8%	55.2%	75.0%	78.7%			
	8.1%	6.6%	5.4%	16.2%	15.8%	11.5%	3.2%			
WN206	0.828	0.898	0.982	0.730	0.487	0.904	0.633			
	69.8%	74.1%	76.5%	70.3%	59.0%	69.2%	56.7%			
	10.0%	10.2%	9.0%	10.8%	23.1%	5.8%	6.6%			
WN205	0.569	0.491	0.491	0.486	0.487	0.692	0.850			
	57.7%	54.6%	55.5%	51.3%	51.3%	61.6%	71.7%			
	12.8%	17.6%	17.3%	13.5%	10.3%	7.7%	1.7%			

Goals (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN202	0.093	0.193	0.153	0.027	-0.026	0.135	-0.115			
	42.0%	46.7%	43.2%	48.6%	35.9%	40.3%	32.8%			
	29.6%	28.4%	28.8%	29.7%	38.4%	21.1%	34.4%			
WN209	-0.400	-0.327	-0.200	-0.486	-0.711	-0.365	-0.672			
	15.1%	20.5%	20.9%	16.2%	10.5%	7.6%	3.2%			
	43.5%	41.1%	37.3%	43.2%	55.2%	38.4%	55.7%			

Content (WN1)

The samples were in strong agreement on the inclusion of the following items of whole number content:

187. Techniques of estimation (91.7%)

192. Mental calculations without the aid of paper and pencil or calculator (91.0%)

188. Specific strategies for solving word problems (86.6%)

189. Mathematical puzzles and games (84.5%)

199. Addition and subtraction developed simultaneously to emphasize relationships between them (72.1%)

193. Multiplication and division developed simultaneously to emphasize relationsips between them (71.7%)

200. Specific consumer skills like balancing a checkbook and calculating best buys (71.6%)

There was less agreement about supporting the following items:

195. Tests of divisibility (62.5%)

198. Computational and/or checking shortcuts (e.g., casting out nines) (62.3%)

190. Operations with signed numbers or integers (59.1%)

194. Specific instructions for operating a four-function calculator (57.5%)

186. Several different algorithms (methods) for each of the four basic operations so that children can choose the method they prefer (47.6%)

There was agreement across samples that the following content should not be included:

191. Justification of each step of an algorithm by relating it to basic number properties (opposed by 44.7%)

196. Only the most efficient algorithm (method) for each operation is taught (opposed by 41.9%)

197. A paper-and-pencil algorithm (method) for calculating square roots (opposed by 60.8%)

Content

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN187	1.474	1.484	1.193	1.541	1.103	1.763	1.781			
	91.7%	92.7%	87.2%	94.6%	79.5%	97.3%	96.9%			
	3.4%	4.3%	5.6%	2.7%	5.2%	0.0%	1.6%			
WN192	1.388	1.389	1.294	1.568	1.487	1.461	1.297			
	91.0%	91.5%	90.8%	91.9%	89.8%	93.4%	87.5%			
	2.6%	3.2%	2.8%	5.4%	0.0%	0.0%	4.7%			
WN188	1.272	1.400	1.156	1.108	0.921	1.487	1.328			
	86.6%	89.5%	86.2%	81.0%	76.3%	90.8%	87.5%			
	6.0%	4.3%	6.4%	10.8%	7.9%	5.3%	4.7%			
WN189	1.183	1.421	1.229	1.324	1.077	0.855	1.125			
	84.5%	88.4%	85.3%	89.1%	87.2%	73.7%	86.0%			
	4.3%	3.2%	1.8%	2.7%	5.2%	9.2%	4.7%			
WN199	0.938	1.095	0.743	1.135	0.949	0.974	0.875			
	72.1%	77.9%	68.8%	78.4%	66.7%	72.4%	68.8%			
	12.6%	8.5%	15.6%	13.5%	7.7%	13.2%	15.6%			
WN193	0.883	1.053	0.633	1.083	0.795	0.987	0.875			
	71.7%	77.7%	64.2%	77.7%	64.1%	76.3%	71.9%			
	11.5%	9.6%	13.8%	11.1%	12.8%	7.9%	14.0%			
WN200	0.835	0.842	0.667	1.081	0.974	0.750	0.984			
	71.6%	69.5%	68.5%	75.6%	74.4%	73.7%	73.5%			
	15.7%	17.9%	21.3%	16.2%	10.3%	11.8%	10.9%			
WN195	0.649	0.862	0.796	0.556	0.368	0.368	0.641			
	62.5%	71.3%	70.3%	58.4%	47.4%	52.6%	59.3%			
	14.5%	9.5%	12.1%	19.4%	15.8%	18.5%	17.2%			

Content (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN198	0.554	0.758	0.587	0.405	0.368	0.355	0.625			
	62.3%	72.6%	64.2%	56.7%	57.9%	51.3%	62.6%			
	18.4%	10.6%	20.2%	24.3%	23.7%	22.3%	15.6%			
WN190	0.517	0.074	0.367	0.811	1.333	0.382	0.922			
	59.1%	42.1%	55.1%	67.5%	89.8%	53.9%	73.4%			
	27.9%	43.1%	34.8%	16.2%	2.6%	28.9%	14.1%			
WN194	0.511	0.295	0.284	0.222	0.359	0.816	1.109			
	57.5%	45.2%	51.3%	47.2%	51.2%	69.8%	81.3%			
	19.8%	25.3%	24.8%	27.7%	23.1%	13.2%	4.7%			
WN186	0.179	0.379	-0.101	0.081	-0.051	0.224	0.500			
	47.6%	53.7%	41.3%	43.2%	38.5%	44.8%	60.9%			
	36.9%	32.7%	44.0%	43.2%	35.9%	36.9%	28.1%			
WN191	-0.150	-0.032	-0.413	-0.270	0.538	-0.342	0.000			
	35.7%	42.1%	23.9%	35.1%	53.9%	26.4%	46.9%			
	44.7%	42.1%	53.2%	54.0%	20.5%	48.7%	39.0%			
WN196	-0.053	-0.043	0.321	0.000	-0.368	-0.118	-0.476			
	35.1%	38.3%	44.1%	38.9%	21.1%	32.9%	23.8%			
	41.9%	41.5%	28.5%	41.7%	52.7%	42.1%	58.7%			
WN197	-0.589	-0.574	-0.349	-0.486	-0.282	-0.961	-0.828			
	23.9%	21.3%	31.2%	29.7%	28.2%	14.5%	20.4%			
	60.8%	61.7%	52.3%	56.7%	48.7%	75.0%	67.2%			

Resources (WN3)

There was general agreement across samples on the inclusion of four resources for teaching about whole numbers:

217. Resource books compiling examples of arithmetic applied to real-life situations (95.9%)

216. Masters of worksheets and activities (85.6%)

220. Standardized practice tests for basic skills (81.9%)

219. Packages of materials for individual student study (80.2%)

The remaining resources were not as high in priority; the interesting thing is that most cluster so closely in level of support:

212. Short videotapes to illustrate basic computational algorithms (75.5%)

213. "Magic response paper" to give immediate feedback by revealing the correct answer just after students have written their answers (73.0%)

211. A calculator for every student (72.5%)

218. Small programmable calculators or computers (72.7%)

215. Physical materials for each student to use in modeling basic operations and algorithms (70.6%)

There was slightly less support for:

214. Audiotapes for verbal drill and practice (65.1%)

Resources

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN217	1.498	1.485	1.480	1.744	1.324					
	95.9%	93.8%	97.5%	100.0%	91.2%					
	1.7%	2.1%	1.6%	0.0%	2.9%					
WN216	1.256	1.330	1.41[illegible]	1.205	0.529					
	85.6%	87.6%	91.8%	84.6%	58.8%					
	5.8%	8.3%	2.4%	0.0%	17.6%					
WN220	1.147	1.021	1.252	1.179	1.088					
	81.9%	75.0%	87.0%	84.7%	79.5%					
	9.2%	15.6%	7.3%	5.1%	2.9%					
WN219	1.038	1.113	0.902	1.205	1.118					
	80.2%	82.4%	74.8%	84.7%	88.2%					
	7.9%	9.3%	9.7%	2.6%	2.9%					
WN215	0.850	1.082	0.691	0.974	0.618					
	70.6%	77.4%	65.8%	74.3%	64.7%					
	10.9%	10.3%	9.7%	10.3%	17.7%					
WN212	0.826	0.938	0.724	1.026	0.647					
	75.5%	78.3%	74.0%	79.5%	67.7%					
	13.3%	12.4%	14.7%	10.3%	14.7%					
WN213	0.812	0.794	0.821	1.103	0.500					
	73.0%	71.2%	74.0%	84.7%	61.7%					
	15.0%	16.5%	13.0%	12.8%	20.6%					
WN211	0.790	0.792	0.699	1.000	0.882					
	72.5%	69.8%	72.3%	76.3%	76.5%					
	17.5%	13.5%	21.1%	13.2%	20.6%					

Resources (continued).

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN218	0.785	0.804	0.715	0.821	0.941					
	72.7%	72.1%	71.6%	74.4%	76.5%					
	14.6%	11.4%	17.1%	18.0%	11.8%					
WN214	0.659	0.732	0.699	0.769	0.176					
	65.1%	66.0%	69.9%	71.8%	38.2%					
	18.4%	17.5%	17.1%	18.0%	26.4%					

Methods (WN4)

The three methods items on whole numbers which rank highest (224) and lowest (226, 222,) all pertain to calculators, and indicate rather clearly the concern for paper-and-pencil computation, even for slower students.

224. The introduction of calculators is postponed until students have learned both the meaning of the operations and the paper-and-pencil algorithms for them. (82.0%)

226. Slower students are allowed to use calculators in order to keep up with the rest of the class. (20.6%)

222. Calculators are used instead of teaching paper-and-pencil algorithms. (19.5%)

The degree of support for item 228 was clearly lower for the MA sample than for the other three samples.

228. Manipulative materials are used in a mathematics laboratory at least once a week. (74.0%)

Two other items which pertain to the use of materials (221, geometric pictures as models for computation; 225, physical materials such as rods and area blocks as models for algorithms) were supported by just over 60% of the total samples.

Support for the two items dealing with the distribution of time differed, with more support for item 223 than for item 230:

223. More than 50% of the instructional time is devoted to drill and practice when teaching the basic facts. (65.8%)

230. More than 50% of the instructional time is devoted to student use of individual study materials to develop and extend whole number ideas. (43.3%)

Mastery learning (item 227) also received support by 67%. The remaining item (229), on the use of activities outside the classroom, was supported much more highly by the AT sample than by any other sample.

Methods

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN224	1.224	1.286	1.296	1.171	0.949					
	82.0%	83.4%	87.0%	75.7%	71.8%					
	8.8%	7.2%	7.4%	9.7%	15.4%					
WN228	0.959	1.345	0.778	1.051	0.526					
	74.0%	85.7%	70.4%	74.4%	57.9%					
	8.1%	3.6%	8.3%	7.7%	18.4%					
WN227	0.793	0.976	0.796	0.950	0.211					
	66.8%	75.3%	66.7%	75.0%	39.5%					
	9.3%	10.6%	6.5%	5.0%	18.4%					
WN221	0.774	0.500	0.796	0.927	1.128					
	63.7%	48.8%	65.7%	68.3%	84.6%					
	7.8%	8.5%	7.4%	7.3%	7.7%					
WN223	0.688	0.765	0.833	0.683	0.128					
	65.8%	66.7%	75.9%	63.4%	38.5%					
	16.8%	17.2%	11.1%	22.0%	25.7%					
WN225	0.678	0.928	0.589	0.634	0.436					
	61.8%	72.2%	57.9%	61.0%	51.2%					
	15.5%	13.2%	14.9%	17.1%	20.5%					
WN229	0.576	1.024	0.491	0.487	-0.077					
	58.7%	76.5%	56.5%	56.4%	28.2%					
	20.0%	11.7%	21.3%	23.1%	30.8%					
WN230	0.196	0.600	0.084	0.000	-0.179					
	43.3%	61.2%	36.4%	38.5%	28.2%					
	27.8%	18.8%	28.0%	35.9%	38.5%					

Methods (continued)

	Total	AT	MT	JC	MA	SP	TF	PR	SB	PT
WN226	-0.614	-0.452	-0.546	-0.878	-0.872					
	20.6%	28.5%	18.5%	14.6%	15.4%					
	58.4%	51.2%	55.6%	68.3%	71.8%					
WN222	-0.669	-0.845	-0.574	-0.732	-0.487					
	19.5%	17.9%	22.2%	17.1%	18.0%					
	62.5%	69.0%	60.1%	63.4%	53.9%					

Who/Time (WN5)

In the cluster on to whom and when whole number topics should be taught, the only item which was supported was:

231. Every student should master whole number computations with paper and pencil before graduating from high school. (90.9%)

A minimal level of support by the AT, SP, and TE samples was also found for:

233. Students who cannot master paper-and-pencil computations by the end of grade 8 should be required to take a special ninth-grade mathematics course on the use of the hand-held calculator. (supported by 50% to 60% of the three named samples, but only 23% to 37% of other samples)

The samples did not support having college-bound students spend at least three weeks of every year reviewing whole number computation (item 232), not introducing algorithms for multi-digit computations until grade 7 (item 235), or postponing remedial work with whole number computation until students are in an adult school or junior college (item 234).

Who/Time

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN231	1.572	1.602	1.622	1.800	1.633	1.356	1.475			
	90.9%	93.2%	91.6%	97.2%	90.0%	86.4%	86.9%			
	6.6%	3.9%	8.4%	0.0%	6.7%	10.2%	8.2%			
WN233	0.111	0.304	-0.050	-0.265	-0.400	0.288	0.393			
	45.4%	50.0%	37.8%	35.3%	23.3%	54.3%	60.7%			
	34.6%	30.4%	38.6%	44.1%	46.7%	32.2%	24.6%			
WN232	-0.359	0.068	-0.437	-0.371	-0.800	-0.390	-0.672			
	29.7%	44.7%	26.9%	25.7%	13.3%	32.2%	18.1%			
	55.1%	43.7%	56.3%	48.6%	70.0%	62.7%	60.7%			
WN235	-0.933	-0.902	-0.714	-1.029	-1.200	-0.847	-1.311			
	14.8%	15.7%	19.3%	11.4%	13.3%	17.0%	4.9%			
	74.3%	71.5%	63.9%	80.0%	83.3%	76.3%	90.1%			
WN234	-1.111	-1.097	-1.168	-1.029	-1.300	-1.034	-1.049			
	10.6%	11.6%	9.2%	14.7%	10.0%	15.3%	4.9%			
	77.9%	77.6%	79.8%	79.4%	83.4%	74.6%	73.8%			

Calculators (WN6)

Three uses of calculators for teaching whole number content were strongly supported by the total sample:

245. Checking answers (89.1%)

249. Adding the cost of several items in a grocery cart (80.3%)

247. Doing a chain of calculations involving several different operations (79.1%)

Four items received moderate support:

242. Solving word problems (73.1%)

250. Finding the divisors of a given number (69.3%)

239. Learning properties of different operations (62.7%)

248. Learning why the long division algorithm works (57.5%)

Three items were only weakly supported:

237. Doing homework (60.1%)

241. Multiplying 782 x 59 (57.1%)

240. Doing the division 641 ÷ 17 (54.1%)

The remaining items were supported by low percentages, with opposition by all samples. This opposition was particularly strong for the last two items on the list.

243. Subtracting 2,150 - 1,983 (supported by 44.6%, opposed by 49.0%)

236. Learning basic number facts (supported by 36.1%, opposed by 57.4%)

246. Calculating change from a five dollar bill (supported by 27.2%, opposed by 65.3%)

244. Multiplying 3 x 13 (supported by 20.2%, opposed by 74.0%)

238. Taking a test on whole number computation (supported by 18.1%, opposed by 78.2%)

Calculators

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN245	1.449	1.650	1.339	1.512	1.156					
	89.1%	95.0%	85.1%	90.3%	34.4%					
	6.8%	2.0%	10.7%	4.8%	9.4%					
WN249	1.153	1.297	1.066	0.875	1.375					
	80.3%	85.1%	76.9%	72.5%	87.5%					
	13.6%	9.9%	16.5%	22.5%	3.1%					
WN247	0.952	1.071	0.851	0.976	0.937					
	79.1%	81.8%	76.9%	78.1%	81.3%					
	15.0%	11.2%	17.4%	14.6%	18.7%					
WN242	0.752	0.8[illegible]0	0.711	0.951	0.437					
	73.1%	74.0%	71.9%	80.5%	65.7%					
	19.7%	18.0%	21.5%	12.2%	28.1%					
WN250	0.683	0.871	0.425	0.925	0.750					
	69.3%	74.3%	61.6%	77.5%	71.9%					
	22.5%	17.8%	29.1%	15.0%	21.9%					
WN239	0.589	0.848	0.298	0.850	0.562					
	62.7%	67.6%	55.4%	70.0%	65.6%					
	24.3%	16.2%	32.3%	20.0%	25.0%					
WN248	0.531	0.840	0.533	0.250	-0.094					
	57.5%	65.0%	60.0%	47.5%	37.5%					
	25.7%	15.0%	25.0%	35.0%	50.0%					
WN237	0.341	0.158	0.281	0.800	0.581					
	60.1%	53.5%	59.5%	75.0%	64.5%					
	31.8%	36.6%	34.7%	17.5%	22.6%					

Calculators (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN241	0.211	0.150	0.231	0.317	0.187					
	57.1%	54.0%	60.3%	58.5%	53.1%					
	36.0%	39.0%	35.6%	34.2%	31.3%					
WN240	0.154	0.090	0.167	0.300	0.125					
	54.1%	50.0%	58.4%	57.5%	46.9%					
	37.0%	39.0%	38.3%	35.0%	28.2%					
WN243	-0.167	-0.040	-0.215	-0.195	-0.344					
	44.6%	49.0%	45.5%	39.1%	34.4%					
	49.0%	46.0%	49.6%	53.6%	50.0%					
WN236	-0.454	-0.280	-0.711	-0.350	-0.156					
	36.1%	40.0%	27.3%	47.5%	43.8%					
	57.4%	55.0%	64.4%	50.0%	46.9%					
WN246	-0.721	-0.480	-0.843	-0.561	-1.219					
	27.2%	31.0%	26.4%	34.1%	9.4%					
	65.3%	58.0%	68.6%	61.0%	81.3%					
WN244	-0.993	-0.899	-0.975	-1.073	-1.250					
	20.2%	22.3%	21.5%	19.5%	9.4%					
	74.0%	72.7%	73.6%	73.2%	81.3%					
WN238	-1.140	-1.240	-1.124	-1.025	-1.031					
	18.1%	16.0%	19.0%	20.0%	18.8%					
	78.2%	81.0%	77.7%	72.5%	78.1%					

Summary: Whole Numbers

- Five goals for teaching whole number computation received strong support (above 80%); these related to consumer education skills, fundamental understandings, logical thinking, job qualifications, and the structure of mathematics.
- Clearly rejected as a goal for teaching whole numbers was "to preserve a traditional emphasis in the curriculum."
- Strong support (above 80%) was given for including estimation, mental calculations, specific problem-solving strategies, and puzzles and games when teaching whole number content; developing operations simultaneously and teaching specific consumer skills were also well-supported (by 72%).
- Resource books of real-life examples, masters of worksheets and activities, standardized practice tests, and individual study materials were strongly supported (above 80%), with other resources supported by 65% to 75%.
- Four-fifths of the samples indicated that calculators should not be used until after students have learned paper-and-pencil algorithms.
- The use of various physical materials was supported by 60% to 75% of the samples.
- Spending more than 50% of instructional time on drill was supported by 65%.
- There was strong support for the idea that paper-and-pencil computational skills should be acquired before graduation from high school.
- There was strong support for the use of calculators for checking and to do a series of computations, but support weakened (and opposition increased) as the indicated computation was perceived to require skills stressing paper-and-pencil procedures.

Fractions and Decimals

Goals (FD2A,B)

Twenty goal statements were written for the fraction/decimals strand. Ten of these involved fractions and a matching set of ten repeated the goal for decimals. Half of the professional samples received five fraction goals and five decimal goals (FD2A), while the other half of the professional samples received the remaining fraction and decimal goals (FD2B). In this analysis, the response for a fraction goal will be contrasted with the corresponding response for a decimal goal. The reader should keep in mind that the actual respondents are different for each half of each pair of statements. However, since both are drawn from the same samples, their responses should be comparable.

26/36. Common fractions (decimals) are used in many vocations such as auto mechanics, carpentry, plumbing, and so on.

For the total samples, this item was strongly supported and ranked highest whether stated for decimals (item 26, 92.5%) or for fractions (item 36, 94.3%). However, the MA samples gave less support than other samples, ranking it fourth in both cases; and the AT sample ranked the decimal form first but the fraction form second. Nevertheless, vocational practicality appeared to be a prime consideration in the teaching of both fractions and decimals.

30/40. Consumers need common fractions (decimals) to compute "best buys".

This statement was also given strong support, and was ranked second for decimals (item 30, 85.2%), but only sixth for fractions (item 40, 80.3%). Again support from the MA sample was decidedly lower for item 40. The ease of comparing decimals seems to be an obvious influence for this goal.

39. Decimals are used in money.

29. Rational numbers need to be contrasted to the sets of the whole numbers, integers, and real numbers.

This is the only pair of items in the set that is not parallel in intention. The decimal item (39) was strongly supported (89.2%) and ranked third, continuing the trend for practicality. Item 29 was given moderately strong support (65.2%), and was ranked sixth.

21/31. Determining how to add, subtract, multiply, and divide common fractions (decimals) illustrates basic mathematical processes and reasoning techniques.

In a sense, these items are the opposite of items 26/36. Both items were strongly supported (item 21 on fractions by 80.1% and item 31 on decimals by 82.4%). The fraction form (item 21) was ranked third, while the decimal form (item 31) was ranked fourth. Thus the theoretical role of both fractions and decimals in mathematics was also seen as important.

24/34. Common fractions (decimals) provide solutions to algebraic equations or number sentences.

Moderately strong support (74.7%) was given to the decimal item (24) and strong support (85.9%) to the fraction item (34), indicating that both are important. Item 24 was ranked fourth and item 34 was ranked fifth, even though the percentage of support is higher for item 34. Traditionally, many textbooks instruct students to leave solutions to equations as fractions. Thus the ranking of this item for decimals might be considered to be higher than expected.

22. Fractions are interpreted as measurements; for example, 7/12 is the length of a stick found by using a ruler.

32. The metric system ... uses decimals almost exclusively.

Item 32 was given strong support (88.0%) and ranked second; item 22 was given far less support (62.5%) and ranked seventh. Obviously, the reference to the metric system causes quite a different interpretation for items 32 than for item 22.

27/37. Common fractions are (decimals provide) simple ways to illustrate division.

This item was given more support for fractions (item 27, 69.7%) than for decimals (item 37, 59.2%). (Item 27 was ranked fifth and item 37, seventh). There was stronger support for fractions from the AT sample and weak support from the MA sample. On the other hand, item 37 (for decimals) received moderate levels of support from both the AT and MA samples but weak support from the MT and JC samples.

25/35. Common fractions (decimals) are used in college-level mathematics.

Item 25 on fractions was given weak support (57.0%), while item 35 on decimals was given slightly more support (61.4%). Ranking was eighth in their respective lists for both items.

28/38. Operations with common fractions (decimals) provide mental exercise.

All samples had more disagreement than agreement with these items. Item 28 on decimals was supported by 27.2% and opposed by 57.5%; item 38 on fractions was supported by 32.8% and opposed by 50.7%. They were both ranked ninth. The SP and TE samples responded only to item 38 on fractions; they were more strongly opposed to it than were other samples.

23/33. Common fractions (decimals) are a traditional part of the curriculum.

All samples opposed these items, ranking them last in both cases. Item 23 on fractions was supported by 24.5% and opposed by 67.5%; item 33 on decimals received very similar percentages (25.6% and 62.8%). The SP and TE samples were more strongly opposed to item 23 than were other samples.

Goals - A

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD26	1.432	1.571	1.530	1.488	0.963	1.316	1.314			
	92.5%	92.8%	94.9%	93.0%	77.7%	93.0%	92.9%			
	4.1%	2.0%	3.5%	2.3%	14.8%	5.3%	4.3%			
FD30	1.163	1.276	1.371	1.163	0.815	1.018	0.914			
	85.2%	91.8%	88.0%	86.0%	77.8%	80.7%	77.2%			
	7.1%	5.1%	5.2%	7.0%	14.8%	12.3%	5.7%			
FD21	1.046	1.082	1.205	1.349	1.444	-0.579	0.771			
	80.1%	79.6%	85.5%	88.4%	88.9%	68.4%	72.8%			
	15.6%	16.3%	11.1%	7.0%	7.4%	26.3%	21.4%			
FD24	0.888	0.745	1.094	0.930	0.963	0.719	0.829			
	74.7%	69.4%	82.9%	76.7%	70.3%	68.4%	74.3%			
	15.0%	20.4%	9.4%	18.6%	7.4%	17.6%	15.7%			
FD27	0.711	0.959	0.838	0.814	0.444	0.509	0.357			
	69.7%	78.5%	72.7%	76.7%	51.8%	66.7%	57.2%			
	17.2%	13.2%	12.[illegible]%	13.9%	22.2%	24.6%	24.3%			
FD29	0.648	0.619	0.[illegible]4	0.558	1.000	0.596	0.203			
	65.2%	64.0%	[illegible].4%	67.5%	74.0%	61.4%	53.6%			
	19.1%	15.5%	3.8%	23.2%	14.8%	15.8%	34.7%			
FD22	0.545	0.622	0.681	0.605	1.074	-0.018	0.429			
	62.5%	63.3%	66.4%	65.1%	77.7%	47.4%	60.0%			
	22.6%	17.4%	19.8%	23.2%	11.1%	42.1%	22.8%			
FD25	0.350	0.184	0.573	0.581	0.741	0.035	0.171			
	57.0%	50.0%	64.1%	67.4%	74.0%	43.9%	52.8%			
	33.0%	38.8%	26.5%	30.2%	18.5%	40.4%	37.1%			

Goals - A (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD28	-0.513	-0.258	-0.207	-0.558	-0.407	-0.857	-1.114			
	27.2%	40.3%	34.5%	20.9%	29.6%	14.3%	10.0%			
	57.5%	49.4%	47.4%	53.5%	55.5%	75.0%	74.2%			
FD23	-0.641	-0.398	-0.299	-0.791	-0.741	-1.053	-1.086			
	24.5%	32.7%	35.0%	18.6%	18.5%	12.3%	11.4%			
	67.5%	61.2%	57.3%	67.4%	62.9%	82.4%	82.9%			

Goals - B

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD36	1.467	1.490	1.563	1.405	1.038					
	94.3%	96.9%	95.0%	95.2%	80.8%					
	3.2%	2.0%	3.4%	0.0%	11.5%					
FD32	1.351	1.541	1.277	1.286	1.077					
	88.0%	90.8%	86.6%	90.4%	80.8%					
	6.3%	4.1%	8.4%	4.8%	7.7%					
FD39	1.263	1.337	1.378	0.976	0.923					
	89.2%	92.9%	94.2%	78.5%	69.2%					
	6.0%	5.1%	2.5%	14.3%	11.5%					
FD31	1.127	1.184	1.085	0.929	1.432					
	82.4%	85.7%	78.9%	80.9%	88.5%					
	12.4%	11.2%	14.4%	11.9%	7.6%					
FD34	1.105	0.847	1.244	1.143	1.385					
	85.9%	75.5%	90.7%	90.4%	96.1%					
	9.2%	15.3%	5.8%	9.5%	0.0%					
FD40	0.968	1.020	0.992	0.905	0.769					
	80.3%	82.7%	80.5%	81.0%	69.2%					
	13.7%	15.3%	11.9%	16.7%	11.5%					
FD37	0.500	0.694	0.373	0.333	0.615					
	59.2%	66.3%	54.3%	54.8%	61.6%					
	21.9%	12.2%	25.4%	33.4%	23.1%					
FD35	0.432	0.388	0.471	0.429	0.423					
	61.4%	60.2%	63.0%	59.5%	61.5%					
	31.6%	31.6%	30.2%	35.7%	30.8%					

Goals - B (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD38	-0.292	-0.268	-0.252	-0.524	-0.192					
	32.8%	34.0%	34.4%	23.8%	34.6%					
	50.7%	50.5%	49.6%	57.1%	46.2%					
FD33	-0.516	-0.490	-0.445	-0.667	-0.692					
	25.6%	25.5%	27.7%	23.8%	19.2%					
	62.8%	66.3%	58.8%	64.3%	65.4%					

Content for Elementary School Students (FD1A)

Ten ways that fractions and decimals might be treated in the elementary school (before grade seven) were listed in this cluster. Strong support was given to one item:

5. Least common multiple and greatest common divisor should be stressed as basic ideas related to fractions. (82.8%)

Moderately strong support was given to three items:

6. Students should be taught to solve a division problem by first estimating whether the answer will be larger or smaller than the number being divided. (73.9%)

9. Decimals should be developed as a means of naming numbers between numbers ... (76.4%)

7. Fractions should be presented as answers to division problems; for example, 7/12 means seven divided by 12. (72.8%)

Only minimal support was shown for the following two items:

10. Fractions should be developed as measures of lengths. (53.6%)

2. Operations with fractions should be taught only for fractions with small denominators ... (56.4%)

Item 2 was given moderate support by the AT sample and strong support by the SP sample, but was strongly opposed by the MA sample.

There was essentially no support for one item; almost as many rejected it as accepted it:

1. All fractions should be written as decimals so that the operations on them can be performed with a calculator. (supported by 46.8%, opposed by 42.8%)

Higher percentages objected to the remaining items:

4. Students should use slide rules, graphs, and charts (nomographs) to solve problems involving fractions. (supported by 31.6%, opposed by 41.6%)

3. Tables of common denominators (factors and multiples) should be given to students. (supported by 21.7%, opposed by 59.8%)

8. Decimals should be introduced by relating them exclusively to money. (supported by 18.4%, opposed 63.2%)

Content for elementary school students

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD5	1.145	1.163	1.302	1.143	1.571	0.980	1.033			
	82.8%	79.6%	84.9%	85.8%	92.8%	82.3%	80.3%			
	10.0%	8.2%	3.8%	9.6%	7.1%	15.7%	13.1%			
FD6	1.032	0.857	0.870	1.000	0.786	1.333	1.133			
	73.9%	67.4%	62.9%	76.2%	57.2%	90.2%	78.4%			
	8.8%	12.3%	7.5%	4.8%	21.4%	3.9%	10.0%			
FD9	0.968	1.163	0.907	0.857	0.786	1.020	0.902			
	76.4%	81.6%	74.1%	76.1%	64.3%	84.3%	70.5%			
	10.0%	6.1%	11.1%	4.8%	14.2%	5.9%	16.4%			
FD7	0.916	1.204	0.852	0.667	0.857	0.882	0.869			
	72.8%	81.6%	68.5%	61.9%	71.4%	78.4%	68.9%			
	13.2%	8.2%	22.2%	9.5%	14.2%	11.7%	11.5%			
FD10	0.420	0.204	0.407	0.619	0.357	0.294	0.656			
	53.6%	44.9%	50.0%	61.9%	57.2%	49.0%	63.9%			
	20.0%	28.6%	16.7%	9.5%	28.5%	25.5%	13.1%			
FD2	0.332	0.592	0.167	-0.190	-0.714	0.784	0.311			
	56.4%	67.3%	50.0%	38.1%	21.4%	70.6%	55.8%			
	33.6%	20.4%	40.7%	47.6%	71.4%	17.6%	37.7%			
FD1	0.012	0.224	-0.056	-0.381	-0.571	0.176	0.033			
	46.8%	55.1%	46.3%	38.1%	28.6%	51.0%	44.3%			
	42.8%	40.8%	44.5%	52.3%	57.2%	37.3%	41.0%			
FD4	-0.220	-0.327	-0.222	-0.190	-0.571	-0.176	-0.098			
	31.6%	24.5%	35.2%	38.1%	35.7%	29.4%	32.8%			
	41.6%	38.7%	37.1%	47.6%	57.1%	39.2%	44.2%			

Content for elementary school students (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD3	-0.606	-0.250	-0.815	-0.810	-0.714	-0.529	-0.672			
	21.7%	33.3%	14.9%	28.6%	21.4%	17.6%	19.7%			
	59.8%	48.0%	68.5%	66.6%	57.2%	54.9%	64.0%			
FD8	-0.620	-0.245	-0.759	-0.952	-1.357	-0.275	-0.803			
	18.4%	28.6%	14.9%	9.5%	14.3%	23.5%	13.1%			
	63.2%	46.9%	72.2%	76.2%	85.7%	49.0%	70.5%			

Content for Secondary School Students (FD1B)

The ten items from cluster FD1A were repeated for this cluster, but this time with respect to how fractions and decimals should be treated after grade six (that is, in grades 7-12). Two items were strongly supported:

15. Least common multiple and greatest common divisor should be stressed as basic ideas related to fractions. (85.0%) (This item was ranked first for both FD1A and FD1B.)

19. Decimals should be developed as a means of naming numbers between numbers ... (80.7%) (This item was ranked third for both FD1A and FD1B.)

Two items were given moderately strong support:

16. Students should be taught to solve a division problem by first estimating whether the answer will be larger or smaller than the number being divided. (79.3%) (This item was ranked second for both FD1A and FD1B.)

17. Fractions should be presented as answers to division problems ... (75.7%) (This item was ranked fourth for both FD1A and FD1B.)

Only weak support was shown for one item:

20. Fractions should be developed as measures of lengths. (52.0%) (This item was ranked fifth for both FD1A and FD1B.)

There was weak opposition to three items:

14. Students should use slide rules, graphs, and charts (nomographs) to solve problems involving fractions. (supported by 32.2%, opposed by 42.1%) (This item was also weakly opposed for FD1A, but ranked sixth for FD1B and eighth for FD1A.)

12. Operations with fractions should be taught only for fractions with small denominators ... (supported by 36.9%, opposed by 52.3%) (This item was weakly supported for FD1A and ranked sixth; it was ranked seventh for FD1B.)

11. All fractions should be written as decimals so that the operations on them can be performed with a calculator. (supported by 33.3%, opposed by 54.0%) (There was slightly more support for this item on FD1A, where it was ranked seventh, compared to eighth for FD1B.)

There was clear opposition to the final two items:

13. Tables of common denominators (factors and multiples) should be given to students. (supported by 16.8%, opposed by 67.5%). (There was also opposition to this on FD1A; in both clusters, it was ranked ninth.)

18. Decimals should be introduced by relating them exclusively to money. (supported by 14.3%, opposed by 75.3%) (This was ranked tenth in both FD1A and FD1B.)

Content for secondary school students

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD15	1.218	1.043	1.328	1.190	1.467	1.169	1.225			
	85.0%	80.9%	91.1%	85.8%	86.7%	81.4%	84.5%			
	6.8%	12.8%	4.5%	9.5%	6.7%	5.1%	5.6%			
FD16	1.096	1.106	0.806	1.048	0.733	1.136	1.423			
	79.3%	80.9%	71.7%	81.0%	73.3%	74.5%	90.2%			
	9.3%	10.6%	13.5%	4.8%	6.7%	10.2%	5.6%			
FD19	1.079	1.170	1.090	0.857	0.867	1.068	1.127			
	80.7%	87.2%	77.6%	71.5%	73.4%	79.7%	84.5%			
	5.3%	8.5%	4.5%	14.3%	6.7%	5.1%	1.4%			
FD17	0.996	1.255	1.134	1.048	0.867	0.847	0.831			
	75.7%	85.1%	83.6%	76.2%	73.3%	69.5%	67.6%			
	8.9%	6.4%	4.5%	0.0%	13.4%	11.9%	14.0%			
FD20	0.391	0.128	0.463	0.429	0.667	0.259	0.535			
	52.0%	40.4%	52.2%	57.1%	66.7%	43.1%	62.0%			
	21.5%	34.0%	19.4%	19.1%	20.0%	24.1%	14.1%			
FD14	-0.257	0.021	-0.493	-0.429	-0.533	-0.203	-0.155			
	32.2%	38.3%	25.4%	23.8%	40.0%	28.8%	38.1%			
	42.1%	29.8%	50.8%	47.6%	53.3%	38.9%	40.8%			
FD12	-0.269	0.149	-0.612	-0.857	-1.333	0.397	-0.366			
	36.9%	46.8%	29.9%	19.1%	6.7%	58.6%	31.0%			
	52.3%	34.1%	64.2%	76.2%	86.6%	29.3%	57.7%			
FD11	-0.407	0.064	-0.657	-0.429	-1.667	0.068	-0.606			
	33.3%	42.6%	23.9%	33.3%	0.0%	47.4%	30.9%			
	54.0%	36.2%	64.2%	52.3%	93.3%	39.0%	60.5%			

Content for secondary school students (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD13	-0.846	-0.404	-1.090	-0.952	-1.200	-0.763	-0.873			
	16.8%	25.6%	12.0%	19.0%	13.3%	22.0%	11.3%			
	67.5%	51.0%	77.7%	71.5%	80.0%	64.4%	67.6%			
FD18	-1.018	-0.787	-1.045	-1.095	-1.533	-0.814	-1.183			
	14.3%	21.3%	16.4%	14.3%	0.0%	15.3%	9.9%			
	75.3%	66.0%	79.1%	76.2%	93.3%	67.8%	80.3%			

Resources (FD3)

Ten resources for teaching fractions and decimals were suggested. Four of these were strongly supported:

47. Drill and practice materials (87.3%)

43. Masters of worksheets and activities (85.9%)

49. Resource booklets with applications (86.9%)

44. Individual study materials (83.6%)

There was moderately strong support for the remaining items:

50. "Magic response paper" to give immediate feedback by revealing the correct answer just after students have written their answers (78.9%)

42. Films and videotapes on fraction and decimal concepts (76.9%)

45. Student sets of measuring devices (76.5%)

48. Large-scale demonstration devices (74.6%)

46. Manipulative materials (66.9%)

41. A calculator designed so that fractions could be input and the answer would be displayed as a fraction (67.5%)

The MA sample supported each of these items at a lower level than did most other samples. In fact, only for items 49 and 44 did this sample react as favorably as others did.

Resources

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD47	1.304	1.410	1.308	1.283	1.000					
	87.3%	89.0%	86.7%	93.5%	75.8%					
	4.0%	5.0%	2.5%	2.2%	9.1%					
FD43	1.211	1.340	1.325	1.000	0.687					
	85.9%	90.0%	88.4%	82.6%	68.8%					
	7.7%	8.0%	5.0%	8.7%	15.7%					
FD49	1.202	1.242	1.143	1.413	1.000					
	86.9%	84.9%	86.6%	91.3%	87.9%					
	6.1%	7.1%	6.7%	2.2%	6.0%					
FD44	1.151	1.220	1.050	1.370	1.000					
	83.6%	84.0%	81.7%	89.1%	81.8%					
	7.1%	6.0%	10.8%	0.0%	6.0%					
FD45	1.030	1.360	0.924	0.935	0.545					
	76.5%	87.0%	71.4%	76.0%	63.6%					
	8.7%	6.0%	10.1%	4.3%	18.2%					
FD50	0.957	0.990	0.958	1.000	0.788					
	78.9%	79.0%	80.0%	80.4%	72.7%					
	10.7%	13.0%	10.0%	6.5%	12.1%					
FD42	0.909	1.060	0.840	1.087	0.455					
	76.9%	80.0%	73.9%	89.2%	60.6%					
	14.1%	13.0%	16.8%	6.5%	18.2%					
FD48	0.896	1.200	0.808	0.870	0.333					
	74.6%	84.0%	73.4%	76.1%	48.5%					
	11.0%	5.0%	12.5%	10.9%	24.3%					

Resources (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD46	0.759	1.150	0.667	0.500	0.273					
	66.9%	79.0%	64.2%	54.4%	57.6%					
	15.7%	11.0%	14.1%	17.3%	33.3%					
FD41	0.589	0.680	0.625	0.696	0.030					
	67.5%	71.0%	67.5%	73.9%	48.5%					
	23.0%	22.0%	20.9%	17.3%	42.5%					

Methods (FD4)

Two items pertaining to methods that could be used for teaching fractions or decimals were strongly supported:

54. Student worksheets are included for drill and practice on fractions and decimal topics at the conclusion of each lesson. (87.0%)

53. Operations with fractions are developed within the context of applications problems. (85.0%)

Moderately strong support was expressed for three items:

51. Geometric pictures of physical models are used to represent computational algorithms for fractions and decimals. (73.2%)

60. Specific objectives, criterion-referenced testing, and other materials are included to encourage use of a mastery learning or an individually paced model. (66.3%)

52. More than 50% of the instructional time is devoted to drill and practice in lessons on fractions and decimals. (65.5%)

Only minimal support was shown for three items (with the last being considerably weaker than the first two):

58. Basic fraction and decimal ideas are introduced through laboratory investigations. (57.0%)

59. Detailed notes are provided to guide the teacher in oral presentations of lessons on fractions and decimals. (49.9%)

57. More than 50% of the instructional time is devoted to student use of individual study materials ... (supported by 40.3%, opposed by 34.6%)

One item was weakly opposed and another was moderately opposed:

56. Basic operations with fractions and decimals are developed through long-term student projects. (supported by 27.3%, opposed by 45.3%)

55. Slower students are allowed to use calculators so they may keep up with the rest of the class. (supported by 20.0%, opposed by 55.4%)

Methods

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD54	1.241	1.330	1.266	1.146	1.000					
	87.0%	91.3%	85.1%	87.8%	80.0%					
	3.2%	3.9%	3.1%	0.0%	5.7%					
FD53	1.137	1.233	1.094	1.317	0.800					
	85.0%	88.3%	82.8%	92.7%	74.2%					
	3.9%	3.9%	3.9%	0.0%	8.6%					
FD51	0.918	0.980	0.875	0.902	0.914					
	73.2%	72.5%	71.9%	78.1%	74.3%					
	6.9%	5.9%	7.1%	4.9%	11.4%					
FD60	0.768	0.990	0.709	0.951	0.114					
	66.3%	76.7%	63.8%	75.6%	34.3%					
	11.4%	8.7%	14.1%	4.9%	17.1%					
FD52	0.648	0.806	0.578	0.634	0.457					
	65.5%	71.8%	61.7%	65.8%	60.0%					
	18.3%	15.5%	18.0%	14.6%	31.4%					
FD58	0.479	0.680	0.352	0.512	0.314					
	57.0%	66.1%	52.3%	53.6%	51.4%					
	20.2%	14.6%	24.2%	12.2%	31.5%					
FD59	0.466	0.631	0.397	0.415	0.286					
	49.9%	61.1%	45.3%	46.3%	37.1%					
	17.4%	17.5%	19.9%	14.6%	11.5%					
FD57	0.121	0.243	-0.070	0.195	0.371					
	40.3%	46.6%	32.8%	43.9%	45.7%					
	34.6%	36.9%	39.9%	26.8%	17.1%					

Methods (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	P
FD56	-0.221	-0.126	-0.344	-0.122	-0.171					
	27.3%	30.1%	24.2%	31.7%	25.8%					
	45.3%	44.7%	49.3%	43.9%	34.3%					
FD55	-0.518	-0.216	-0.606	-0.780	-0.771					
	20.0%	31.4%	16.6%	9.7%	11.5%					
	55.4%	47.0%	56.7%	65.9%	62.9%					

Who/Time (FD5)

The ten items in this cluster focused on the relative importance and placement of fractions versus decimals. Only one item was given moderately strong support, one was given minimal support, and the remainder were given little or no support. The item which received strong support was:

70. Students should be taught fractions with small denominators useful in various vocations. (76.0%)

Support of this item was particularly strong from SP and TE samples, moderately strong from the AT, MT, and JC samples, and minimal from the MA sample.

The item receiving minimal support was:

62. More attention should be given to operations with decimals than operations with fractions. (55.5%)

This item was strongly supported by the SP sample and gained moderately strong support from AT and TE samples. Although the MT sample was divided, both the JC and MA samples definitely opposed the item. A similar item was given to the lay samples (as item 750). Overall, 33.1% of the lay samples supported the item, while 44.4% opposed it. The PR sample was divided, while the SB and PT samples were more opposed.

There was also marked division in the responses of professional samples to another item:

65. Operations with decimals should be introduced before operations with fractions. (supported by 40.9%, opposed by 33.0%)

The SP sample gave moderate support to this item, and the TE and AT samples gave minimal support. But opposition was reflected by the MT, JC, and MA samples.

For the other seven items, percentages of disagreement were higher than percentages of agreement; for the last two items, in fact, there was no support whatever. In almost every instance, support was highest from the SB sample, while the MT, JC, and MA samples were most opposed.

67. Operations with decimals should be included in the first- or second-grade mathematics program (the earlier the better). (supported by 33.8%, opposed by 44.8%)

66. All students should master operations with decimals, but not all should be expected to master operations with fractions. (supported by 31.4%, opposed by 60.1%)

61. Less attention should be given to the addition and subtraction of fractions. (supported by 31.1%, opposed by 64.7%)

64. Work with fractions should be delayed until seventh or eighth grade. (supported by 15.4%, opposed by 75.8%)

63. Division of fractions should be omitted from the curriculum except for very bright children. (supported by 14.2%, opposed by 80.0%)

69. Only college-bound students should be taught fractions (e.g., in algebra courses). (supported by 2.9%, opposed by 96.1%)

68. Fractions should be omitted from the curriculum. (supported by 1.4%, opposed by 95.9%)

Item 64 was also given to the lay samples (as item 776). These three groups were strongly opposed, with support from only 8.2% and opposition from 77.7%. An item identical to 67 was given (as item 743) to lay samples. It was supported by 27.6%, with 59.5% opposed, proportions close to those of the SP and TE samples.

Who/Time

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD70	0.907	1.056	0.679	0.553	0.382	1.356	1.131			
	76.0%	76.7%	69.7%	63.2%	55.9%	93.3%	88.5%			
	15.9%	12.1%	21.1%	26.4%	35.3%	3.4%	8.2%			
FD62	0.357	0.720	-0.018	-0.462	-0.853	1.271	0.705			
	55.5%	66.3%	43.1%	23.1%	14.7%	89.9%	68.9%			
	31.1%	19.7%	40.3%	53.9%	70.6%	6.8%	21.3%			
750	-0.113							0.064	-0.323	-0.356
	33.1%							38.7%	25.8%	26.7%
	44.4%							38.1%	51.6%	53.4%
FD65	0.086	0.439	-0.367	-0.436	-0.500	0.695	0.344			
	40.9%	55.2%	22.9%	20.5%	17.7%	64.4%	50.9%			
	33.0%	25.2%	38.5%	48.7%	50.0%	18.7%	31.2%			
FD67	-0.127	0.093	-0.055	-0.179	-0.088	-0.322	-0.443			
	33.8%	43.0%	34.9%	25.6%	35.3%	28.9%	24.6%			
	44.8%	38.3%	45.7%	35.9%	44.2%	64.4%	59.0%			
743	-0.412							-0.477	-0.315	-0.356
	27.6%							27.0%	27.2%	31.1%
	59.5%							62.0%	57.7%	53.3%
FD66	-0.498	-0.160	-0.936	-1.231	-1.147	0.271	-0.213			
	31.4%	39.6%	21.1%	5.1%	14.7%	54.2%	39.3%			
	60.1%	48.1%	72.4%	87.2%	82.4%	35.6%	52.5%			
FD61	-0.620	-0.453	-1.073	-1.256	-1.529	0.458	-0.230			
	31.1%	36.8%	16.5%	10.3%	5.9%	66.1%	41.0%			
	64.7%	60.4%	77.0%	87.2%	91.1%	30.5%	54.1%			

Who/Time (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD64	-1.000	-0.860	-1.358	-1.205	-1.235	-0.559	-0.770			
	15.4%	22.4%	5.5%	2.6%	8.8%	28.8%	19.7%			
	75.8%	70.1%	83.5%	84.7%	85.3%	61.0%	75.4%			
776	-1.092							-1.046	-1.261	-1.120
	8.2%							7.9%	5.7%	14.0%
	77.7%							75.3%	85.2%	82.0%
FD63	-1.081	-0.738	-1.578	-1.590	-1.647	-0.322	-0.885			
	14.2%	24.3%	3.7%	2.6%	2.9%	30.5%	13.1%			
	80.0%	70.0%	91.7%	97.4%	97.1%	55.9%	78.7%			
FD69	-1.687	-1.467	-1.807	-1.692	-1.735	-1.661	-1.852			
	2.9%	6.5%	0.9%	2.6%	2.9%	3.4%	0.0%			
	96.1%	89.8%	99.1%	97.5%	97.0%	96.6%	100.0%			
FD68	-1.748	-1.561	-1.881	-1.872	-1.765	-1.661	-1.836			
	1.4%	1.8%	0.0%	0.0%	5.9%	3.4%	0.0%			
	95.9%	89.8%	100.0%	97.4%	94.1%	94.9%	100.0%			

Calculators (FD6)

Only one use of calculators to teach fractions and decimals was strongly supported:

80. Finding the area of a lot whose length is 73.28 units and whose width is 35.92 units (81.0%)

Two items received moderately strong support from all samples:

74. Developing ideas about decimals (66.5%)

72. Homework involving problems with decimals (64.9%)

Weak support was given to one other item:

79. Reducing all quantities in a recipe by one-third (51.3%)

There was little support for the remaining items, with the percentage of those disagreeing increasing:

73. Developing ideas about common fractions (supported by 40.7%, opposed by 42.5%)

75. Finding equivalent forms of a given fraction ... (supported by 40.5%, opposed by 44.8%)

71. Homework involving problems with common fractions (supported by 36.5%, opposed by 55.6%)

76. Reducing fractions (supported by 33.3%, opposed by 55.2%)

78. Taking a test involving decimals (supported by 38.0%, opposed by 53.4%)

77. Taking a test involving fractions (supported by 22.9%, opposed by 67.7%)

Calculators

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD80	1.115	0.950	1.145	1.324	1.320					
	81.0%	73.0%	82.9%	91.9%	88.0%					
	13.6%	21.0%	10.2%	8.1%	8.0%					
FD74	0.626	0.646	0.590	0.865	0.360					
	66.5%	64.7%	68.4%	67.5%	64.0%					
	23.7%	22.3%	25.6%	16.2%	32.0%					
FD72	0.480	0.390	0.564	0.649	0.200					
	64.9%	60.0%	70.1%	67.5%	56.0%					
	28.7%	34.0%	24.8%	21.6%	36.0%					
FD79	0.280	0.350	0.171	0.486	0.200					
	51.3%	53.0%	48.7%	56.7%	48.0%					
	37.3%	36.0%	40.2%	32.4%	36.0%					
FD73	-0.036	0.020	-0.060	0.216	-0.520					
	40.7%	41.4%	41.0%	43.2%	32.0%					
	42.5%	37.4%	44.5%	37.8%	60.0%					
FD75	-0.082	0.070	-0.137	-0.108	-0.400					
	40.5%	46.0%	38.4%	37.8%	32.0%					
	44.8%	44.0%	43.6%	48.6%	48.0%					
FD71	-0.300	-0.253	-0.293	-0.162	-0.720					
	36.5%	36.3%	39.6%	35.1%	24.0%					
	55.6%	58.6%	52.6%	45.9%	72.0%					
FD76	-0.323	-0.200	-0.333	-0.243	-0.880					
	33.3%	37.0%	33.3%	32.4%	20.0%					
	55.2%	51.0%	53.8%	56.7%	76.0%					

Calculators (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD78	-0.351	-0.600	-0.248	0.162	-0.600					
	38.0%	29.0%	42.7%	51.3%	32.0%					
	53.4%	61.0%	49.6%	40.5%	60.0%					
FD77	-0.756	-0.830	-0.735	-0.459	-1.000					
	22.9%	21.0%	23.9%	27.0%	20.0%					
	67.7%	70.0%	66.7%	59.4%	76.0%					

Summary: Fractions and Decimals

- Strong support (over 80%) was given to four goals for teaching fractions, related to their use in vocations, for consumer purchases, in illustrating basic mathematical ideas, and in providing solutions to algebraic equations.
- Strong support was given to five goals for teaching decimals, related to their use in vocations, for consumer purchases, in money, in illustrating basic mathematical ideas, and because of their use in the metric system.
- Support by 73% to 83% was given to treating four topics on fractions and decimals in the elementary school: least common multiple and greatest common divisor as basic ideas related to fractions, estimation of the size of a dividend, decimals developed as a means of naming numbers between numbers, and fractions presented as answers to division problems.
- Support from 76% to 85% was given to treating the same four topics on fractions and decimals in the secondary school as were given most support as elementary school topics.
- Four resources for teaching fractions and decimals were strongly supported (by over 80%): drill and practice materials, masters of worksheets and activities, resource booklets with applications, and individual study materials.
- Two strategies for teaching fractions and decimals were given strong support: having worksheets for drill and practice on each lesson, and using applications to develop operations with fractions.
- Only one item was given moderate support (by 76%) from the set of items on to whom and when fractions should be taught; this approved the teaching of fractions with small denominators useful in vocations.
- There was very little support (15%) for delaying work with fractions until grade 7 or 8, or for omitting division of fractions except for very

bright children; there was almost <u>no</u> support (1% to 3%) for teaching fractions only to college-bound students or for omitting fractions from the curriculum.

- Only one use of calculators to teach fractions and decimals was strongly supported; it involved finding an area when dimensions were given to two decimal places.

Ratio, Proportion, and Percent

Goals (RP2)

All samples indicated strong agreement for three goals involving practical uses of ratio, proportion, and percent. They were:

438. To acquire consumer skills such as using percent in analyzing the financing of a purchase ... (94.0%)

441. To develop proportional thinking as an important problem-solving technique (91.9%)

444. To acquire skills necessary for applying mathematics in vocational settings (86.5%)

There was also good agreement with moderately strong support on four goal statements that were more academic in nature. However, support for these "academic" statements was less than that for the "practical" statements. The "academic" statements were:

443. To develop, apply, and extend the understanding of fractions (74.9%)

439. To demonstrate that ratios provide the foundations for a powerful reasoning process (70.0%)

437. To provide a setting for practicing computational skills (68.1%)

440. To learn special techniques, such as diverse and inverse variation, that are powerful tools in sciences such as physics and chemistry (65.8%)

The remaining three goals were given little support by any group; in fact, there was more opposition than support for the last two:

445. To develop and practice disciplined work habits (37.4%)

442. To identify students who possess mathematical talent (supported by 24.0%, opposed by 33.1%)

436. To preserve a traditional emphasis in the curriculum (supported by 17.9%, opposed by 46.9%)

Goals

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
RP438	1.371	1.467	1.460	1.333	1.129	1.407	1.211			
	94.0%	95.7%	94.0%	90.0%	90.3%	98.3%	91.6%			
	2.1%	1.1%	3.0%	6.7%	3.2%	1.7%	0.0%			
RP441	1.306	1.239	1.202	1.367	1.323	1.525	1.324			
	91.9%	88.0%	90.9%	93.3%	93.5%	96.6%	92.9%			
	1.6%	3.3%	3.0%	0.0%	0.0%	0.0%	0.0%			
RP444	1.099	1.239	1.170	1.067	0.903	1.186	0.845			
	86.5%	90.2%	88.0%	93.4%	80.6%	93.2%	73.3%			
	2.6%	1.1%	5.0%	3.3%	6.5%	0.0%	1.4%			
RP443	0.874	0.957	1.152	1.067	0.806	0.576	0.577			
	74.9%	79.4%	89.9%	90.0%	67.7%	56.0%	60.6%			
	8.3%	8.7%	5.1%	6.7%	3.2%	11.9%	12.7%			
RP439	0.859	0.793	0.890	0.967	0.968	0.915	0.761			
	70.0%	68.4%	71.0%	73.3%	74.2%	71.2%	66.2%			
	9.1%	10.9%	10.0%	10.0%	3.2%	6.8%	9.8%			
RP437	0.710	0.761	1.000	1.000	0.645	0.458	0.352			
	68.1%	68.5%	83.0%	83.3%	67.8%	57.7%	49.3%			
	12.8%	15.2%	6.0%	6.7%	12.9%	17.0%	18.3%			
RP440	0.702	0.424	0.790	1.000	0.677	0.847	0.704			
	65.8%	52.2%	71.0%	83.3%	64.5%	69.4%	66.2%			
	9.9%	16.3%	12.0%	3.3%	9.7%	3.4%	7.0%			
RP445	0.115	0.413	0.400	0.233	-0.065	-0.085	-0.479			
	37.4%	52.2%	52.0%	33.3%	32.2%	22.1%	14.1%			
	26.3%	19.6%	23.0%	13.4%	32.3%	30.5%	39.4%			

Goals (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
RP442	-0.131	-0.065	0.210	-0.567	-0.258	0.017	-0.577			
	24.0%	27.2%	37.0%	13.4%	22.6%	23.8%	7.0%			
	33.1%	33.7%	21.0%	46.7%	41.9%	28.8%	43.6%			
RP436	-0.432	-0.511	0.080	-0.567	-0.813	-0.492	-0.775			
	17.9%	17.4%	33.0%	20.0%	9.4%	8.5%	8.4%			
	46.9%	50.0%	26.0%	60.0%	56.3%	45.7%	63.4%			

Content (RP1)

The practical inclination of all samples with regard to content on ratio, proportion, and percent is evident in the five top-ranked content items. Two were strongly supported, while the other three were given moderately strong support:

422. Percent should be introduced in a real-life context. (95.8%)

424. Percent should be introduced in terms of merchandising ... (84.3%)

426. A percent, such as 63%, should be converted to the ratio of 63/100. (74.6%)

427. Ratio should be introduced as a method for determining the "best buy" in a supermarket or sporting goods store. (69.1%)

433. Shortcuts and memory devices should be taught ... (69.9%)

Some differences across samples are apparent. Thus, the MA sample gave little support to item 433, while the MT sample gave it strong support.

Five items were given only minimal support:

423. Direct and indirect variations should be identified as two different patterns when data are graphed. (56.2%)

430. Ratio should be developed as a special kind of fraction before applications of the concept are made. (52.9%)

428. Each percent problem should be solved by writing an appropriate number sentence. (52.8%)

431. Proportions should be introduced as ways to describe mixtures. (50.3%)

435. Ratio and proportion should be developed in connection with similar geometric figures even in non-geometry courses. (53.3%)

Note that four of these five statements deal with ratio and proportion (or variation). The samples tended to agree on items involving the teaching of percent, but seem to be less certain about the approach that should be taken when teaching ratio and proportion.

Five content statements were given very little support. For the last four, opposition was equivalent or greater than support; in fact, the final item was overwhelmingly not supported.

425. Proportions should be introduced with illustrations of simple chemistry and physics experiments. (46.6%)

421. Ratio should be introduced as a measure of the "steepness" of different straight-line graphs ... (supported by 41.9%, opposed by 39.0%)

429. Every percent problem should be solved by setting up a proportion. (supported by 38.5%, opposed by 38.6%)

432. Proportions should not be dignified by special treatment but as simply a part of equation solving. (supported by 33.3%, opposed by 45.0%)

434. Percent should be introduced as a special key on a calculator and the meaning of the concept should be discovered by examining the effects of that key. (supported by 17.3%, opposed by 63.1%)

Content

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
RP422	1.576	1.729	1.443	1.464	1.516	1.650	1.574			
	95.8%	97.9%	91.5%	92.8%	100.0%	96.7%	98.3%			
	2.4%	1.0%	4.7%	7.1%	0.0%	1.7%	0.0%			
RP424	1.183	1.490	1.236	1.071	0.871	1.117	0.885			
	84.3%	93.7%	88.7%	82.1%	74.2%	81.7%	70.5%			
	6.8%	3.1%	5.6%	7.1%	6.4%	6.7%	14.8%			
RP426	0.974	1.083	0.670	1.036	0.548	1.300	1.197			
	74.6%	76.0%	66.1%	78.6%	54.8%	85.0%	85.3%			
	12.6%	12.5%	17.9%	10.7%	16.1%	6.7%	8.2%			
RP427	0.751	1.031	0.708	0.429	0.581	0.683	0.689			
	69.1%	83.4%	65.1%	60.7%	61.3%	66.6%	63.9%			
	16.2%	7.3%	16.0%	28.6%	19.4%	20.0%	19.6%			
RP433	0.728	0.812	1.123	0.571	0.032	0.800	0.262			
	69.9%	74.0%	84.0%	71.5%	45.2%	71.7%	49.2%			
	17.6%	14.6%	8.5%	21.4%	35.5%	15.0%	29.5%			
RP423	0.536	0.333	0.743	0.286	0.586	0.483	0.639			
	56.2%	42.8%	66.7%	53.6%	51.7%	51.7%	67.3%			
	12.7%	12.5%	8.6%	28.6%	10.3%	11.6%	14.8%			
RP430	0.432	0.798	0.538	0.857	-0.129	0.217	-0.016			
	52.9%	69.1%	59.5%	67.9%	29.0%	38.3%	36.1%			
	23.4%	11.7%	24.5%	3.6%	35.5%	26.7%	39.3%			
RP428	0.402	0.726	0.396	0.464	-0.387	0.567	0.115			
	52.8%	66.3%	50.0%	50.0%	22.6%	58.3%	47.6%			
	27.3%	17.9%	26.4%	28.6%	48.4%	16.6%	42.6%			

Content (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	P
RP431	0.338	0.427	0.425	0.321	0.290	0.233	0.180			
	50.3%	53.2%	56.7%	46.4%	45.2%	45.0%	44.3%			
	22.0%	17.7%	19.8%	21.4%	19.4%	28.4%	27.9%			
RP435	0.333	0.354	0.267	0.357	0.129	0.333	0.508			
	53.3%	54.2%	51.4%	57.1%	38.7%	56.6%	57.4%			
	27.0%	22.9%	31.4%	21.4%	32.3%	31.7%	21.3%			
RP425	0.259	0.177	0.255	0.464	0.355	0.283	0.230			
	46.6%	40.7%	45.3%	57.2%	51.6%	51.6%	45.9%			
	25.4%	26.0%	22.7%	21.5%	22.6%	30.0%	27.9%			
RP421	0.061	-0.105	0.132	0.296	0.333	-0.217	0.230			
	41.9%	33.7%	44.3%	55.5%	46.6%	31.6%	52.5%			
	39.0%	45.2%	37.7%	37.0%	23.3%	43.3%	36.1%			
RP429	0.039	0.411	-0.104	-0.679	-0.581	0.317	0.082			
	38.5%	53.7%	34.9%	14.2%	9.7%	46.6%	39.4%			
	38.6%	29.5%	41.5%	67.8%	54.8%	28.3%	36.0%			
RP432	-0.177	0.063	-0.142	-0.500	-0.226	-0.119	-0.508			
	33.3%	42.1%	38.7%	21.4%	19.3%	32.2%	23.8%			
	45.0%	38.9%	44.3%	57.1%	38.8%	40.7%	57.6%			
RP434	-0.770	-0.604	-0.783	-0.750	-1.129	-0.700	-0.902			
	17.3%	18.8%	16.1%	21.4%	6.4%	23.3%	14.7%			
	63.1%	56.3%	64.2%	67.9%	74.2%	60.0%	67.2%			

Resources (RP3)

What resources would the samples like to have available for teaching ratio, proportion, and percent? All samples were agreed in strongly supporting five resources; and a sixth item (450) received almost as much support:

454. Resource books of applications of ratio and percent to real-life problems (93.3%)

452. Master copies for making activities and worksheets (82.8%)

449. A laboratory book of experiments illustrating ratio and proportion (85.1%)

453. Mathematics laboratory manipulative materials for ratio and percent (80.2%)

455. Short films and videotapes illustrating basic concepts of ratio and percent (80.2%)

450. Individualized study materials for ratio and percent (78.4%)

Less but still moderately strong support was given to another item:

446. Charts for reading percents visually (62.4%)

There was very little support for the remaining three items, all of which involved machines or calculators:

451. Machines for plotting graphs (supported by 45.9%, opposed by 35.1%)

447. Calculators that allow three numbers of a proportion to be input, with the fourth member calculated and displayed when the "equals" key is pushed (supported by 43.2%, opposed by 38.8%)

448. Small computers or calculators programmed to handle all three types of percent problems automatically (supported by 35.4%, opposed by 42.5%)

Resources

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
RP454	1.493	1.461	1.582	1.517	1.333					
	93.3%	92.2%	94.9%	96.6%	89.8%					
	3.0%	4.9%	3.0%	0.0%	0.0%					
RP452	1.161	1.333	1.268	0.862	0.667					
	82.8%	87.3%	88.7%	72.4%	64.1%					
	7.1%	6.9%	5.2%	13.8%	7.7%					
RP449	1.112	1.010	1.173	1.207	1.154					
	85.1%	82.4%	84.7%	93.1%	87.2%					
	7.1%	9.8%	7.1%	6.9%	0.0%					
RP453	1.075	1.196	0.969	0.931	1.128					
	80.2%	82.4%	76.3%	79.3%	84.6%					
	6.8%	6.9%	6.2%	13.8%	2.6%					
RP455	0.989	1.127	1.020	0.621	0.821					
	80.2%	83.3%	81.6%	69.0%	76.9%					
	11.2%	7.8%	8.2%	24.1%	17.9%					
RP450	0.925	0.941	0.949	0.759	0.949					
	78.4%	77.5%	82.7%	69.0%	76.9%					
	10.8%	11.7%	10.2%	13.8%	7.7%					
RP446	0.545	0.755	0.592	0.138	0.179					
	62.4%	69.6%	64.3%	48.2%	48.8%					
	22.0%	15.6%	21.4%	41.3%	25.7%					
RP451	0.090	-0.088	0.112	0.345	0.308					
	45.9%	39.2%	48.0%	51.7%	53.8%					
	35.1%	43.1%	33.6%	24.1%	25.7%					

Resources (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
RP447	-0.071	0.127	-0.051	-0.414	-0.385					
	43.2%	49.0%	42.9%	37.9%	33.3%					
	38.8%	32.3%	38.8%	51.7%	46.1%					
RP448	-0.235	0.069	-0.357	-0.690	-0.385					
	35.4%	46.1%	27.6%	24.1%	35.9%					
	42.5%	35.3%	44.9%	58.6%	43.6%					

Methods (RP4)

Strong support was given to the following two types of teaching strategies for ratio, proportion, and percent, and a third item (458) received almost as much support:

457. Student worksheets are included for drill and practice at the conclusion of each lesson. (85.3%)

456. Simple physical experiments ... are done in a laboratory setting. (81.7%)

458. Projects ... are included for assignment to individuals and teams of students. (78.6%)

Moderate support was given to one other item:

464. Each ratio, proportion, or percent topic is introduced by giving the class a problem. (66.3%)

Minimal support was evidenced for three items; a fourth received less support:

459. Specific objectives, criterion-referenced testing, and other materials are included to encourage the use of mastery learning or an individually paced model. (56.6%)

465. Detailed notes are provided to guide the teacher in oral presentations ... (54.7%)

460. Field trips are taken in which students can observe the use of ratio, proportion, and percent in business and industry. (52.1%)

461. Activities are included that anticipate the class being divided into small discussion groups. (46.1%)

Far more opposition than support was expressed toward the last two items:

462. Graphs and charts are used to eliminate as much computation as possible. (supported by 25.2%, opposed by 48.9%)

463. Students are expected to read formal presentations of basic ideas ... before classroom activities are devoted to these ideas. (supported by 25.1%, opposed by 49.4%)

Methods

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
RP457	1.213	1.133	1.355	1.152	1.029					
	85.3%	82.2%	92.7%	81.8%	73.5%					
	4.1%	5.5%	1.8%	6.1%	5.9%					
RP456	1.109	1.178	1.027	1.091	1.206					
	81.7%	83.3%	80.9%	75.7%	85.3%					
	5.6%	4.4%	6.3%	9.1%	2.9%					
RP458	1.015	1.267	0.964	0.848	0.676					
	78.6%	90.0%	77.3%	69.7%	61.8%					
	6.3%	2.2%	8.2%	9.1%	8.8%					
RP464	0.712	0.656	0.636	0.909	0.912					
	66.3%	66.7%	59.1%	81.8%	73.5%					
	10.5%	15.5%	10.0%	6.0%	2.9%					
RP459	0.551	0.622	0.560	0.727	0.152					
	56.6%	57.8%	57.7%	69.7%	36.4%					
	13.6%	7.7%	14.7%	15.2%	24.3%					
RP465	0.449	0.411	0.573	0.485	0.118					
	54.7%	57.8%	57.3%	54.6%	38.3%					
	18.0%	20.0%	12.7%	21.2%	26.5%					
RP460	0.397	0.689	0.400	0.091	-0.088					
	52.1%	65.5%	49.1%	42.4%	35.3%					
	24.0%	17.8%	23.6%	30.4%	35.3%					
RP461	0.300	0.478	0.191	0.485	0.000					
	46.1%	54.4%	41.8%	57.6%	26.5%					
	21.8%	16.6%	24.5%	24.2%	23.5%					

Methods (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
RP462	-0.323	-0.044	-0.440	-0.606	-0.412					
	25.2%	34.4%	22.0%	18.2%	17.6%					
	48.9%	37.8%	53.2%	60.6%	52.9%					
RP463	-0.397	-0.567	-0.182	-0.606	-0.441					
	25.1%	16.7%	33.6%	18.2%	26.5%					
	49.4%	55.5%	41.8%	54.6%	52.9%					

Who/Time (RP5)

There was moderately strong support for only one item from the cluster of items on when and to whom ratio, proportion, and percent should be taught:

468. The mastery of percent problems should be a condition for high school graduation. (63.6%)

Support for another item was minimal:

469. More time should be devoted to ratio and proportion than is presently allowed in the school curriculum. (56.4%)

There was strong disagreement with the other three items:

470. Most of the work with direct and indirect variation should be handled in science classes rather than mathematics classes. (supported by 11.8%, opposed by 66.1%)

466. Ratio and proportion should not be introduced until grade 9. (supported by 7.0%, opposed by 87.1%)

467. Only bright students should be taught all three types of percent problems. (supported by 7.5%, opposed by 86.6%)

Who/Time

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
RP468	0.642	0.570	0.674	1.059	0.949	0.474	0.443			
	63.6%	62.0%	66.3%	82.3%	71.8%	50.9%	58.6%			
	21.4%	24.1%	18.9%	11.7%	18.0%	26.3%	24.3%			
RP469	0.556	0.333	0.463	0.882	0.526	0.684	0.686			
	56.4%	47.4%	53.7%	67.7%	50.0%	68.4%	58.6%			
	13.2%	24.4%	13.7%	0.0%	7.9%	15.8%	7.1%			
RP470	-0.684	-0.519	-0.789	-0.794	-0.872	-0.491	-0.729			
	11.8%	10.1%	11.6%	11.8%	7.7%	19.3%	10.0%			
	66.1%	51.9%	68.5%	73.5%	76.9%	66.7%	68.6%			
RP466	-1.244	-1.154	-1.168	-1.088	-1.103	-1.632	-1.286			
	7.0%	12.8%	7.4%	5.8%	5.1%	1.8%	5.7%			
	87.1%	80.7%	89.4%	82.4%	77.0%	96.5%	91.4%			
RP467	-1.263	-0.987	-1.189	-1.265	-1.513	-1.316	-1.486			
	7.5%	18.0%	6.3%	5.8%	0.0%	7.0%	2.9%			
	86.6%	76.9%	87.4%	82.3%	94.9%	85.9%	94.2%			

Calculators (RP6)

Only one use of calculators for teaching ratio, proportion, and percent was strongly supported:

474. Checking answers (92.7%)

However, six items received moderately strong support:

472. Doing homework (70.9%)

480. Given that 4 hours work is needed to produce 17 finished brackets, finding how much time is needed to produce 25 (68.5%)

477. Finding what percent of $3000 would yield $50 interest in a period of a year (68.4%)

475. Solving the problem, "If 3 cans of corn cost 89¢ what would be the cost of 10 cans of corn?" (64.4%)

478. Developing ideas about percents greater than 100% (62.7%)

479. Calculating the final amount owed if an item sells for $15 and the sales tax is 5% (61.3%)

The final three items were given minimal support:

473. Calculating the number of dollars saved if a $250 coat is purchased during a 30% discount sale (56.3%)

476. Finding the distance from Centerburg to Roseville if the length separating them on a map is 1½ inches and the map scale is ½ inch = 3 miles (55.7%)

471. Taking a test on ratio, proportion, and/or percent (57.4%)

Calculators

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
RP474	1.668	1.707	1.712	1.562	1.525					
	92.7%	93.9%	94.1%	90.7%	87.5%					
	3.8%	3.0%	4.2%	3.1%	5.0%					
RP472	0.733	0.449	0.873	0.781	0.975					
	70.9%	63.2%	75.5%	68.8%	77.5%					
	19.7%	24.5%	16.1%	28.2%	12.5%					
RP480	0.699	0.717	0.602	0.719	0.925					
	68.5%	69.7%	67.0%	65.7%	72.5%					
	24.6%	21.2%	27.1%	25.0%	25.0%					
RP477	0.660	0.768	0.534	0.645	0.775					
	68.4%	71.7%	65.3%	67.7%	70.0%					
	25.4%	18.2%	30.5%	25.9%	27.5%					
RP478	0.644	0.859	0.678	0.437	0.175					
	62.7%	70.7%	62.7%	56.3%	47.5%					
	23.2%	17.1%	22.1%	25.1%	40.0%					
RP475	0.574	0.566	0.424	0.719	0.925					
	64.4%	65.7%	57.6%	71.9%	75.0%					
	28.3%	26.3%	33.9%	18.8%	25.0%					
RP479	0.401	0.424	0.331	0.437	0.525					
	61.3%	63.7%	58.5%	62.5%	62.5%					
	34.6%	31.4%	37.3%	34.4%	35.0%					
RP473	0.358	0.459	0.237	0.187	0.600					
	56.3%	59.2%	51.7%	53.2%	65.0%					
	36.1%	33.6%	39.8%	37.5%	30.0%					

Calculators (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
RP476	0.322	0.333	0.229	0.406	0.500					
	55.7%	55.5%	51.7%	59.4%	65.0%					
	35.7%	33.3%	38.1%	34.4%	35.0%					
RP471	0.213	0.186	0.068	0.344	0.600					
	57.4%	55.6%	54.7%	62.5%	65.0%					
	37.4%	38.1%	41.9%	34.4%	25.0%					

Summary: Ratio, Proportion, and Percent

- Strong support (over 80%) was given to three goals for teaching ratio, proportion, and percent: to acquire consumer skills, to develop proportional thinking as a problem-solving technique, and to acquire skills for vocational applications.
- Two content items, both on percent, were strongly supported: introducing percent in a real-life context and in terms of merchandising.
- Six resources for teaching ratio, proportion, and percent were supported by over 78%: resource books of applications, master copies of activities and worksheets, books of laboratory experiments, manipulative materials, short films and videotapes, and individualized study materials.
- Support by over 78% was given to three strategies for teaching ratio, proportion, and percent: student worksheets for drill and practice, physical experiments in a laboratory setting, and projects for assignment to individuals or teams of students.
- There was moderately strong support for only one item on when and to whom to teach percent: 64% agreed that mastery of percent problems should be a condition for high school graduation.
- Teaching variation in science classes, not introducing ratio and proportion until grade 9, and teaching all three types of percent only to bright students were strongly rejected (by 66% to 87%).
- Only one use of calculators for teaching ratio, proportion, and percent was strongly supported (by 92%): checking answers.

Measurement

Goals (MS2)

Of the ten items in the goal cluster on measurement, six goals were strongly supported:

578. To acquire skills necessary for living in today's world (94.6%)

571. To develop skills that are prerequisite to other school work such as science or mathematics (92.1%)

577. For everyday use in the home (e.g., comparison, decisions) (92.6%)

580. To develop and practice estimation skills (88.1%)

579. To develop job-oriented skills (84.2%)

575. To learn to use specific tools for measurement (e.g., protractors, rulers, micrometers, calipers, scales) (80.2%)

Two goals were given moderate support, with one obviously much more strongly supported than the other:

572. To give meanings to the numbers that are used in arithmetic (77.0%)

573. To provide laboratory experiences (65.2%)

Item 576 was given minimal support:

576. To relate mathematics to historical and cultural developments (49.5%)

Finally, all responding samples opposed one item:

574. To develop physical coordination (supported by 23.4%, opposed by 33.6%)

Goals

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
MS578	1.473	1.520	1.591	1.400	1.417	1.480	1.219			
	94.6%	92.1%	96.2%	94.3%	94.4%	97.4%	92.2%			
	1.2%	3.0%	0.0%	2.9%	0.0%	0.0%	1.6%			
MS571	1.418	1.356	1.545	1.514	1.472	1.280	1.328			
	92.1%	87.1%	96.2%	97.2%	91.7%	90.6%	90.6%			
	2.5%	5.0%	0.8%	0.0%	0.0%	4.0%	3.1%			
MS577	1.381	1.451	1.485	1.429	1.111	1.400	1.156			
	92.6%	91.2%	97.8%	91.4%	80.6%	94.6%	89.1%			
	0.7%	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%			
MS580	1.269	1.127	1.176	1.371	1.111	1.507	1.437			
	88.1%	82.4%	87.0%	91.4%	83.3%	92.0%	95.3%			
	1.4%	1.0%	2.3%	0.0%	5.6%	0.0%	0.0%			
MS579	1.156	1.287	1.326	1.200	0.944	1.133	0.719			
	84.2%	88.1%	90.2%	88.5%	80.5%	85.3%	64.1%			
	3.2%	6.0%	0.8%	0.0%	5.6%	1.3%	6.3%			
MS572	1.007	1.030	1.182	1.086	1.028	0.960	1.094			
	77.0%	72.3%	80.4%	82.8%	80.6%	72.0%	78.2%			
	4.3%	5.0%	2.3%	5.7%	8.3%	2.7%	6.3%			
MS575	1.016	1.098	1.136	0.829	0.556	1.120	0.875			
	80.2%	80.4%	86.3%	74.2%	61.1%	84.0%	76.6%			
	4.3%	5.9%	1.6%	8.6%	13.9%	1.3%	3.1%			
MS573	0.752	0.891	0.629	0.514	0.361	1.000	0.844			
	65.2%	71.2%	59.0%	54.3%	50.0%	74.7%	71.9%			
	6.8%	6.9%	4.5%	14.3%	19.4%	1.3%	6.2%			

Goals (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
MS576	0.401	0.333	0.445	0.171	0.528	0.280	0.594			
	49.5%	47.0%	53.0%	34.3%	52.7%	42.7%	61.0%			
	13.5%	17.6%	13.7%	17.1%	5.6%	14.7%	7.8%			
MS574	-0.151	-0.010	-0.129	-0.543	-0.472	-0.013	-0.188			
	23.4%	36.3%	21.3%	8.6%	16.7%	21.4%	21.9%			
	33.6%	33.3%	30.3%	51.4%	52.8%	22.7%	32.8%			

Content for Elementary School Students (MS1E)

Half of the content items were stated in terms of measurement topics that should be included in mathematics textbooks for the elementary school. Four of these items were strongly supported:

554. The metric system (95.5%)

557. Use of measurement devices (e.g., ruler, protractors, micrometers) (96.0%)

559. Estimation of measurements (93.3%)

558. The use of both non-standard and standard units of measure (79.5%)

Moderate support was given to one item:

556. Formulas for areas of polygons and circles (72.0%)

Support was minimal for three other items:

560. History of measurement systems (58.0%)

551. Scientific notation (e.g., $5000 = 5 \times 10^3$) (57.3%)

552. The multiplication and division of units (e.g., $\frac{\text{miles}}{\text{hr}} \times \text{hr} = \text{miles}$) (57.4%)

For one other item, support was weak:

555. Significant digits (49.3%)

And general opposition was expressed toward one item:

553. Conversion between different measurement systems (supported by 29.8%, opposed by 63.1%)

High coefficients of agreement are indicative of the importance accorded to the metric system (item 554) and to estimation (item 559). The inconsistency of support for items 551 and 555 should be noted: scientific notation and significant digits are among the tools used in estimation, yet they are given far less support than is the general idea of estimation.

Content for elementary school students

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
MS554	1.720	1.654				1.800	1.754			
	95.5%	92.3%				98.4%	98.3%			
	1.3%	2.9%				0.0%	0.0%			
MS557	1.607	1.495				1.700	1.705			
	96.0%	95.1%				96.6%	96.8%			
	4.0%	4.9%				3.3%	3.3%			
MS559	1.576	1.262				1.883	1.852			
	93.3%	85.4%				100.0%	100.0%			
	4.5%	9.7%				0.0%	0.0%			
MS558	1.138	0.903				1.233	1.443			
	79.5%	73.7%				76.7%	91.8%			
	7.1%	7.8%				8.3%	4.9%			
MS556	0.764	0.615				0.750	1.033			
	72.0%	67.3%				70.0%	82.0%			
	17.8%	23.1%				16.6%	9.8%			
MS560	0.504	0.398				0.617	0.574			
	58.0%	51.5%				65.0%	62.3%			
	18.3%	24.3%				10.0%	16.4%			
MS551	0.453	0.462				0.383	0.508			
	57.3%	58.6%				53.3%	59.0%			
	29.4%	28.9%				31.6%	27.9%			
MS552	0.440	0.663				-0.017	0.508			
	57.4%	67.3%				38.3%	59.0%			
	27.5%	23.1%				41.7%	21.3%			

Content for elementary school students (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
MS555	0.289	0.317				0.083	0.443			
	49.3%	49.0%				43.3%	55.7%			
	29.3%	27,9%				38.4%	22.9%			
MS553	-0.618	-0.385				-1.050	-0.590			
	29.8%	37.5%				18.3%	27.9%			
	63.1%	56.8%				75.0%	62.3%			

Content for Secondary School Students (MS1S)

A second set of content items concerning measurement was presented in terms of whether the topics should be included for all secondary students at some point in grades 7-12. Eight of the items are like or similar to topics listed for elementary schools in the previous set of items.

Three items were very strongly supported:

564. The metric system (96.7%)

569. Estimation and approximations of measures (88.9%)

562. The multiplication and division of units (e.g., $\frac{\text{miles}}{\text{hr}} \times \text{hr} = \text{miles}$) (84.8%)

Support was slightly less, but still moderately strong for the following four items:

561. Angle and arc measurement (75.8%)

566. Formulas for areas of polygons and circles (71.3%)

568. The use of arbitrary and standardized units of measure (66.8%)

565. Significant digits (61.2%)

"Conversion between similar units in different systems" (item 563) was weakly supported by the MT sample (52.3%), well supported by the MA and JC samples (90.2% and 74.3%, respectively), but opposed by the SP and TE samples (66.1% and 49.3% did not give support). The samples gave equivocal support to the teaching of "formulas for distance on the coordinate plane" (item 567) and "history of measurement systems" (item 570) (both opposed by over 40% of the combined samples, and supported by 41.3% and 36.5%, respectively).

We note that, as with the elementary content items, the TE and SP samples see conversion as significantly less important content than the other samples. And these same two samples indicated that estimation was more important than did the other samples.

Content for secondary school students

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
MS564	1.761		1.721	1.707	1.714	1.864	1.803			
	96.7%		94.5%	97.6%	97.1%	98.3%	98.6%			
	1.8%		2.3%	2.4%	2.9%	1.7%	0.0%			
MS569	1.376		1.194	1.073	1.086	1.763	1.704			
	88.9%		84.5%	78.0%	85.7%	98.3%	97.1%			
	6.6%		11.7%	9.8%	8.6%	0.0%	0.0%			
MS562	1.191		1.202	1.439	1.457	1.017	1.042			
	84.8%		86.1%	95.2%	85.7%	78.0%	81.7%			
	10.2%		9.4%	4.9%	5.8%	17.0%	11.3%			
MS561	0.910		0.806	0.878	1.257	0.746	1.085			
	75.8%		74.5%	75.6%	88.5%	66.1%	80.3%			
	18.5%		18.7%	17.0%	8.6%	27.1%	16.9%			
MS566	0.809		0.667	0.561	0.571	0.983	1.183			
	71.3%		66.7%	61.0%	68.6%	78.0%	81.7%			
	20.6%		24.8%	29.3%	28.6%	15.3%	8.4%			
MS568	0.795		0.583	0.390	0.294	1.373	1.169			
	66.8%		63.0%	43.9%	47.1%	89.8%	77.5%			
	14.7%		18.1%	17.1%	29.4%	3.4%	9.8%			
MS565	0.549		0.302	0.390	0.714	0.831	0.775			
	61.2%		50.4%	53.7%	71.4%	76.2%	67.6%			
	23.9%		30.3%	29.2%	20.0%	15.3%	18.3%			
MS563	0.284		0.411	1.195	0.943	-0.508	-0.141			
	52.3%		52.7%	90.2%	74.3%	32.2%	35.2%			
	36.7%		28.7%	9.8%	22.9%	66.1%	49.3%			

Content for secondary school students (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
MS567	0.024		-0.242	0.146	0.314	-0.102	0.394			
	41.3%		30.5%	41.4%	54.2%	39.0%	56.4%			
	45.5%		54.7%	39.0%	31.5%	50.9%	35.2%			
MS570	-0.063		-0.132	-0.195	0.029	-0.119	0.142			
	36.5%		34.9%	24.4%	35.3%	35.6%	47.9%			
	40.1%		43.5%	39.0%	38.2%	44.1%	32.4%			

Resources (MS3)

Ten items concerned preferences for resources to be used in teaching measurement. Four of the ten items were strongly supported:

590. Resource books with problems involving the application of measurement concepts (87.5%)

583. Masters of worksheets and activities (82.0%)

588. Student booklets of experiments or activities (83.1%)

581. A basic kit of measuring tools for each student (80.5%)

Another four items were given moderately strong support:

587. Large-scale measuring devices for teacher demonstrations (78.3%)

585. Individual study materials for measurement (77.9%)

589. Videotaped interviews with craftsmen and workers describing how they use measurement on the job (77.2%)

582. Films or videotapes showing basic measuring processes (78.5%)

There was very little support for the remaining two items:

584. Electronic measuring tools that show all measurements on a digital display similar to that of a calculator (45.1%)

586. Calculators with special keys for converting between measurement systems (39.6%)

The AT and MT populations appear most interested in having printed materials for students, particularly if they emphasize drill, practice, and/or applications. (This tendency appears to be common across curricular strands.) It should also be noted that each of the samples simply wanted any resource with the exception of electronic resources.

Resources

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
MS590	1.166	1.217	1.125	1.300	1.031					
	87.5%	90.5%	86.0%	96.7%	75.1%					
	5.1%	4.7%	6.2%	3.3%	3.1%					
MS583	1.126	1.231	1.219	1.000	0.531					
	82.0%	88.5%	82.8%	83.3%	56.3%					
	6.5%	4.8%	6.3%	6.7%	12.5%					
MS588	1.095	1.198	1.078	1.100	0.812					
	83.1%	86.8%	82.1%	86.6%	71.9%					
	5.8%	3.7%	8.6%	0.0%	6.3%					
MS581	1.075	1.343	1.023	0.867	0.625					
	80.5%	89.2%	77.4%	83.3%	62.5%					
	10.3%	6.9%	10.9%	10.0%	18.8%					
MS587	1.007	1.086	0.930	1.100	0.968					
	78.3%	81.9%	75.8%	80.0%	74.2%					
	9.5%	7.6%	11.7%	6.7%	9.7%					
MS585	0.980	1.105	0.844	1.067	1.031					
	77.9%	84.8%	72.6%	80.0%	75.1%					
	9.5%	8.6%	13.3%	3.3%	3.1%					
MS589	0.939	1.000	0.976	0.833	0.687					
	77.2%	80.0%	79.5%	70.0%	65.7%					
	10.9%	8.6%	9.5%	16.6%	18.8%					
MS582	0.911	1.087	0.836	0.867	0.687					
	78.5%	87.4%	74.2%	76.7%	68.8%					
	9.6%	4.9%	12.5%	3.3%	18.8%					

Resources (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
MS584	0.142	0.124	0.156	0.233	0.062					
	45.1%	46.7%	44.5%	46.6%	40.7%					
	29.8%	33.4%	28.9%	20.0%	31.3%					
MS586	-0.092	-0.248	-0.070	0.267	0.000					
	39.6%	34.3%	37.5%	56.7%	50.0%					
	39.7%	46.7%	36.0%	30.0%	40.6%					

Methods (MS4)

The methods cluster requested reactions to materials using particular strategies for teaching measurement. The samples are in remarkably close agreement, with most strategies of teaching being well-perceived.

Two of the ten items were strongly supported:

592. Assignments for students or teams of students include projects that require measurement. (86.9%)

597. Student worksheets are included for drill and practice on measurement topics at the conclusion of each lesson. (85.2%)

Six other items had moderately strong support:

593. Presentations and discussions of measurement techniques are given before students actively measure. (78.7%)

598. Each measurement topic is introduced by giving the class a problem. (77.1%)

594. Basic measurement ideas are introduced through laboratory investigations. (73.1%)

596. Simulations, wherein each student plays the role of a consumer or worker using measurement in real-world situations, are frequently included. (70.8%)

591. Activities are included that would require students to go outside the classroom to measure things. (70.5%)

600. Specific objectives, criterion-referenced testing, and other materials are included to encourage use of a mastery learning or an individually paced model. (63.9%)

A ninth item received only slightly less support:

599. Detailed notes are provided to guide the teacher in oral presentations of lessons about measurement. (59.3%)

Perhaps the most significant item is 595, in which is advocated a teaching strategy of devoting more than half of instructional time to the development and extension of ideas; it received the lowest ranking by each population (with support from only 49.5%). Why it received such limited support could be a topic for further study.

Methods

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
MS592	1.187	1.210	1.192	1.139	1.147					
	86.9%	86.6%	87.0%	36.2%	88.2%					
	4.3%	3.9%	5.4%	2.8%	2.9%					
MS597	1.167	1.152	1.231	1.333	0.794					
	85.2%	86.7%	86.2%	91.7%	70.5%					
	3.7%	4.8%	2.3%	0.0%	8.8%					
MS593	1.089	1.038	1.132	1.222	0.941					
	78.7%	76.2%	81.5%	86.1%	67.7%					
	5.3%	6.7%	4.6%	2.8%	5.9%					
MS598	0.970	0.819	1.008	1.306	0.941					
	77.1%	70.5%	78.4%	91.7%	76.5%					
	6.2%	8.6%	6.9%	0.0%	2.9%					
MS594	0.944	0.943	0.962	1.000	0.824					
	73.1%	71.4%	77.0%	69.4%	67.7%					
	7.5%	10.5%	6.9%	2.8%	5.9%					
MS596	0.856	0.952	0.877	0.806	0.529					
	70.8%	76.2%	72.3%	63.9%	55.9%					
	9.5%	11.5%	6.1%	11.1%	14.7%					
MS591	0.780	0.838	0.746	0.750	0.765					
	70.5%	74.3%	70.0%	63.9%	67.7%					
	16.1%	17.1%	16.1%	16.7%	11.8%					
MS600	0.722	0.942	0.602	0.972	0.235					
	63.9%	76.9%	58.6%	69.5%	38.2%					
	12.6%	8.7%	14.8%	2.8%	26.5%					

Methods (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
MS599	0.675	0.838	0.623	0.778	0.265					
	59.3%	69.6%	56.1%	61.1%	38.3%					
	9.2%	6.7%	10.8%	5.6%	14.7%					
MS595	0.397	0.571	0.231	0.722	0.147					
	49.5%	60.9%	40.7%	55.5%	41.2%					
	22.7%	20.0%	27.6%	5.6%	29.4%					

Who/Time (MS5)

This five-item strand focuses on when measurement topics should be taught or to whom they should be taught. All six populations sampled were in close agreement. Only one item was strongly supported:

602. Work on measurement should appear at every level from K-8. (93.7%)

The lay samples were given a similar item, and their reaction was equally supportive:

749. Work on measurement should be taught in the elementary school (96.4%)

The professional samples gave moderate support to another item:

605. Measurement should be a strong focus on ninth-grade general mathematics or consumer mathematics. (70.8%)

There was little or no support for the remaining three items:

604. Measurement should be a major theme of geometry. (supported by 39.3%, opposed by 42.2%)

601. All work in measurement should be taught by science teachers or in the context of science lessons. (supported by only 7.4%, opposed by 88.1%)

603. Topics in measurement should not be introduced before junior high school. (supported by only 6.5%, opposed by 92.1%)

Who/Time

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
MS602	1.653	1.663	1.525	1.625	1.268	1.908	1.831			
	93.7%	93.9%	90.7%	96.9%	80.5%	100.0%	98.5%			
	3.3%	3.0%	5.9%	0.0%	7.3%	0.0%	1.5%			
749	1.578							1.640	1.430	1.644
	96.4%							96.5%	95.7%	97.8%
	2.3%							2.8%	2.2%	0.0%
MS605	0.768	0.636	0.873	0.719	0.512	0.987	0.708			
	70.8%	66.6%	72.1%	68.8%	53.7%	81.5%	73.9%			
	13.4%	19.2%	8.4%	15.6%	17.0%	9.2%	15.4%			
MS604	-0.044	0.071	-0.339	-0.188	-0.317	0.303	0.154			
	39.3%	42.4%	25.4%	34.4%	29.3%	57.9%	46.1%			
	42.2%	37.4%	52.5%	46.9%	51.2%	31.5%	35.4%			
MS601	-1.328	-1.276	-1.195	-1.156	-0.902	-1.605	-1.677			
	7.4%	11.3%	7.6%	9.4%	14.6%	2.6%	1.5%			
	88.1%	83.7%	87.3%	90.7%	70.7%	97.4%	95.4%			
MS603	-1.582	-1.485	-1.475	-1.625	-1.439	-1.750	-1.800			
	6.5%	9.1%	8.5%	3.1%	7.3%	3.9%	3.1%			
	92.1%	88.9%	89.8%	96.9%	90.3%	96.0%	95.4%			

Calculators (MS6)

Two uses of calculators in connection with measurement content were strongly supported by the total samples. They were:

613. Checking answers (92.4%)

606. Finding the number of gallons of water a swimming pool will hold (83.5%)

Five other uses received moderate support:

608. Converting from one system of units to another (77.6%)

609. Calculating the diameter of a tree after measuring its circumference (73.4%)

612. Finding the number of rolls of wallpaper necessary to cover the walls of a room whose dimensions are given (71.2%)

615. Finding the total length of a road rally course given the odometer readings at various checkpoints (67.0%)

610. Doing homework problems involving measurements (66.0%)

Two items were given minimal support:

614. Finding the area of the opening of a fireplace 125 cm tall and 205 cm wide (59.6%)

607. Taking a test on measurement (51.4%)

One item was opposed by all samples:

611. Finding the volume of a rectangular shipping crate, 2 ft. x 4 ft. x 5 ft. (supported by 24.1%, opposed by 71.3%)

Calculators

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
MS613	1.594	1.667	1.667	1.406	1.325					
	92.4%	96.4%	94.1%	87.5%	80.0%					
	5.0%	2.7%	4.2%	9.4%	10.0%					
MS606	1.208	1.171	1.167	1.437	1.250					
	83.5%	82.0%	82.5%	90.6%	85.0%					
	11.5%	10.8%	13.3%	6.2%	12.5%					
MS608	1.023	1.098	1.000	1.031	0.875					
	77.6%	77.7%	78.4%	78.2%	75.0%					
	14.8%	12.5%	16.6%	12.5%	17.5%					
MS609	0.914	0.723	0.942	1.250	1.100					
	73.4%	66.9%	73.3%	84.4%	82.5%					
	19.8%	21.4%	20.8%	12.5%	17.5%					
MS612	0.848	0.927	0.717	1.187	0.750					
	71.2%	76.4%	65.0%	81.3%	67.5%					
	20.9%	14.6%	27.5%	9.4%	27.5%					
MS615	0.726	0.884	0.613	0.812	0.550					
	67.0%	70.6%	65.5%	68.8%	60.0%					
	24.4%	17.8%	27.7%	25.0%	32.5%					
MS610	0.660	0.405	0.733	1.094	0.800					
	66.0%	60.3%	67.5%	78.2%	67.5%					
	22.1%	28.8%	21.7%	9.4%	15.0%					
MS614	0.398	0.420	0.333	0.406	0.525					
	59.6%	61.6%	56.7%	59.4%	62.5%					
	32.2%	28.6%	35.8%	31.3%	32.5%					

Calculators (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
MS607	0.135	-0.080	0.192	0.469	0.300					
	51.4%	41.1%	55.0%	65.7%	57.5%					
	36.8%	42.0%	33.4%	34.4%	35.0%					
MS611	-0.815	-0.748	-0.917	-0.875	-0.650					
	24.1%	25.2%	21.7%	18.8%	32.5%					
	71.3%	69.3%	73.4%	75.1%	67.5%					

Summary: Measurement

- Six goals for teaching measurement were strongly supported (by over 80%). These goals involved acquiring skills for living in today's world, for other school work, for use in the home, for estimation, for jobs, and for using specific tools.
- As measurement content for elementary school mathematics, four topics received strong support: the metric system, use of measurement devices, estimation, and the use of both non-standard and standard units of measure.
- For measurement content for all students in grades 7-12, three items received strong support: the metric system, estimation, and the multiplication and division of units.
- The four resources for measurement most strongly supported (by over 80%) included resource books with problems, masters of worksheets or activities, student books with experiments, and a basic kit of measuring tools.
- Four other resources for measurement were given support by about 78%. Thus, it is apparent that the samples wanted almost any resource; they failed to support only two electronic resources.
- The listed teaching strategies for measurement were also well accepted, with support for 7 of 10 strategies above 70%. Strongest (above 80% support) were assignments including projects and worksheets for drill and practice at the conclusion of each lesson.
- It was felt (by over 80%) that work on measurement should be taught at every level from K-8, and over 70% indicated that measurement should be a strong focus of general or consumer mathematics.
- Only two calculator uses for teaching measurement received strong support (above 80%) - checking answers and a volume problem.

Algebra

Goals (AL2)

The several samples were in remarkably close agreement in their perception of the goals of algebra. As in most areas, they were willing to accept a wide range of goals. Seven of the ten goal statements received a high level of support. They were:

145. To learn how to apply mathematics (91.9%)

143. To build the background for taking more mathematics (85.6%)

140. To gain skills necessary for work and vocations (81.3%)

142. To prepare for college (80.8%)

137. To learn to read mathematics (77.7%)

141. To gain an appreciation for a type of mathematics that is more powerful and versatile than arithmetic (75.5%)

136. To consolidate arithmetic skills (73.8%)

None of the goals listed were rejected, but support was noticeably weaker in all samples for:

138. To preserve options with respect to career and vocational choice (61.7%)

144. To understand the use and power of computers (60.1%)

139. To assure adequate scientific manpower (43.7%)

Goals

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL145	1.412	1.375	1.463	1.415	1.207	1.441	1.437			
	91.9%	87.5%	92.6%	97.6%	86.2%	91.5%	95.8%			
	3.2%	5.2%	3.3%	0.0%	10.3%	1.7%	0.0%			
AL143	1.245	1.177	1.298	1.220	1.207	1.390	1.155			
	85.6%	80.2%	85.9%	92.7%	93.1%	89.8%	81.7%			
	3.8%	7.3%	3.3%	2.4%	3.4%	1.7%	2.8%			
AL140	1.050	1.156	1.099	1.220	1.034	0.949	0.817			
	81.3%	85.5%	83.4%	90.2%	75.9%	81.3%	69.0%			
	4.8%	6.3%	4.2%	2.4%	0.0%	5.1%	7.0%			
AL142	1.038	1.000	1.116	1.073	1.207	1.000	0.901			
	80.8%	77.1%	83.5%	85.4%	96.6%	77.9%	74.6%			
	4.8%	6.3%	5.0%	2.4%	3.4%	3.4%	5.6%			
AL137	1.034	1.115	0.909	1.024	1.103	1.051	1.099			
	77.7%	76.0%	73.6%	70.7%	82.8%	83.0%	84.5%			
	4.8%	0.0%	11.6%	4.8%	6.9%	1.7%	1.4%			
AL141	1.017	0.927	1.099	0.878	1.034	0.949	1.127			
	75.5%	70.8%	78.5%	78.1%	75.9%	67.8%	81.7%			
	6.9%	10.4%	5.8%	9.7%	13.8%	1.7%	4.2%			
AL136	0.961	1.138	0.942	0.976	1.000	0.814	0.859			
	73.8%	76.6%	74.4%	70.7%	75.9%	72.9%	70.5%			
	8.7%	5.3%	8.3%	9.7%	10.3%	10.2%	11.3%			
AL138	0.705	0.625	0.785	0.585	0.759	0.644	0.775			
	61.7%	58.4%	65.3%	51.2%	62.0%	61.1%	66.2%			
	9.9%	11.4%	9.1%	7.3%	13.7%	10.2%	8.4%			

Goals (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL144	0.649	0.562	0.661	0.683	0.276	0.845	0.718			
	60.1%	55.2%	60.3%	63.4%	51.7%	68.9%	60.6%			
	9.9%	14.5%	9.9%	7.3%	27.5%	1.7%	4.2%			
AL139	0.365	0.333	0.372	0.024	0.379	0.508	0.465			
	43.7%	41.7%	46.3%	34.1%	41.3%	45.8%	46.5%			
	15.8%	15.6%	16.6%	24.4%	20.7%	8.5%	14.1%			

Content for Elementary School Students (AL1E)

The AT, SP, and TE samples were asked their preferences with respect to including or not including fifteen selected algebraic topics in the elementary school curriculum. The samples were in close agreement in supporting the inclusion of the following topics:

81. Solving open number sentences (87.1%)

88. Making generalizations about numerical patterns (84.3%)

91. Writing equations to solve word problems (75.9%)

94. Inequalities (75.5%)

Over 70% of each sample indicated they would definitely or probably include each of the above topics in the elementary school curriculum. The TE sample was noticeably stronger then either of the other two in their support of inequalities.

Seven items were only moderately supported:

92. Studying structural properties of number systems (e.g., the commutative property) (68.5%)

82. Evaluating formulas (62.3%)

90. Study of simple mathematical functions or mappings (57.4%)

89. Writing algebraic expressions (53.9%)

83. Operating with signed numbers (51.9%)

85. Using exponents (including scientific notation) (51.2%)

84. Graphing of number sentences (44.0%)

Support for all seven of these items is considerably stronger from the TE sample than from the AT or SP samples, although the SP sample does give fairly strong support to item 82 (evaluating formulas).

The samples were also in agreement in their failure to support the inclusion of the following topics:

95. Studying finite systems (e.g., clock arithmetic) (supported by 41.4%, opposed by 36.8%)

93. Using set notation (supported by 38.9%, opposed by 39.8%)

87. Multiplying expressions like (+3) x (-5) (supported by 36.6%, opposed by 48.2%)

86. Writing computer programs (supported by 22.8%, opposed by 52.1%)

Item 87 may be uninterpretable due to an error in typing the format and probably should be ignored in the analysis.

Content for elementary school students

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL81	1.389	1.302				1.475	1.443			
	87.1%	83.4%				88.1%	91.8%			
	6.0%	7.3%				6.8%	3.3%			
AL88	1.153	0.896				1.271	1.443			
	84.3%	74.0%				91.5%	93.4%			
	6.5%	10.4%				3.4%	3.2%			
AL91	0.972	0.948				1.000	0.984			
	75.9%	73.9%				76.3%	78.7%			
	13.4%	14.6%				11.9%	13.1%			
AL94	0.796	0.708				0.661	1.066			
	75.5%	71.9%				71.1%	85.2%			
	12.9%	15.7%				17.0%	4.9%			
AL92	0.667	0.698				0.288	0.984			
	68.5%	67.7%				57.7%	80.3%			
	18.0%	18.8%				27.1%	8.2%			
AL82	0.651	0.389				0.780	0.934			
	62.3%	50.5%				66.1%	77.1%			
	19.1%	24.2%				17.0%	13.1%			
AL90	0.444	0.406				0.136	0.803			
	57.4%	55.2%				44.1%	73.8%			
	24.1%	23.9%				33.9%	14.8%			
AL89	0.437	0.354				0.517	0.492			
	53.9%	50.0%				58.7%	55.8%			
	21.0%	20.8%				20.7%	21.3%			

Content for elementary school students (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL83	0.356	-0.073				0.339	1.049			
	51.9%	34.4%				52.5%	78.6%			
	32.9%	43.8%				30.5%	18.1%			
AL85	0.256	0.179				0.153	0.508			
	51.2%	49.4%				47.5%	57.4%			
	33.0%	36.9%				35.6%	24.6%			
AL84	0.208	-0.021				0.068	0.705			
	44.0%	34.3%				39.0%	63.9%			
	30.5%	35.4%				33.9%	19.7%			
AL95	0.069	0.124				-0.153	0.197			
	41.4%	41.2%				32.2%	50.9%			
	36.8%	38.1%				42.4%	29.5%			
AL93	-0.019	0.125				-0.356	0.082			
	38.9%	43.8%				23.7%	45.9%			
	39.8%	35.4%				47.4%	39.4%			
AL87	-0.185	0.000				-0.339	-0.328			
	36.6%	45.8%				32.2%	26.2%			
	48.2%	40.6%				57.6%	50.8%			
AL86	-0.437	-0.526				-0.271	-0.459			
	22.8%	18.9%				28.8%	23.0%			
	52.1%	54.8%				49.1%	50.8%			

Content for All Students (AL1ES-1)

Two forms of this item requested respondents to identify those algebraic topics (from a given list of ten) that should be taught to all students. On the first form, the several samples were in agreement in their strong support of the following topics being taught to all students:

97. Work with signed numbers (92.7%)

96. Solving linear equations (89.9%)

101. Writing equations to solve word problems (83.0%)

98. Use of exponents (including scientific notation) (81.3%)

Minimal support was given to two items:

99. Multiplying expressions like (a + 3) x (b - 5) (54.1%)

100. Right-triangle trigonometry (51.7%)

In each case the MA sample supported the topic at a moderately strong level.

The samples clearly did not support the following as legitimate requirements for all students:

105. Sequences and series (supported by 30.2%, opposed by 55.8%)

103. Studying finite systems (e.g., clock arithmetic) (supported by 24.3%, opposed by 57.7%)

102. Using quantifiers and set notation (supported by 17.4%, opposed by 64.5%)

104. Solving systems of equations (e.g., two or more equations with two or more unknowns) (supported by 38.1%, opposed by 52.0%)

Content for all students

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL97	1.585	1.186	1.701	1.844	1.878	1.480	1.785			
	92.7%	84.6%	95.7%	96.9%	100.0%	90.7%	95.4%			
	4.9%	8.3%	3.4%	3.1%	0.0%	8.0%	3.1%			
AL96	1.466	1.237	1.444	1.813	1.585	1.360	1.723			
	89.9%	85.6%	90.6%	96.9%	92.7%	84.0%	96.9%			
	7.3%	9.3%	7.7%	3.1%	2.4%	12.0%	3.0%			
AL101	1.176	1.232	0.889	1.094	1.463	1.200	1.446			
	83.0%	85.2%	75.2%	81.3%	85.4%	88.0%	87.7%			
	12.5%	11.6%	19.7%	15.6%	2.4%	9.3%	9.2%			
AL98	1.136	0.804	1.188	1.094	1.268	1.320	1.262			
	81.3%	68.1%	82.9%	81.3%	87.8%	92.0%	81.5%			
	11.5%	18.6%	10.2%	15.6%	4.9%	5.3%	12.3%			
AL99	0.393	0.216	0.419	0.531	1.049	-0.053	0.646			
	54.1%	45.3%	50.5%	65.7%	78.0%	42.6%	66.1%			
	33.3%	40.2%	31.6%	28.1%	9.7%	48.0%	26.2%			
AL100	0.315	0.083	0.299	0.437	0.878	0.213	0.385			
	51.7%	40.6%	51.3%	56.3%	68.3%	52.0%	55.4%			
	34.3%	40.7%	35.1%	25.0%	17.0%	41.3%	30.8%			
AL104	-0.164	-0.330	-0.154	0.062	0.634	-0.720	0.092			
	38.1%	34.0%	39.3%	46.9%	65.9%	18.6%	43.1%			
	52.0%	57.7%	51.3%	46.9%	21.9%	76.0%	41.5%			
AL105	-0.417	0.227	-0.718	-0.688	-0.341	-0.507	-0.646			
	30.2%	51.6%	21.4%	21.9%	34.2%	28.0%	17.4%			
	55.5%	36.0%	65.0%	59.4%	53.6%	60.0%	61.6%			

Content for all students (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL103	-0.494	-0.189	-0.573	-0.813	-0.195	-0.947	-0.308			
	24.3%	34.8%	23.0%	12.5%	31.7%	6.6%	32.3%			
	57.7%	47.4%	57.3%	71.9%	41.5%	77.3%	53.9%			
AL102	-0.675	-0.368	-0.573	-1.125	-0.951	-0.787	-0.785			
	17.4%	24.2%	19.7%	9.4%	4.9%	12.0%	21.5%			
	64.5%	53.7%	60.7%	81.2%	75.6%	68.0%	67.7%			

Content for All Students (AL1ES-2)

On this second form of the previous item, respondents were also asked to identify those algebraic topics (from a list of ten) that should be taught to all students. There is less strong support indicated for teaching this set of topics than was true for the set in AL1ES-1. Also, there is noticeably more disagreement among the samples in the pattern of response. One topic received very strong support by all samples:

106. Evaluating formulas (93.3%)

Three other topics received moderately strong support:

109. Making generalizations about number patterns (70.6%)

112. Inequalities (70.8%)

107. Graphing of number sentences (63.2%)

The topic of inequalities (item 112) received only weak support from the MT sample, but was strongly supported by the MA, SP, and TE samples.

Item 110 may pose a problem of interpretation. The item refers to study of "simple mathematical functions or mappings". It receives good support from the AT, MA, SP, and TE samples, but only marginal support from the MT and JC samples. Perhaps the latter groups read something unique in the word "mappings".

The samples generally provided little support for including the remaining topics for all students:

111. Studying structural properties of number systems (e.g., the commutative property) (52.8%)

115. Properties of classes of numbers (e.g., integers, rationals, reals) (49.1%)

114. Adding, subtracting, multiplying, and dividing polynomial expressions (46.6%)

108. Writing computer programs (supported by 34.1%, opposed by 46.9%)

113. Proving algebraic generalizations (supported by 25.5%, opposed by 58.6%)

The MT and JC samples were noticeably strong in the rejection of the last topic. The MA sample deviated from the other samples in its support of item 114. Only the AT sample indicated real support for item 111.

Taking AL1ES-1 and AL1ES-2 together suggests a very conservative posture for the samples surveyed. The list of topics to be taught to all students would not go beyond those which have been in seventh- and eighth-grade textbooks for years, and would include very little of what was incorporated into textbooks at that level under the name of "modern" mathematics in the 1960's -- e.g., sets, quantifiers, finite systems, other number bases, and structural pproperties.

Content for all students

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL106	1.608	1.308	1.731	1.714	1.839	1.554	1.771			
	93.3%	86.9%	95.4%	96.4%	96.8%	91.1%	98.5%			
	4.3%	6.5%	2.8%	3.6%	0.0%	8.9%	1.4%			
AL109	0.820	1.009	0.546	0.536	0.677	0.911	1.057			
	70.6%	79.4%	62.9%	60.7%	61.3%	75.0%	72.9%			
	12.6%	5.6%	22.2%	17.9%	16.1%	9.0%	7.1%			
AL112	0.721	0.759	0.398	0.393	1.065	1.071	0.857			
	70.8%	67.6%	62.1%	53.5%	83.8%	83.9%	80.0%			
	18.2%	14.8%	27.8%	28.5%	13.0%	10.7%	12.8%			
AL107	0.644	0.430	0.467	0.607	0.806	0.768	1.086			
	63.2%	53.2%	61.7%	53.6%	61.3%	67.9%	81.5%			
	23.6%	27.1%	30.8%	28.6%	16.1%	19.6%	11.4%			
AL110	0.612	0.682	0.306	0.250	1.133	0.750	0.786			
	64.4%	65.4%	57.4%	42.9%	80.0%	73.3%	68.6%			
	22.1%	19.6%	35.2%	35.7%	13.3%	12.5%	11.5%			
AL111	0.245	0.607	0.028	-0.143	0.161	0.339	0.143			
	52.8%	67.3%	49.1%	35.7%	45.2%	57.2%	42.9%			
	33.5%	22.4%	43.5%	50.0%	35.5%	30.3%	30.0%			
AL115	0.208	0.290	0.250	0.036	0.129	0.143	0.171			
	49.1%	54.2%	50.9%	39.2%	48.4%	44.7%	45.7%			
	34.0%	29.9%	38.0%	39.3%	45.2%	32.1%	28.6%			
AL114	0.140	0.047	0.176	0.107	0.742	-0.018	0.100			
	46.6%	41.2%	51.0%	42.8%	61.3%	39.2%	48.6%			
	39.1%	37.4%	40.8%	46.4%	16.1%	46.4%	40.0%			

Content for all students (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL108	-0.195	-0.370	-0.306	0.071	-0.032	-0.161	0.043			
	34.1%	27.8%	36.1%	46.5%	45.2%	30.3%	34.3%			
	46.9%	55.5%	52.8%	35.7%	41.9%	42.9%	34.2%			
AL113	-0.477	-0.299	-0.741	-0.750	-0.516	-0.375	-0.308			
	25.5%	29.9%	20.4%	17.9%	25.9%	30.4%	25.7%			
	58.6%	47.7%	70.4%	78.6%	61.3%	55.4%	50.0%			

Content for College-Bound Non-Mathematics/Science Majors (AL1S)

Respondents identified which of a list of twenty advanced algebraic topics they would include for the general college-bound population. The responses to this cluster of items reveal sharp differences among the samples. For example, the JC sample ranked 13 items on the negative side of 0, while the SP and MT samples had only 2 and 3 items, respectively, in this negative area.

The following topics received moderate support for inclusion from the total sample:

118. Probability functions (e.g., probability theory) (78.7%)

131. Mathematical models (68.3%)

120. Trigonometric functions and their inverses (63.2%)

128. Exponential and logarithmic functions (65.0%)

116. Matrix algebra (e.g., linear systems) (61.1%)

117. Finite mathematics (e.g., combinatorics) (59.1%)

However, support varied on these items. Only marginal support was given to item 128 by the JC sample and to item 117 by the MT and SP samples. Little support was given to item 120 by the JC and MA samples. The MA and TE samples gave moderately strong support to item 116.

Only minimal to weak support was given to six items. They were:

121. Theory of equations (e.g., fundamental theorem, solvability) (52.3%)

122. Analytic geometry (e.g., conic sections) (50.7%)

127. Sequences and series (55.8%)

129. Approximating graphed data with best-fit polynomials (46.4%)

135. Trigonometric identities and equations (47.5%)

133. Transformations applied to graphing (42.2%)

There was essentially no support for the remaining items:

119. The system of complex numbers (supported by 42.5%, opposed by 41.9%)

124. Categories of functions (e.g., algebraic, exponential, transcendental) (supported by 42.4%, opposed by 40.7%)

132. Systems of non-linear equations (supported by 37.1%, opposed by 38.1%)

134. Approximating the roots to higher degree polynomial equations (supported by 37.2%, opposed by 40.8%)

125. Introductory calculus (supported by 37.5%, opposed by 48.3%)

126. Limits and continuity (supported by 31.2%, opposed by 51.5%)

130. Vectors and vector spaces (supported by 28.3%, opposed by 49.4%)

123. Algebraic structures (e.g., groups, rings, fields) (supported by 20.3%, opposed by 63.2%)

Content for college-bound non-mathematics/science majors

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL118	0.878		0.828	0.595	0.714	1.102	1.050			
	78.7%		75.5%	70.3%	78.5%	87.7%	83.4%			
	13.6%		13.9%	24.3%	14.3%	8.2%	10.0%			
AL131	0.748		0.545	0.676	0.893	1.041	0.898			
	68.3%		57.8%	67.5%	78.6%	81.6%	74.6%			
	13.2%		17.4%	16.2%	7.1%	4.1%	13.6%			
AL120	0.639		0.926	0.081	0.393	0.837	0.350			
	63.2%		76.2%	35.1%	39.3%	71.4%	58.4%			
	23.0%		14.0%	37.8%	35.7%	16.3%	31.6%			
AL128	0.605		0.598	0.378	1.107	0.646	0.492			
	65.0%		64.8%	56.7%	78.6%	68.8%	61.1%			
	21.8%		24.6%	21.6%	10.7%	18.8%	23.7%			
AL117	0.561		0.311	0.757	0.857	0.510	0.850			
	59.1%		45.0%	75.7%	75.0%	57.1%	71.7%			
	19.6%		25.5%	13.5%	10.7%	24.4%	11.7%			
AL116	0.542		0.413	0.270	0.929	0.531	0.800			
	61.0%		55.3%	54.0%	71.4%	63.2%	70.0%			
	26.1%		29.7%	37.8%	10.7%	28.6%	16.7%			
AL121	0.361		0.648	-0.054	0.107	0.490	0.050			
	52.3%		61.5%	40.5%	42.9%	57.2%	41.7%			
	28.0%		20.5%	43.2%	32.2%	24.4%	35.0%			
AL122	0.358		0.475	-0.081	0.393	0.327	0.400			
	50.7%		53.2%	35.1%	57.2%	46.9%	55.0%			
	25.3%		20.5%	45.9%	32.2%	20.4%	23.3%			

Content for college-bound non-mathematics/science majors (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL127	0.348		0.533	-0.135	0.000	0.673	0.167			
	55.8%		59.8%	35.1%	42.8%	75.5%	50.0%			
	28.7%		24.6%	40.5%	46.4%	14.3%	33.3%			
AL129	0.234		0.231	0.054	0.143	0.592	0.100			
	46.4%		42.1%	45.9%	42.8%	67.3%	40.0%			
	30.2%		28.9%	32.4%	35.7%	24.5%	33.4%			
AL135	0.159		0.492	-0.361	0.179	0.122	-0.183			
	47.5%		59.0%	25.0%	46.4%	49.0%	36.7%			
	37.0%		25.5%	61.1%	42.8%	36.7%	43.4%			
AL133	0.118		0.197	-0.270	-0.036	0.265	0.150			
	42.2%		45.9%	18.9%	32.2%	47.0%	50.0%			
	32.4%		28.7%	40.5%	35.7%	30.6%	35.0%			
AL119	0.044		0.205	-0.378	-0.071	0.265	-0.150			
	42.5%		48.4%	29.7%	28.6%	51.0%	38.3%			
	41.9%		36.9%	62.2%	46.5%	30.6%	46.7%			
AL124	0.027		0.131	-0.081	-0.321	0.163	-0.068			
	42.4%		45.1%	37.8%	32.1%	42.8%	44.1%			
	40.7%		36.1%	45.9%	50.0%	36.7%	45.8%			
AL132	-0.003		0.221	-0.541	-0.607	0.388	-0.167			
	37.1%		45.9%	16.2%	10.7%	53.1%	31.6%			
	38.1%		32.8%	59.4%	53.6%	22.4%	41.7%			
AL134	-0.068		0.041	-0.459	0.071	0.020	-0.183			
	37.2%		42.6%	21.6%	39.3%	36.7%	35.0%			
	40.8%		37.7%	54.0%	35.7%	38.8%	43.3%			

Content for college-bound non-mathematics/science majors (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL125	-0.166		0.090	-0.676	-0.071	0.061	-0.600			
	37.5%		46.7%	16.2%	42.8%	49.0%	20.0%			
	48.3%		40.2%	62.1%	46.4%	42.9%	61.7%			
AL126	-0.292		-0.058	-1.027	-0.464	0.061	-0.517			
	31.2%		38.8%	10.8%	25.0%	44.9%	20.0%			
	51.5%		43.8%	75.6%	60.7%	40.9%	56.7%			
AL130	-0.313		-0.149	-0.730	-0.357	-0.163	-0.492			
	28.3%		33.1%	18.9%	25.0%	28.6%	25.4%			
	49.4%		44.7%	64.8%	57.1%	38.8%	54.2%			
AL123	-0.598		-0.689	-0.811	-0.786	-0.286	-0.450			
	20.3%		16.4%	18.9%	10.7%	28.6%	26.7%			
	63.2%		63.9%	78.4%	71.4%	51.0%	58.3%			

Resources (AL3)

Items in this cluster may be interpreted as an indication of which proposed teaching resources the samples would prefer to have for teaching algebra. Perhaps the most surprising thing about the pattern of responses is the clear agreement on the high-ranked resources and the sharp disagreement on the low-ranked ones. All samples tended to agree on the usefulness of four of the resources:

148. Booklets of algebraic applications to contemporary problems (89.3%)

149. Masters of worksheets and activities (85.1%)

150. Physical materials and equipment for laboratory experiments (76.3%)

152. Booklets of games and recreational activities that can be analyzed algebraically (81.2%)

There was moderate support for two technological resources:

147. Individual study carrels equipped with computer assisted instruction terminals and videotape cartridge players (71.6%)

151. Personal computers for every two students (64.2%)

The JC and MA samples wanted one resource more than the AT and MT samples did:

155. Computer-driven graphing and plotting equipment (53.9%)

The pattern reversed on the three lowest-ranked items. The AT and MT samples wanted these items much more than the JC and MA samples did:

154. Materials with minimal reading requirements (49.1%)

146. Calculators that can display the equation of a line given the coordinates of two points (51.1%)

153. Calculators that will display the roots of a linear or quadratic equation when the coefficients are input (41.2%)

Resources

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL148	1.369	1.179	1.435	1.606	1.464					
	89.3%	85.3%	91.3%	96.9%	85.7%					
	2.2%	4.3%	1.7%	0.0%	0.0%					
AL149	1.219	1.358	1.339	0.879	0.630					
	85.1%	89.5%	89.6%	72.7%	66.6%					
	6.3%	4.3%	5.2%	3.0%	22.2%					
AL150	0.948	1.160	0.896	0.606	0.857					
	76.3%	84.1%	76.6%	63.7%	64.2%					
	10.4%	8.5%	10.5%	18.2%	7.2%					
AL152	0.923	0.979	0.896	0.939	0.821					
	81.2%	84.2%	78.3%	84.8%	78.5%					
	9.6%	9.5%	11.8%	3.0%	10.7%					
AL147	0.786	0.705	0.791	1.000	0.786					
	71.6%	67.4%	72.2%	81.8%	71.4%					
	15.5%	19.0%	15.7%	9.1%	10.7%					
AL151	0.661	0.611	0.652	0.758	0.750					
	64.2%	61.1%	65.2%	69.7%	64.3%					
	17.4%	16.8%	18.3%	9.1%	25.0%					
AL155	0.343	0.021	0.400	0.667	0.821					
	53.9%	37.9%	57.4%	69.7%	75.0%					
	23.6%	30.5%	22.6%	15.1%	14.3%					
AL154	0.273	0.789	0.235	-0.515	-0.393					
	49.1%	67.4%	47.0%	30.3%	17.8%					
	28.1%	14.8%	27.0%	54.5%	46.4%					

Resources (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL146	0.181	0.319	0.357	-0.636	-0.036					
	51.1%	54.3%	58.3%	24.2%	42.8%					
	31.1%	22.3%	26.9%	63.7%	39.3%					
AL153	0.044	0.064	0.278	-0.333	-0.536					
	41.2%	39.3%	53.0%	27.3%	14.2%					
	33.0%	31.9%	25.2%	45.5%	53.5%					

<u>Methods (AL4)</u>

The order of suppo-t for materials that stress particular teaching strategies for algebra is essentially the same for all samples. There is, however, some discrepancy in the strength of support or non-support. Strong support was given to materials that use problems arising in the social or natural sciences (item 156, 87.6%), that include student worksheets for drill and practice (item 157, 81.5%), or that infer algebraic ideas from general patterns of arithmetic (item 158, 78.7%). The use of geometric models, simple machines, and other applications (item 162) received moderately strong support (67.6%), while the use of deductive sequences (item 161, 58.4%) and laboratory investigations (item 160, 55.2%) received slightly less support.

Little support was given to the remaining items. The use of computing devices (item 159, 45.9%) received marginal support at best. The samples would also not support devoting more than 50% of instructional time to individual study materials (item 164, 36.6%) or to introducing ideas through long-term, realistic student projects (item 163, 39.1%). Finally, materials designed with the expectation that students would read formal presentations of basic algebraic ideas before classroom activities are devoted to these ideas (item 165) was supported by 27.1% and rejected by 49.2%.

Methods

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL156	1.256	1.029	1.351	1.485	1.314					
	87.6%	81.4%	90.0%	90.9%	94.3%					
	2.2%	2.9%	1.8%	0.0%	2.9%					
AL157	1.221	1.225	1.342	1.000	1.029					
	81.5%	81.4%	85.6%	72.7%	77.1%					
	3.6%	4.9%	1.8%	3.0%	5.7%					
AL158	1.053	0.980	1.180	1.091	0.829					
	78.7%	77.5%	82.8%	78.8%	68.5%					
	2.2%	3.9%	0.9%	0.0%	2.9%					
AL162	0.719	0.843	0.613	0.545	0.857					
	67.6%	73.6%	63.1%	57.6%	74.3%					
	10.0%	9.8%	10.8%	9.1%	8.6%					
AL161	0.594	0.676	0.559	0.576	0.486					
	58.4%	58.8%	56.7%	66.7%	54.2%					
	12.4%	6.9%	13.5%	21.2%	17.1%					
AL160	0.456	0.725	0.342	0.152	0.314					
	55.2%	66.7%	49.5%	45.5%	48.6%					
	20.6%	13.8%	23.4%	36.4%	17.1%					
AL159	0.270	0.461	0.243	0.121	-0.057					
	45.9%	54.9%	44.1%	45.4%	25.8%					
	22.4%	15.7%	22.5%	33.3%	31.5%					
AL163	0.114	0.333	-0.009	0.152	-0.171					
	39.1%	45.1%	36.0%	51.5%	20.0%					
	31.3%	25.5%	36.0%	33.3%	31.4%					

Methods (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL164	0.018	-0.010	0.009	0.212	-0.057					
	36.6%	36.2%	36.9%	36.4%	37.1%					
	37.7%	40.2%	40.5%	18.2%	40.0%					
AL165	-0.321	-0.495	-0.216	-0.333	-0.143					
	27.1%	16.8%	33.3%	27.3%	37.1%					
	49.2%	53.5%	45.9%	42.4%	54.2%					

Who/Time (AL5)

Respondents were asked to react to ten statements concerning the placing of algebra at different points in the curriculum or offering special programs for special groups of students. The samples indicated moderately strong agreement with the following statements, with only the MA sample showing marginal support for item 168:

168. A special algebra course for vocational students should be offered. (70.2%)

172. Different algebra courses should be offered for students with different interests and abilities. (70.0%)

The MA sample agreed strongly (80.6%) with item 166, but other samples disagreed:

166. Every student graduating from high school should be required to take a full-year algebra course. (supported by 41.6%, opposed by 54.6%)

This statement was also given to the lay samples, as item 777. They also disagreed with the item, with the strongest disagreement coming from the PR sample.

There was very little support for the remaining items, with disagreement increasing. Most dramatic is the opposition to item 175.

170. The theme for algebra courses should be functions. (supported by 35.1%, opposed by 54.6%)

173. By 1990, the skills and concepts of the traditional beginning algebra course of the 1970's should be acquired before students enter ninth grade. (supported by 32.3%, opposed by 50.5%)

171. Algebra should be combined with geometry and other mathematical areas instead of being taught in separate courses. (supported by 28.1%, opposed by 53.2%)

167. Algebra should be studied for two years before taking a course in geometry. (supported by 20.1%, opposed by 64.8%)

169. For many students, a "historical and cultural mathematics" course should be substituted for algebra. (supported by 19.6%, opposed by 62.2%)

174. Trigonometry should not be included in algebra courses at any level. (supported by 18.1%, opposed by 71.1%)

175. Formal work with algebra should be dropped from the school curriculum since it bears so little relation to real world problems. (supported by 3.2%, opposed by 94.6%)

One of these items, 171, was also given to lay samples (as item 744). Their reactions were very similar to those of the other samples.

Who/Time

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL168	0.727	1.000	0.712	0.429	0.139	0.667	0.892			
	70.2%	74.3%	71.2%	62.9%	50.0%	70.6%	76.9%			
	17.8%	7.9%	19.0%	34.3%	27.8%	18.7%	15.4%			
AL172	0.709	0.723	0.636	0.600	0.389	1.000	0.738			
	70.0%	70.3%	68.1%	65.8%	63.9%	77.0%	70.7%			
	20.8%	18.8%	22.8%	25.8%	27.8%	13.6%	21.5%			
AL170	0.027	0.030	0.031	-0.114	-0.306	0.236	0.046			
	35.1%	26.0%	33.6%	34.3%	30.5%	48.6%	40.0%			
	33.9%	29.0%	30.6%	42.9%	55.6%	30.6%	35.4%			
AL166	-0.124	-0.260	-0.288	0.629	1.083	-0.840	0.169			
	41.6%	38.0%	37.2%	54.3%	80.6%	24.0%	47.7%			
	54.6%	58.0%	59.8%	34.3%	19.5%	74.7%	46.2%			
777	-0.544							-0.648	-0.307	-0.224
	25.9%							22.7%	35.2%	32.6%
	64.6%							69.0%	52.2%	55.1%
AL173	-0.223	0.069	-0.121	-0.143	-0.083	-0.716	-0.446			
	32.3%	46.6%	32.6%	34.3%	36.1%	14.9%	26.2%			
	50.5%	43.6%	43.2%	51.4%	47.3%	66.2%	60.0%			
AL171	-0.364	-0.420	-0.568	-0.257	-0.361	-0.230	-0.077			
	28.1%	30.0%	25.0%	31.5%	27.8%	23.0%	35.4%			
	53.2%	57.0%	62.9%	48.5%	55.6%	43.2%	40.0%			
744	-0.418							-0.310	-0.570	-0.511
	22.2%							24.4%	20.4%	17.8%
	54.2%							50.0%	62.4%	53.4%

Who/Time (continued)

	Total	AT	MT	JC	MA	SR	TE	PR	SB	PT
AL167	-0.567	-0.248	-0.580	-0.200	-0.639	-0.893	-0.815			
	20.1%	25.7%	18.3%	34.3%	19.4%	14.7%	13.8%			
	64.8%	51.5%	65.7%	57.1%	72.2%	74.6%	72.3%			
AL169	-0.640	-0.297	-0.750	-0.600	-1.167	-0.507	-0.831			
	19.6%	25.7%	20.4%	22.9%	5.6%	21.3%	12.3%			
	62.2%	48.5%	65.1%	60.0%	86.1%	58.7%	69.3%			
AL174	-0.727	-0.696	-0.841	-0.829	-0.444	-0.568	-0.831			
	18.1%	14.7%	17.5%	17.1%	22.2%	25.7%	13.9%			
	71.1%	66.7%	75.7%	74.3%	63.9%	70.3%	72.3%			
AL175	-1.685	-1.275	-1.855	-1.714	-1.972	-1.773	-1.708			
	3.2%	9.8%	0.8%	2.9%	0.0%	2.6%	0.0%			
	94.6%	83.3%	98.4%	97.1%	100.0%	97.3%	96.9%			

Calculators (AL6)

Only one use of calculators in algebra was strongly supported:

183. Checking answers (92.5%)

Four other uses received moderately strong support:

185. Working with limits of sequences (74.3%)

181. Demonstrating that $(a + b)^2 = a^2 + b^2$ for several specific values of a and b (70.1%)

177. Making a graph from a given equation (63.1%)

184. Simplifying expressions containing irrational numbers (62.2%)

Four of the remaining items received weak support:

179. Finding the value of d when $d = \frac{1}{2}gt^2$, if $g = 32$ and $t = 5$ (54.9%)

182. Solving systems of linear equations (54.1%)

178. Finding the solution of an equation (54.8%)

180. Working algebra work problems (50.9%)

Finally, opposition was slightly stronger than support on one item:

176. Taking an algebra test (supported by 46.2%, opposed by 48.9%)

Calculators

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL183	1.619	1.778	1.582	1.545	1.400					
	92.5%	96.7%	92.7%	90.9%	82.9%					
	2.6%	0.0%	2.7%	6.1%	5.7%					
AL185	1.011	1.033	0.927	1.061	1.471					
	74.3%	66.6%	74.5%	81.8%	85.7%					
	11.9%	4.4%	17.3%	15.2%	11.5%					
AL181	0.907	1.144	0.791	1.000	0.571					
	70.1%	75.6%	68.2%	75.7%	57.1%					
	21.2%	12.2%	23.7%	24.3%	34.3%					
AL177	0.567	0.578	0.291	0.939	1.057					
	63.1%	62.2%	55.5%	72.8%	80.0%					
	29.5%	23.3%	40.9%	21.2%	17.1%					
AL184	0.509	1.000	0.327	0.242	0.086					
	62.2%	73.0%	60.0%	54.5%	48.6%					
	31.9%	18.0%	37.3%	39.4%	42.9%					
AL179	0.418	0.500	0.373	0.515	0.257					
	54.9%	53.4%	56.4%	60.7%	48.6%					
	34.7%	27.7%	37.2%	36.4%	42.9%					
AL182	0.276	0.456	0.009	0.303	0.629					
	54.1%	55.6%	47.3%	57.6%	68.6%					
	35.8%	30.0%	41.8%	39.4%	28.6%					
AL178	0.220	0.278	-0.091	0.606	0.686					
	54.8%	54.4%	44.5%	69.7%	74.3%					
	36.2%	32.2%	48.2%	24.3%	20.0%					

Calculators (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL180	0.169	0.422	0.000	0.424	-0.200					
	50.9%	54.5%	47.7%	66.7%	37.1%					
	38.9%	31.1%	42.2%	33.3%	54.3%					
AL176	0.131	0.056	-0.345	0.273	-0.314					
	46.2%	51.1%	40.0%	60.6%	40.0%					
	48.9%	40.0%	57.3%	36.4%	57.1%					

Summary: Algebra

- Strong support (over 80%) was given to four goals for teaching algebra; these concerned applying mathematics, building background for taking more mathematics, gaining vocational skills, and preparing for college. The remaining goals were accepted by over 60%, except for "assuring adequate scientific manpower", supported by only 44%.
- Support was strongest (above 70%) for including four of 15 algebraic topics in the elementary school curriculum: solving number sentences, making generalizations about number patterns, writing equations to solve word problems, and inequalities.
- The samples did not support including four of the 15 algebraic topics in the elementary school curriculum, including finite systems, set notation, and computer programming.
- Strong support (above 80%) was given to including four of ten algebraic topics in the curriculum for all students: signed numbers, linear equations, writing equations to solve word problems, and exponents. From a second set of ten topics, strong support (93%) was given only to evaluating formulas.
- The samples did not support teaching all students the following algebraic topics: sequences and series, finite systems, set notation, and systems of equations. On the second set of ten topics, computer programming and proving algebraic generalizations were not supported.
- The list of algebraic topics to be taught to all students would not go beyond those topics which have been in grades 7 and 8 textbooks for years.
- For college-bound students not majoring in mathematics or science, six topics were given moderate support (59%-79%): probability func-

tions, mathematical models, exponential and logarithmic functions, trigonometric functions, matrix algebra, and finite mathematics.

- Support is strongest (above 75%) for having four resources available for teaching algebra: booklets with application problems, masters of worksheets and activities, booklets of games and activities, and physical materials and equipment for laboratory experiments.
- Support was strong (above 79%) for having instructional materials for algebra that emphasize problems arising in the social or natural sciences, worksheets for drill and practice, and inferring algebraic ideas from arithmetic patterns.
- Only two items about the type of algebra course to be offered received support (at the 70% level); favored were a special algebra course for vocational students and different courses for students with different interests and abilities.
- Totally rejected was the idea that formal work with algebra should be dropped from the curriculum.
- Using calculators for checking answers was the only use strongly supported.
- Using calculators when taking an algebra test was accepted and rejected by almost equal percentages.

Geometry

Goals (GM2)

The survey samples did not depart markedly from traditional patterns in their perception of the goals of geometry in the school curriculum. Although all listed goals received at least minimal support, the following four goals received strong support:

303. To develop logical thinking abilities (94.0%)

300. To develop spatial intuitions about the real world (89.8%)

305. To acquire the knowledge needed for study of more mathematics (84.8%)

301. To learn to read and interpret mathematical arguments (82.2%)

Moderate support was given to one goal:

299. To learn to make proofs (65.7%)

The remaining five goals received minimal support:

302. To practice arithmetic and algebraic skills (60.6%)

304. To develop skills and knowledge needed by the consumer (58.8%)

297. To develop job-oriented skills (58.1%)

298. To appreciate historical and cultural development (54.1%)

296. To motivate students who dislike computation (52.0%)

Perhaps it is worth noting that job-oriented/consumer-oriented goals appear somewhat lower in the rank order here than in the listing of goals for algebra, while logical thinking abilities are at the top of the geometry list. This is possibly a reflection of the historical role geometry has held in the curriculum.

Goals

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
GM303	1.517	1.584	1.556	1.444	1.634	1.493	1.344			
	94.0%	94.4%	97.5%	91.7%	97.6%	92.0%	89.0%			
	0.7%	1.1%	0.9%	0.0%	0.0%	0.0%	1.6%			
GM300	1.315	1.270	1.205	1.083	1.146	1.573	1.516			
	89.8%	88.7%	87.2%	77.8%	82.9%	100.0%	95.4%			
	2.8%	4.5%	3.4%	8.3%	2.4%	0.0%	0.0%			
GM305	1.150	1.057	1.214	1.444	0.976	1.160	1.094			
	84.8%	81.8%	88.1%	94.4%	75.6%	86.6%	81.3%			
	4.1%	3.4%	4.3%	0.0%	9.7%	4.0%	3.1%			
GM301	1.107	0.921	1.222	0.972	1.244	1.040	1.219			
	82.2%	69.6%	88.1%	83.3%	82.9%	78.7%	92.2%			
	5.2%	6.7%	2.6%	8.3%	2.4%	10.7%	1.6%			
GM299	0.674	0.506	0.819	0.528	0.561	0.676	0.797			
	65.7%	55.1%	69.9%	63.9%	61.0%	66.2%	76.6%			
	15.7%	20.3%	11.2%	19.5%	29.3%	14.9%	7.9%			
GM304	0.623	0.966	0.427	0.611	0.463	0.733	0.484			
	58.8%	73.1%	48.7%	61.1%	56.1%	65.4%	50.0%			
	12.6%	9.0%	18.0%	16.7%	12.2%	9.3%	9.4%			
GM302	0.610	0.932	0.590	0.417	0.439	0.560	0.484			
	60.6%	72.7%	60.7%	52.8%	51.2%	61.4%	53.1%			
	11.6%	9.1%	11.2%	19.5%	12.2%	9.4%	14.0%			
GM297	0.583	0.955	0.496	0.417	0.390	0.680	0.328			
	58.1%	76.4%	54.7%	47.3%	48.8%	65.3%	42.2%			
	12.3%	5.6%	17.1%	22.2%	14.7%	6.7%	12.5%			

Goals (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
GM298	0.479	0.326	0.427	0.250	0.537	0.493	0.859			
	54.1%	46.0%	53.0%	38.9%	56.1%	54.7%	73.5%			
	12.6%	15.7%	16.3%	13.9%	9.8%	12.0%	3.2%			
GM296	0.411	0.739	0.145	0.500	0.073	0.520	0.484			
	52.0%	62.5%	41.9%	55.6%	48.8%	54.6%	53.1%			
	20.2%	12.5%	28.2%	19.5%	24.4%	16.0%	18.8%			

Content for Elementary School Students (GM1E)

Respondents were asked their perception as to whether each of a list of fifteen geometric topics should be included in the elementary school curriculum. Clearly the three samples surveyed would support a broader collection of geometric topics than currently seem to be included in the elementary school curriculum. Topics strongly supported by all samples were:

258. Properties of triangles and rectangles (91.5%)

260. Parallel and perpendicular lines (93.7%)

264. Geometry of symmetry (81.5%)

255. Similar figures (magnification and reduction) (80.6%)

Somewhat more moderately but still clearly supported were:

263. Properties of circles (77.9%)

265. Coordinate geometry (associating number pairs with points) (71.2%)

254. Constructions with a straightedge and compass (69.2%)

256. Congruence by transformations (slides, flips, and turns with movement of figures to match) (67.1%)

259. Three-dimensional geometry (61.5%)

It is of interest to note that the AT sample was far less positive about items 256 and 259 than about previous items.

For a number of items the responses were equivocal--about as many persons failed to support the item as supported it:

252. Geometry of distance and direction (vector geometry) (47.0%)

251. Geometry of tesselations (tiling) (38.7%)

262. Congruent (matching) figures by the methods of Euclid (38.7%)

261. Geometry on a sphere (globe) (37.6%)

253. The geometry of shadows (projective geometry) (32.0%)

The only item with strong opposition to inclusion was:

257. Logical reasoning principles including axioms and proof (supported by 23.0%, opposed by 58.6%)

Content for elementary school students

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
GM258	1.419	1.304				1.525	1.479			
	91.5%	89.1%				94.9%	91.6%			
	4.1%	5.5%				3.4%	2.8%			
GM260	1.311	1.239				1.305	1.408			
	93.7%	92.3%				94.9%	94.4%			
	4.6%	4.4%				5.1%	4.2%			
GM264	1.041	0.815				1.119	1.268			
	81.5%	72.8%				86.5%	8[illegible].8%			
	9.1%	12.0%				10.2%	4.2%			
GM255	1.009	0.857				1.085	1.141			
	80.6%	72.6%				84.7%	87.3%			
	8.6%	12.1%				8.5%	4.2%			
GM263	0.973	0.826				1.017	1.127			
	77.9%	72.9%				79.7%	83.1%			
	10.8%	15.2%				11.9%	4.2%			
GM265	0.806	0.848				0.881	0.690			
	71.2%	75.0%				77.9%	60.5%			
	12.6%	11.9%				11.9%	14.1%			
GM254	0.774	0.912				0.644	0.704			
	69.2%	73.7%				66.1%	66.2%			
	16.3%	11.0%				23.7%	16.9%			
GM256	0.743	0.587				0.661	1.014			
	67.1%	59.8%				66.1%	77.5%			
	16.7%	19.6%				22.0%	8.4%			

Content for elementary school students (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
GM259	0.579	0.341				0.695	0.845			
	61.5%	55.0%				66.1%	66.2%			
	21.3%	28.6%				18.6%	14.1%			
GM252	0.181	0.141				0.017	0.371			
	47.0%	42.4%				44.1%	55.8%			
	32.6%	31.5%				39.0%	28.6%			
GM251	0.159	-0.022				0.220	0.338			
	38.7%	30.0%				44.1%	45.1%			
	30.0%	34.5%				30.5%	23.9%			
GM262	0.045	0.261				-0.305	0.056			
	38.7%	44.6%				30.5%	38.1%			
	33.8%	19.5%				52.5%	36.7%			
GM261	-0.009	0.154				-0.288	0.014			
	37.6%	46.2%				27.1%	33.2%			
	39.4%	35.2%				50.9%	35.2%			
GM253	-0.068	-0.043				-0.102	-0.070			
	32.0%	30.4%				35.6%	31.0%			
	35.6%	34.8%				33.8%	38.0%			
GM257	-0.577	-0.141				-0.797	-0.958			
	23.0%	37.0%				17.0%	9.8%			
	58.6%	44.6%				62.7%	73.2%			

Content for All Students (GM1ES-1, GM1ES-2)

Two lists, one of ten and one of five items, asking respondents to identify geometric topics that should or should not be included in the secondary school for all students before graduation, were included on different forms of the survey instruments. The data are combined into a single list for easier reference, with the items from the shorter cluster identified by *.

Three topics received strong support from the combined samples:

272. Properties of triangles and rectangles (94.0%)

*276. Properties of circles (83.9%)

269. Similar figures (magnification and reduction) (85.3%)

Support from the AT sample was lower for items 276 and 269 than that of other samples.

Six other items received moderately strong support:

*277. Coordinate geometry (associating number pairs with points) (75.0%)

270. Congruence by transformations (moving figures to match) or reflection (66.3%)

275. Congruent (matching) figures by the methods of Euclid (63.2%)

273. Three-dimensional geometry (62.2%)

271. Logical reasoning principles including axioms and proofs (61.1%)

267. Geometry of distance and direction (vector geometry) (60.1%)

For the last five items, the AT sample again gave a comparatively low level of support, with the SP sample also low on four of the items (270, 275, 271, 267).

Mixed support was given to one item and there was clear opposition to five items:

274. Geometry of the sphere (globe) (supported by 45.9%, opposed by 30.7%)

268. The geometry of shadows (projective geometry) (supported by 34.3%, opposed by 42.8%)

*280. Non-Euclidean geometries (supported by 16.2%, opposed by 67.1%)

*278. Finite geometries (e.g., nine point geometry) (supported by 10.6%, opposed by 66.6%)

*279. Symbolic logic and truth tables (supported by 31.0%, opposed by 54.4%)

266. Geometry of tesselations (tiling) (supported by 24.9%, opposed 50.3%)

Content for all students

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
GM272	1.509	1.241	1.579	1.526	1.545	1.576	1.656			
	94.0%	84.3%	97.2%	100.0%	90.9%	96.6%	96.7%			
	3.6%	8.4%	2.8%	0.0%	6.1%	1.7%	1.6%			
GM276*	1.210	1.000	1.148	1.375	1.462	1.293	1.262			
	83.9%	75.0%	83.4%	87.5%	87.1%	88.0%	88.6%			
	9.2%	15.5%	11.1%	7.5%	2.6%	5.2%	6.6%			
GM269	1.155	0.690	1.085	1.395	1.455	1.375	1.393			
	85.3%	65.5%	85.8%	97.3%	90.9%	95.0%	91.8%			
	7.9%	17.9%	8.5%	2.6%	3.0%	3.4%	3.3%			
GM277*	0.905	0.821	0.657	1.100	1.256	0.780	1.230			
	75.0%	75.0%	67.6%	80.0%	79.5%	71.2%	85.2%			
	16.1%	15.5%	23.2%	12.5%	7.7%	20.4%	8.2%			
GM270	0.689	0.464	0.664	0.658	0.879	0.649	1.000			
	66.3%	58.3%	67.3%	65.7%	72.7%	59.6%	78.7%			
	20.0%	25.0%	15.0%	26.3%	18.2%	22.9%	16.4%			
GM273	0.604	0.286	0.439	0.605	0.727	0.793	1.082			
	62.2%	51.2%	55.1%	63.2%	72.7%	69.0%	77.1%			
	22.8%	35.7%	25.3%	15.8%	21.2%	19.0%	9.8%			
GM275	0.587	0.289	0.766	0.737	0.636	0.379	0.754			
	63.2%	51.8%	70.1%	71.0%	66.6%	51.8%	70.5%			
	22.4%	31.3%	18.7%	21.0%	27.3%	22.4%	14.8%			
GM271	0.543	0.345	0.785	0.553	0.939	0.186	0.517			
	61.1%	54.7%	71.0%	60.5%	75.8%	45.7%	60.0%			
	28.1%	32.1%	19.6%	31.6%	15.2%	42.4%	28.3%			

Content for all students (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
GM267	0.483	0.417	0.528	0.595	0.909	0.241	0.426			
	60.1%	54.7%	62.3%	67.5%	75.7%	51.7%	59.0%			
	25.3%	27.4%	21.7%	24.3%	6.0%	34.5%	31.1%			
GM274	0.197	0.024	0.121	0.237	0.545	0.276	0.279			
	45.9%	45.2%	42.1%	42.1%	57.6%	50.0%	45.9%			
	30.7%	39.3%	32.7%	28.9%	12.2%	32.7%	24.6%			
GM268	-0.156	-0.120	-0.368	-0.132	-0.152	0.000	0.000			
	34.3%	33.7%	28.3%	31.6%	30.3%	44.9%	39.3%			
	42.8%	42.1%	51.0%	39.5%	36.4%	38.0%	39.3%			
GM266	-0.365	-0.369	-0.467	-0.526	-0.667	-0.362	0.082			
	24.9%	21.5%	23.4%	13.2%	18.2%	29.3%	39.4%			
	50.3%	48.8%	52.3%	57.9%	63.6%	53.4%	34.4%			
GM279*	-0.369	-0.214	-0.481	-0.100	-0.103	-0.586	-0.525			
	31.0%	33.3%	26.8%	42.5%	43.6%	24.2%	26.2%			
	54.4%	46.5%	57.4%	47.5%	43.6%	63.8%	62.3%			
GM278*	-0.817	-0.458	-0.954	-0.825	-1.154	-0.931	-0.738			
	10.6%	13.2%	7.5%	7.5%	5.1%	13.8%	14.8%			
	66.6%	44.6%	74.1%	70.0%	76.9%	74.2%	67.2%			
GM280*	-0.825	-0.627	-1.111	-0.700	-0.923	-0.845	-0.590			
	16.2%	18.1%	6.5%	25.0%	15.4%	17.2%	24.6%			
	67.1%	51.8%	79.7%	65.0%	66.7%	72.5%	62.3%			

Content for College-Bound Non-Mathematics/Science Majors (GM1S)

The samples surveyed would apparently include few advanced geometric topics in the curriculum for the college-bound student who will not be a science or mathematics major. Only two items received moderately strong support:

283. Coordinate (analytic) geometry (77.6%)

282. Straightedge and compass constructions (77.7%)

Minimal support was given to four additional topics:

287. A variety of proof formats (58.1%)

293. Solid geometry (57.8%)

284. Symbolic logic and work with truth tables (51.4%)

281. Locus theorems (49.9%)

Support for two topics was equivocal:

285. Vectors (supported by 44.0%, opposed by 36.3%)

292. Geometry of the sphere (supported by 39.9%, opposed by 34.1%)

For the remaining seven items, those favoring non-inclusion outnumbered those favoring inclusion:

286. Transformational geometry (supported by 29.9%, opposed by 42.8%)

288. Non-Euclidean geometry (supported by 29.8%, opposed by 47.1%)

295. Study of axiomatic structures (supported by 29.7%, opposed by 41.3%)

294. Network theory (supported by 24.1%, opposed by 43.5%)

290. Finite geometries (supported by 23.1%, opposed by 49.2%)

291. Projective geometry (supported by 21.0%, opposed by 53.2%)

289. Transformations by matrices (supported by 20.0%, opposed by 58.3%)

Content for college-bound non-mathematics/science majors

	Total	AT	MT	JC	MA	SP	TE	PR	SB	P
GM283	1.010		0.821	0.882	0.950	1.071	1.314			
	77.6%		70.6%	76.5%	77.5%	80.4%	85.7%			
	10.9%		13.7%	11.7%	17.5%	10.7%	2.9%			
GM282	0.959		1.011	0.765	0.825	1.071	0.971			
	77.7%		82.1%	70.6%	72.5%	82.1%	74.3%			
	12.2%		12.6%	17.6%	20.0%	8.9%	7.1%			
GM287	0.432		0.309	0.471	0.175	0.571	0.614			
	58.1%		55.3%	55.8%	45.0%	66.0%	64.2%			
	24.9%		28.7%	23.5%	30.0%	25.0%	17.2%			
GM293	0.405		0.337	0.382	0.200	0.636	0.443			
	57.8%		55.8%	53.0%	50.0%	72.7%	55.7%			
	22.1%		28.5%	23.5%	27.5%	14.6%	15.7%			
GM281	0.297		0.191	0.382	0.375	0.327	0.329			
	49.9%		46.8%	47.1%	55.0%	52.7%	50.0%			
	24.5%		28.7%	20.6%	20.0%	23.7%	24.3%			
GM284	0.286		0.351	0.059	0.450	0.125	0.343			
	51.4%		52.1%	44.1%	60.0%	42.9%	55.7%			
	28.6%		24.5%	41.2%	22.5%	32.2%	28.5%			
GM285	0.115		-0.105	0.118	0.475	0.107	0.214			
	44.0%		33.7%	35.3%	65.0%	48.2%	47.2%			
	36.3%		47.4%	29.4%	30.0%	35.7%	28.6%			
GM292	0.010		-0.074	0.059	0.100	0.000	0.058			
	39.9%		41.1%	41.1%	45.0%	38.2%	36.2%			
	34.1%		40.0%	32.4%	32.5%	36.4%	26.1%			

Content for college-bound non-mathematics/science majors (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
GM286	-0.184		-0.457	-0.529	-0.475	0.161	0.243			
	29.9%		18.1%	14.7%	17.5%	50.0%	44.3%			
	42.8%		51.0%	55.9%	52.5%	32.1%	28.5%			
GM295	-0.201		-0.274	-0.235	-0.100	0.036	-0.338			
	29.7%		27.4%	23.5%	30.0%	41.0%	26.5%			
	41.3%		40.0%	44.2%	37.5%	35.7%	48.5%			
GM288	-0.278		-0.558	-0.441	-0.225	-0.054	-0.029			
	29.8%		20.0%	23.5%	32.5%	39.2%	37.2%			
	47.1%		61.1%	58.9%	40.0%	35.7%	35.8%			
GM294	-0.340		-0.674	-0.176	-0.325	-0.200	-0.086			
	24.1%		13.7%	20.6%	30.0%	29.1%	32.9%			
	43.5%		56.9%	29.4%	45.0%	41.8%	32.9%			
GM290	-0.386		-0.611	-0.353	-0.650	-0.107	-0.171			
	23.1%		15.8%	20.5%	12.5%	35.8%	30.0%			
	49.2%		58.9%	47.1%	62.5%	41.1%	35.7%			
GM291	-0.498		-0.653	-0.412	-0.550	-0.143	-0.586			
	21.0%		17.9%	20.5%	22.5%	26.8%	20.0%			
	53.2%		60.0%	50.0%	52.5%	39.3%	57.1%			
GM289	-0.576		-0.737	-0.647	-0.575	-0.321	-0.529			
	20.0%		14.7%	23.5%	17.5%	26.8%	21.4%			
	58.3%		63.2%	64.7%	57.5%	51.8%	54.3%			

<u>Resources (GM3)</u>

It is encouraging that the samples at all levels expressed a preference for a resource-rich environment for teaching geometry. Support was strongest for three items:

311. Resource books with applications of geometry to real problems (91.1%)

308. Short films or videotapes showing basic geometric concepts (82.3%)

309. Masters of worksheets and activities (81.4%)

But with levels of support above 69% were six other items:

310. Individual study materials (77.8%)

313. Large-scale demonstration models and devices (77.8%)

315. Manipulative materials and laboratory experiments (74.2%)

307. A kit of measuring tools for every student (73.0%)

314. 35 mm slides of basic geometric figures (69.4%)

306. Computer generated and animated graphics (69.3%)

The final item was essentially rejected:

312. Drafting tables and equipment (supported by 33.2%, opposed by 42.9%)

Resources

	Total	AT	MT	JC	MA	SP	TE	PR	SB	P'
GM311	1.427	1.494	1.389	1.500	1.325					
	91.1%	88.6%	90.5%	97.0%	92.5%					
	3.2%	5.1%	3.2%	0.0%	2.5%					
GM309	1.113	1.443	1.095	0.941	0.641					
	81.4%	88.6%	82.1%	85.3%	61.5%					
	8.5%	6.4%	6.4%	8.8%	17.9%					
GM308	1.032	1.241	0.874	0.971	1.050					
	82.3%	88.6%	75.8%	82.3%	85.0%					
	8.8%	7.6%	11.6%	8.8%	5.0%					
GM315	0.968	1.291	0.863	0.824	0.700					
	74.2%	82.3%	71.6%	76.5%	62.5%					
	8.9%	6.3%	7.4%	17.7%	10.0%					
GM310	0.956	1.114	0.842	1.000	0.875					
	77.8%	78.5%	74.7%	88.2%	75.0%					
	7.2%	6.3%	9.5%	8.8%	2.5%					
GM313	0.923	1.165	0.895	0.882	0.550					
	77.8%	84.8%	75.8%	82.3%	65.0%					
	10.9%	7.6%	10.6%	8.8%	20.0%					
GM307	0.903	1.114	0.642	1.059	0.975					
	73.0%	77.2%	63.2%	79.4%	82.5%					
	16.9%	12.7%	24.2%	11.7%	12.5%					
GM306	0.790	0.468	0.916	0.853	1.075					
	69.3%	54.4%	75.8%	73.6%	80.0%					
	12.9%	20.2%	8.5%	11.7%	10.0%					

Resources (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
GM314	0.685	0.949	0.579	0.588	0.500					
	69.4%	81.0%	63.2%	70.6%	60.0%					
	18.5%	11.4%	23.2%	17.6%	22.5%					
GM312	-0.178	-0.076	-0.179	-0.294	-0.282					
	33.2%	34.2%	36.9%	23.5%	30.8%					
	42.9%	39.3%	44.2%	44.2%	46.1%					

Methods (GM4)

It is perhaps surprising that only one item on teaching strategies for geometry received strong support:

318. Student worksheets ... for drill and practice ... at the conclusion of each lesson (83.2%)

Support was moderately strong for three other items:

319. Basic geometric ideas are introduced through laboratory investigations. (75.1%)

325. Long-term projects ... to be assigned to individuals or to teams of students (65.6%)

323. Simulations ... of real-world situations (60.0%)

Minimal support was given to three items:

316. Activities ... that would require students to go outside the classroom to measure things (58.6%)

324. Detailed notes ... to guide the teacher in oral presentation (55.4%)

320. ... use of a mastery learning or an individually paced model (54.2%)

In each case, the AT sample was much more supportive than were other samples. This sample was also more supportive of items 322 and 321, but even this more positive reaction did not substantially affect the poor acceptance of them by other samples.

322. ... small discussion groups (48.0%)

321. More than 50% of instructional time is devoted to ... individual study materials to develop and extend geometric ideas (42.1%)

Materials written with the expectation that students would read formal presentations before class discussion (item 317) were accepted by only 25.3% and were opposed by 52.7%.

Methods

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
GM318	1.100	1.145	1.170	1.088	0.788					
	83.2%	85.6%	87.0%	82.4%	66.7%					
	5.2%	7.2%	5.0%	0.0%	6.0%					
GM319	0.944	1.195	0.870	0.706	0.788					
	75.1%	82.9%	73.0%	64.7%	72.8%					
	9.6%	7.3%	12.0%	8.8%	9.1%					
GM325	0.624	0.747	0.750	0.176	0.394					
	65.6%	67.5%	75.0%	41.2%	57.5%					
	14.8%	14.4%	12.0%	23.5%	15.2%					
GM316	0.566	0.915	0.460	0.471	0.121					
	58.6%	70.8%	57.0%	50.0%	42.5%					
	21.7%	18.3%	22.0%	14.7%	36.4%					
GM324	0.514	0.768	0.540	0.353	-0.030					
	55.4%	72.0%	52.0%	41.2%	39.4%					
	16.8%	14.7%	15.0%	11.8%	33.4%					
GM323	0.508	0.759	0.410	0.324	0.364					
	60.0%	72.3%	57.0%	44.2%	54.5%					
	19.6%	14.4%	24.0%	17.7%	21.2%					
GM320	0.506	0.765	0.440	0.412	0.156					
	54.2%	64.2%	52.0%	50.0%	40.7%					
	17.8%	16.1%	19.0%	11.7%	25.1%					
GM322	0.264	0.506	0.230	0.147	-0.121					
	48.0%	57.9%	49.0%	38.3%	30.3%					
	24.4%	18.1%	28.0%	23.5%	30.3%					

Methods (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
GM321	0.185	0.415	0.160	0.029	-0.152					
	42.1%	51.3%	43.0%	29.4%	30.3%					
	31.3%	29.2%	30.0%	29.4%	42.5%					
GM317	-0.349	-0.614	-0.220	-0.091	-0.333					
	25.3%	20.5%	27.0%	30.3%	27.3%					
	52.7%	63.9%	46.0%	36.4%	60.6%					

Who/Time (GM5)

This cluster asked samples to consider the placement of geometric topics in the curriculum. Only two items were given moderately strong support:

327. A full-year course in applied geometry ... should be available as a high school elective course. (71.4%)

334. Intuitive geometric concepts are at least as important in grade 1 as number concepts. (65.8%)

Support from the MA sample for item 327 and from the AT sample for item 334 was minimal, however.

Support from most samples was equivocal for three items:

330. Geometry modules ... that could be inserted in present mathematics courses or combined to form short courses (supported by 46.4%, opposed by 30.6%)

335. More of the mathematics curriculum in grades 7 and 8 should be devoted to geometry. (supported by 43.2%, opposed by 28.1%)

332. A second year of advanced geometry should be offered (supported by 38.0%, opposed by 40.3%)

Lay samples were also given item 335 (as item 756); they accepted it at a lower level than most samples, although close to the reaction of the AT and MT samples (supported by 23.0%, opposed by 43.8%).

Opposition was greater to the remaining items:

326. A full-year course in geometry should be delayed until students have taken two years of algebra. (supported by 28.6%, opposed by 52.9%)

329. Separate courses in geometry should be abolished and the content integrated ... (supported by 23.6%, opposed by 62.7%)

333. Much of the mathematics taught in grade 4 should be geometry ... (supported by 11.8%, opposed by 56.3%)

331. The geometric topics presently taught in elementary schools form an adequate minimum knowledge ... for high school graduation. (supported by 15.1%, opposed by 75.4%)

328. No geometric topics should be taught before seventh grade. (supported by 5.6%, opposed by 91.3%)

The lay samples were given item 329 (as item 772); their reactions were very similar (supported by 21.8%, opposed by 62.0%).

Thus, the samples appeared to support the teaching of geometry in the elementary school, but did not agree with a "pause" in the focus on arithmetic in order to emphasize geometry in grade 4. Essentially, samples supported the current status of geometry in both elementary and secondary schools.

Who/Time

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
GM327	0.802	1.107	0.860	0.763	0.303	0.754	0.643			
	71.4%	78.6%	74.7%	76.3%	51.5%	64.9%	70.0%			
	14.9%	8.3%	11.2%	13.1%	36.3%	19.3%	15.7%			
GM334	0.671	0.333	0.579	0.895	1.030	0.579	1.000			
	65.8%	53.6%	61.6%	73.7%	72.7%	64.9%	80.0%			
	21.6%	33.3%	25.2%	7.9%	9.1%	26.3%	11.4%			
GM330	0.144	0.470	-0.206	0.342	-0.121	0.175	0.286			
	46.4%	57.9%	35.5%	50.0%	39.4%	47.4%	50.0%			
	30.6%	20.5%	44.0%	18.4%	36.4%	31.6%	25.7%			
GM335	0.129	-0.214	-0.168	0.579	0.394	0.123	0.629			
	43.2%	27.4%	30.8%	65.8%	45.5%	43.9%	67.1%			
	28.1%	38.1%	40.2%	10.5%	9.1%	31.6%	12.9%			
756	-0.250							-0.201	-0.376	-0.167
	23.0%							24.3%	20.4%	23.8%
	43.8%							42.0%	51.7%	33.3%
GM332	-0.018	0.536	-0.084	-0.211	-0.061	-0.193	-0.314			
	38.0%	57.2%	34.6%	29.0%	45.5%	29.8%	28.6%			
	40.3%	19.1%	41.1%	47.4%	42.5%	54.4%	48.6%			
GM326	-0.320	-0.181	-0.168	-0.184	-0.606	-0.544	-0.471			
	28.6%	30.1%	32.7%	31.6%	18.2%	28.1%	24.3%			
	52.9%	45.7%	50.4%	47.3%	60.6%	59.6%	58.5%			
GM329	-0.614	-0.655	-0.776	-0.447	-0.970	-0.474	-0.357			
	23.6%	19.0%	19.7%	26.3%	21.3%	29.9%	30.0%			
	62.7%	67.8%	64.5%	52.6%	69.7%	61.4%	57.2%			

Who/Time (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
772	-0.610							-0.650	-0.511	-0.500
	21.8%							20.7%	26.1%	22.0%
	62.0%							63.3%	60.2%	56.0%
GM333	-0.707	-0.798	-0.757	-0.026	-0.394	-1.123	-0.700			
	11.8%	16.7%	5.6%	26.3%	21.2%	7.0%	7.1%			
	56.3%	59.5%	52.4%	23.7%	48.5%	73.7%	65.7%			
GM331	-0.887	-0.750	-0.729	-1.000	-1.152	-0.842	-1.143			
	15.1%	16.7%	23.4%	0.0%	6.0%	19.3%	10.0%			
	75.4%	73.8%	68.2%	76.3%	78.8%	73.7%	87.2%			
GM328	-1.542	-1.417	-1.280	-1.711	-1.697	-1.614	-1.871			
	5.6%	7.2%	11.2%	0.0%	0.0%	7.0%	0.0%			
	91.3%	88.1%	84.1%	97.4%	94.0%	92.9%	100.0%			

Calculators (GM6)

Two uses of the calculator for geometric instruction were strongly supported by all the samples:

343. Using trigonometry to find the length of a side of a triangle (85.4%)

338. Finding the length of the third side of a right triangle using the Pythagorean theorem (83.4%)

Four uses received moderately strong support:

341. Finding the circumference of a circle, given the distance (72.2%)

342. Calculating the volume of a cone, when the diameter of the base is 6 cm and the height is 10 cm (68.0%)

344. Calculating the coordinates of the new vertices of a triangle after a given transformation (63.9%)

337. Computing the area of a trapezoid (65.2%)

Two items were given minimal support:

340. Doing geometry homework (54.7%)

345. Taking a geometry test (51.9%)

The final two items were opposed by all samples:

339. Finding the measure of the complement or supplement of a 57° angle (supported by 32.1%, opposed by 60.7%)

336. Finding the midpoint of a line, if the coordinates of the endpoints are (2,3) and (7,1) (supported by 27.9%, opposed by 60.8%)

The high degree of agreement across samples on almost all of these items is noteworthy.

Calculators

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
GM343	1.354	1.148	1.333	1.600	1.590					
	85.4%	80.2%	85.2%	92.5%	89.8%					
	7.9%	7.4%	11.2%	0.0%	7.7%					
GM338	1.233	1.213	1.167	1.385	1.308					
	83.4%	81.3%	83.3%	87.1%	84.6%					
	10.5%	7.5%	12.9%	7.7%	12.8%					
GM341	0.891	0.900	0.815	1.000	0.974					
	72.2%	70.1%	72.2%	79.5%	69.2%					
	19.5%	18.8%	21.3%	15.4%	20.5%					
GM342	0.780	0.840	0.676	0.950	0.769					
	68.0%	66.6%	67.6%	75.0%	64.1%					
	24.2%	19.7%	27.7%	20.0%	28.2%					
GM344	0.692	0.734	0.546	0.825	0.872					
	63.9%	60.7%	62.1%	65.0%	74.4%					
	18.8%	13.9%	24.1%	15.0%	18.0%					
GM337	0.648	0.800	0.500	0.775	0.615					
	65.2%	67.6%	62.0%	70.0%	64.1%					
	27.4%	22.6%	33.3%	20.0%	28.2%					
GM340	0.371	0.346	0.213	0.590	0.641					
	54.7%	54.3%	51.9%	56.4%	61.5%					
	29.6%	27.1%	37.0%	23.1%	20.6%					
GM345	0.213	0.073	0.037	0.675	0.513					
	51.9%	46.3%	46.7%	67.5%	61.5%					
	35.8%	37.8%	42.0%	22.5%	28.2%					

Calculators (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
GM339	-0.449	-0.125	-0.636	-0.410	-0.641					
	32.1%	38.8%	30.8%	30.7%	23.1%					
	60.7%	47.6%	68.2%	64.1%	64.1%					
GM336	-0.475	-0.190	-0.593	-0.462	-0.744					
	27.9%	30.4%	27.7%	28.2%	23.1%					
	60.8%	45.6%	66.7%	64.1%	71.8%					

Summary: Geometry

- Four goals for geometry received strong support (over 80%): to develop logical thinking abilities, to develop spatial intuitions, to acquire the knowledge for further study, and to learn to read and interpret mathematical arguments.
- Job and consumer skills were not ranked as high for geometry as for some other strands.
- Four geometric topics were strongly supported for inclusion in the elementary school curriculum: properties of triangles and rectangles, parallel and perpendicular lines, geometry of symmetry, and similar figures.
- Opposition was strong to the use of "logical reasoning principles including axioms and proofs" in the elementary school curriculum.
- Strong support was given to including three geometric topics in the secondary school curriculum for all students: properties of triangles and rectangles, properties of circles, and similar figures.
- For college-bound students not majoring in mathematics or science, only two geometric topics were given moderately strong support (77% for each): coordinate geometry and straightedge and compass constructions.
- Support was above 69% for all except one resource for teaching geometry. Strongly accepted (by above 80%) were resource books of applications, masters of worksheets and activities, and short films or videotapes showing basic geometric concepts.
- Only one teaching strategy for geometry received strong support (by 83%): student worksheets for drill and practice to be used at the conclusion of each lesson.

- The availability as an elective of a full-year course in applied geometry and that intuitive geometric concepts are at least as important in grade 1 as number concepts were each accepted at a moderately strong level (71% and 65%, respectively).
- There was strong opposition (over 60% did not support the item) to three items: (1) abolishing separate courses in geometry in favor of integrating geometric content in other courses; (2) considering the geometric topics presently taught in elementary schools to provide adequate minimum knowledge for high school graduation; and (3) not teaching geometric topics until grade 7.
- Use of the calculator for two problems with triangles were the only items given strong support.

Probability and Statistics

Goals (PS2)

Ten items provided evidence on the importance of goals for probability and statistics. Five goals were strongly supported:

372. To enable students to read and think critically about graphs and other data in other subjects such as science or social science (94.8%)

371. To help consumers deal with statistical information (91.6%)

376. To demonstrate how to organize, summarize, and present data in easily interpretable forms (85.6%)

373. To give experience in dealing with estimation and approximation (82.7%)

374. To apply mathematics to other disciplines (83.7%)

With moderately strong support was one item:

379. To teach skills necessary for further study (72.0%)

Four other items had only minimal support:

377. To provide practice in such basic mathematical topics as sets, ratio, and graphing (57.7%)

378. To teach skills necessary for employment (57.2%)

375. To understand the use and power of computers (54.5%)

380. To provide practice in basic computational skills (50.3%)

The AT sample gave this last item far more support (73.2%), while the SP and TE samples each gave it very weak support (slightly over 30%).

Goals

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PS372	1.462	1.407	1.384	1.441	1.515	1.583	1.525			
	94.8%	91.3%	94.0%	94.1%	100.0%	98.3%	95.1%			
	1.6%	4.9%	2.0%	0.0%	0.0%	0.0%	0.0%			
PS371	1.379	1.317	1.333	1.441	1.333	1.417	1.492			
	91.6%	89.0%	89.9%	91.1%	87.9%	93.4%	98.3%			
	2.2%	4.9%	2.0%	0.0%	0.0%	3.3%	0.0%			
PS376	1.234	1.235	1.222	1.206	1.333	1.333	1.115			
	85.6%	85.2%	87.9%	94.1%	87.9%	83.4%	78.7%			
	2.7%	3.7%	3.0%	2.9%	3.0%	1.7%	1.6%			
PS373	1.316	1.136	1.162	0.971	1.091	1.100	1.246			
	82.7%	80.2%	83.8%	82.3%	78.8%	78.3%	90.1%			
	3.5%	8.6%	1.0%	2.9%	3.0%	5.0%	0.0%			
S374	1.133	1.321	1.232	1.000	0.970	0.967	1.049			
	83.7%	87.6%	87.9%	73.5%	81.8%	76.7%	85.2%			
	3.5%	3.7%	4.0%	2.9%	6.0%	3.4%	1.6%			
S379	0.861	0.889	0.980	1.059	0.727	0.767	0.689			
	72.0%	72.9%	78.7%	85.3%	60.6%	66.6%	64.0%			
	4.9%	6.1%	5.1%	5.9%	0.0%	3.3%	6.6%			
PS378	0.631	0.927	0.657	0.618	0.606	0.467	0.377			
	57.2%	65.8%	61.6%	55.8%	57.6%	48.3%	47.5%			
	13.0%	8.5%	15.1%	11.8%	6.1%	13.4%	19.7%			
PS377	0.543	0.840	0.657	0.412	0.545	0.300	0.279			
	57.7%	70.4%	64.7%	55.9%	60.6%	43.4%	42.6%			
	15.5%	8.6%	14.1%	20.5%	15.1%	16.6%	22.9%			

Goals (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PS375	0.531	0.476	0.707	0.500	0.455	0.567	0.344			
	54.5%	56.1%	62.6%	52.9%	51.5%	51.7%	44.3%			
	14.7%	15.9%	11.1%	14.7%	21.3%	15.0%	14.7%			
PS380	0.440	1.012	0.531	0.324	0.333	0.033	0.049			
	50.3%	73.2%	54.1%	50.0%	51.5%	30.0%	32.8%			
	19.3%	10.9%	17.3%	23.5%	21.3%	23.3%	26.3%			

Content for Elementary School Students (PS1E)

Ten items were in the cluster of topics in probability and statistics which might be included in the elementary school curriculum. Two items were strongly supported:

346. Collection and organization of data (e.g., graphs, tables) (94.3%)

348. Reading and interpreting statistical information (85.8%)

Four items were given moderately strong support:

347. Predicting outcomes (76.1%)

355. Decision-making (e.g., for voting or consumer situations) (68.4%)

349. Measures of central tendency (e.g., mean, median, mode) (66.8%)

351. Calculating the probability of an event occurring (63.6%)

There was essentially very little support for four items, with opposition particularly strong for the final item:

353. Testing of conjectures and hypotheses (supported by 43.5%, opposed by 39.1%)

350. Measures of spread (e.g., range, quartiles, etc.) (supported by 35.4%, opposed by 33.7%)

352. Combinations and permutations (supported by 31.6%, opposed by 43.5%)

354. Calculating probabilities of compound and conditional events (supported by 15.6%, opposed by 60.9%)

Content for elementary school students

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PS346	1.686	1.596				1.772	1.743			
	94.3%	93.9%				96.5%	92.8%			
	2.2%	4.0%				1.8%	0.0%			
PS348	1.279	1.061				1.386	1.500			
	85.8%	76.8%				91.2%	94.3%			
	7.1%	11.1%				5.3%	2.9%			
PS347	1.009	1.020				0.860	1.114			
	76.1%	75.7%				72.0%	80.0%			
	11.1%	16.1%				10.5%	4.3%			
PS355	0.813	1.061				0.929	0.371			
	68.4%	75.7%				78.5%	50.0%			
	14.2%	7.0%				12.5%	25.7%			
PS349	0.748	0.525				0.754	1.057			
	66.8%	53.5%				70.2%	82.9%			
	14.6%	17.2%				19.3%	7.2%			
PS351	0.573	0.444				0.411	0.886			
	63.6%	59.6%				55.3%	75.8%			
	18.2%	24.3%				19.7%	8.5%			
PS350	0.053	-0.121				-0.140	0.457			
	34.4%	27.3%				35.1%	47.1%			
	33.7%	39.4%				42.1%	18.6%			
PS353	0.040	0.232				-0.143	-0.086			
	43.5%	52.6%				33.9%	38.6%			
	39.1%	35.4%				41.1%	42.9%			

Content for elementary school students (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PS352	-0.196	-0.101				-0.554	-0.043			
	31.6%	34.4%				16.1%	40.0%			
	43.5%	39.4%				57.2%	38.5%			
PS354	-0.707	-0.586				-1.000	-0.643			
	15.6%	17.1%				8.9%	18.6%			
	60.9%	55.5%				71.4%	60.0%			

Content for Secondary School Students (PS1S)

The content cluster of topics in probability and statistics which could be included in the secondary school mathematics curriculum was constructed around a unique stem. Instead of asking for agreement or disagreement with the inclusion of a possible topic, respondents were asked to identify the most inclusive group for whom they felt instruction on the topic was appropriate. Choices were:

a. Noncollege-bound secondary school students
b. College-bound secondary school students
c. All secondary school students
d. Not appropriate for secondary school students
e. Undecided

Of the fifteen topics suggested, the MT, JC, MA, SP and TE samples strongly endorsed one (item 369) and gave moderately strong support to three others as suitable for all secondary students:

369. Collection and organization of data (e.g., graphs, tables) (85.0%)

359. Measures of central tendency (e.g., mean, median, mode) (78.6%)

364. Reading and interpreting statistical information (73.7%)

365. Decision-making (e.g., for voting or consumer situations (71.4%)

Four other topics were given moderate support as most appropriate for college-bound students:

358. Curve fitting and prediction (71.0%)

356. Probability distributions (e.g., normal, binomal) (70.8%)

367. Combinations and permutations (69.6%)

370. Calculating probabilities of compound and conditional events (65.5%)

The reactions of the samples were more divided between choices on the remaining seven topics. For one topic (item 263), there was minimal support for inclusion only for college-bound students, with no other choice clearly selected. The appropriateness of four topics (items 357, 360, 361, 366) for all students or only for college-bound was not clear. For the remaining two items (363, 368), opinions were divided between the appropriateness for the college-bound or for no students.

362. Correlation (56.4% for college-bound students)

357. Predicting outcomes (58.4% for all students, 29.5% for college-bound students)

360. Ranking procedures (49.2% for all students, 25.6% for college-bound students)

361. Calculating the probability of an event occurring (56.6% for all students, 36.5% for college-bound students)

366. Measures of spread (e.g., range, quartiles) (36.8% for all students, 43.1% for college-bound students)

363. Statistical testing of hypotheses (54.7% for college-bound students, 28.9% for no students)

368. Experimental design (39.2% for college-bound students, 35.7% for no students)

Content for secondary school students

	Total	MT	JC	MA	SP	TE
PS356						
college-bound	70.8%	68.5%	81.1%	62.5%	74.0%	69.4%
all students	16.8%	18.0%	8.1%	18.8%	17.8%	17.7%
no students	6.3%	7.2%	5.4%	12.5%	2.7%	6.5%
PS357						
college-bound	29.5%	29.7%	51.4%	29.0%	26.0%	20.6%
all students	58.4%	59.5%	35.1%	51.6%	67.1%	63.5%
no students	2.2%	2.7%	2.7%	3.2%	1.4%	1.6%
PS358						
college-bound	71.0%	73.9%	59.5%	46.9%	80.8%	73.4%
all students	7.9%	7.2%	10.8%	25.0%	5.5%	1.6%
no students	11.4%	8.1%	21.6%	12.5%	5.5%	17.2%
PS359						
college-bound	16.4%	25.9%	5.4%	6.3%	15.1%	12.5%
all students	78.6%	68.8%	83.8%	90.6%	82.2%	82.8%
no students	0.9%	0.9%	5.4%	0.0%	0.0%	0.0%
PS360						
college-bound	25.6%	35.1%	32.4%	15.6%	20.5%	15.6%
all students	49.2%	47.7%	45.9%	46.9%	53.4%	50.0%
no students	6.3%	3.6%	10.8%	9.4%	2.7%	10.9%
PS361						
college-bound	36.5%	41.1%	54.1%	34.4%	26.0%	31.3%
all students	56.6%	50.0%	35.1%	56.3%	68.5%	67.2%
no students	0.9%	1.9%	2.7%	0.0%	0.0%	0.0%
PS362						
college-bound	56.4%	60.2%	56.8%	50.0%	65.8%	42.2%
all students	11.9%	9.7%	8.1%	12.5%	6.8%	23.4%
no students	17.9%	11.5%	16.2%	25.0%	19.2%	25.0%

Content for secondary school students (continued)

	Total	MT	JC	MA	SP	TE
PS363						
college-bound	54.7%	61.9%	61.1%	34.4%	63.0%	39.1%
all students	6.3%	5.3%	0.0%	15.6%	5.5%	7.8%
no students	28.9%	19.5%	30.6%	43.8%	23.3%	43.8%
PS364						
college-bound	18.8%	27.4%	16.7%	6.3%	21.6%	7.8%
all students	73.7%	62.8%	77.8%	84.4%	73.0%	85.9%
no students	1.9%	3.5%	0.0%	3.1%	0.0%	1.6%
PS365						
college-bound	11.6%	13.4%	16.7%	12.5%	6.8%	10.9%
all students	71.4%	73.2%	66.7%	62.5%	77.0%	68.8%
no students	3.8%	2.7%	5.6%	3.1%	1.4%	7.8%
PS366						
college-bound	43.1%	49.6%	38.9%	31.3%	52.1%	29.7%
all students	36.8%	26.5%	41.7%	46.9%	27.4%	57.8%
no students	10.4%	12.4%	5.6%	9.4%	9.6%	10.9%
PS367						
college-bound	69.6%	66.4%	70.3%	59.4%	79.5%	68.8%
all students	21.3%	17.7%	21.6%	37.5%	12.3%	29.7%
no students	2.5%	3.5%	2.7%	3.1%	1.4%	1.6%
PS368						
college-bound	39.2%	40.7%	48.6%	25.0%	46.6%	29.7%
all students	9.1%	10.6%	0.0%	6.3%	12.3%	9.4%
no students	35.7%	23.9%	37.8%	53.1%	30.1%	53.1%
PS369						
college-bound	10.6%	16.8%	10.8%	0.0%	5.4%	10.9%
all students	85.0%	79.6%	86.5%	93.8%	89.2%	84.4%
no students	0.0%					

Content for secondary school students (continued)

	Total	MT	JC	MA	SP	TE
PS370						
college-bound	65.5%	67.3%	54.1%	68.8%	71.2%	60.9%
all students	7.5%	7.1%	2.7%	6.3%	5.5%	14.1%
no students	16.3%	14.2%	35.1%	15.6%	11.0%	15.6%

Resources (PS3)

Eleven of the fifteen suggested resources for teaching probability and statistics were supported by over 75% of the combined samples:

388. Resource books with applications and problems .... (90.8%).

381. A syllabus that suggests ... topics and methods for each grade level together with specific times when they should be introduced (87.8%)

382. A series of short films or videotapes that can be used to motivate and introduce specific ... concepts (87.0%)

387. Masters of worksheets and activities ... (86.3%)

383. In-service materials to teach teachers the content ... (84.8%)

394. Booklets of experiments and related laboratory equipment (80.0%)

384. ... textbooks that emphasize projects and activities (79.3%)

389. Individual study materials for students (79.3%)

392. Coordinated curriculum materials ... (77.4%)

390. Descriptions of teaching methods ... (76.6%)

386. Probability and statistics materials for use with small computers (76.0%)

Two items were given only minimal support, and a third even less support:

393. A test item bank with test items coordinated to behavioral objectives ... (54.2%)

395. Outlines of outstanding presentations ... (56.0%)

391. Standardized tests in probability and statistics which allow for comparison with students from other schools (48.2%)

The final resource was opposed by all samples:

385. Audiotapes of lectures by eminent statisticians (supported by 26.0%, opposed by 49.7%)

As one studies the data for these items, differences in the reactions of the various samples become apparent; for instance:

(1) The MA sample perceived short films or videotapes (item 382),

in-service materials (item 383), descriptions of suitable methods for teaching (item 390), and coordinated curriculum materials (item 392), as less valuable resources than other samples.

(2) The JC sample perceived the role of experiments supported by appropriate equipment (item 394) and test item banks (item 393) as more important than other samples, and were less accepting of masters of worksheets and activities (item 387).

(3) The AT sample seemed less enthralled by the prospect of using a small computer (item 386) than the other samples.

Resources

	Total	AT	MT	JC	MA	SP	TE	PR	SB	F
PS381	1.274	1.361	1.319	1.059	1.038					
	87.8%	87.6%	90.2%	82.4%	84.6%					
	5.2%	6.2%	2.7%	8.8%	7.7%					
PS388	1.285	1.134	1.389	1.294	1.385					
	90.8%	86.6%	93.8%	91.2%	92.4%					
	2.9%	6.2%	0.9%	2.9%	0.0%					
PS382	1.185	1.186	1.248	1.235	0.846					
	87.0%	87.6%	90.3%	85.3%	73.1%					
	6.3%	6.2%	5.4%	0.0%	19.2%					
PS387	1.181	1.258	1.257	0.853	1.000					
	86.3%	91.8%	86.7%	73.5%	80.8%					
	4.8%	5.2%	4.5%	5.9%	3.8%					
PS383	1.167	1.206	1.150	1.176	1.077					
	84.8%	88.7%	84.0%	85.3%	73.1%					
	9.2%	8.3%	9.7%	8.8%	11.5%					
PS384	1.052	0.907	1.195	1.118	0.885					
	79.3%	73.2%	82.3%	88.3%	76.9%					
	7.4%	11.3%	4.4%	2.9%	11.5%					
PS389	1.044	0.990	1.106	0.912	1.154					
	79.3%	76.3%	83.2%	79.4%	73.1%					
	5.9%	9.3%	3.5%	2.9%	7.7%					
PS390	0.981	1.010	1.080	0.765	0.731					
	76.6%	76.3%	83.2%	70.6%	57.7%					
	7.0%	5.2%	4.5%	11.7%	19.2%					

esources (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
S392	0.922	0.959	1.009	0.765	0.615					
	77.4%	80.4%	81.4%	70.6%	57.7%					
	9.2%	8.3%	9.7%	8.8%	11.5%					
S394	0.904	0.804	0.920	1.088	0.962					
	80.0%	75.3%	79.6%	91.1%	84.6%					
	8.5%	11.4%	9.7%	0.0%	3.8%					
PS386	0.844	0.526	0.973	1.176	1.038					
	76.0%	62.9%	80.5%	91.2%	84.6%					
	10.7%	18.6%	8.0%	2.9%	3.8%					
PS393	0.398	0.196	0.545	0.765	0.038					
	54.2%	46.4%	58.9%	73.5%	38.5%					
	23.4%	28.9%	20.6%	8.8%	34.6%					
PS395	0.404	0.175	0.513	0.529	0.615					
	56.0%	48.5%	61.1%	58.8%	57.7%					
	23.3%	34.0%	17.7%	17.6%	15.4%					
PS391	0.222	-0.258	0.504	0.382	0.577					
	48.2%	28.9%	59.3%	58.8%	57.7%					
	31.5%	47.4%	23.9%	23.5%	15.4%					
PS385	-0.359	-0.670	-0.159	-0.206	-0.269					
	26.0%	16.5%	33.6%	26.4%	26.9%					
	49.7%	67.0%	39.8%	38.3%	42.3%					

Methods (PS4)

Three suggested strategies for teaching probability and statistics were strongly supported. They were:

398. Materials include many examples of real-world data ... (94.3%)

397. Students perform experiments with dice and cards and study games of chance. (86.2%)

403. Problems that arise in the social or natural sciences are used to extract and develop ... concepts. (84.3%)

Three other items were given almost as much support, and one was given even more moderate support:

401. Cases where statistics were misinterpreted or misused are studied. (78.1%)

404. Projects are suggested that are designed to be assigned to individuals or to teams of students. (78.0%)

396. Students are required to analyze data that they have gathered outside the classroom. (75.8%)

402. Detailed notes are provided to guide the teacher in oral presentations ... (62.5%)

Minimal support was given to two items:

405. Specific objectives, criterion-referenced testing, and other materials are included to encourage use of a mastery learning or individually paced model. (51.3%)

399. Students are provided with ready-made data bases from previously completed experiments. (53.1%)

And all samples opposed the final statement:

400. Students are expected to read formal presentations of basic ... ideas before classroom activities are devoted to these ideas. (supported by 17.2%, opposed by 58.4%)

Methods

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PS398	1.506	1.566	1.482	1.429	1.458					
	94.3%	97.0%	93.7%	89.2%	91.7%					
	2.3%	2.0%	1.8%	3.6%	4.2%					
PS397	1.210	1.190	1.209	1.250	1.250					
	86.2%	87.0%	86.4%	89.3%	79.2%					
	4.6%	6.0%	4.5%	0.0%	4.2%					
PS403	1.115	0.960	1.209	1.000	1.458					
	84.3%	78.7%	89.1%	78.6%	91.7%					
	3.8%	7.1%	0.9%	7.1%	0.0%					
PS401	1.008	0.657	1.136	1.464	1.333					
	78.1%	63.6%	86.4%	92.9%	83.4%					
	10.7%	18.2%	8.1%	0.0%	4.2%					
PS404	0.965	1.030	0.991	0.929	0.625					
	78.0%	82.8%	78.9%	78.5%	54.2%					
	8.5%	10.1%	6.5%	7.1%	12.5%					
PS396	0.954	1.061	0.855	1.036	0.875					
	75.8%	79.8%	72.7%	75.0%	75.0%					
	12.6%	11.1%	16.3%	3.6%	12.5%					
PS402	0.680	0.724	0.809	0.179	0.478					
	62.5%	66.3%	69.1%	32.1%	52.1%					
	12.3%	11.2%	9.1%	17.8%	26.1%					
PS405	0.414	0.616	0.409	0.143	-0.083					
	51.3%	59.6%	53.6%	39.3%	20.9%					
	18.0%	16.1%	17.3%	21.4%	25.0%					

Methods (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PS399	0.363	0.120	0.464	0.357	0.917					
	53.1%	45.0%	55.5%	50.0%	79.2%					
	21,7%	33.0%	14.5%	17.9%	12.5%					
PS400	-0.576	-0.990	-0.373	-0.321	-0.083					
	17.2%	7.0%	23.6%	17,8%	29.1%					
	58.4%	76.0%	50.9%	42.9%	37.5%					

Who/Time (PS5)

Three items about when and to whom to teach probability and statistics were given moderately strong support:

408. A course in probability and statistics lasting at least one semester should be offered as a high school elective for students who have successfully completed one year of algebra. (76.9%)

407. Ideas from probability and statistics should be included in every mathematics textbook from grades 1-8. (69.8%)

410. Probability and statistics should be offered as part of the general mathematics or consumer mathematics course. (65.3%)

Two other items were given minimal support:

412. Probability and statistics should be offered as a senior-level advanced course for high ability mathematics and science students. (57.2%)

413. Probability and statistics should be offered as part of an interdisciplinary course. (52.2%)

The remaining items were not supported by far more than supported them:

406. Probability and statistics should be a required course for all ninth graders. (supported by 17.1%, opposed by 66.5%)

409. Probability and statistics should only be considered as enrichment topics for mathematics. (supported by 21.0%, opposed by 69.1%)

411. Probability and statistics should replace most of the traditional work with fractions in grades 6, 7, and 8. (supported by 10.1%, opposed by 77.7%)

The lay samples were given a version of item 409 focusing only on statistics (as item 753); their responses were most like those of the AT sample. The SB and PT samples, in particular were more accepting of this item than most other samples, although at a very weak level.

Finally, the possibility that the professional samples might support probability or statistics but not both was assessed by two items:

414. Statistics belongs in the curriculum but probability does not. (supported by 4.7%, opposed by 86.0%)

415. Probability belongs in the curriculum but statistics does not. (supported by 3.1%, opposed by 88.9%)

Note that both items were very strongly opposed at the same level.

Who/Time

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PS408	1.013	1.021	0.955	0.974	0.630	0.885	1.410			
	76.9%	76.9%	73.2%	76.3%	59.2%	76.9%	91.8%			
	11.7%	7.4%	16.1%	10.5%	22.2%	17.3%	1.6%			
PS407	0.740	0.621	0.500	0.500	0.519	1.288	1.148			
	69.8%	67.4%	62.5%	63.2%	62.9%	88.4%	78.7%			
	20.0%	21.0%	26.8%	23.7%	18.5%	7.6%	14.7%			
PS410	0.601	0.351	0.459	0.658	0.370	0.962	1.016			
	65.3%	51.5%	62.2%	71.1%	48.1%	78.9%	85.3%			
	18.2%	24.8%	18.0%	18.4%	25.9%	13.4%	8.2%			
PS412	0.492	0.406	0.634	0.605	0.778	0.538	0.131			
	57.2%	54.2%	61.6%	65.8%	66.6%	55.8%	46.0%			
	25.6%	26.1%	21.5%	15.8%	22.0%	23.0%	42.6%			
PS413	0.411	0.361	0.384	0.474	0.259	0.462	0.525			
	52.2%	49.4%	49.1%	55.3%	37.0%	59.6%	60.6%			
	17.5%	22.7%	17.9%	15.8%	14.8%	15.4%	13.1%			
PS406	-0.686	-0.354	-0.973	-0.974	-0.963	-0.538	-0.500			
	17.1%	25.0%	8.0%	7.9%	7.4%	27.0%	23.4%			
	66.5%	55.2%	73.2%	81.6%	77.7%	65.4%	58.4%			
PS409	-0.696	-0.156	-0.523	-1.026	-0.630	-1.135	-1.311			
	21.0%	37.5%	24.3%	5.2%	18.5%	13.5%	6.5%			
	69.1%	52.0%	61.2%	86.9%	74.1%	78.9%	88.5%			
753	0.141							-0.247	-0.065	0.111
	35.3%							31.6%	38.0%	44.5%
	46.6%							52.9%	39.1%	37.8%

'ho/Time (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
'S411	-1.073	-1.010	-1.384	-1.342	-1.407	-0.596	-0.689			
	10.1%	13.6%	1.8%	0.0%	7.4%	23.0%	16.4%			
	77.7%	76.0%	86.6%	88.9%	89.2%	63.5%	63.9%			
'S414	-1.290	-1.156	-1.196	-1.184	-1.185	-1.577	-1.541			
	4.7%	6.3%	6.3%	0.0%	14.8%	0.0%	1.6%			
	86.0%	83.3%	81.2%	86.9%	81.5%	96.1%	91.8%			
PS415	-1.346	-1.175	-1.277	-1.368	-1.370	-1.538	-1.557			
	3.1%	4.1%	3.6%	0.0%	7.4%	1.9%	1.6%			
	88.9%	84.5%	84.8%	94.7%	88.9%	96.1%	93.4%			

Calculators (PS6)

Only five uses of calculators for teaching probability and statistics were listed. Of these, three were strongly supported:

420. Doing homework in probability and statistics (84.5%)

419. Calculating the probability that several events will occur in a certain sequence (84.8%)

418. Taking a probability and statistics test (80.0%)

The two other items were also supported, but at a lower level:

416. Calculating the average of the numbers 5, 7, 12, 19, and 23 (61.9%)

417. Making a graph from a number sentence or equation (55.5%)

It is interesting to conjecture why doing homework and taking a test with a calculator are considered far more appropriate with probability and statistics content than with other content.

Calculators

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PS420	1.337	0.894	1.452	1.758	1.857					
	84.5%	71.3%	87.8%	97.0%	100.0%					
	8.1%	14.9%	6.9%	0.0%	0.0%					
PS419	1.311	1.191	1.400	1.394	1.250					
	84.8%	80.9%	87.9%	87.9%	82.1%					
	7.8%	8.5%	6.9%	6.1%	10.7%					
PS418	1.174	0.819	1.200	1.606	1.750					
	80.0%	67.0%	82.6%	90.9%	100.0%					
	11.5%	21.2%	9.5%	0.0%	0.0%					
PS416	0.548	0.457	0.565	0.515	0.821					
	61.9%	58.5%	63.5%	57.6%	71.5%					
	31.5%	32.9%	32.2%	30.3%	25.0%					
PS417	0.381	0.319	0.191	0.667	1.036					
	55.5%	53.2%	48.7%	66.7%	78.6%					
	34.5%	32.9%	40.0%	30.3%	21.4%					

Summary: Probability and Statistics

- Five goals for probability and statistics were strongly supported (by over 80%): using data in other subjects, dealing with statistical information as consumers, organizing data in easily interpretable forms, dealing with estimation and approximation, and applying mathematics in other disciplines.
- Two statistics topics were strongly supported for inclusion in the elementary school curriculum: the collection and organization of data, and reading and interpreting statistical information.
- Rejected for inclusion in the elementary school curriculum was calculating probabilities of compound and conditional events.
- Four probability and statistics topics considered appropriate (by over 70%) for all secondary students were: the collection and organization of data, measures of central tendency, reading and interpreting statistical information, and decision making.
- Four probability and statistics topics considered appropriate (by 66%-71%) only for college-bound students were: curve fitting and prediction, probability distributions, combinations and permutations, and calculating probabilities of compound and conditional events.
- Eleven of 15 resources for probability and statistics were supported by over 75%.
- Three strategies for teaching probability and statistics were strongly supported: materials with real-world data, experiments, and problems from the sciences.
- Reading formal presentations before doing classroom activities was not accepted (by 58.4%).

- Offering probability and statistics as an elective course was supported by 77%.
- Rejected (by over 65%) were making probability and statistics a required course for ninth graders, considering them only as enrichment topics, or using them to replace work with fractions in grades 6-8. There was rejection (by over 85%) that either probability and statistics belongs in the curriculum but not the other.
- Three uses of calculators for teaching probability and statistics were strongly supported (by over 80%): doing homework, calculating the probability that several events will occur in a certain sequence, and taking a test.

Computer Literacy

Goals (CL2)

There was substantial agreement and support across samples on the rank ordering of goals for computer literacy. Although strongest support was given to the first two goals, support for the remaining three was moderately strong.

635. To develop logical thinking abilities (80.0%)

632. To prepare for the (future) (81.1%)

634. To understand the capability of the computer to provide access to large bodies of information (78.9%)

633. To introduce alternative techniques for solving problems, proving theorems, etc. (70.4%)

631. To acquire fundamental computer techniques necessary for vocational training (63.9%)

__Goals__

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
CL635	1.084	1.160	1.036	1.000	0.895	1.123	1.157			
	80.0%	81.1%	77.3%	77.1%	76.4%	84.2%	82.8%			
	7.4%	7.6%	10.0%	11.5%	5.2%	7.1%	2.9%			
CL632	1.082	0.905	1.200	1.250	1.231	1.123	0.957			
	81.1%	75.3%	82.7%	80.6%	89.7%	84.2%	80.0%			
	4.4%	7.6%	1.8%	5.6%	2.6%	3.5%	4.3%			
CL634	0.988	0.972	1.018	1.029	1.026	0.982	0.929			
	78.9%	77.3%	81.9%	77.1%	84.6%	79.0%	74.3%			
	5.3%	5.6%	4.5%	5.7%	7.7%	8.8%	1.4%			
CL633	0.817	0.733	1.000	0.657	0.487	0.893	0.857			
	70.4%	64.8%	78.2%	71.4%	51.3%	75.0%	72.8%			
	8.1%	9.5%	3.6%	17.1%	7.7%	10.7%	7.1%			
CL631	0.672	0.858	0.909	0.667	0.462	0.404	0.357			
	63.9%	71.7%	76.4%	58.3%	61.6%	45.6%	51.4%			
	11.5%	8.5%	3.6%	11.1%	20.5%	19.3%	17.2%			

Content (CL1)

The total sample and each individual sample supported most strongly the inclusion of the following computer literacy topics in the mathematics curriculum:

628. The types of mathematical and non-mathematical problems that can be solved by a computer (91.3%)

619. The roles of computers in society (88.5%)

618. Writing programs in a simple computer language such as BASIC (87.5%)

623. Flow charting (82.0%)

627. Operation of a programmable calculator (82.7%)

Moderately strong support was given to the following items:

616. Procedures for accessing or operating a computer system (73.4%)

621. Issues of privacy and security raised by computers (66.3%)

630. Data processing for business applications (67.2%)

620. Methods for debugging or correcting computer programs (60.4%)

On three goals, support was minimal:

629. Computational programming languages (e.g., FORTRAN, COBOL) (57.2%)

617. Memory storage and access systems (58.6%)

625. History of computing devices (56.0%)

No more than weak support was given to the final three items:

624. The use of machine language (50.8%)

622. The functioning of microprocessor units (34.2%)

626. Languages for non-computational programs (e.g., Coursewriter, PLATO) (31.0%)

However, there are individual instances in which at least one sample ranked each item slightly higher than did other samples (e.g., item 624 is ranked higher by the AT sample than by others).

It is interesting to note that the AT sample diverged most frequently from the remaining samples (in 5 of the 15 cases), followed by the SP and then the TE samples. The MT, JC, and MA samples tended to agree in their rankings most closely.

Some items may not have been clearly understood by the respondees; e.g., data processing for business applications (item 630) or the use of machine language (item 624), ranked sixth and eighth respectively by the AT sample.

Content

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
CL619	1.371	1.225	1.319	1.250	1.293	1.596	1.667			
	88.5%	81.0%	89.1%	90.6%	85.3%	96.2%	95.0%			
	4.8%	7.2%	5.8%	6.3%	4.8%	0.0%	1.7%			
CL628	1.353	1.241	1.398	1.469	1.244	1.404	1.443			
	91.3%	89.3%	91.5%	96.9%	85.3%	96.1%	91.8%			
	1.5%	2.7%	1.7%	0.0%	0.0%	0.0%	1.6%			
CL618	1.298	1.116	1.294	1.344	1.415	1.500	1.367			
	87.5%	80.4%	84.9%	93.8%	95.1%	92.3%	93.3%			
	4.8%	9.8%	4.2%	3.1%	0.0%	0.0%	5.0%			
CL623	1.132	1.018	1.235	1.062	0.927	1.269	1.200			
	82.0%	75.0%	88.2%	81.2%	80.5%	86.5%	80.0%			
	3.8%	3.6%	3.4%	3.1%	9.7%	1.9%	3.3%			
CL627	1.113	0.991	1.161	1.062	1.195	1.212	1.131			
	82.7%	75.9%	83.9%	90.6%	85.3%	88.4%	82.0%			
	5.5%	8.0%	4.2%	9.4%	4.9%	1.9%	4.9%			
CL616	0.964	0.919	1.085	0.812	0.780	1.173	0.833			
	73.4%	68.4%	79.7%	68.8%	70.8%	84.6%	65.0%			
	11.6%	9.9%	10.2%	12.5%	19.5%	5.7%	16.7%			
CL621	0.779	0.554	0.798	0.656	0.683	1.077	1.033			
	66.3%	59.8%	64.7%	65.7%	65.9%	76.9%	73.3%			
	13.9%	21.5%	11.8%	12.5%	17.1%	5.8%	10.0%			
CL630	0.692	0.955	0.731	0.531	0.341	0.635	0.500			
	67.2%	78.3%	67.3%	62.5%	53.6%	67.3%	58.3%			
	15.2%	10.8%	12.6%	12.6%	19.5%	17.3%	25.0%			

Content (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
CL620	0.622	0.500	0.695	0.656	0.610	0.827	0.517			
	60.4%	54.4%	63.6%	62.5%	65.9%	65.4%	56.7%			
	18.1%	23.2%	17.0%	6.2%	19.5%	9.6%	23.3%			
CL629	0.565	0.604	0.630	0.531	0.561	0.538	0.410			
	57.2%	54.9%	59.7%	62.6%	56.1%	59.6%	52.5%			
	16.8%	15.3%	14.3%	12.5%	19.5%	17.3%	24.6%			
CL617	0.561	0.679	0.559	0.437	0.293	0.769	0.417			
	58.6%	59.8%	57.7%	59.4%	48.8%	69.3%	55.0%			
	16.1%	13.4%	13.6%	18.8%	24.4%	11.5%	23.3%			
CL625	0.493	0.437	0.487	0.500	0.317	0.596	0.633			
	56.0%	50.0%	56.3%	56.3%	56.1%	59.6%	63.4%			
	15.9%	17.0%	17.6%	12.5%	19.6%	11.5%	13.3%			
CL624	0.240	0.911	0.277	-0.063	-0.341	0.038	-0.350			
	50.8%	75.0%	53.8%	43.8%	31.7%	32.7%	31.7%			
	31.5%	9.8%	30.3%	46.9%	51.2%	34.6%	50.0%			
CL622	0.127	0.161	0.101	-0.156	-0.268	0.673	0.067			
	34.2%	32.1%	32.8%	34.4%	24.4%	52.0%	31.6%			
	27.0%	23.3%	27.7%	43.8%	41.5%	5.8%	31.7%			
CL626	0.038	0.232	0.034	-0.219	-0.024	0.019	-0.115			
	31.0%	35.7%	27.9%	25.0%	34.1%	26.9%	32.8%			
	27.9%	19.7%	26.2%	34.4%	36.6%	25.0%	39.3%			

Resources (CL3)

There was substantial agreement across samples on the rank ordering of desired resources for computer literacy:

638. Several small, personal mini-computers for each class (83.6%)

637. A terminal connected to a large computer (80.0%)

636. Wall-sized demonstration screens connected to computers for video output (77.9%)

640. Workbooks with paper-and-pencil algorithms simulating computer processes (63.0%)

639. Equipment for batch processing (56.1%)

Support for the first three was obviously greater than for the last two.

Slight differences in the rankings are of some interest; note, for example, the preference of the MT sample for computer terminals rather than personal computers, or the low level of enthusiasm by the MA sample for batch processing equipment.

Resources

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
CL638	1.199	1.113	1.211	1.061	1.576					
	83.6%	79.2%	83.5%	81.8%	100.0%					
	6.0%	10.4%	3.7%	6.0%	0.0%					
CL637	1.146	0.868	1.426	1.091	1.182					
	80.0%	68.9%	89.8%	78.8%	84.9%					
	8.6%	14.1%	2.8%	6.1%	12.1%					
CL636	1.060	0.755	1.294	1.000	1.333					
	77.9%	66.0%	85.4%	78.7%	91.0%					
	8.2%	15.1%	4.6%	3.0%	3.0%					
CL640	0.630	0.698	0.633	0.576	0.455					
	63.0%	67.0%	61.4%	60.7%	57.5%					
	16.7%	15.1%	15.6%	15.1%	27.3%					
CL639	0.464	0.362	0.743	0.424	-0.091					
	56.1%	51.4%	66.1%	51.5%	42.5%					
	20.7%	21.9%	12.9%	21.2%	42.4%					

Methods (CL4)

When the items on strategies for teaching computer literacy are considered, lower means on this cluster than on the first three computer literacy clusters are apparent. There was moderately strong support for five items:

647. Field trips are taken in which students can observe the use of computers in business and industry. (74.1%)

645. Students are assigned individual projects to study different computer applications and the impact of these applications. (68.1%)

649. At least 50% of the instructional time is devoted to students writing computer programs. (63.1%)

648. Detailed notes are provided to guide the teacher in oral presentations of computer topics. (63.1%)

644. Programming techniques are taught by computer-assisted instruction in a tutorial mode. (63.5%)

For one item, support was minimal:

646. Computer ideas are taught by simulations using large-scale devices to demonstrate how a computer works. (54.1%)

Very little support was given to the final four items:

650. More than 50% of the instructional time is devoted to student use of individual study materials to develop and extend computer ideas. (42.8%)

641. Cases where the computer was misused are studied. (42.5%)

643. Program writing is taught by a trial-and-error approach that emphasizes discovery of fundamental programming principles. (44.1%)

642. Students are expected to read formal presentations of computer ideas before classroom activities are devoted to these ideas. (31.3%)

Methods

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
CL647	0.935	1.137	0.963	0.811	0.364					
	74.1%	83.4%	74.8%	64.8%	54.6%					
	7.6%	4.9%	7.4%	5.4%	18.2%					
CL645	0.738	0.618	0.785	0.892	0.788					
	68.1%	59.8%	71.9%	75.7%	72.7%					
	11.1%	11.8%	12.1%	8.1%	9.1%					
CL649	0.693	0.420	0.832	0.865	0.879					
	63.1%	49.0%	68.2%	70.2%	81.8%					
	13.7%	17.0%	14.0%	5.4%	12.1%					
CL648	0.688	0.843	0.776	0.514	0.121					
	63.1%	71.6%	66.4%	56.7%	33.3%					
	14.3%	10.7%	13.1%	18.9%	24.3%					
CL644	0.661	0.760	0.61[illegible]	0.514	0.667					
	63.5%	64.0%	65.4%	62.1%	57.5%					
	13.3%	8.0%	15.0%	18.9%	18.2%					
CL646	0.520	0.578	0.551	0.459	0.303					
	54.1%	58.8%	56.1%	45.9%	42.4%					
	13.6%	13.7%	14.0%	8.1%	18.2%					
CL650	0.263	0.343	0.264	0.135	0.152					
	42.8%	46.1%	43.4%	35.1%	39.4%					
	23.4%	18.6%	23.6%	27.0%	33.3%					
CL641	0.236	0.087	0.243	0.324	0.576					
	42.5%	33.0%	44.8%	45.9%	60.6%					
	24.3%	27.2%	24.3%	21.6%	18.2%					

Methods (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
CL643	0.161	0.235	0.150	0.216	-0.091					
	44.1%	45.1%	44.8%	45.9%	36.3%					
	34.4%	31.4%	35.5%	29.7%	45.4%					
CL642	-0.146	-0.162	-0.236	-0.081	0.121					
	31.3%	26.6%	33.0%	27.0%	45.5%					
	40.2%	40.0%	44.4%	35.1%	33.4%					

Who/Time (CL5)

For this cluster of items on when and to whom computer literacy topics should be taught, lower levels of support than on previous clusters can be noted. Only moderate support was given to one item:

656. Computer literacy topics should be integrated within the present mathematics curriculum from grades K-12. (67.7%)

There is minimal support for two items:

653. Students should interact with a computer or computer terminal as early as the primary grades. (57.7%)

652. At least one course whose major theme is computer literacy and which lasts for at least one semester should be required of all high school graduates. (53.0%)

Weak support was given to one additional item:

657. Because the computer techniques needed for vocational training are different from those needed by college-bound students, at least two different types of computer courses should be offered in every high school. (46.5%)

The remaining six items were essentially rejected; support was minimal, and more opposed each item than supported it.

659. Courses about computers should be strictly elective. (supported by 35.5%, opposed by 40.3%)

655. All high school graduates should be able to write simple computer programs. (supported by 32.3%, opposed by 49.6%)

660. Computer courses should use a wide variety of hardware with instructions in the use of each type forming a major part of the course. (supported by 28.3%, opposed by 47.0%)

654. Separate computer science departments should be established in high schools to parallel mathematics departments and science departments. (supported by 27.4%, opposed by 51.6%)

651. Computer literacy courses should be taught primarily within the social studies curriculum since it is the effect of computers upon society that is important. (supported by 6.3%, opposed by 81.2%)

658. Knowledge of computers is only needed by specialists; they should receive courses and training in this area only after they leave high school. (supported by 6.3%, opposed by 88.9%)

There was substantial agreement across samples on most items. In a few instances (e.g., items 653, 655, 657, 659), there is some variance; thus, the AT and MT populations are much more in favor of separate courses for vocational and college-bound students (item 657) than are other groups.

Who/Time

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
CL656	0.700	0.340	0.588	0.533	0.970	1.103	1.000			
	67.7%	53.4%	64.7%	63.3%	81.8%	84.5%	74.6%			
	17.1%	23.3%	21.5%	23.3%	6.0%	10.3%	9.8%			
CL653	0.454	0.194	0.471	0.467	0.606	0.654	0.607			
	57.7%	49.6%	57.9%	53.3%	69.7%	61.5%	63.9%			
	24.4%	34.0%	24.5%	20.0%	15.2%	21.1%	18.0%			
CL652	0.323	0.272	0.108	0.733	0.273	0.519	0.426			
	53.0%	50.5%	44.1%	63.3%	51.5%	61.5%	60.6%			
	31.7%	36.0%	37.3%	13.3%	36.3%	25.0%	27.9%			
CL657	0.225	0.520	0.412	0.000	-0.182	0.224	-0.183			
	46.5%	57.8%	52.9%	30.0%	30.3%	48.3%	33.8%			
	30.3%	22.5%	21.6%	36.7%	36.4%	31.0%	47.9%			
CL659	-0.035	0.146	0.255	-0.500	-0.152	-0.293	-0.254			
	35.5%	37.8%	49.0%	10.0%	30.3%	31.1%	29.6%			
	40.3%	31.1%	33.4%	46.6%	39.4%	51.7%	52.1%			
CL655	-0.194	-0.505	-0.373	0.033	-0.394	0.308	0.197			
	32.3%	19.4%	25.5%	36.7%	27.2%	52.0%	49.2%			
	49.6%	56.3%	59.8%	40.0%	54.6%	36.6%	34.5%			
CL660	-0.283	-0.049	-0.029	-0.767	-1.000	-0.259	-0.471			
	28.3%	33.1%	38.2%	10.0%	15.1%	29.3%	20.0%			
	47.0%	35.9%	35.3%	70.0%	72.8%	48.3%	57.1%			
CL654	-0.371	0.087	-0.176	-0.567	-1.000	-0.784	-0.689			
	27.4%	44.7%	32.3%	13.4%	12.2%	9.8%	19.7%			
	51.6%	33.0%	45.1%	56.7%	72.8%	66.7%	67.2%			

Who/Time (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
CL651	-1.094	-0.816	-1.311	-1.067	-1.515	-0.942	-1.115			
	6.3%	10.7%	1.9%	10.0%	0.0%	9.6%	4.9%			
	81.2%	69.9%	88.4%	76.7%	96.9%	80.7%	81.9%			
CL658	-1.287	-1.068	-1.157	-1.267	-1.515	-1.534	-1.493			
	6.3%	7.8%	9.8%	6.7%	0.0%	3.4%	4.2%			
	88.9%	85.4%	83.3%	93.3%	96.9%	93.1%	93.0%			

Summary: Computer Literacy

- Two goals for computer literacy were given strong support (over 80%): to develop logical thinking abilities and to prepare for the future. However, moderately strong support (above 60%) was given to the remaining three goals.
- Five computer literacy content topics were strongly supported (by over 80%) for inclusion in the curriculum: types of problems that can be solved by a computer, societal roles of computers, writing programs in a simple computer language, flow charting, and the operation of a programmable calculator.
- The resources for computer literacy supported most strongly (above 80%) were mini-computers and terminals connected to a large computer.
- Field trips to observe computers in use was supported by 74.1%. Four other resources were given moderate support (63% to 68%).
- Support for items about to whom and when computer literacy topics should be taught were less strongly supported than items in other clusters. Highest support (67.7%) was given to integration of topics within the curriculum from grades K-12.

Problem Solving

Goals (PB2)

All professional samples were asked to respond to ten goals for problem solving. Of these ten, five were strongly supported:

502. To develop methods of thinking and logical reasoning (95.4%)

506. To acquire skills necessary for living in today's world (86.3%)

509. To acquire problem-solving techniques that are vital to having a well-rounded education (85.8%)

508. To develop creative thought processes (84.2%)

505. To apply recently taught mathematical ideas (84.0%)

Four other items were given moderately strong support:

510. To enhance the ability to apply mathematics in science (78.6%)

507. To develop the skills to approach new topics in mathematics independently (76.2%)

504. To learn how to read mathematics (73.6%)

501. To provide a setting for practicing computational skills (68.9%)

The tenth statement was only weakly supported:

503. To identify students who possess mathematical talent (46.5%)

Goals

	Total	AT	MT	JC	MA	SP	TE	PR	SB	FT
PB502	1.588	1.642	1.524	1.714	1.710	1.561	1.529			
	95.4%	94.8%	94.3%	100.0%	93.5%	94.7%	97.1%			
	1.6%	0.0%	3.9%	0.0%	0.0%	3.5%	0.0%			
PB509	1.319	1.365	1.352	1.679	1.032	1.333	1.174			
	85.8%	87.5%	89.5%	100.0%	71.0%	85.9%	78.3%			
	2.9%	2.1%	3.8%	0.0%	9.7%	1.8%	1.4%			
PB506	1.284	1.604	1.410	1.500	0.871	1.105	0.900			
	86.3%	94.8%	91.4%	89.3%	74.2%	84.2%	72.8%			
	3.6%	1.0%	4.8%	0.0%	9.7%	3.6%	4.3%			
PB508	1.282	1.281	1.260	1.250	1.258	1.263	1.357			
	84.2%	84.4%	83.6%	89.3%	80.6%	82.5%	85.7%			
	4.4%	4.1%	5.8%	3.6%	9.7%	3.5%	1.4%			
PB505	1.132	1.250	1.181	1.071	1.065	0.982	1.071			
	84.0%	88.5%	83.8%	78.5%	83.9%	80.7%	82.9%			
	3.3%	3.1%	2.9%	3.6%	3.2%	3.6%	4.3%			
PB507	1.036	0.958	0.933	1.107	1.000	1.175	1.171			
	76.2%	73.0%	76.2%	71.4%	67.7%	77.2%	85.7%			
	5.2%	3.1%	9.5%	0.0%	6.4%	3.6%	4.3%			
PB510	0.959	0.969	1.010	1.179	1.129	0.702	0.914			
	78.6%	79.2%	80.0%	89.3%	90.3%	64.9%	77.1%			
	3.9%	5.2%	4.8%	0.0%	0.0%	7.0%	1.4%			
PB504	0.922	0.844	1.143	1.036	0.903	0.684	0.857			
	73.6%	70.9%	83.8%	75.0%	77.5%	63.2%	68.6%			
	6.0%	9.4%	4.8%	3.6%	3.2%	7.0%	4.3%			

Goals (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PB501	0.798	1.000	0.971	0.929	0.839	0.544	0.400			
	68.9%	75.8%	75.2%	75.0%	77.5%	54.4%	55.7%			
	16.1%	13.7%	12.4%	14.3%	9.7%	17.5%	27.1%			
PB503	0.416	0.448	0.476	0.393	0.419	0.281	0.400			
	46.5%	46.9%	52.3%	46.4%	48.4%	43.8%	38.6%			
	15.5%	16.7%	15.3%	21.4%	13.0%	17.6%	11.5%			

Content for Elementary School Students (PBIE)

The AT, SP, and TE samples were asked to respond to ten statements regarding problem-solving techniques that might be taught to elementary students. Three of these techniques were strongly supported:

489. Construct a table and search for patterns (92.4%)

485. Translate the problem into number sentences or equations (88.6%)

483. Write and solve a simpler problem; then extend the solution to the original problem (87.2%)

Three others received moderately strong support:

488. Draw a picture, diagram, or graph to represent the problem situation (76.3%)

486. Guess and test possible solutions (74.3%)

490. Teach primarily global problem-solving ideas (e.g., read plan, work, check) (71.0%)

Two items received only minimal support:

484. Explore the problem by using flow charts (56.4%)

487. Start with an approximate answer and work backwards (54.3%)

There was equivocal support for the remaining two items:

481. Categorize problems into specific types ..., then teach a method of solution for each type (supported by 44.2%, opposed by 41.0%)

482. Generate many possible answers using a calculator or computer, then check to see which one meets the conditions of the problem (supported by 36.5%, opposed by 42.6%)

While some differences between samples can be noted, in only two instances does it appear remarkable. The TE sample is decidedly less supportive of teaching global problem-solving ideas (item 490) than the other two samples. And on item 481, the AT sample expresses far more approval for categorizing problems.

Content for elementary school students

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PB489	1.417	1.253				1.451	1.656			
	92.4%	89.9%				92.2%	96.8%			
	3.3%	6.1%				2.0%	0.0%			
PB485	1.224	1.020				1.373	1.433			
	88.6%	83.8%				92.1%	93.4%			
	6.2%	10.1%				3.9%	1.7%			
PB483	1.147	1.020				1.235	1.279			
	87.2%	84.9%				94.2%	85.2%			
	4.7%	6.0%				5.9%	1.6%			
PB486	0.924	0.848				1.059	0.933			
	74.3%	72.7%				80.4%	71.7%			
	13.4%	17.1%				9.8%	10.0%			
PB488	0.905	0.838				0.804	1.098			
	76.3%	73.7%				72.5%	83.6%			
	11.4%	13.1%				13.8%	6.5%			
PB490	0.895	0.969				1.078	0.623			
	71.0%	73.5%				78.5%	60.6%			
	14.7%	9.2%				9.8%	27.9%			
PB484	0.483	0.394				0.529	0.590			
	56.4%	52.6%				62.8%	57.3%			
	17.1%	21.2%				13.7%	13.1%			
PB487	0.429	0.398				0.412	0.492			
	54.3%	53.1%				51.0%	59.0%			
	21.5%	22.5%				21.5%	19.7%			

Content for elementary school students (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PB481	0.076	0.500				-0.392	-0.213			
	44.2%	58.2%				27.5%	36.1%			
	41.0%	27.5%				54.9%	50.8%			
PB482	-0.152	-0.071				-0.235	-0.213			
	36.5%	39.4%				33.3%	34.5%			
	42.6%	40.5%				45.1%	44.2%			

Content for Secondary School Students (PBIS)

The MT, JC, MA, SP, and TE samples were given approximately the same ten statements about problem-solving techniques that the AT, SP, and TE samples were given, but were asked to react to their appropriateness for secondary students. (Item 495 differed by one word; item 494 included "writing a computer program" as well as using flow charts.) The three items most strongly supported (by over 84%) were exactly the same items most strongly supported at the elementary level.

Similarly, two of the three statements given moderately strong support at the elementary level were given moderately strong support at the secondary level--although at a lower level. Support was considerably weaker for teaching primarily global problem-solving ideas (item 500) than for the corresponding item (490) at the elementary level.

For the remaining items, support at the secondary level was weak, and (except for item 491) at a lower level than for the elementary school focus. There was even more opposition to using the calculator or computer to generate and check answers (item 492, supported by 30.0%, opposed by (49.5%).

Content for secondary school students

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PB499	1.328		1.144	1.036	1.333	1.475	1.606			
	89.7%		86.4%	82.2%	91.7%	91.5%	95.8%			
	5.1%		6.3%	7.1%	0.0%	6.8%	2.8%			
PB495	1.201		0.991	1.143	1.292	1.339	1.408			
	88.0%		81.9%	78.5%	87.5%	89.8%	91.5%			
	8.6%		13.5%	10.7%	0.0%	8.5%	2.8%			
PB493	1.167		1.027	1.036	1.375	1.186	1.352			
	84.3%		80.1%	82.1%	83.3%	84.8%	91.6%			
	4.8%		8.1%	0.0%	4.2%	3.4%	2.8%			
PB498	0.628		0.324	0.571	0.708	0.780	0.972			
	62.8%		50.4%	57.2%	79.1%	66.1%	76.1%			
	19.1%		27.0%	14.3%	16.7%	16.9%	11.3%			
PB496	0.560		0.279	0.857	0.583	0.627	0.817			
	63.1%		54.0%	71.5%	66.6%	66.1%	70.4%			
	23.5%		34.2%	3.6%	25.0%	20.4%	16.9%			
PB500	0.555		0.600	0.071	0.125	0.729	0.676			
	55.4%		56.3%	35.7%	41.7%	66.1%	57.8%			
	17.8%		16.3%	32.1%	25.0%	13.6%	15.5%			
PB494	0.212		-0.099	0.071	0.125	0.576	0.479			
	49.4%		40.5%	46.4%	37.5%	62.7%	57.8%			
	27.6%		39.6%	32.2%	20.8%	17.0%	18.3%			
PB491	0.099		0.541	-0.214	0.042	0.034	-0.394			
	47.8%		60.3%	35.7%	50.0%	45.8%	33.9%			
	39.6%		27.0%	46.5%	41.7%	40.7%	55.0%			

Content for secondary school students (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SR	PT
PB497	0.082		-0.198	0.071	0.375	0.102	0.408			
	42.0%		34.2%	28.5%	50.0%	40.7%	57.7%			
	37.6%		49.5%	21.4%	29.1%	35.6%	29.5%			
PB492	-0.273		-0.270	-0.036	-0.792	-0.220	-0.239			
	30.0%		27.9%	39.3%	20.9%	32.2%	31.0%			
	49.5%		47.7%	39.2%	70.8%	45.8%	52.1%			

Resources (PB3)

This cluster contained fifteen types of resources that might be useful in teaching problem solving. Four of these fifteen statements were strongly supported by over 80%:

525. A resource guide to real-life problems (87.7%)

513. In-service training on problem-solving methods for all teachers who teach mathematics (83.4%)

517. Materials in every class for modeling problems and problem solutions (83.0%)

514. Supplementary materials which contain many more problems like those in textbooks (80.7%)

Six other resources were also well supported:

511. Computers for problem exploration (79.0%)

520. Hand-held calculators for use in problem-solving situations (76.2%)

512. Textbook modules for teaching appropriate problem-solving strategies (heuristics) at every grade level (76.2%)

516. Card files of problems (72.7%)

524. Practice tests similar to standardized problem solving tests (74.5%)

518. Materials for problem-solving contests and competitions (67.2%)

One item was given only minimal support:

519. Laboratory resources outside the school for problem investigation (59.9%)

Support was weak and rather equivocal for three items:

523. More time for mathematics (e.g., longer class periods) (supported by 44.6%, opposed by 27.8%)

515. Resource books with problems that appeal to girls (supported by by 47.2%, opposed by 34.6%)

521. Resource books of problems written especially for ethnic minority students (supported by 35.9%, opposed by 40.2%)

There was strong disagreement with the final statement:

522. Textbooks with all verbal problems in a single chapter (supported by 8.0%, opposed by 80.1%)

Differences among samples are notable on some items. For instance, the MA sample is far less supportive of resource guides to real-life problems (item 525) and card files of problems (item 516) than other samples. The MT sample approves of in-service training on problem-solving methods (item 513) less than do other samples. Both the MT and AT samples want computers (item 511) and calculators (item 520) less than do the other two samples. The AT sample would like modules (item 512) more than other samples. And other examples are apparent in other items.

Resources

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PB525	1.282	1.372	1.212	1.406	1.133					
	87.7%	91.9%	84.6%	96.9%	76.6%					
	4.8%	4.7%	5.8%	0.0%	6.7%					
PB513	1.265	1.372	1.076	1.469	1.400					
	83.4%	88.4%	75.3%	90.7%	90.0%					
	7.1%	7.0%	8.6%	3.1%	6.7%					
PB517	1.206	1.419	1.057	1.094	1.233					
	83.0%	89.6%	77.1%	81.3%	86.6%					
	5.5%	4.7%	5.8%	6.3%	6.7%					
PB514	1.075	1.138	1.105	1.031	0.833					
	80.7%	81.6%	82.9%	81.3%	70.0%					
	10.2%	11.4%	7.7%	9.4%	16.7%					
PB511	1.016	0.871	0.924	1.375	1.367					
	79.0%	71.8%	77.1%	93.8%	90.0%					
	11.5%	11.8%	15.3%	0.0%	10.0%					
PB520	0.976	0.859	0.838	1.469	1.267					
	76.2%	70.6%	74.3%	90.7%	83.3%					
	13.1%	16.5%	16.2%	0.0%	6.7%					
PB512	0.972	1.128	0.848	1.000	0.933					
	76.2%	84.9%	71.5%	78.2%	66.6%					
	8.3%	4.7%	10.5%	12.5%	6.7%					
PB516	0.810	0.953	0.857	0.656	0.400					
	72.7%	79.0%	75.2%	65.7%	53.3%					
	12.3%	12.8%	10.5%	9.4%	20.0%					

Resources (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PB524	0.714	0.682	0.837	0.781	0.533					
	74.5%	68.2%	80.8%	78.1%	66.6%					
	14.8%	16.5%	11.5%	12.5%	23.3%					
PB518	0.715	0.616	0.771	0.562	0.967					
	67.2%	61.7%	69.5%	65.7%	76.7%					
	13.1%	16.3%	9.6%	18.8%	10.0%					
PB519	0.544	0.647	0.438	0.625	0.533					
	59.9%	67.0%	55.2%	56.2%	60.0%					
	17.1%	14.2%	22.9%	9.4%	13.3%					
PB523	0.161	0.096	-0.019	0.719	0.367					
	44.6%	45.7%	36.6%	62.5%	50.0%					
	27.8%	32.6%	33.7%	3.1%	20.0%					
PB515	0.122	0.126	0.076	0.375	0.000					
	47.2%	47.1%	46.6%	56.3%	40.0%					
	34.6%	35.6%	36.2%	21.9%	40.0%					
PB521	-0.167	0.047	-0.250	-0.219	-0.433					
	35.9%	42.3%	35.6%	34.4%	20.0%					
	40.2%	34.2%	45.2%	37.5%	43.3%					
PB522	-1.270	-1.326	-1.125	-1.313	-1.567					
	8.0%	7.0%	10.5%	9.4%	0.0%					
	80.1%	81.4%	75.0%	84.4%	90.0%					

Methods (PB4)

Fifteen statements about teaching strategies were presented to the AT, MT, JC, and MA samples. Three of these were strongly supported:

527. Problem assignments are designed to challenge students to think. (97.4%)

535. Projects that involve real-life problem situations should be assigned to individuals or teams of students. (83.9%)

532. Problems are used to introduce mathematical topics. (83.2%)

A statement similar to item 532 was given to the lay samples; they gave it slightly less support:

787. Each new mathematical topic is introduced with a problem to be solved. (75.6%)

Four other items were given moderately strong support by the professional samples:

526. Students work in small groups to solve problems. (73.6%)

538. Problems are given in which the use of physical materials will aid in the solution. (74.0%)

536. Students are shown how to solve a problem, then similar practice problems are assigned. (71.9%)

539. Problems are given that do not have exactly one correct answer. (61.7%)

There was minimal support for two items and weak support for a third:

533. Students are taught to solve problems according to types. (55.7%)

540. Specific objectives, criterion-reference testing, and other materials are included to encourage use of a mastery learning or individually paced model. (54.9%)

528. Students are required to create problems and exchange them with one another for solution. (47.8%)

For two items, support was minimal and the percentage not favoring the items was rather close to the percentage supporting them:

531. More than 50% of the instructional time is devoted to drill and practice on problem solving. (supported by 41.5%, opposed by 34.6%)

530. Problems are included that require more than a single class period to solve. (supported by 33.5%, opposed by 42.9%)

For the remaining items, opposition was far stronger than support:

537. Students are expected to read formal presentations about problem-solving methods before classroom activities are devoted to these ideas. (supported by 25.1%, opposed by 52.2%)

529. Reading is de-emphasized by presenting problems orally or with pictures, charts, et cetera. (supported by 28.1%, opposed by 54.1%)

534. Only problems which students can answer quickly are assigned. (supported by 6.5%, opposed by 84.8%)

This last item was also given to the lay samples (as item 761); reaction was even more negative, with 91.0% disagreeing.

Methods

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PB527	1.538	1.588	1.492	1.531	1.565					
	97.4%	97.0%	96.6%	100.0%	100.0%					
	1.1%	1.0%	1.7%	0.0%	0.0%					
PB535	1.175	1.347	1.120	1.062	0.875					
	83.9%	89.1%	80.4%	90.7%	70.8%					
	3.3%	1.0%	3.4%	3.1%	12.5%					
PB532	0.996	0.804	1.060	1.156	1.292					
	83.2%	75.5%	85.5%	90.6%	95.8%					
	6.5%	11.8%	4.3%	3.1%	0.0%					
787	0.965							0.954	0.965	1.041
	75.6%							75.0%	79.1%	73.5%
	4.5%							4.3%	5.8%	4.1%
PB526	0.883	1.050	0.814	1.031	0.304					
	73.6%	80.0%	72.1%	81.3%	43.5%					
	12.1%	7.0%	16.1%	3.1%	26.0%					
PB538	0.836	1.050	0.709	0.781	0.625					
	74.0%	83.1%	70.0%	68.8%	62.5%					
	8.4%	4.0%	11.9%	9.4%	8.3%					
PB536	0.799	0.861	0.812	0.656	0.667					
	71.9%	72.3%	74.3%	65.6%	66.7%					
	12.5%	12.9%	11.1%	12.5%	16.7%					
PB533	0.509	0.618	0.538	0.187	0.333					
	55.7%	56.8%	59.8%	43.8%	45.8%					
	17.1%	10.8%	18.0%	28.2%	25.0%					

Methods (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PB539	0.500	0.663	0.308	0.500	0.750					
	61.7%	67.4%	55.5%	62.5%	66.6%					
	21.1%	18.8%	26.5%	18.8%	8.4%					
PB540	0.451	0.620	0.385	0.344	0.208					
	54.9%	61.0%	53.8%	46.9%	45.9%					
	18.3%	15.0%	18.8%	18.7%	29.2%					
PB528	0.406	0.618	0.271	0.437	0.125					
	47.8%	56.9%	41.5%	50.0%	37.5%					
	21.1%	12.7%	28.0%	15.6%	29.2%					
PB531	0.098	0.069	0.043	0.594	-0.167					
	41.5%	40.2%	37.6%	62.5%	37.5%					
	34.6%	38.2%	33.3%	15.6%	50.0%					
PB530	-0.113	-0.176	-0.085	-0.219	0.167					
	33.5%	33.3%	32.5%	25.0%	50.0%					
	42.9%	44.2%	42.7%	46.9%	33.3%					
PB537	-0.387	-0.743	-0.179	-0.250	-0.083					
	25.1%	11.9%	34.1%	31.3%	29.2%					
	52.2%	63.3%	44.4%	56.3%	37.5%					
PB529	-0.416	0.119	-0.692	-0.500	-1.208					
	28.1%	48.6%	18.8%	15.7%	4.2%					
	54.1%	36.7%	63.2%	56.3%	79.1%					
PB534	-1.167	-1.186	-1.111	-1.031	-1.542					
	6.5%	5.9%	8.6%	6.2%	0.0%					
	84.8%	84.3%	82.9%	84.4%	95.8%					

Methods (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
761	-1.269							-1.207	-1.322	-1.400
	5.2%							5.2%	5.5%	4.4%
	91.0%							89.6%	92.2%	93.3%

Who/Time (PBS)

In the cluster on when and to whom problem solving should be taught, two items received moderately strong support from professional samples:

550. Students should be taught to find problems within situations. (79.6%)

543. Short problem-solving units should be included after each mathematical topic is taught. (78.7%)

When the lay samples were given item 543 (as item 766), their response was very strongly supportive (96.8%).

Minimal support was given one item:

548. An interdisciplinary problem-solving course should be offered. (58.7%)

For the remaining items, more disagreed than agreed; over 90%, in fact, failed to accept the last four items listed:

541. A separate problem-solving course, lasting at least one semester, should be required of all students before high school graduation. (supported by 40.5%, opposed by 45.3%)

547. All problem solving should be done within existing mathematics courses. (supported by 37.1%, opposed by 48.2%)

544. Most students should study practical applications of mathematics; only a few should study puzzles or esoteric mathematical problems. (supported by 31.8%, opposed by 57.4%)

542. Problem solving is a function of intelligence and cannot really be taught except to gifted students. (supported by 5.1%, opposed by 90.6%)

549. Problem solving should not be taught in the elementary grades. (supported by 5.0%, opposed by 91.1%)

546. Different problem-solving courses should be offered for girls. (supported by 3.1%, opposed by 94.2%)

545. Problem solving is important only for college-bound students. (supported by 2.2%, opposed by 96.8%)

Two of these items were also given to the lay samples: item 541 (as item 774) and item 545 (as item 748). While the combined response was not widely dissimilar for items 541 and 774, there was divergence across samples. The SB and PT samples were, however, close to the AT sample in giving support at a minimal level to requiring a problem-solving course for high school graduation.

Lay samples disagreed with item 748 (that problem-solving is more important for college-bound students). However, the strength of the opposition is decidedly less for the lay samples (68.0%) than for the professional samples (96.8%).

Who/Time

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PB550	1.043	0.903	0.849	1.176	1.000	1.305	1.310			
	79.6%	74.8%	69.8%	88.3%	76.7%	91.6%	90.2%			
	6.2%	10.7%	7.6%	2.9%	6.7%	1.7%	2.8%			
PB543	0.906	0.971	0.916	1.059	0.933	0.898	0.718			
	78.8%	78.4%	79.8%	88.2%	83.3%	74.6%	74.6%			
	11.8%	12.8%	9.2%	8.8%	13.3%	13.6%	14.1%			
766	1.390							1.362	1.326	1.622
	96.8%							97.1%	94.4%	100.0%
	1.6%							1.7%	2.2%	0.0%
PB548	0.505	0.786	0.286	0.706	0.467	0.390	0.479			
	58.7%	71.9%	49.6%	67.6%	60.0%	54.3%	53.5%			
	17.7%	10.7%	24.3%	11.8%	20.0%	18.7%	18.3%			
PB541	-0.015	0.515	0.059	0.273	-0.367	-0.390	-0.563			
	40.5%	57.4%	42.1%	48.5%	30.0%	28.8%	24.0%			
	45.3%	25.8%	42.8%	36.4%	56.7%	61.0%	63.4%			
774	0.314							0.227	0.461	0.673
	47.3%							44.1%	53.9%	59.2%
	26.3%							29.5%	22.4%	10.2%
PB547	-0.140	-0.480	0.000	0.235	-0.267	0.017	0.085			
	37.1%	26.4%	37.9%	32.3%	30.0%	45.7%	49.3%			
	48.2%	62.7%	39.5%	50.0%	46.6%	42.3%	46.5%			
PB544	-0.361	-0.461	-0.176	-0.206	-0.500	-0.288	-0.606			
	31.8%	29.4%	38.7%	35.3%	23.3%	32.2%	25.3%			
	57.4%	62.8%	49.6%	53.0%	63.3%	56.0%	63.4%			

Who/Time (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PB542	-1.345	-1.475	-1.084	-1.147	-1.300	-1.644	-1.465			
	5.1%	2.0%	8.4%	5.8%	3.3%	5.1%	4.2%			
	90.6%	93.0%	87.4%	82.4%	90.0%	94.9%	92.9%			
PB549	-1.552	-1.471	-1.328	-1.559	-1.600	-1.915	-1.718			
	5.0%	5.9%	7.6%	5.8%	3.3%	0.0%	4.2%			
	91.1%	88.3%	85.7%	91.1%	96.7%	100.0%	94.4%			
PB545	-1.647	-1.775	-1.525	-1.500	-1.333	-1.831	-1.718			
	2.2%	1.0%	1.7%	5.9%	6.6%	1.7%	1.4%			
	96.8%	99.0%	95.8%	94.2%	90.0%	98.3%	98.5%			
748	-0.642							-0.566	-0.774	-0.667
	23.9%							26.8%	17.2%	26.7%
	68.0%							64.0%	73.1%	73.3%
PB546	-1.701	-1.706	-1.538	-1.765	-1.800	-1.797	-1.817			
	3.1%	3.0%	5.9%	2.9%	0.0%	1.7%	1.4%			
	94.2%	93.2%	89.9%	94.1%	100.0%	98.3%	97.2%			

Summary: Problem Solving

- Five of 10 goals for problem solving were strongly supported (by over 80%). These pertained to developing methods of thinking and reasoning, acquiring skills needed "for today's world", acquiring techniques vital to a well-rounded education, developing creative thought processes, and applying recently taught ideas. Four other goals were given moderately strong support.
- Teaching of three problem-solving techniques received strong support: constructing a table and searching for patterns, writing an equation for a problem, and solving a simpler problem first. Receiving almost as much support (over 74%) were drawing a picture and guessing-and-testing.
- The same three problem-solving techniques most strongly supported at the elementary level were also rated highest for teaching to all secondary students.
- Four of 15 resources for teaching problem solving were strongly supported: resource guides to real-life problems, in-service training for teachers, materials for modeling problems and solutions, and supplementary materials with many additional problems. Six other resources were supported by over 67%.
- Three strategies for teaching problem solving were strongly supported: problem assignments designed to challenge students to think, projects involving real-life situations for individuals or teams, and using problems to introduce mathematical topics.
- Both professional and lay samples strongly disagreed with the statement that "only problems which students can answer quickly" should be assigned.

- Two items on when and to whom problem solving should be taught received support by 79%: teaching students to find problems within situations and including short problem-solving units after each mathematical topic is taught. Seven items from this cluster were not accepted by large percentages (45% to 97%).

Chapter III

Preference Survey: Across Strands

Items within each cluster were written to have integrity to the original strand. For example, the methods cluster for whole numbers contains several items about the use of calculators to teach concepts, since the potential impact of calculators is greater for whole numbers than for, say, geometry. For this reason the methods cluster (and all other clusters) is different for each strand. Even items that are similar in intent may have a slightly different wording in different strands due to the emphasis of a particular strand. Nevertheless, several common ideas or themes can be identified across different strands. In this section, several of these across-strand themes are identified, and data are presented and discussed for each of them. Major themes involve: applications; drill and practice; individualization; differentiated programs for special groups; use of calculators; use of computers; estimation and approximation; laboratory/activity-based approaches; use of out-of-class activities and projects; reading and textbooks; use of audio/visual aids; and logic, deductive methods, and structure.* Summaries for each major theme are presented at the end of the chapter.

For additional information on interpreting tables, refer to the introduction to chapter II.

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* Many of the items and clusters of items on the survey forms pertained at least indirectly to basic skills, and are discussed throughout these pages. However, no systematic attempt was made to focus on basic skills since the Instructional Affairs Committee of the National Council of Teachers of Mathematics recently conducted such a survey. Refer to the March 1980 issue of the Journal for Research in Mathematics Education for a report on this survey.

Drill and Practice

A number of questions across content strands pertain to drill and practice or to materials that would be used for drill and practice. Not unexpectedly, there is relatively strong support for most of these items, with average percentages ranging from 70% up.

The topics covered in this section are:

(1) Percentage of instructional time for drill and practice

(2) Practice (varying types)

(3) Worksheets at conclusion of each lesson

(4) Master copies of worksheets

(5) Magic response paper

(6) Standardized practice tests

(7) Mastery and review

Percentage of instructional time for drill and practice

Should more than 50% of instructional time be spent on drill and practice? Over 60% of the AT, MT, JC, and MA samples supported spending this amount of time on drill and practice when the content was fractions [FD52]. The AT, MT, and JC samples gave a similar level of support when the content was whole numbers [WN223], while the MA sample gave far less support (38.5%). For problem solving [PB531], far less support (41.5%) was given by the AT, MT, and MA samples; for this content area, the JC sample gave the same level of support (62.5%) they had given for the other two content areas.

The SP and TE samples disagreed with this percentage of time being devoted to drill and practice [673, 689]; for both elementary and secondary levels, only 23% of these samples expressed support for the item in which no content area was stated. On another generic (general) item [784], the lay samples were as supportive as the AT, MT, JC, and MA samples were toward one or more of the items. While only 61.1% of the SB sample supported the item, 69.4% of the PT sample and 74.2% of the PR sample agreed.

Apparently many of these samples (with the exception of the SB and TE samples) are unaware of the evidence from a cluster of research studies (e.g., Shipp and Deer, 1960; Shuster and Pigge, 1965; Zahn, 1966; Dubriel, 1978) that achievement is promoted when more than 50% of instructional time is spent on developmental activities. Moreover, there is strong evidence (e.g., see Weaver and Suydam, 1972) that drill programs do not result in better attainment of mathematical goals. Thus, spending 50% or more time on drill and practice could have serious consequences for the future achievement of children.

Perhaps the response of the SB and TE samples would have been different if they had been responding within a particular content area. On the other hand, they may know, or have greater belief in, the research evidence.

Percentage of instructional time for drill and practice

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD52	0.648	0.806	0.578	0.634	0.457					
	65.5%	71.8%	61.7%	65.8%	60.0%					
	18.3%	15.5%	18.0%	14.6%	31.4%					
WN223	0.688	0.765	0.833	0.683	0.128					
	65.8%	66.7%	75.9%	63.4%	38.5%					
	16.8%	17.2%	11.1%	22.0%	25.7%					
PB531	0.098	0.069	0.043	0.594	-0.167					
	41.5%	40.2%	37.6%	62.5%	37.5%					
	34.6%	38.2%	33.3%	15.6%	50.0%					
673	-0.541					-0.428	-0.643			
	23.4%					27.0%	20.2%			
	61.3%					57.2%	64.9%			
689	-0.608					-0.443	-0.763			
	23.3%					28.9%	18.2%			
	64.1%					59.8%	68.1%			
784	0.841							0.893	0.612	0.878
	71.4%							74.2%	61.1%	69.4%
	14.8%							14.2%	20.0%	10.2%
	48.5%	59.6%	58.4%	63.9%	45.3%	28.0%	19.2%	74.2%	61.1%	69.4%

Practice (varying types)

There is strong support across samples for the provision of drill and practice materials [FD47, 715, 727]. It is interesting to note that the degree of support is stronger for these materials at the elementary level [715] than at the secondary level [727], except for the PT sample, which strongly supports them at both levels. However, the use of audiotapes for drill and practice [WN214] received less support (65.1%), with the MA sample giving these little credence (38.2%).

Two items on using problems for practice resulted in differing levels of acceptance; interestingly, only 71.9% of the professional samples supported them for problem solving [PB536], while 86.9% of the lay samples supported them on the generic (general) item [793].

The percentages of agreement on seven goal statements related to practice differ. Least support (less than 60%) is given to the idea that probability and statistics should be taught for the purpose of providing practice with basic mathematical ideas [PS377] or with basic computational skills [PS380]. There is slightly more support (60.6%) that geometry should be taught to practice basic arithmetic and algebraic skills [GM302]. A total of 68.1% agree that ratio and proportion should be used to provide a setting for basic computational skills [RP437]. An even larger percentage (68.9%) feel that this is also an appropriate goal for problem solving [PB501].

When the phrasing regarding drill and practice is expressed in terms of applying recently learned mathematical ideas within problem solving [PB505], 84.0% support the goal. Similarly, when measurement is viewed as a vehicle for practicing estimation skills [MS580], support is very high (88.1%).

Thus, the support of drill and practice as a curricular goal depends not only upon the specific content involved, but also upon the specific type of skill being practiced.

In response to an item which no other sample received, the PR, SB, and PT samples gave little support to using calculators for doing practice exercises in class [768], reflecting their generally adverse reaction to the use of calculators.

Practice (varying types)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD47	1.304	1.410	1.308	1.283	1.000					
	87.3%	89.0%	86.7%	93.5%	75.8%					
	4.0%	5.0%	2.5%	2.2%	9.1%					
715	1.238	(1.659)				1.338	1.144	1.659		
	88.1%	96.5%				90.0%	86.3%	96.5%		
	5.8%	0.6%				5.3%	6.3%	0.[illegible]%		
727	1.072	(1.551)				1.172	0.982	1.551		
	81.8%	96.0%				85.4%	78.6%	96.0%		
	6.9%	2.0%				6.6%	7.2%	2.0%		
WN214	0.659	0.732	0.699	0.769	0.176					
	65.1%	66.0%	69.9%	71.8%	38.2%					
	18.4%	17.5%	17.1%	18.0%	26.4%					
PB536	0.799	0.861	0.812	0.656	0.667					
	71.9%	72.3%	74.3%	65.6%	66.7%					
	12.5%	12.9%	11.1%	12.5%	16.7%					
793	1.260							1.225	1.345	1.36[illegible]
	86.9%							86.1%	89.6%	88.0%
	4.1%							3.2%	6.9%	6.[illegible]
PS377	0.543	0.840	0.657	0.412	0.545	0.300	0.279			
	57.7%	70.4%	64.7%	55.9%	60.6%	43.4%	42.6%			
	15.5%	8.6%	14.1%	20.5%	15.1%	16.6%	22.9%			
PS380	0.440	1.012	0.531	0.324	0.333	0.033	0.049			
	50.3%	73.2%	54.1%	50.0%	51.5%	30.0%	32.8%			
	19.3%	10.9%	17.3%	23.5%	21.3%	23.3%	26.3%			

Practice (varying types) (continued)

GM302	0.610	0.932	0.590	0.417	0.439	0.560	0.484			
	60.6%	72.7%	60.7%	52.8%	51.2%	61.4%	53.1%			
	11.6%	9.1%	11.2%	19.5%	12.2%	9.4%	14.0%			
RP437	0.710	0.761	1.000	1.000	0.645	0.458	0.352			
	68.1%	68.5%	83.0%	83.3%	67.8%	57.7%	49.3%			
	12.8%	15.2%	6.0%	6.7%	12.9%	17.0%	18.3%			
PB501	0.798	1.000	0.971	0.929	0.839	0.544	0.400			
	68.9%	75.8%	75.2%	75.0%	77.5%	54.4%	55.7%			
	16.1%	13.7%	12.4%	14.3%	9.7%	17.5%	27.1%			
PB505	1.132	1.250	1.181	1.071	1.065	0.982	1.071			
	84.0%	88.5%	83.8%	78.5%	83.9%	80.7%	82.9%			
	3.3%	3.1%	2.9%	3.6%	3.2%	3.6%	4.3%			
MS580	1.269	1.127	1.176	1.371	1.111	1.507	1.437			
	88.1%	82.4%	87.0%	91.4%	83.3%	92.0%	95.3%			
	1.4%	1.0%	2.3%	0.0%	5.6%	0.0%	0.0%			
768	-0.172							-0.058	-0.298	-0.57
	38.7%							42.2%	34.3%	26.9%
	45.9%							42.4%	50.0%	58.0

Worksheets at conclusion of each lesson

Worksheets for providing practice at the conclusion of each lesson [FD54, AL157, GM318, RP457, MS597, 675, 691, 758] were supported by between 82% and 87% of the AT, MT, JC, and PR samples, while the PT sample was even more supportive (93.2%). The MA, SP, TE, and SB samples gave support at levels ranging from 70.4% to 77.6%, with the TE sample least supportive. It is somewhat surprising that there is so little difference in percentages across content areas and across samples. It is also surprising that the feeling that worksheets should be available after each lesson is so strong.

Worksheets at conclusion of each lesson

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD54	1.241	1.330	1.266	1.146	1.000					
	87.0%	91.3%	85.1%	87.8%	80.0%					
	3.2%	3.9%	3.1%	0.0%	5.7%					
AL157	1.221	1.225	1.342	1.000	1.029					
	81.5%	81.4%	85.6%	72.7%	77.1%					
	3.6%	4.9%	1.8%	3.0%	5.7%					
GM318	1.100	1.145	1.170	1.088	0.788					
	83.2%	85.6%	87.0%	82.4%	66.7%					
	5.2%	7.2%	5.0%	0.0%	6.0%					
RP457	1.213	1.133	1.355	1.152	1.029					
	85.3%	82.2%	92.7%	81.8%	73.5%					
	4.1%	5.5%	1.8%	6.1%	5.9%					
MS597	1.167	1.152	1.231	1.333	0.794					
	85.2%	86.7%	86.2%	91.7%	70.5%					
	3.7%	4.8%	2.3%	0.0%	8.8%					
675	0.806					0.776	0.833			
	71.6%					70.4%	72.6%			
	9.7%					9.8%	9.5%			
691	0.823					0.927	0.725			
	72.9%					78.0%	68.1%			
	11.3%					8.6%	13.8%			
758	0.993							0.954	0.843	1.455
	82.4%							82.2%	77.6%	93.2%
	11.7%							13.2%	12.4%	4.5%
	81.1%	85.4%	87.3%	83.3%	73.6%	74.2%	70.4%	82.2%	77.6%	93.2%

Master copies of worksheets

What materials would help teachers use worksheets? One idea might be to provide master copies of worksheets that could be copied in individual classrooms. The percentages of agreement on having master copies of worksheets were remarkably consistent across all content areas examined. The professional samples agreed, with total percentages ranging from 81% to 86%, except for one item [719] where they were proposed for the secondary level. Despite the fact that members of the SP and TE groups have been vocal in decrying the extensive use of worksheets in the elementary school, they gave support at the 82% level [707]. The MA sample, however, rated such materials lower than other samples did. The PR sample expressed strong agreement at the 90% level for both elementary and secondary levels. The total percentages across items indicate strongest support by PR, AT, and MT samples, followed by SP, JC, and TE samples, with the MA sample least supportive.

Master copies of worksheets

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD43	1.211	1.340	1.325	1.000	0.687					
	85.9%	90.0%	88.4%	82.6%	68.8%					
	7.7%	8.0%	5.0%	8.7%	15.7%					
AL149	1.219	1.358	1.339	0.879	0.630					
	85.1%	89.5%	89.6%	72.7%	66.6%					
	6.3%	4.3%	5.2%	3.0%	22.2%					
WN216	1.256	1.330	1.415	1.205	0.529					
	85.6%	87.6%	91.8%	84.6%	58.8%					
	5.8%	8.3%	2.4%	0.0%	17.6%					
GM309	1.113	1.443	1.095	0.941	0.641					
	81.4%	88.6%	82.1%	85.3%	61.5%					
	8.5%	6.4%	6.4%	8.8%	17.9%					
PS387	1.181	1.258	1.257	0.853	1.000					
	86.3%	91.8%	86.7%	73.5%	80.8%					
	4.8%	5.2%	4.5%	5.9%	3.8%					
RP452	1.161	1.333	1.268	0.862	0.667					
	82.8%	87.3%	88.7%	72.4%	64.1%					
	7.1%	6.9%	5.2%	13.8%	7.7%					
MS583	1.126	1.231	1.219	1.000	0.531					
	82.0%	88.5%	82.8%	83.3%	56.3%					
	6.5%	4.8%	6.3%	6.7%	12.5%					
707	1.052 (1.512)					1.113	0.994	1.512		
	85.8% 91.8%					82.7%	82.5%	91.8%		
	8.4% 1.8%					13.3%	10.7%	1.8%		

Master copies of worksheets (continued)

719	0.853 (1.379)					0.974	0.744	1.379
	71.9% 90.3%					77.6%	66.7%	90.3%
	12.2% 4.0%					11.8%	12.5%	4.0%
	84.1%	89.0%	87.2%	79.2%	65.3%	80.2%	74.6%	91.1%

Magic response paper

Another material to use for drill and practice is a kind of paper that reveals the correct answer after the student has written his or her response. On two items [FD50, WN213], approximately 75% of the four samples (AT, MT, JC, and MA) responded that they would like magic response paper. Interestingly, the AT sample ranked it lower than did other samples, and the MA sample much higher for fractions and decimals than for whole numbers.

Magic response paper

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD50	0.957	0.990	0.958	1.000	0.788					
	78.9%	79.0%	80.0%	80.4%	72.7%					
	10.7%	13.0%	10.0%	6.5%	12.1%					
WN213	0.812	0.794	0.821	1.103	0.500					
	73.0%	71.2%	74.0%	84.7%	61.7%					
	15.0%	16.5%	13.0%	12.8%	20.6%					

Standardized practice tests

The results of drill and practice programs are often measured by standardized tests. Thus, drill and practice materials might be provided in standardized test formats. An item on such standardized practice tests appeared four times. The AT, MT, JC, and MA samples indicated they would like such tests at the 81.9% level for whole numbers [WN220], while 74.5% supported their availability for problem solving [PB524]. Only 52.1% of the SP and TE samples thought they were needed at the elementary level [713] and 57.7% of the same samples supported their availability at the secondary level [725]. On the other hand, the PT sample supported them at both levels (79.3% and 74.3%). Why the SP and TE samples were less supportive is open to question; perhaps different definitions of how the practice tests would be designed or used were being applied.

On two related items, support was tenuous from the AT, MT, JC, and MA samples. Only 48.2% supported the need for standardized tests in probability and statistics [PS391], while a slightly higher percentage (54.2%) favored test item banks, also for probability and statistics [PS393]. Perhaps if the items had been asked for other content areas, the response would have been different.

Teaching whole-number computation "to be able to do well on standardized tests" [WN202] was given little support (42.0%) by the professional samples, while the lay samples gave slightly more support (51.2%) to this goal for teaching mathematics [736]. The PT sample was notably more supportive (69.5%) than other samples.

Standardized practice tests

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN220	1.147	1.021	1.252	1.179	1.088					
	81.9%	75.0%	87.0%	84.7%	79.5%					
	9.2%	15.6%	7.3%	5.1%	2.9%					
PB524	0.741	0.682	0.837	0.781	0.533					
	74.5%	68.2%	80.8%	78.1%	66.6%					
	14.8%	16.5%	11.5%	12.5%	23.3%					
713	0.357 (1.018)					0.536	0.188	1.018		
	52.1% 79.3%					57.6%	46.9%	79.3%		
	24.4% 9.5%					19.2%	29.4%	9.5%		
725	0.369 (0.949)					0.507	0.244	0.949		
	53.8% 76.4%					57.9%	50.0%	76.4%		
	24.1% 10.0%					21.7%	26.2%	10.0%		
PS391	0.222	-0.258	0.504	0.382	0.577					
	48.2%	28.9%	59.3%	58.8%	57.7%					
	31.5%	47.4%	23.9%	23.5%	15.4%					
PS393	0.398	0.196	0.545	0.765	0.038					
	54.2%	46.4%	58.9%	73.5%	38.5%					
	23.4%	28.9%	20.6%	8.8%	34.6%					
WN202	0.093	0.193	0.153	0.027	-0.026	0.135	-0.115			
	42.0%	46.7%	43.2%	48.6%	35.9%	40.3%	32.8%			
	29.6%	28.4%	28.8%	29.7%	38.4%	21.1%	34.4%			
736	0.313							0.265	0.228	[illegible]
	51.2%							48.1%	50.6%	[illegible]
	25.8%							26.0%	31.1%	[illegible]

Mastery and review

The goal of drill and practice is mastery. There is strong support (ranging from 85% to 100%) for mastery of whole-number computational skills [WN231, 745] by all groups before graduation from high school. If students have not mastered computational skills by the end of grade 8, however, only 49.4% of the total samples are willing to require them to take a special ninth-grade course on the use of calculators [WN233].

Mastery of other content areas received varying levels of support. Only 31.4% of the professional samples thought that all students should master operations with decimals but not fractions [FD66]. The SP group supported this most strongly (54.2%), while the JC and MA samples were particularly negative toward the idea. Response to an item indicating that "by 1990 the skills and concepts of the traditional beginning algebra course of the 1970s should be acquired before students enter ninth grade" [AL173] was supported at a similar level (32.3%). That the mastery of percentage problems should be a condition for high school graduation [RP468, 747] was supported by 63.7% of the professional samples and 81.1% of the lay samples. The JC sample responded at a higher level than the other professional samples; the level of agreement of this group was more similar to that of the lay samples.

The items pertaining to review received little support from most groups. When asked about having college-bound students review whole-number computation for at least three weeks of every school year [WN232, 755], the PT sample gave it decidedly stronger support [75.6%] than any other group, compared to an average of only 29.1% for the professional samples. The MA and TE samples were particularly non-supportive. Perhaps the idea of college-bound students needing review is abhorrent to these samples, or perhaps the term "at least" gave them visions of an extended review process which would limit the time for more advanced mathematical topics. No support from any sample was found for waiting to do remedial work until after high school graduation [WN234]. Competency with whole-number computation is obviously expected before high school graduation.

Mastery and review

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN231	1.572	1.602	1.622	1.800	1.633	1.356	1.475			
	90.9%	93.2%	91.6%	97.2%	90.0%	86.4%	86.9%			
	6.6%	3.9%	8.4%	0.0%	6.7%	10.2%	8.2%			
745	1.787							1.737	1.849	1.857
	97.1%							95.4%	100.0%	97.6%
	0.6%							1.2%	0.0%	0.0%
WN233	0.111	0.304	-0.050	-0.265	-0.400	0.288	0.393			
	45.4%	50.0%	37.8%	35.3%	23.3%	54.3%	60.7%			
	34.6%	30.4%	38.6%	44.1%	46.7%	32.2%	24.6%			
FD66	-0.498	-0.160	-0.936	-1.231	-1.147	0.271	-0.213			
	31.4%	39.6%	21.1%	5.1%	14.7%	54.2%	39.3%			
	60.1%	48.1%	72.4%	87.2%	82.4%	35.6%	52.5%			
AL173	-0.223	0.069	-0.121	-0.143	-0.083	-0.716	-0.446			
	32.3%	46.6%	32.6%	34.3%	36.1%	14.9%	26.2%			
	50.5%	43.6%	43.2%	51.4%	47.3%	66.2%	60.0%			
RP468	0.642	0.570	0.674	1.059	0.949	0.474	0.443			
	63.6%	62.0%	66.3%	82.3%	71.8%	50.9%	58.6%			
	21.4%	24.1%	18.9%	11.7%	18.0%	26.3%	24.3%			
747	1.189							1.109	1.301	1.267
	81.1%							80.4%	81.7%	82.2%
	9.3%							10.3%	6.5%	11.1%
WN232	-0.359	0.068	-0.437	-0.371	-0.800	-0.390	-0.672			
	29.7%	44.7%	26.9%	25.7%	13.3%	32.2%	18.1%			
	55.1%	43.7%	56.3%	48.6%	70.0%	62.7%	60.7%			

Mastery and review (continued)

755	0.395							0.407	0.118	0.976
	49.4%							48.3%	39.8%	75.6%
	25.5%							22.1%	37.7%	12.2%
WN234	-1.111	-1.097	-1.168	-1.029	-1.300	-1.034	-1.049			
	10.6%	11.6%	9.2%	14.7%	10.0%	15.3%	4.9%			
	77.9%	77.6%	79.8%	79.4%	83.4%	74.6%	73.8%			

Summary: Drill and Practice

- Devoting more than 50% of instructional time to drill and practice was given moderately strong support (over 60%) by the AT, MT, JC, and MA samples for whole numbers and fractions. Little support (41.5%) was given to drill and practice in problem-solving by these samples, however.
- Lay samples gave moderately strong support (71.4%) to devoting more than 50%*of instructional time to drill and practice. But SP and TE samples disagreed with this practice (61.3% oppose).
- Worksheets for providing practice at the conclusion of each lesson were given strong support (above 80%) across many content areas. Providing teachers with master copies of worksheets also received strong support.
- Providing drill and practice items in standardized test formats was strongly supported (81.9%) for whole numbers, and moderately supported (74.5%) for problem solving by the AT, MT, JC, and MA samples. But the SP and TE samples gave the idea only minimal support at the elementary and secondary levels.
- Mastery of whole number computational skills before graduation from high school received very strong support (from 85% to 100%) from all samples. Mastery of percentage problems before graduation received a similar level of support (81.1%) from lay samples, but more moderate support (63.7%) from professional samples.

Applications

Three of the introductory items relate to projections of increased or decreased emphasis on the applications of mathematics in the curriculum of the 1980s. These items were:

UF8 Applications of mathematics

UF28 Mathematics and careers

UF44 — Mathematics for consumers

In a sense, support for emphasis on the applications of mathematics is even stronger than the strong indices of agreement would suggest. Very small percentages of the samples would support decreased emphasis on any of the items. For example, for UF8 less than 2% of the AT, MT, JC, PR, or PT samples (and only 2.3% of the SB sample) support any degree of decreased emphasis, while over 83% of each sample support some degree of increased emphasis. While the indices of agreement are slightly lower for UF28 and UF44, still only 5.6% and 6.1% of the professional samples would decrease the current emphasis, and these percentages are lowered particularly by the response of the TE sample. Only 1.3% of the lay samples would decrease emphasis on mathematics for consumers. Clearly the majority of these samples support emphasis on applications in general, and applications for careers and for consumers in particular, at or above current levels.

The lay samples were asked on other items to indicate how important they felt applications were in school mathematics [729, 732, 737, 738]. Their extremely strong support (above the 95% level in all but one case) indicates clearly that the lay samples see practical applications to solve problems in everyday life [729], to gain skills necessary for employment [737], to make consumer decisions [738], and, to a slightly lesser extent (83.8%), to preserve student options on career and vocational choices [732] as being very important in school mathematics.

However, the professional samples would not <u>limit</u> the mathematics curriculum to practical concerns. When asked if most students should study practical applications of mathematics, with only a few studying puzzles or esoteric mathematical problems [PB544], only 31.8% agreed.

Emphasis on applications

	Total	AT	MT	JC	MA	SP	TE	Total	PR	SB	PT
UF8	1.094	1.329	1.229	1.323	0.792	0.910	0.862	1.194	1.219	1.125	1.1[illegible]0
	80.9%	86.9%	89.3%	95.2%	62.5%	72.2%	72.4%	82.9%	83.3%	79.5%	86.0%
	3.8%	1.4%	0.6%	1.6%	0.0%	7.5%	9.0%	0.8%	0.6%	2.3%	0.0%
UF28	0.796	1.117	0.895	0.883	0.855	0.642	0.550				
	64.8%	75.6%	73.3%	76.6%	65.4%	54.1%	53.5%				
	5.6%	2.2%	4.8%	5.0%	3.6%	4.6%	10.7%				
UF44	0.688					0.857	0.534	1.322	1.349	1.204	1.465
	60.6%					69.9%	52.0%	87.1%	88.5%	84.9%	86.1%
	6.1%					3.0%	8.9%	1.3%	1.1%	2.2%	0.0%

Applications: Lay samples' estimates of importance

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
729	1.816							1.802	1.846	1.842
	98.3%							98.1%	98.3%	99.0%
	0.5%							0.6%	0.5%	0.0%
732	1.176							1.157	1.187	1.263
	83.8%							83.9%	83.6%	84.2%
	2.5%							2.3%	3.3%	2.2%
737	1.576							1.531	1.621	1.737
	95.2%							94.1%	96.7%	98.9%
	1.1%							1.1%	1.6%	0.0%
738	1.552							1.550	1.516	1.634
	95.6%							95.0%	96.1%	96.8%
	1.4%							1.5%	1.6%	0.0%
PB544	-0.361	-0.461	-0.176	-0.206	-0.500	-0.288	-0.606			
	31.8%	29.4%	38.7%	35.3%	23.3%	32.2%	25.3%			
	57.4%	62.8%	49.6%	53.0%	63.3%	56.0%	63.4%			

Applications: General goals

Goals related to the application of mathematics were also strongly supported by the professional samples. Goal items may be clustered into those relating to applications generally, to consumer applications, and to vocational or career preparation. The two items with the lowest percentages of support (78.6% and 83.7%) pertain to applying mathematics in science [PB510] and in other disciplines [PS374], although an item on interpreting graphs and other data for use in science and social studies [PS372] receives far higher support (94.8%). It is interesting that applying recently taught mathematical ideas is not perceived more strongly as a goal of problem solving, when so many textbook problems are designed to do just that: on item PB505, only 84% supported this goal. Nevertheless, this is quibbling: there is obviously strong support across all samples for these general goals related to applications.

Applications: General goals

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL145	1.412	1.375	1.463	1.415	1.207	1.441	1.437			
	91.9%	87.5%	92.6%	97.6%	86.2%	91.5%	95.8%			
	3.2%	5.2%	3.3%	0.0%	10.3%	1.7%	0.0%			
GM300	1.315	1.270	1.205	1.083	1.146	1.573	1.516			
	89.8%	88.7%	87.2%	77.8%	82.9%	100.0%	95.4%			
	2.8%	4.5%	3.4%	8.3%	2.4%	0.0%	0.0%			
PS372	1.462	1.407	1.384	1.441	1.515	1.533	1.525			
	94.8%	91.3%	94.0%	94.1%	100.0%	98.3%	95.1%			
	1.6%	4.9%	2.0%	0.0%	0.0%	0.0%	0.0%			
PS374	1.133	1.321	1.232	1.000	0.970	0.967	1.049			
	83.7%	87.6%	87.9%	73.5%	81.8%	76.7%	85.2%			
	3.5%	3.7%	4.0%	2.9%	6.0%	3.4%	1.6%			
PB505	1.132	1.250	1.181	1.071	1.065	0.982	1.071			
	84.0%	88.5%	83.8%	78.5%	83.9%	80.7%	82.9%			
	3.3%	3.1%	2.9%	3.6%	3.2%	3.6%	4.3%			
PB510	0.959	0.969	1.010	1.179	1.129	0.702	0.914			
	78.6%	79.2%	80.0%	89.3%	90.3%	64.9%	77.1%			
	3.9%	5.2%	4.8%	0.0%	0.0%	7.0%	1.4%			

Applications: Consumer goals

Several items ask if consumer needs should be a goal of teaching particular aspects of mathematics. There was generally strong support for goals related to consumer concerns: at the 80% and 90% levels except for geometry [GM304], which is apparently not so strongly seen (58.8%) as related to consumerism. Strongest support comes for item WN207 on whole numbers (94.7%), items MS578 and MS579 on measurement (both 94.6%), item RP438 on ratio and proportion (94.0%), and item PS371 on probability and statistics (91.6%). Support is slightly weaker for item PB506 on problem solving (86.3%), item FD30 on decimals (85.2%), and item FD40 on fractions (80.3%). The lay samples are very supportive (97.1%) of consumer goals on the generic item [781].

It is somewhat puzzling that support should be higher for ratio and proportion and less for fractions and decimals, since all are used in comparison of prices and quantities. When the exact questions are examined, it is apparent that the ratio and propotion item (which relates to percent) is quite specific about "analyzing the financing of a purchase such as a new car or a house". On the other hand, the decimal and fraction items only refer very generally to determining "best buys". It seems possible that the differences in percentage levels relate not to the different mathematics content strands, but to the level of specificity in the wording of each item. The reader should be aware that differences in wording of similar items can account for differences in the way the items were perceived and answered.

Applications: Consumer goals

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD30	1.163	1.276	1.371	1.163	0.815	1.018	0.914			
	85.2%	91.8%	88.0%	86.0%	77.8%	80.7%	77.2%			
	7.1%	5.1%	5.2%	7.0%	14.8%	12.3%	5.7%			
FD40	0.968	1.020	0.992	0.905	0.769					
	80.3%	82.7%	80.5%	81.0%	69.2%					
	13.7%	15.3%	11.9%	16.7%	11.5%					
WN207	1.458	1.546	1.568	1.432	1.179	1.462	1.295			
	94.7%	96.3%	97.3%	91.9%	87.1%	98.1%	90.1%			
	1.2%	1.9%	0.9%	2.7%	2.6%	0.0%	0.0%			
GM304	0.623	0.966	0.427	0.611	0.463	0.733	0.484			
	58.8%	73.1%	48.7%	61.1%	56.1%	65.4%	50.0%			
	12.6%	9.0%	18.0%	16.7%	12.2%	9.3%	9.4%			
PS371	1.379	1.317	1.333	1.441	1.333	1.417	1.492			
	91.6%	89.0%	89.9%	91.1%	87.9%	93.4%	98.3%			
	2.2%	4.9%	2.0%	0.0%	0.0%	3.3%	0.0%			
RP438	1.371	1.467	1.460	1.333	1.129	1.407	1.211			
	94.0%	95.7%	94.0%	90.0%	90.3%	98.3%	91.6%			
	2.1%	1.1%	3.0%	6.7%	3.2%	1.7%	0.0%			
PB506	1.284	1.604	1.410	1.500	0.871	1.105	0.900			
	86.3%	94.8%	91.4%	89.3%	74.2%	84.2%	72.8%			
	3.6%	1.0%	4.8%	0.0%	9.7%	3.6%	4.3%			
MS577	1.381	1.451	1.485	1.429	1.111	1.400	1.156			
	92.6%	91.2%	97.8%	91.4%	80.6%	94.6%	89.1%			
	0.7%	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%			

Applications: Consumer goals (continued)

MS578	1.473	1.520	1.591	1.400	1.417	1.480	1.219			
	94.6%	92.1%	96.2%	94.3%	94.4%	97.4%	92.2%			
	1.2%	3.0%	0.0%	2.9%	0.0%	0.0%	1.6%			
781	1.587							1.577	1.539	1.740
	97.1%							97.4%	96.7%	96.0%
	1.8%							1.7%	2.2%	2.0%

Applications: Vocational/career goals

Although the data may be interpreted generally as supporting vocational/career goals, it is interesting to note that more "advanced" content areas have noticeably lower levels of support. Support is very high for item FD26 on decimals (92.5%), item FD36 on fractions (94.3%), item RP444 on ratio and proportion (86.5%), item WN201 on whole numbers (85.3%), item MS579 on measurement (84.2%), and item AL140 on algebra (81.3%). Another algebra item suggesting that algebra should be taught "to preserve options with respect to career and vocational choice" [AL138] receives less support, however (61.7%). When asked if formal work with algebra should be dropped because it has little relation to real-world problems [AL175, 751], 94.6% of the professional samples and 76.4% of the lay samples disagreed.

For probability and statistics [PS378] and computer literacy [CL631], 57.2% and 63.9% agreed with the goals, respectively. The respondents may feel that a smaller percentage of students will enter vocations or careers employing these skills. In geometry [GM297], 58.1% agreed with the goal; the classical nature of these programs may be seen as less related to vocational or career goals than are the other areas. It is possible to gain some insight into the question by examining responses to the following items:

AL168 770 A special algebra course for vocational students should be offered.

GM327 746 A full-year course in applied geometry should be available as a high school elective course.

With the exception of the MA and SB samples, there is at least moderate support (above the 60% level) for such applied courses in algebra and geometry.

Should content be altered to match vocational goals? One item [FD70] asked if students should be taught fractions with small denominators useful in various vocations. In general, 76.0% of the professional samples agreed, with strong agreement (93.3%) coming from the SP sample and minimal agreement (55.9%) coming from the MA sample.

Applications: Vocational/career goals

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD26	1.432	1.571	1.530	1.488	0.963	1.316	1.314			
	92.5% 4.1%	92.8% 2.0%	94.9% 3.5%	93.0% 2.3%	77.7% 14.8%	93.0% 5.3%	92.9% 4.3%			
FD36	1.467	1.490	1.563	1.405	1.038					
	94.3% 3.2%	96.9% 2.0%	95.0% 3.4%	95.2% 0.0%	80.8% 11.5%					
RP444	1.099	1.239	1.170	1.067	0.903	1.186	0.845			
	86.5% 2.6%	90.2% 1.1%	88.0% 5.0%	93.4% 3.3%	80.6% 6.5%	93.2% 0.0%	73.3% 1.4%			
WN201	1.192	1.194	1.333	1.139	1.128	1.269	0.934			
	85.3% 4.9%	85.2% 7.4%	89.1% 3.6%	80.5% 8.4%	82.1% 5.2%	88.5% 0.0%	80.3% 4.9%			
MS579	1.156	1.287	1.326	1.200	0.944	1.133	0.719			
	84.2% 3.2%	88.1% 6.0%	90.2% 0.8%	88.5% 0.0%	80.5% 5.6%	85.3% 1.3%	64.1% 6.3%			
AL140	1.050	1.156	1.099	1.220	1.034	0.949	0.817			
	81.3% 4.8%	85.5% 6.3%	83.4% 4.2%	90.2% 2.4%	75.9% 0.0%	81.3% 5.1%	69.0% 7.0%			
AL138	0.705	0.625	0.785	0.585	0.759	0.644	0.775			
	61.7% 9.9%	58.4% 11.4%	65.3% 9.1%	51.2% 7.3%	62.0% 13.7%	61.1% 10.2%	66.2% 8.4%			
AL175	-1.685	-1.275	-1.855	-1.714	-1.972	-1.773	-1.773			
	3.2% 94.6%	9.8% 83.3%	0.8% 98.4%	2.9% 97.1%	0.0% 100.0%	2.6% 97.3%	0.0% 96.9%			

Applications: Vocational/career goals (continued)

751	-0.974							-0.977	-1.054	-0.800
	10.7%							8.2%	14.0%	13.4%
	76.4%							76.0%	80.6%	68.9%
PS378	0.631	0.927	0.657	0.618	0.606	0.467	0.377			
	57.2%	65.8%	61.6%	55.8%	57.6%	48.3%	47.5%			
	13.0%	8.5%	15.1%	11.8%	6.1%	13.4%	19.7%			
CL631	0.672	0.858	0.909	0.667	0.462	0.404	0.357			
	63.9%	71.7%	76.4%	58.3%	61.6%	45.6%	51.4%			
	11.5%	8.5%	3.6%	11.1%	20.5%	19.3%	17.2%			
GM297	0.583	0.955	0.496	0.417	0.390	0.680	0.328			
	58.1%	76.4%	54.7%	47.3%	48.8%	65.3%	42.2%			
	12.3%	5.6%	17.1%	22.2%	14.7%	6.7%	12.5%			

Applications: Applied algebra/geometry course

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL168	0.727	1.000	0.712	0.429	0.139	0.667	0.892			
	70.2%	74.3%	71.2%	62.9%	50.0%	70.6%	76.9%			
	17.8%	7.9%	19.0%	35.3%	27.8%	18.7%	15.4%			
770	0.598							0.620	0.398	0.800
	63.7%							65.1%	54.6%	70.0%
	19.9%							20.0%	26.1%	8.0%
GM327	0.802	1.107	0.860	0.763	0.303	0.754	0.643			
	71.4%	78.6%	74.7%	76.3%	51.5%	64.9%	70.0%			
	14.9%	8.3%	11.2%	13.1%	36.3%	19.3%	15.7%			
746	0.779							0.813	0.674	0.867
	65.9%							69.0%	59.7%	66.7%
	13.0%							11.2%	19.6%	6.7%
FD70	0.907	1.056	0.679	0.553	0.382	1.356	1.131			
	76.0%	76.7%	69.7%	63.2%	55.9%	93.3%	88.5%			
	15.9%	12.1%	21.1%	26.4%	35.3%	3.4%	8.2%			

<u>Applications: Resource booklets</u>

In addition to items relating to the goals of school mathematics, a set of items in the resources section of the questionnaires also pertained to the role of applications. Respondents were asked to react to the desirability of resource booklets containing applications. There was a high level of support (80% or above) for such materials in all samples. The only exceptions to this were in problem solving; support was weak (46.2%) for resource books with problems that appeal to girls [PB515], and even weaker (40.2%) for resource books of problems written especially for ethnic minority students [PB521]. In both cases, the percentages of those who would "rather not be bothered with this" or "definitely would not want this" were approximately equivalent to the percentages of those who "would definitely want this" or thought they "might be nice to have". It may be that the difficulty in writing such materials was foreseen; it may be that bias was operating; or it simply may be that no need for such materials was perceived.

Applications: Resource booklets

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD49	1.202	1.242	1.143	1.413	1.000					
	86.9%	84.9%	86.6%	91.3%	87.9%					
	6.1%	7.1%	6.7%	2.2%	6.0%					
AL148	1.369	1.179	1.435	1.606	1.464					
	89.3%	85.3%	91.3%	96.9%	85.7%					
	2.2%	4.3%	1.7%	0.0%	0.0%					
AL152	0.923	0.979	0.896	0.939	0.821					
	81.2%	84.2%	78.3%	84.8%	78.5%					
	9.6%	9.5%	11.3%	3.0%	10.7%					
WN217	1.498	1.485	1.480	1.744	1.324					
	95.9%	93.8%	97.5%	100.0%	91.2%					
	1.7%	2.1%	1.6%	0.0%	2.9%					
GM311	1.427	1.494	1.389	1.500	1.325					
	91.1%	88.6%	90.5%	97.0%	92.5%					
	3.2%	5.1%	3.2%	0.0%	2.5%					
PS388	1.285	1.134	1.389	1.294	1.385					
	90.8%	86.6%	93.8%	91.2%	92.4%					
	2.9%	6.2%	0.9%	2.9%	0.0%					
RP449	1.112	1.010	1.173	1.207	1.154					
	85.1%	82.4%	84.7%	93.1%	87.2%					
	7.1%	9.8%	7.1%	6.9%	0.0%					
RP454	1.493	1.461	1.582	1.517	1.333					
	93.3%	92.2%	94.9%	96.6%	89.8%					
	3.0%	4.9%	3.0%	0.0%	0.0%					

Applications: Resource booklets (continued)

PB514	1.075	1.138	1.105	1.031	0.833			
	80.7%	81.6%	82.9%	81.3%	70.0%			
	10.2%	11.4%	7.7%	9.4%	16.7%			
PB515	0.122	0.126	0.076	0.375	0.000			
	47.2%	47.1%	46.6%	56.3%	40.0%			
	34.6%	35.6%	36.2%	21.9%	40.0%			
PB521	-0.167	0.047	-0.250	-0.219	-0.433			
	35.9%	42.3%	35.6%	34.4%	20.0%			
	40.2%	34.2%	45.2%	37.5%	43.3%			
PB525	1.282	1.372	1.212	1.406	1.133			
	87.7%	91.9%	84.6%	96.9%	76.6%			
	4.8%	4.7%	5.8%	0.0%	6.7%			
MS588	1.095	1.198	1.078	1.100	0.812			
	83.1%	86.8%	82.1%	86.6%	71.9%			
	5.8%	3.7%	8.6%	0.0%	6.3%			
MS590	1.166	1.217	1.125	1.300	1.031			
	87.5%	90.5%	86.0%	96.7%	75.1%			
	5.1%	4.7%	6.2%	3.3%	3.1%			
711	1.553	(1.380)				1.550	1.556	1.380
	96.5%	94.8%				96.1%	96.9%	94.8%
	0.6%	0.6%				1.3%	0.0%	0.6%
723	1.591	(1.405)				1.579	1.601	1.405
	98.8%	95.1%				98.0%	99.4%	95.1%
	0.9%	0.9%				2.0%	0.0%	0.9%

Applications as context for instruction

Several sets of items pertaining to applications were included in the methods portions of the questionnaires. One queried the desirably of developing concepts or procedures within the context of real-world or applications problems (although the wording differed on items). Consistently strong support (above the 80% level) for using applications as a context for instruction in mathematics was given, with support even stronger from the lay samples than from the professional samples.

Realism seems to be the key to support. Approximately 72% of the lay samples agreed that "Problems should be realistic even though they might involve sensitive social issues" [782].

Applications as context for instruction

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD53	1.137	1.233	1.094	1.317	0.800					
	85.0%	88.3%	82.8%	92.7%	74.2%					
	3.9%	3.9%	3.9%	0.0%	8.6%					
AL156	1.256	1.059	1.351	1.485	1.314					
	87.6%	81.4%	90.0%	90.9%	94.3%					
	2.2%	2.9%	1.8%	0.0%	2.9%					
PS403	1.115	0.960	1.209	1.000	1.458					
	84.3%	78.7%	89.1%	78.6%	91.7%					
	3.8%	7.1%	0.9%	7.1%	0.0%					
683	1.481					1.454	1.506			
	95.0%					94.8%	95.3%			
	0.3%					0.0%	0.6%			
699	1.477					1.513	1.444			
	96.5%					97.3%	95.7%			
	0.9%					1.4%	0.6%			
764	1.383							1.443	1.267	1.386
	92.3%							94.3%	90.0%	88.6%
	2.5%							2.3%	2.2%	4.5%
782	0.822							0.836	0.828	0.720
	71.9%							73.5%	69.0%	66.0%
	12.2%							10.3%	18.4%	14.0%

Applications: Simulations

Another set of methods items dealt with the use of simulations, in which each student would play the role of a consumer or worker using mathematics in a real-world situation. Apparently, this method is an accepted teaching strategy for measurement [MS596], with support at the 70.8% level, and for the generic (general) items answered for the elementary [686] and secondary [702] levels by the SP and TE samples, where support averages 70%. However, even on these items, the JC and MA samples are not particularly supportive, and they, along with the MT sample, are not particularly supportive of the use of simulations in geometry [GM323], where the level drops to 60.0%.

Applications: Simulations

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
GM323	0.508	0.759	0.410	0.324	0.364					
	60.0%	72.3%	57.0%	44.2%	54.5%					
	19.6%	14.4%	24.0%	17.7%	21.2%					
MS596	0.856	0.952	0.877	0.806	0.529					
	70.8%	76.2%	72.3%	63.9%	55.9%					
	9.5%	11.5%	6.1%	11.1%	14.7%					
686	0.844					0.862	0.827			
	71.5%					70.4%	72.6%			
	11.3%					11.2%	11.3%			
702	0.816					0.973	0.667			
	70.9%					79.3%	62.9%			
	10.7%					7.3%	13.8%			

Applications: Consumer content

As a final bit of evidence as to the respondents' reactions to the area of applications, their levels of agreement with content decisions that involve incorporation of elements of consumer mathematics phrased in different ways were assessed by a number of items. Support was very high (above the 88% level) for materials including real-world data [PS398], introducing percentage in a real-life context [RP422], and teaching about computers in society [CL619].

Introducing percentage in terms of merchandizing [RP424, 773] was also given high support (84.3%) by the professional samples, but was given weaker support (66.8%) by the lay samples. Introducing ratio as a method for determining the "best buy" [RP427] received only 69.1% support, with specific consumer skills such as balancing a checkbook [WN200, 781] only slightly higher at 71.6% for the professional samples, but with the lay samples at the 97% level.

On one item on general or consumer mathematics courses, responses from both professional and lay samples indicated that approximately 70% favored having measurement as a strong focus of such a course [MS605, 775] (although support was low for the MA sample). On a second item, less support from the professional samples (65.3%) and decidedly weak support (40.9%) from the lay samples was found for having probability and statistics as part of the course [PS410, 779]. Support was low for both MA and AT samples, as well as the lay samples.

Data processing for business applications [CL630] received a similar level of support (67.2%); interestingly, support on this item was highest from the AT sample (78.3%) and lowest for the MA sample (53.6%).

Applications: Consumer content

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN200	0.835	0.842	0.667	1.081	0.974	0.750	0.984			
	71.6%	69.5%	68.5%	75.6%	74.4%	73.7%	73.5%			
	15.7%	17.9%	21.3%	16.2%	10.3%	11.8%	10.9%			
PS398	1.506	1.566	1.482	1.429	1.458					
	94.3%	97.0%	93.7%	89.2%	91.7%					
	2.3%	2.0%	1.8%	3.6%	4.2%					
PS410	0.601	0.351	0.459	0.658	0.370	0.962	1.016			
	65.3%	51.5%	62.2%	71.1%	48.1%	78.9%	85.3%			
	18.2%	24.8%	18.0%	18.4%	25.9%	13.4%	8.2%			
RP422	1.576	1.729	1.443	1.464	1.516	1.650	1.574			
	95.8%	97.9%	91.5%	92.8%	100.0%	96.7%	98.3%			
	2.4%	1.0%	4.7%	7.1%	0.0%	1.7%	0.0%			
RP424	1.183	1.490	1.236	1.071	0.871	1.117	0.885			
	84.3%	93.7%	88.7%	82.1%	74.2%	81.7%	70.5%			
	6.8%	3.1%	5.6%	7.1%	6.4%	6.7%	14.8%			
RP427	0.751	1.031	0.708	0.429	0.581	0.683	0.689			
	69.1%	83.4%	65.1%	60.7%	61.3%	66.6%	63.9%			
	16.2%	7.3%	16.0%	23.6%	19.4%	20.0%	19.6%			
MS605	0.768	0.636	0.873	0.719	0.512	0.987	0.708			
	70.8%	66.6%	72.1%	68.8%	53.7%	81.5%	73.9%			
	13.4%	19.2%	8.4%	15.6%	17.0%	9.2%	15.4%			
CL619	1.371	1.225	1.319	1.250	1.293	1.596	1.667			
	88.5%	81.0%	89.1%	90.6%	85.3%	96.2%	95.0%			
	4.8%	7.2%	5.8%	6.3%	4.8%	0.0%	1.7%			

pplications: Consumer content (continued)

1630	0.692	0.955	0.731	0.531	0.341	0.635	0.500			
	67.2%	78.3%	67.3%	62.5%	53.6%	67.3%	58.3%			
	15.2%	10.8%	12.6%	12.6%	19.5%	17.3%	25.0%			
773	0.662							0.700	0.591	0.520
	66.8%							68.0%	65.9%	60.0%
	15.8%							14.0%	20.5%	20.0%
775	0.741							0.722	0.809	0.755
	70.0%							69.3%	78.7%	59.2%
	11.5%							11.8%	11.2%	10.2%
779	0.064							0.000	0.080	0.500
	40.9%							38.7%	42.0%	56.3%
	32.5%							34.9%	30.7%	18.8%
781	1.587							1.577	1.539	1.740
	97.1%							97.4%	96.7%	96.0%
	1.8%							1.7%	2.2%	2.0%

Summary: Applications

- Projections of increased future emphasis are seen for applications of mathematics (80.9%), mathematics and careers (64.8%), and mathematics for consumers (60.6%).
- Lay samples gave very strong support (above 95%) to the importance of applications for solving problems in everyday life, gaining skills necessary for employment, and making consumer decisions.
- Lay samples gave strong support (83.8%) to the importance of mathematics in preserving student options on career and vocational choices.
- There was strong support across all samples for mathematics course goals related to applications.
- Consumer needs as a goal of teaching particular aspects of mathematics were strongly supported for all areas except geometry, which is apparently not so strongly seen as related to consumerism.
- Support for vocational/career goals was very strong (over 80%) for decimals, fractions, ratio and proportion, whole numbers, measurement, and algebra. Support was minimal for probability and statistics, computer literacy, and geometry, however.
- Resource booklets containing applications were strongly supported by all samples. However, resource books containing problems written to appeal to special audiences (e.g., girls, ethnic minorities) were given very little support.
- The use of applications as a context for instruction was given consistently strong support.
- Simulations as a teaching method were given moderately strong support by the AT, SP, and TE samples, but were only minimally supported by the MT, JC, and MA samples.

- Support for incorporating elements of consumer mathematics ranged from strong (88%) to moderately strong (67%) depending upon the specific content involved.

Individualization

The professional and lay samples were asked whether individualization should receive increased emphasis during the 1980s [UF7]. Most samples gave moderately strong support for increasing emphasis on individualization (60% to 65%). The JC sample (51.0%) and the MT sample (44.6%) were somewhat less supportive, and the MA sample gave little support (28.5%). In all instances, a larger percentage of each sample checked "somewhat more emphasis" than checked "much more emphasis", and a substantial percentage of each sample (19% to 50%) checked "same emphasis". Relatively small percentages would decrease the emphasis on individualization.

Emphasis on individualization

	Total	AT	MT	JC	MA	SP	TE	Total	PR	SB	PT
UF7	0.551	0.603	0.436	0.510	0.089	0.789	0.853	0.746	0.766	0.636	0.796
	53.2%	61.6%	44.4%	51.0%	28.5%	64.5%	65.3%	59.9%	59.9%	56.8%	65.3%
	13.4%	19.1%	12.3%	12.2%	21.5%	9.2%	4.0%	7.2%	6.8%	9.1%	6.1%

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Individual study materials

Other questions were included in the body of the survey forms to determine the level of support responding groups would give to particular aspects of the individualization of instruction. The extent to which they would want classroom teachers to have individual study materials was asked for the areas of fractions [FD44], whole numbers [WN219], geometry [GM310], probability and statistics [PS384], ratio and proportion [RP450], and measurement [MS585], while the SP, TE, and PR samples responded to a generic (general) item.

In each sample and across samples, there was strong support for the use of such materials, ranging from 77.8% for geometry to 83.6% for fractions. The SP, TE, and PR samples gave particularly strong support (88.8%) at the secondary level [720] and even more support (92.3%) at the elementary level [708].

Individual study materials

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD44	1.151	1.220	1.050	1.370	1.000					
	83.6%	84.0%	81.7%	89.1%	81.8%					
	7.1%	6.0%	10.8%	0.0%	6.0%					
WN219	1.038	1.113	0.902	1.205	1.118					
	80.2%	82.4%	74.8%	84.7%	88.2%					
	7.9%	9.3%	9.7%	2.6%	2.9%					
GM310	0.956	1.114	0.842	1.000	0.875					
	77.8%	78.5%	74.7%	88.2%	75.0%					
	7.2%	6.3%	9.5%	8.8%	2.5%					
PS389	1.044	0.990	1.106	0.912	1.154					
	79.3%	76.3%	83.2%	79.4%	73.1%					
	5.9%	9.3%	3.5%	2.9%	7.7%					
RP450	0.925	0.941	0.949	0.759	0.949					
	78.4%	77.5%	82.7%	69.0%	76.9%					
	10.8%	11.7%	10.2%	13.8%	7.7%					
MS585	0.980	1.105	0.844	1.067	1.031					
	77.9%	84.8%	72.6%	80.0%	75.1%					
	9.5%	8.6%	13.3%	3.3%	3.1%					
708	1.373 (1.700)					1.371	1.375	1.700		
	92.3% 97.0%					92.0%	92.5%	97.0%		
	3.9% 0.6%					5.9%	1.9%	0.6%		
720	1.259 (1.407)					1.289	1.232	1.407		
	88.8% 90.8%					89.5%	88.1%	90.8%		
	5.3% 2.0%					5.9%	4.8%	2.0%		

Individual study time

Respondents were also queried concerning their willingness to devote major instructional time to individualized instruction. Respondents were asked the extent to which they would be positively or negatively influenced with respect to selecting instructional materials if "more than 50% of the instructional time is devoted to student use of individual study materials to develop and extend ideas." For the AT, MT, JC, and MA samples, this question was asked for fractions [FD57], algebra [AL164], whole numbers [WN230], geometry [GM321], measurement [MS595], and computer literacy [CL650]. For the other samples, it was asked as a generic (general) item [677, 693, 788].

The generally low levels of support (26.6% to 49.5%) for this item may be occasioned by the fact that such a large portion (more than 50%) of instructional time was specified. It is interesting to note that even with such a major commitment required, the AT sample still would be moderately strong in their support for several content areas, particularly whole numbers and measurement, and, apparently, such a position would be supported by the lay samples as well.

Individual study time

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD57	0.121	0.243	−0.070	0.195	0.371					
	40.3%	46.6%	32.8%	43.9%	45.7%					
	34.6%	36.9%	39.9%	26.8%	17.1%					
AL164	0.018	−0.010	0.009	0.212	−0.057					
	36.6%	36.2%	36.9%	36.4%	37.1%					
	37.7%	40.2%	40.5%	18.2%	40.0%					
WN230	0.196	0.600	0.084	0.000	−0.179					
	43.3%	61.2%	36.4%	38.5%	28.2%					
	27.8%	18.8%	28.0%	35.9%	38.5%					
CM321	0.185	0.415	0.160	0.029	−0.152					
	42.1%	51.3%	43.0%	29.4%	30.3%					
	31.3%	29.2%	30.0%	29.4%	42.5%					
MS595	0.397	0.571	0.231	0.722	0.147					
	49.5%	60.9%	40.7%	55.5%	41.2%					
	22.7%	20.0%	27.6%	5.6%	29.4%					
CL650	0.263	0.343	0.264	0.135	0.152					
	42.8%	46.1%	43.4%	35.1%	39.4%					
	23.4%	18.6%	23.6%	27.0%	33.3%					
677	0.159					0.289	0.042			
	43.8%					46.7%	41.0%			
	32.2%					25.6%	38.1%			
693	0.235					0.220	0.250			
	46.1%					45.4%	46.9%			
	31.0%					32.6%	29.4%			

ndividual study time (continued)

788	0.360	0.273	0.477	0.776
	50.1%	46.8%	54.7%	65.3%
	25.7%	28.2%	22.1%	14.2%

Individualization: Mastery learning model

In other generic items [674, 690] which included an aspect of individualization, respondents were asked the extent to which they would be positively or negatively influenced by instructional materials in which "specific objectives, criterion referenced testing, and other materials are included to encourage use of a mastery learning or an individually paced model". The AT, MT, JC, and MA samples responded to this item for the content areas fractions and decimals [FD60], whole numbers [WN227], geometry [GM320], probability and statistics [PS405], ratio and proportion [RP459], problem solving [PB540], and measurement [MS600].

The MA sample was noticeably weak in its support of this item. In each of the remaining samples, the support ranged from moderate to strong, with a clear tendency for higher levels of support to be given to "basic" areas such as whole numbers (66.8%), fractions and decimals (66.3%), and measurement (63.9%). The SP sample was noticeably stronger in their support than either the TE or other professional samples. The PR, SB, and PT samples were highly supportive (92.4%) of a related item [760]. This may be primarily an indication of their positive response to the phrase "specified competency level" in their form of the item.

The topic of mastery learning, which appears along with individualization in the introductory items, was also one of those for which some groups were asked to indicate the degree of change in emphasis which should occur in the 1980s.

	Total	AT	MT	JC	MA	SP	TE
UF11	0.707	1.025	0.970			0.658	0.446
	61.4%	70.9%	69.7%			60.8%	52.4%
	11.6%	3.8%	3.0%			12.0%	19.9%

Very small percentages (3.8% and 3.0%) of the AT and MT samples would decrease emphasis on mastery learning, but larger percentages of the SP and TE samples would (12.0% and 19.9%, respectively). While the inferred ranking of the item for the AT and MT samples is virtually the same, there is a decided difference in the ranking by the SP and TE samples, with the TE sample giving less relative importance to mastery learning.

Individualization: Mastery learning model

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PR
FD60	0.768	0.990	0.709	0.951	0.114					
	66.3%	76.7%	63.8%	75.6%	34.3%					
	11.4%	8.7%	14.1%	4.9%	17.1%					
WN227	0.793	0.976	0.796	0.950	0.211					
	66.8%	75.3%	66.7%	75.0%	39.5%					
	9.3%	10.6%	6.5%	5.0%	18.4%					
GM320	0.506	0.765	0.440	0.412	0.156					
	54.2%	64.2%	52.0%	50.0%	40.7%					
	17.8%	16.1%	19.0%	11.7%	25.1%					
PS405	0.414	0.616	0.409	0.143	-0.083					
	51.3%	59.6%	53.6%	39.3%	20.9%					
	18.0%	16.1%	17.3%	21.4%	25.0%					
RP459	0.551	0.622	0.560	0.727	0.152					
	56.6%	57.8%	57.7%	69.7%	36.4%					
	13.6%	7.7%	14.7%	15.2%	24.3%					
PB540	0.451	0.620	0.385	0.344	0.208					
	54.9%	61.0%	53.8%	46.9%	45.9%					
	18.3%	15.0%	18.8%	18.7%	29.2%					
MS600	0.722	0.942	0.602	0.972	0.235					
	63.9%	76.9%	58.6%	69.5%	38.2%					
	12.6%	8.7%	14.8%	2.8%	26.5%					
674	0.742					1.000	0.512			
	67.9%					75.4%	61.3%			
	15.1%					9.4%	20.3%			

ndividualization: Mastery learning model (continued)

690	0.761	1.047	0.494			
	71.3%	80.7%	62.5%			
	17.7%	8.7%	26.3%			
760	1.357			1.339	1.341	1.465
	92.4%			92.5%	92.0%	93.0%
	3.9%			4.0%	4.5%	2.3%

Individualization: Specific aspects

Two items were included that pertained to individual study in a computer-assisted instruction mode [AL147, CL644]. Although the individualization aspect is confounded with other points, the response patterns provide some additional evidence of support for individualization, at a moderately high level (71.6% and 63.5%).

Reactions to individualizing through project work were considered by another set of items. Moderate to strong support was given, as discussed in the section on "Out-of-Class Activities and Projects".

One final set of items of possible interest under the individualization category involved permitting slower students to use a calculator "to keep up with the rest of the class". As is noted in the section on "Use of Calculators", there was very little support for this idea.

ndividualization: CAI

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
L147	0.786	0.705	0.791	1.000	0.786					
	71.6%	67.4%	72.2%	81.8%	71.4%					
	15.5%	19.0%	15.7%	9.1%	10.7%					
1.644	0.661	0.760	0.617	0.514	0.667					
	63.5%	64.0%	65.4%	62.1%	57.5%					
	13.3%	8.0%	15.0%	18.9%	18.2%					

Summary: Individualization

- Increasing the emphasis on individualization during the 1980's was given moderately strong support by the AT, SP, TE, PR, SB, and PT samples. Support was much weaker from the MT, JC, and MA samples, however, ranging from 44.6% to 28.5%.
- All groups gave moderately strong to strong support for giving classroom teachers individual study materials for classroom use.
- Very little support was given to devoting more than 50% of instructional time to student use of individual study materials; however, the AT sample did give minimal support for the idea when used with whole numbers and measurement.
- Increasing emphasis on mastery learning received moderately strong support from AT and MT samples, but slightly less support from SP and TE samples.
- Specifying competency levels in instructional materials received very strong support (above 92%) from lay samples.
- Instructional materials with specific objectives, criterion-referenced testing, and other aspects of a mastery learning or individually paced model were given moderately strong support (above 63%) by all professional samples except the MA sample which gave very little support (20% to 40%).
- Individual study by computer-assisted instruction was given moderately strong support (71.6% to 63.5%).

Differentiated Programs for Special Groups

Four introductory items queried respondents as to the amount of emphasis that should be given in mathematics to four groups: women [UF22], minorities [US23], gifted students [UF24], and low achievers [UF40]. Fifty percent of the respondents thought that minorities should receive about the same emphasis as now, while 40% indicated this response for women in mathematics. The need for increased emphasis on women was perceived by 52.5%, while 38.5% indicated that there should be increased emphasis on minorities.

Over 75% of most samples believe that more emphasis should be given to gifted students. The JC and MA samples gave the least support of all samples to these students (60.0% and 69.6%, respectively). Only a small percentage of any sample believes that less emphasis should be given to the gifted, however. Support for increasing emphasis on low achievers is lower, with an average of 58.6% for the professional samples and 66.0% for the lay samples. The MA sample is least supportive (40.5%), while the AT and PT samples are most supportive (72.2% and 77.3%, respectively). Less than 8.3% indicated that these students should be given less support, with the exception of the MA sample (16.4%).

In the remainder of this section, items that pertain to three groups of students with special needs are considered: the gifted, girls, and college-bound students. Other special groups, including slower students and students from ethnic groups, are considered elsewhere in this report. the needs of the non-college-bound student are also considered in a wide variety of questions.

Emphasis on particular groups of students

	Total	AT	MT	JC	MA	SP	TE	Total	PR	SB	PT
UF22	0.574	0.664	0.481	0.617	0.065	0.788	0.767				
	52.5%	52.1%	44.3%	65.0%	47.8%	63.4%	56.6%				
	6.8%	4.3%	2.6%	15.0%	28.3%	1.9%	3.3%				
UF23	0.338	0.340	0.304	0.317	0.196	0.404	0.517				
	38.5%	38.3%	36.7%	40.0%	35.7%	40.4%	43.3%				
	11.2%	11.4%	9.5%	18.4%	17.9%	5.7%	6.7%				
UF24	1.069	1.143	1.133	0.750	1.143	1.037	1.053	1.326	1.509	1.108	1.067
	75.1%	75.7%	81.7%	60.0%	69.6%	75.3%	75.6%	84.3%	89.2%	79.6%	75.6%
	2.6%	2.1%	1.9%	-1.7%	0.0%	4.6%	3.8%	2.6%	1.1%	4.3%	4.4%
UF40	0.681	0.935	0.807	0.810	0.297	0.783	0.525	0.987	0.966	0.935	1.182
	58.6%	72.2%	63.9%	67.8%	40.5%	55.0%	49.2%	66.0%	64.6%	63.4%	77.3%
	8.9%	4.7%	7.6%	6.0%	16.4%	8.3%	8.2%	2.2%	1.7%	4.3%	0.0%

Gifted students

Support for a senior-level probability and statistics course for high-ability students [PS412] is moderate from most professional samples (62% to 67%), except for the AT sample (54.2%) and the TE sample (46.0%). Why the latter sample in particular gives so little support to the idea is unclear. The PR and SB samples both support this course [783] above the 70% level, while the PT sample gives only minimal support (56.2%).

That only bright students should be taught all three types of percent problems [RP467] is rejected by every sample (86.6% disagree), as is the suggestion [PB542] that "problem solving is a function of intelligence and cannot really be taught except to gifted students" (where 90.6% disagree). Similarly, the idea that "division of fractions should be omitted from the curriculum except for very bright students" [FD63] is rejected by 80.0%.

The use of course units in ratio and proportion [RP422] or in problem solving [PB503] to identify students who possess mathematical talent gathers almost twice the expected response for the "undecided" choice (42.8% and 38.0%, respectively). The remaining respondees tend to tip negatively toward the idea in ratio and proportion (33.1% disagree) and positively toward the idea in problem solving (46.5% agree).

Gifted students

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PS412	0.492	0.406	0.634	0.605	0.778	0.538	0.131			
	57.2%	54.2%	61.6%	65.8%	66.6%	55.8%	46.0%			
	25.6%	26.1%	21.5%	15.8%	22.2%	23.0%	42.6%			
783	0.877							0.905	0.899	0.625
	73.0%							75.3%	73.1%	56.2%
	12.7%							12.9%	12.3%	12.5%
RP467	-1.263	-0.987	-1.189	-1.265	-1.513	-1.316	-1.486			
	7.5%	18.0%	6.3%	5.8%	0.0%	7.0%	2.9%			
	86.6%	76.9%	87.4%	82.3%	94.9%	85.9%	94.2%			
PB542	-1.345	-1.475	-1.084	-1.147	-1.300	-1.644	-1.465			
	5.1%	2.0%	8.4%	5.8%	3.3%	5.1%	4.2%			
	90.6%	93.0%	87.4%	82.4%	90.0%	94.9%	92.9%			
FD63	-1.081	-0.738	-1.578	-1.590	-1.647	-0.322	-0.885			
	14.2%	24.3%	3.7%	2.6%	2.9%	30.5%	13.1%			
	80.0%	70.0%	91.7%	97.4%	97.1%	55.9%	78.7%			
RP422	1.576	1.729	1.443	1.464	1.516	1.650	1.574			
	95.8%	97.9%	91.5%	92.8%	100.0%	96.7%	98.3%			
	2.4%	1.0%	4.7%	7.1%	0.0%	1.7%	0.0%			
PB503	0.416	0.448	0.476	0.393	0.419	0.281	0.400			
	46.5%	46.9%	52.3%	46.4%	48.4%	43.8%	38.6%			
	15.5%	16.7%	15.3%	21.4%	13.0%	17.6%	11.5%			

Special materials/courses for girls

Little support (47.2%) was given to providing resource books with problems that appeal to girls [PB515], while the idea that different problem-solving courses should be offered to girls [PB546] was clearly rejected by all samples.

Special materials/courses for girls

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PB515	0.122	0.126	0.076	0.375	0.000					
	47.2%	47.1%	46.6%	56.3%	40.0%					
	34.6%	35.6%	36.2%	21.9%	40.0%					
PB546	-1.701	-1.706	-1.538	-1.765	-1.800	-1.797	-1.817			
	3.1%	3.0%	5.9%	2.9%	0.0%	1.7%	1.4%			
	94.2%	93.2%	89.9%	94.1%	100.0%	98.3%	97.2%			

College-bound students

How many years of high school mathematics (grades 9-12) should college-bound students study [742]? Almost half (47.4%) of the lay samples responded "four years"; 35.8% responded "three years"; and only 16.8% responded "two years" or less. (In contrast, only 15.3% indicated that four years of high school mathematics should be required for high school graduation for all students [741]; 25.3% responded "three years"; 46.6%, "two years"; and 12.8%, one year or less.)

A sizable portion (63.8%) of the lay samples felt that at least one course in mathematics for the college-bound student should make extensive use of the computer [780]. When asked whether or not college-bound students needed different computer techniques than vocational students [CL657], 46.5% of the professional samples disagreed.

How important is whole-number computation as a basic skill for college-bound students? When it was suggested that these students should spend at least three weeks of every school year reviewing whole-number computation [WN232, 755], 35.1% of the professional samples disagreed. The strongest disagreement came from the MA sample (70.0%); the weakest disagreement came from the AT sample (43.7%). The lay samples tended to agree, although very weakly; their agreement of 49.4% is only slightly over the expected 40% level.

Finally, content strands for algebra, geometry, and probability and statistics contained questions about the desirability of teaching specific topics for college-bound students. Details may be found in those sections.

College-bound students

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
742	-1.266							-1.223	-1.228	-1.574
	3.4%							3.9%	3.3%	1.1%
	83.2%							82.7%	80.6%	91.5%
780	0.646							0.641	0.618	0.735
	63.8%							62.7%	[illegible].4%	65.3%
	17.4%							17.7%	20.2%	10.2%
CL657	0.225	0.520	0.412	0.000	-0.182	0.224	-0.183			
	46.5%	57.8%	52.9%	30.0%	30.3%	48.3%	33.8%			
	30.3%	22.5%	21.6%	36.7%	36.4%	31.0%	47.9%			
WN232	-0.359	0.068	-0.437	-0.371	-0.800	-0.390	-0.672			
	29.7%	44.7%	26.9%	25.7%	13.3%	32.2%	18.1%			
	55.1%	43.7%	56.3%	48.6%	70.0%	62.7%	60.7%			
755	0.395							0.407	0.118	0.976
	49.4%							48.3%	39.8%	75.6%
	25.5%							22.1%	37.7%	12.2%
741	-0.420							-0.309	-0.453	-0.979
	12.9%							14.8%	12.2%	3.2%
	40.6%							35.2%	42.0%	67.0%

Summary: Differentiated Programs for Special Groups

- Increased emphasis for gifted students was supported by over 75% of most samples.
- Support for a senior-level probability and statistics course for high-ability students was moderate from most professional samples (62% to 67%), except from the AT sample (54.2%) and the TE sample (46.0%).
- Increased emphasis for women was supported by 52.5% of most samples but 40% indicated that women should receive about the same emphasis as now.
- Different problem-solving courses for girls were strongly rejected, and very little support was shown for providing resource books with problems that appeal to girls.
- Increased emphasis for minorities was supported by only 38.5%, while 50% felt minorities should receive about the same emphasis as now.
- Increased emphasis for low achievers received moderately strong support (63.4% to 77.3%) from all professional and lay samples except MA, SP, and TE. In these three cases support was minimal (40.5% to 55.0%).
- Almost half (47.4%) of the lay samples believed that college-bound students should study four years of mathematics in grades 9-12.
- Extensive use of the computer in at least one mathematics course for college-bound students was given moderately strong support (63.8%) by the lay samples.

Use of Calculators

The introductory item on the use of calculators indicates that 54.3% of the professional populations sampled indicated they should receive more emphasis, 14.0% indicated less emphasis, and the remainder (31.7%) are undecided. The lay samples were less supportive of increasing emphasis on calculators, with only 16% of the PT sample in favor of this. The SP and TE samples are decidedly more favorable toward increased use of calculators than are the other samples. No percentage in either sample indicated they should receive less emphasis. It should be noted, however, that far less than the expected percentage (40%) in <u>any</u> group except the PT sample indicated that less emphasis should be placed on calculators. This appears to be a sign of their "slow but sure" acceptance noted by Suydam (1979).

It must be noted that, for the calculator items, there is a difference in the responses from that used on other clusters of items. The "a" response is "very appropriate", as elsewhere; the "b" response is "only in special circumstances". This is referred to as supportive, but obviously it is not precisely the same as that given by the usual "b" response of "somewhat or probably appropriate".

Use of calculators

	Total	AT	MT	JC	MA	SP	TE	Total	PR	SB	PT
UFS	0.492	0.340	0.464	0.426	0.319	1.088	1.000				
	54.3%	51.3%	51.2%	45.5%	44.7%	85.3%	73.7%	35.8%	40.2%	29.5%	16.0%
	14.0%	20.7%	13.6%	13.1%	17.1%	0.0%	0.0%	24.0%	19.3%	33.0%	42.0%

Developing ideas and concepts

For algebra, little support (45.9%) is given for developing basic ideas with calculators [AL159], but more support (70.1%) is given for exploring the values of $(a + b)^2$ [AL181] and a slightly higher percentage (74.3%) approve the use of calculators for working with limits of sequences [AL185].

Support at the 66.5% level is given for developing ideas about decimals [FD74], but not for developing ideas about fractions [FD73]; the coefficient of agreement for the latter item is -0.036. Over 60% support the use of calculators for developing ideas about percents greater than 100% [RP478], but 63.1% disagree with the idea that "percent should be introduced as a special key on a calculator" [RP434].

Finally, the SP, TE, PR, SB, and PT samples were asked in general [662] about the appropriateness of using calculators to develop ideas and concepts. The SP and TE samples supported this idea at the 85.5% and 82.3% levels, respectively. Acceptance by the lay samples was lower, ranging from 42.5% to 55.4%.

Developing ideas and concepts

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD73	-0.036	0.020	-0.060	0.216	-0.520					
	40.7%	41.4%	41.0%	43.2%	32.0%					
	42.5%	37.4%	44.5%	37.8%	60.0%					
FD74	0.626	0.646	0.590	0.865	0.360					
	66.5%	64.7%	68.4%	67.5%	64.0%					
	23.7%	22.3%	25.6%	16.2%	32.0%					
AL159	0.270	0.461	0.243	0.121	-0.057					
	45.9%	54.9%	44.1%	45.4%	25.8%					
	22.4%	15.7%	22.5%	33.3%	31.5%					
AL181	0.907	1.144	0.791	1.000	0.571					
	70.1%	75.6%	68.2%	75.7%	57.1%					
	21.2%	12.2%	23.7%	24.3%	34.3%					
AL185	1.011	1.033	0.927	1.061	1.171					
	74.3%	66.6%	74.5%	81.8%	85.7%					
	11.9%	4.4%	17.3%	15.2%	11.5%					
RP434	-0.770	-0.604	-0.783	-0.750	-1.129	-0.700	-0.902			
	17.3%	18.8%	16.1%	21.4%	6.4%	23.3%	14.7%			
	63.1%	56.3%	64.2%	67.9%	74.2%	60.0%	67.2%			
RP478	0.644	0.859	0.678	0.437	0.175					
	62.7%	70.7%	62.7%	56.3%	47.5%					
	23.2%	17.1%	22.1%	25.1%	40.0%					
662	1.263 (0.299)					1.315	1.216	0.362	0.251	0.043
	83.8% 53.1%					85.5%	82.3%	55.4%	51.9%	42.5%
	11.3% 28.9%					10.3%	12.2%	26.6%	32.4%	35.1%
	57.2%	56.1%	53.6%	55.9%	45.5%	54.4%	48.5%	55.4%	51.9%	42.5%

<u>Learning basic number facts</u>

The use of calculators to help children learn basic facts [WN236] was supported by only 47.3% of the professional populations sampled. Apparently, this reflects a belief that the basic facts must be learned <u>first</u>, before calculators are used; that calculators could facilitate the learning of the facts (as indicated by research, e.g., Shumway, 1978) is apparently not accepted by many. Even the SP and TE samples are less in favor of this use of calculators [668] than they are of other uses (58.4%). The MT sample is decidedly less supportive than other samples; this may reflect the belief that students come to high school without knowing basic facts (as a <u>few</u> students do), and that these students <u>must</u> learn <u>without</u> calculators what they have <u>already</u> failed to learn without calculators.

Learning basic number facts

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN236	-0.454	-0.280	-0.711	-0.350	-0.156					
	36.1%	40.0%	27.3%	47.5%	43.8%					
	57.4%	55.0%	64.4%	50.0%	46.9%					
668	0.434					0.414	0.453			
	58.4%					56.6%	60.0%			
	31.1%					31.1%	31.2%			
	47.3%									

Learning why an algorithm works

There is moderate support for using calculators for learning why an algorithm works, with only 65.1% of the samples favoring the three items [WN239, WN248, 667]. The SP sample is strong supportive (80.8%), even more so than the TE sample (69.8%), which is at about the same level as the AT sample. The JC and MA samples responded differently to WN239 (which more than 65% supported) and WN248 (which less than 48% supported). This apparently is a function of the items: WN239 refers to "learning properties of different operations", while WN248 refers explicitly to "learning why the long division algorithm works". These two samples saw a difference in intent between the two items, or perhaps they have qualms about using calculators in connection with division (this will also be noted in the section on "using calculators for calculating").

Learning why an algorithm works

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN239	0.589	0.848	0.298	0.850	0.562					
	62.7%	67.6%	55.4%	70.0%	65.6%					
	24.3%	16.2%	32.3%	20.0%	25.0%					
WN248	0.531	0.840	0.533	0.250	-0.094					
	57.5%	65.0%	60.0%	47.5%	37.5%					
	25.7%	15.0%	25.0%	25.0%	50.0%					
667	1.079					1.265	0.909			
	75.1%					80.8%	69.8%			
	17.1%					11.9%	22.0%			
	65.1%	66.3%	57.7%	58.8%	51.6%	80.8%	69.8%			

Checking answers

When the specific way in which calculators are used is considered, discrepancies across types of use as well as across populations are noted. As was reported previously, checking answers is a use of calculators which is non-controversial. It is agreed upon by almost every group, with 92.7% of all samples expressing support; on only one item [WN245] did only one group (MA) fail to rank it first among the possible uses of calculators. Professional samples were asked about the appropriateness of using calculators to check answers within the specific areas of algebra, whole numbers, ratio and proportion, and measurement. When the data from these samples for items AL183, WN245, RP474, and MS613 are compared with results from item 664, responded to by the SP, TE, and lay samples, the status does not change. It is interesting to note that, across items, the AT, SP, and TE samples are most supportive, and the MA sample is least supportive of this use of calculators.

Checking answers

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL183	1.619	1.778	1.582	1.545	1.400					
	92.5%	96.7%	92.7%	90.9%	82.9%					
	2.6%	0.0%	2.7%	6.1%	5.7%					
WN245	1.449	1.650	1.339	1.512	1.156					
	89.1%	95.0%	85.1%	90.3%	84.4%					
	6.8%	2.0%	10.7%	4.8%	9.4%					
RP474	1.668	1.707	1.712	1.562	1.525					
	92.7%	93.9%	94.1%	90.7%	87.5%					
	3.8%	3.0%	4.2%	3.1%	5.0%					
MS613	1.594	1.667	1.667	1.406	1.325					
	92.4%	96.4%	94.1%	87.5%	80.0%					
	5.0%	2.7%	4.2%	9.4%	10.0%					
664	1.817	(1.238)				1.818	1.817	1.261	1.183	1.211
	96.3%	89.2%				96.7%	96.1%	89.5%	89.4%	87.4%
	1.1%	5.3%				1.6%	0.6%	5.2%	6.7%	3.2%
	92.0%	95.5%	91.5%	89.9%	83.7%	96.7%	96.1%	89.5%	89.4%	87.4%

Solving word problems

Support for the use of calculators to solve word problems ranged from 50.9% to 73.1% for the AT, MT, JC, and MA samples. This is a contradiction of the beliefs of the educators cited by Suydam (1976) who expressed a strong argument that calculators could be used to facilitate the teaching of problem solving because the burden of computation could be removed, allowing a focus on the process of problem solving. It should be noted that the SP and TE samples supported this use of calculators (94% and 88.7%, respectively), in contrast to other samples; the JC sample was also supportive (80.5%) within the area of whole numbers [WN242]. The lay samples, and in particular the PT sample, were not supportive; perhaps the PT sample did not understand the implications of the item.

Solving (word) problems

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL180	0.169	0.422	0.000	0.424	-0.200					
	50.9%	54.5%	47.7%	66.7%	37.1%					
	38.9%	31.1%	42.2%	33.3%	54.3%					
WN242	0.752	0.820	0.711	0.951	0.437					
	73.1%	74.0%	71.9%	80.5%	65.7%					
	19.7%	18.0%	21.5%	12.2%	28.1%					
RP475	0.574	0.566	0.424	0.719	0.925					
	64.4%	65.7%	57.6%	71.9%	75.0%					
	28.3%	26.3%	33.9%	18.8%	25.0%					
665	1.455	(0.171)				1.483	1.428	0.323	0.039	-0.426
	91.3%	49.0%				94.0%	88.7%	55.1%	44.4%	24.5%
	5.4%	30.8%				3.3%	7.3%	26.0%	36.5%	46.8%
	65.7%	64.7%	59.1%	73.0%	59.3%	94.0%	88.7%	55.1%	44.4%	24.5%

Doing homework

For the eight items on using calculators for doing homework, the percentage of support across samples ranges from 24% to 89.9%. There is variance of two types. First, some samples are decidedly more supportive than others — the SP and TE samples (who are in general supportive of calculator use) give support at the 86.7% and 89.9% levels, respectively; one sample, PT, is decidedly not in favor of this use of calculators (70.5% disagree with the statement); and the PR and SB samples give it low levels of support (50.3% and 45.8%, respectively). Second, the level of support varies by content area. Thus, there is much stronger support for using calculators to do homework in (1) probability and statistics (84.5%) and (2) ratio and proportion (70.9%) than for homework with fractions (36.5%) or geometry (54.7%). Interestingly, doing homework with decimals [FD72], whole numbers, and measurement all receive moderate support across samples (60% to 66%), although there is variance between samples.

Doing homework

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD71	-0.300	-0.253	-0.293	-0.162	-0.720					
	36.5%	36.3%	39.6%	35.1%	24.0%					
	55.6%	58.6%	52.6%	45.9%	72.0%					
FD72	0.480	0.390	0.564	0.649	0.200					
	64.9%	60.0%	70.1%	67.5%	56.0%					
	28.7%	34.0%	24.8%	21.6%	36.0%					
WN237	0.341	0.158	0.281	0.800	0.581					
	60.1%	53.5%	59.5%	75.0%	64.5%					
	31.8%	36.6%	34.7%	17.5%	22.6%					
GM340	0.371	0.346	0.213	0.590	0.641					
	54.7%	54.3%	51.9%	56.4%	61.5%					
	29.6%	27.1%	37.0%	23.1%	20.6%					
PS420	1.337	0.894	1.452	1.758	1.857					
	84.5%	71.3%	87.8%	97.0%	100.0%					
	8.1%	14.9%	6.9%	0.0%	0.0%					
RP472	0.733	0.449	0.873	0.781	0.975					
	70.9%	63.2%	75.5%	68.8%	77.5%					
	19.7%	24.5%	16.1%	28.2%	12.5%					
MS610	0.660	0.405	0.733	1.094	0.800					
	66.0%	60.3%	67.5%	78.2%	67.5%					
	22.1%	28.8%	21.7%	9.4%	15.0%					
661	1.181	(0.070)				1.030	1.321	0.238	0.034	-0.779
	88.4%	45.5%				86.7%	89.9%	50.3%	45.8%	19.0%
	6.5%	35.5%				8.6%	4.6%	28.4%	37.4%	70.6%
	63.5%	57.0%	64.6%	68.3%	64.4%	86.7%	89.9%	50.3%	45.8%	19.0%

Taking a test

There is very little support (18.1% to 57.4%) for using calculators on tests in specific areas, except for tests on probability and statistics, where there is strong support (80%); the MA and JC samples were particularly supportive (90.9% and 100%, respectively). And the SP and TE samples were more supportive in general than others. On most of the items, the support comes more from the "b" response, "only in special circumstances", than from the "a" response, "very appropriate". There is more support for using calculators for geometry, ratio and proportion, measurement, and especially probability and statistics, than for fractions and decimals, algebra, and whole numbers. In other words, there is less concern about using calculators when it makes little difference whether or not they are used. On the other hand, the PT sample expressed strong disapproval (73.7% disagreed). The fact that many tests would need to be redesigned, to make them plausible in assessing particular goals if calculators were used, may be a factor in the responses to this set of items.

Taking a test

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD77	-0.756	-0.830	-0.735	-0.459	-1.000					
	22.9%	21.0%	23.9%	27.0%	20.0%					
	67.7%	70.0%	66.7%	59.4%	76.0%					
FD78	-0.351	-0.600	-0.248	0.162	-0.600					
	38.0%	29.0%	42.7%	51.3%	32.0%					
	53.4%	61.0%	49.6%	40.5%	60.0%					
AL176	-0.131	0.056	-0.345	0.273	-0.314					
	46.2%	51.1%	40.0%	60.6%	40.0%					
	48.9%	40.0%	57.3%	36.4%	57.1%					
WN238	-1.140	-1.240	-1.124	-1.025	-1.031					
	18.1%	16.0%	19.0%	20.0%	18.8%					
	78.2%	81.0%	77.7%	72.5%	78.1%					
GM345	0.213	0.073	0.037	0.675	0.513					
	51.9%	46.3%	46.7%	67.5%	61.5%					
	35.8%	37.8%	42.0%	22.5%	28.2%					
PS418	1.174	0.819	1.200	1.606	1.750					
	80.0%	67.0%	82.6%	90.9%	100.0%					
	11.5%	21.2%	9.5%	0.0%	0.0%					
RP471	0.213	0.186	0.068	0.344	0.600					
	57.4%	55.6%	54.7%	62.5%	65.0%					
	37.4%	38.1%	41.9%	34.4%	25.0%					
MS607	0.135	-0.080	0.192	0.469	0.300					
	51.4%	41.1%	55.0%	65.7%	57.5%					
	36.8%	42.0%	33.4%	34.4%	37.0%					

Taking a test (continued)

663	0.838	(-0.360)				0.652	1.009	-0.186	-0.453	-1.137
	79.2%	30.8%				74.8%	83.1%	35.7%	26.8%	11.6%
	12.4%	48.7%				17.2%	8.0%	42.8%	52.6%	73.6%
	47.6%	40.9%	45.6%	55.7%	49.4%	74.8%	83.1%	35.7%	26.8%	11.6%

Solving equations

It is interesting that the degree of support for using calculators to solve algebraic equations is consistent for all three items across samples at the 54% level. However, the MT sample, responsible for teaching this content in algebra, gives divergent support to the three items. Highest support (67.3%) is given to solving systems of linear equations [AL182]. Less support (56.4%) is given to evaluating a formula [AL179], and the MT sample is divided regarding the use of calculators for "finding the solution of an equation" [AL178].

The three geometry items [GM338, GM341, GM342] all deal with the evaluation of geometric formulas. The level of support is highest (83.4%) regarding use of the Pythagorean theorem [GM338] and lowest (68%) for a problem involving the volume of a cone [GM342]. These levels are higher than the levels for corresponding algebra items.

The SP and TE samples again give strong support (85.2%) on the generic (general) item [670].

Solving equations

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL178	0.220	0.278	-0.091	0.606	0.686					
	54.8%	54.4%	44.5%	69.7%	74.3%					
	36.2%	32.2%	48.2%	24.3%	20.0%					
AL179	0.418	0.500	0.373	0.515	0.257					
	54.9%	53.4%	56.4%	60.7%	48.6%					
	34.7%	27.7%	37.2%	36.4%	42.9%					
AL182	0.276	0.456	0.009	0.303	0.629					
	54.1%	55.6%	47.3%	57.6%	68.6%					
	35.8%	30.0%	41.8%	39.4%	28.6%					
GM338	1.233	1.213	1.167	1.385	1.308					
	83.4%	81.3%	83.3%	87.1%	84.6%					
	10.5%	7.5%	12.9%	7.7%	12.8%					
GM341	0.891	0.900	0.815	1.000	0.974					
	72.2%	70.1%	72.2%	79.5%	69.2%					
	19.5%	18.8%	21.3%	15.4%	20.5%					
GM342	0.780	0.840	0.676	0.950	0.769					
	68.0%	66.6%	67.6%	75.0%	64.1%					
	24.2%	19.7%	27.7%	20.0%	28.2%					
670	1.166					1.140	1.190			
	85.2%					86.0%	84.4%			
	7.5%					8.0%	7.0%			
	67.5%	63.6%	61.9%	71.6%	68.2%	86.0%	84.4%			

Doing a chain of calculations involving several different operations

Using a calculator to do a chain of calculations involving different operations is perceived favorably by all samples, with support at 79.1% when a whole number context is specified [WN247] and at 95.4% for a generic (general) item [666], given only to the SP and TE samples. For a specific example of a chaining operation [PS419, calculating the probability that several events will occur in a certain sequence], the support level is 84.8%. As noted in "using calculators for calculating", when more than one operation is involved, support tends to be higher.

Doing a chain of calculations involving several different operations

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN247	0.952	1.071	0.851	0.976	0.937					
	79.1%	81.8%	76.9%	78.1%	81.3%					
	15.0%	11.2%	17.4%	14.6%	18.7%					
666	1.642					1.619	1.664			
	95.4%					95.3%	95.4%			
	1.6%					1.6%	1.5%			
PS419	1.311	1.191	1.400	1.394	1.250					
	84.8%	80.9%	87.9%	87.9%	82.1%					
	7.8%	8.5%	6.9%	6.1%	10.7%					

Computing area

There is more support for using calculators to compute area than there is for many other purposes. The SP and TE samples are most positive (93.5%) on the general item [671], but each of the other samples gives it support ranging from 66% to 76%. As might be expected, support is stronger where the calculation becomes more involved. Thus, item MS612 (finding the number of rolls of wallpaper necessary to cover the walls of a room whose dimensions are given) receives fairly good support (71.2%), while on MS614 (finding the area of the opening of a fireplace 125 cm tall and 205 cm wide) support is weaker (59.6%). Computing the area of a trapezoid [GM337] is given moderate support (65.2%).

Where decimals are involved [FD80], using calculators receives much stronger support (81.0%) across samples. It should also be noted that use of calculators for multiplication generally receives support (see "using calculators for calculating").

Computing area

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD80	1.115	0.950	1.145	1.324	1.320					
	81.0%	73.0%	82.9%	91.9%	88.0%					
	13.6%	21.0%	10.2%	8.1%	8.0%					
GM337	0.648	0.800	0.500	0.775	0.615					
	65.2%	67.6%	62.0%	70.0%	64.1%					
	27.4%	22.6%	33,3%	20.0%	28.2%					
MS612	0.848	0.927	0.717	1.187	0.750					
	71,2%	76.4%	65.0%	81.3%	67.5%					
	20.9%	14.6%	27.5%	9.4%	27.5%					
MS614	0.398	0.420	0.333	0.406	0.525					
	59.6%	61.6%	56.7%	59.4%	62.5%					
	32.2%	28.6%	35.8%	31.3%	32.5%					
671	1.486					1.472	1.500			
	93.5%					94.4%	92.6%			
	2.7%					2.7%	2.7%			
	74.1%	69.7%	66.7%	75.7%	70.5%	94.4%	92.6%			

Making graphs

Support for using calculators in making graphs was at a high level (above 76%) for TE, MA, and SP samples, at a moderate level for the JC sample (approximately 70%), but at a lower level for the AT and MT samples (48.7% to 62.2%). While it would be appropriate for the MT sample to use calculators for this purpose, apparently many do not accept it.

Making graphs

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL177	0.567	0.578	0.291	0.939	1.057					
	63.1%	62.2%	55.5%	72.8%	80.0%					
	29.5%	23.3%	40.9%	21.2%	17.1%					
PS417	0.381	0.319	0.191	0.667	1.036					
	55.5%	53.2%	48.7%	66.7%	78.6%					
	34.5%	32.9%	40.0%	30.3%	21.4%					
669	1.230					1.136	1.316			
	80.8%					76.7%	84.6%			
	7.8%					8.6%	7.0%			
	66.5%	57.7%	52.1%	69.8%	79.3%	76.7%	84.6%			

Using trigonometry

There is strong support (80% to 96%) across all groups for using calculators for trigonometry. Possibly they see the use of calculators as an alternative to the use of tables, and are therefore willing to accept the substitute.

Using trigonometry

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
GM343	1.354	1.148	1.333	1.600	1.590					
	85.4%	80.2%	85.2%	92.5%	89.8%					
	7.9%	7.4%	11.2%	0.0%	7.7%					
672	1.630					1.636	1.625			
	96.0%					95.6%	96.4%			
	0.6%					1.4%	0.0%			
	90.7%									

Using calculators: General availability

The operation of a programmable calculator [CL627] is strongly supported (82.7%) within the computer literacy content area; having small programmable calculators or computers available is also well-supported (72.7%) in one whole-number item [WN218]. Having a calculator available for every student [WN211] also receives support at the 72.5% level. However, giving instruction for using a four-function calculator [WN194] is given only minimal support (57.5%).

Using calculators: General availability

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN194	0.511	0.295	0.284	0.222	0.359	0.816	1.109			
	57.5%	45.2%	51.3%	47.2%	51.2%	69.8%	81.3%			
	19.8%	25.3%	24.8%	27.7%	23.1%	13.2%	4.7%			
CL627	1.113	0.991	1.161	1.062	1.195	1.212	1.131			
	82.7%	75.9%	83.9%	90.6%	85.3%	88.4%	82.0%			
	5.5%	8.0%	4.2%	9.4%	4.9%	1.9%	4.9%			
WN218	0.785	0.804	0.715	0.821	0.941					
	72.7%	72.1%	71.6%	74.4%	76.5%					
	14.6%	11.4%	17.1%	18.0%	11.8%					
WN211	0.790	0.792	0.699	1.000	0.882					
	72.5%	69.8%	72.3%	76.3%	76.5%					
	17.5%	13.5%	21.1%	13.2%	20.6%					
	71.4%	65.8%	69.8%	72.1%	72.4%	79.1%	81.7%			

Using calculators: When

Very few (19.5%) in the four samples AT, MT, JC, and MA believe that calculators should be used instead of paper-and-pencil algorithms [WN222]. Rather, that their use should be postponed until after pencil-and-paper algorithms are learned [WN224, 762] was approved by over 80% of the AT, MT, JC, MA, and SB samples, with the PT sample concurring at the 93.4% level. The SP and TE samples express far less support (54.2% and 50.9%) when asked this item specific to the elementary level [688] and secondary level [704]. Indeed, when asked if mental calculations (without the aid of paper-and-pencil or calculator) should be taught [WN192, 752], 91.0% of the professional samples and 87.6% of the lay samples agreed.

Requiring students who have not learned paper-and-pencil computation by the end of grade 8 to take a calculator course in grade 9 [WN233, 778] is acceptable to only 45.4% of the professional samples, with AT, SP, and TE samples most in favor, and only 29.6% of the lay samples. Using calculators for problem solving is supported by 76.1% of the professional samples [PB528], while only 38.7% of the lay samples would allow their use for practice [768].

Using calculators: When

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN222	-0.669	-0.845	-0.574	-0.732	-0.487					
	19.5%	17.9%	22.2%	17.1%	18.0%					
	62.5%	69.0%	60.1%	63.4%	53.9%					
WN224	1.224	1.286	1.296	1.171	0.949					
	82.0%	83.4%	87.0%	75.7%	71.8%					
	8.8%	7.2%	7.4%	9.7%	15.4%					
762	1.091							0.844	1.286	1.644
	80.3%							74.0%	85.7%	93.4%
	13.6%							19.1%	7.7%	4.4%
688	0.376					0.371	0.381			
	54.2%					53.7%	54.8%			
	29.2%					29.2%	29.2%			
704	0.329					0.227	0.425			
	50.9%					46.6%	55.1%			
	34.8%					38.0%	31.9%			
WN192	1.388	1.389	1.294	1.568	1.487	1.461	1.297			
	91.0%	91.5%	90.8%	91.9%	89.8%	93.4%	87.5%			
	2.6%	3.2%	2.8%	5.4%	0.0%	0.0%	4.7%			
752	1.217							1.229	1.161	1.289
	87.6%							89.1%	85.0%	86.7%
	6.4%							6.2%	7.6%	4.4%
WN233	0.111	0.304	-0.050	-0.265	-0.400	0.288	0.393			
	45.4%	50.0%	37.8%	35.3%	23.3%	54.3%	60.7%			
	34.6%	30.4%	38.6%	44.1%	46.7%	32.2%	24.6%			

Using calculators: When (continued)

778	-0.337					-0.386	-0.102	-0.400
	29.6%					27.2%	37.5%	32.0%
	47.5%					48.9%	39.7%	52.0%
PB520	0.976	0.859	0.838	1.469	1.267			
	76.2%	70.6%	74.3%	90.7%	83.3%			
	13.1%	16.5%	16.2%	0.0%	6.7%			
768	-0.172					-0.058	-0.298	-0.570
	38.7%					42.2%	34.3%	26.9%
	45.9%					42.4%	50.0%	58.0%

Using calculators with slower students

The AT, MT, JC, and MA samples were asked if calculators should be used to allow slower students "to keep up with the rest of the class" within the areas of whole numbers [WN226] and fractions and decimals [FD55]. Negative coefficients of agreement for all samples indicate that they do not approve of this idea. The SP and TE samples were divided on the idea at both the elementary [678] and secondary [694] levels. The PR sample tended to be divided on the general idea [785], but the SB and PT samples disapproved (54.1% and 62.0%, respectively). Perhaps the quoted phrase was interpreted in a way which would make the use of calculators harmful to these students. Or perhaps the belief that some researchers have reported, that even slower students must learn algorithmic procedures without calculators, was operating.

Using calculators with slower students

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN226	-0.614	-0.452	-0.546	-0.878	-0.872					
	20.6%	28.5%	18.5%	14.6%	15.4%					
	58.4%	51.2%	55.6%	68.3%	71.8%					
FD55	-0.518	-0.216	-0.606	-0.780	-0.771					
	20.0%	31.4%	16.6%	9.7%	11.5%					
	55.4%	47.0%	56.7%	65.9%	62.9%					
678	0.163					0.092	0.226			
	43.1%					38.2%	47.6%			
	31.5%					34.2%	29.1%			
694	0.094					0.173	0.019			
	44.3%					48.0%	40.8%			
	32.4%					31.3%	33.3%			
785	-0.349							-0.250	-0.494	-0.800
	27.7%							31.3%	20.0%	16.0%
	48.3%							44.9%	54.1%	62.0%
	31.1%	30.0%	17.6%	12.2%	13.5%	43.1%	44.2%	31.3%	20.0%	16.0%

Using calculators for calculating

Reactions to the use of calculators appear to differ depending on the operation and on the magnitude of the numbers involved.

For addition, using calculators is strongly favored (80.3%) to find the sum of several items [WN249]; finding averages received moderate support (61.9%), as did finding the sum of several measures (67.0%) [PS416, MS615]. In the latter two cases, a second operation is also needed, and this may account for these being accepted, or it may just be that any time three or more numbers are involved, calculators are acceptable.

For subtraction, however, the use of calculators is not favored (49% to 74% disagree) [WN243, WN246, GM339]; only for finding coordinates [GM344] did it seem reasonable to a sizeable number (63.9%).

The items in which calculators are used for multiplication generally received approval from at least 50% of the samples [FD79, WN241, RP473, RP476, RP477, RP479, RP480, MS608, MS609]. However, calculators are not acceptable for "easy" multiplication (74% disagreed with item WN244), or for an "easy" volume problem [MS611], on which 71.3% disagree. However, on what was perceived to be a more difficult volume problem [MS606], 83.5% would allow the use of calculators.

Using calculators for division is weakly accepted (54.1%) for doing a division like 641 divided by 17 [WN240] and more strongly accepted (69.3%) for finding the divisors of a given number [WN250]. Reaction is divided on finding equivalent forms of a given fraction with a calculator [FD75], but calculators are rejected for reducing fractions [FD76].

Reactions are also divided on writing fractions as decimals in order to operate with them on calculators at the elementary level [FD1], and tend to be slightly negative at the secondary level [FD11], with 54% disagreeing with the item. The lay samples, and particularly the PT sample, reject the item, with 69% to 90% disagreeing [769]. Generating many answers to problems and then checking for correctness with the calculator is also acceptable to two-thirds of the samples at both the elementary and secondary levels [PB482, PB492]. The calculator is acceptable at the 62.2% level for simplifying expressions with irrationals [AL184], but is not acceptable (60.8% disagree) for finding the midpoint of a line segment given the coordinates of the endpoints [GM336].

Using calculators for calculating

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN249	1.153	1.297	1.066	0.875	1.375					
	80.3%	85.1%	76.9%	72.5%	87.5%					
	13.6%	9.9%	16.5%	22.5%	3.1%					
PS416	0.548	0.457	0.565	0.515	0.821					
	61.9%	58.5%	63.5%	57.6%	71.5%					
	31.5%	32.9%	32.2%	30.3%	25.0%					
MS615	0.726	0.884	0.613	0.812	0.550					
	67.0%	70.6%	65.5%	68.8%	60.0%					
	24.4%	17.8%	27.7%	25.0%	32.5%					
WN243	-0.167	-0.040	-0.215	-0.195	-0.344					
	44.6%	49.0%	45.5%	39.1%	34.4%					
	49.0%	46.0%	49.6%	53.6%	50.0%					
WN246	-0.721	-0.480	-0.843	-0.561	-1.219					
	27.2%	31.0%	23.4%	34.1%	9.4%					
	65.3%	58.0%	68.6%	61.0%	81.3%					
GM339	-0.449	-0.125	-0.636	-0.410	-0.641					
	32.1%	38.8%	30.8%	30.7%	23.1%					
	60.7%	47.6%	68.2%	64.1%	64.1%					
GM344	0.692	0.734	0.546	0.825	0.872					
	63.9%	60.7%	62.1%	65.0%	74.4%					
	18.8%	13.9%	24.1%	15.0%	18.0%					
FD79	0.280	0.350	0.171	0.486	0.200					
	51.3%	53.0%	48.7%	56.7%	48.0%					
	37.3%	36.0%	40.2%	32.4%	36.0%					

Using calculators for calculating (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN241	0.211	0.150	0.231	0.317	0.187					
	57.1%	54.0%	60.3%	58.5%	53.1%					
	36.0%	39.0%	35.6%	34.2%	31.3%					
RP473	0.358	0.459	0.237	0.187	0.600					
	56.3%	59.2%	51.7%	53.2%	65.0%					
	36.1%	33.6%	39.8%	37.5%	30.0%					
RP476	0.322	0.333	0.229	0.406	0.500					
	55.7%	55.5%	51.7%	59.4%	65.0%					
	35.7%	33.3%	38.1%	34.4%	35.0%					
RP477	0.660	0.768	0.534	0.645	0.775					
	68.4%	71.7%	65.3%	67.7%	70.0%					
	25.4%	18.2%	30.5%	25.9%	27.5%					
RP479	0.401	0.424	0.331	0.437	0.525					
	61.3%	63.7%	58.5%	62.5%	62.5%					
	34.6%	31.4%	37.3%	24.4%	35.0%					
RP480	0.699	0.717	0.602	0.719	0.925					
	68.5%	69.7%	67.0%	65.7%	72.5%					
	24.6%	21.2%	27.1%	25.0%	25.0%					
MS608	1.023	1.098	1.000	1.031	0.875					
	77.6%	77.7%	78.4%	78.2%	75.0%					
	14.8%	12.5%	16.6%	12.5%	17.5%					
MS609	0.914	0.723	0.942	1.250	1.100					
	73.4%	66.9%	73.3%	84.4%	82.5%					
	19.8%	21.4%	20.8%	12.5%	17.5%					

Using calculators for calculating (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN244	-0.993	-0.899	-0.975	-1.073	-1.250					
	20.2%	22.3%	21.5%	19.5%	9.4%					
	74.0%	72.7%	73.6%	73.2%	81.3%					
MS611	-0.815	-0.748	-0.917	-0.875	-0.650					
	24.1%	25.2%	21.7%	18.8%	32.5%					
	71.3%	69.3%	73.4%	75.1%	67.5%					
MS606	1.208	1.171	1.167	1.437	1.250					
	83.5%	82.0%	82.5%	90.6%	85.0%					
	11.5%	10.8%	13.3%	6.2%	12.5%					
WN240	0.154	0.090	0.167	0.300	0.125					
	54.1%	50.0%	58.4%	57.5%	46.9%					
	37.0%	39.0%	38.3%	35.0%	28.2%					
WN250	0.683	0.871	0.425	0.925	0.750					
	69.3%	74.3%	61.6%	77.5%	71.9%					
	22.5%	17.8%	29.1%	15.0%	21.9%					
FD75	-0.082	0.070	-0.137	-0.108	-0.400					
	40.5%	46.0%	38.4%	37.8%	32.0%					
	44.8%	44.0%	43.6%	48.6%	48.0%					
FD76	-0.323	-0.200	-0.333	-0.243	-0.880					
	33.3%	37.0%	33.3%	32.4%	20.0%					
	55.2%	51.0%	53.8%	56.7%	76.0%					
FD1	0.012	0.224	-0.056	-0.381	-0.571	0.176	0.033			
	46.8%	55.1%	46.3%	38.1%	28.6%	51.0%	40.3%			
	42.8%	40.8%	44.5%	52.3%	57.2%	37.3%	41.0%			

Using calculators for calculating (continued)

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD11	-0.407	0.064	-0.657	-0.429	-1.667	0.068	-0.606			
	33.3%	42.6%	23.9%	33.3%	0.0%	47.4%	30.9%			
	54.0%	36.2%	64.2%	52.3%	93.3%	39.0%	60.5%			
769	-0.844							-0.794	-0.770	-1.320
	15.4%							16.0%	18.3%	6.0%
	72.4%							70.7%	69.0%	90.0%
PB482	-0.152	-0.071				-0.235	-0.213			
	36.5%	39.4%				33.3%	34.5%			
	42.6%	40.5%				45.1%	44.2%			
PB492	-0.273		-0.270	-0.036	-0.792	-0.220	-0.239			
	30.0%		27.9%	39.3%	20.9%	32.2%	31.0%			
	49.5%		47.7%	39.2%	70.8%	45.8%	52.1%			
AL184	0.509	1.000	0.327	0.242	0.086					
	62.2%	73.0%	60.0%	54.5%	48.6%					
	31.9%	18.0%	37.3%	39.4%	42.9%					
GM336	-0.475	-0.190	-0.593	-0.462	-0.744					
	27.9%	30.4%	27.7%	28.2%	23.1%					
	60.8%	45.6%	66.7%	64.1%	71.8%					

Special keys or features

What support would be given by teachers and others to the classroom use of calculators that have special displays or capabilities (e.g., designed to handle fractions, equations of lines, etc.)? In general, this idea is supported by the SP, TE, and PR samples (71.0%) at the elementary level [705] and at the secondary level (by 86.0%) [717]. However, results are generally divided when specific special features are mentioned. Some support (67.5%) is accorded the desire for a calculator on which fractions are the mode of input and output [FD41]. But there is no strong agreement or disagreement on the desirability of a variety of other special features for algebra [AL146, AL153], ratio and proportion [RP447, RP448], or measurement [MS586]. These features are ideas that did not exist on calculators at the time of the survey; perhaps the divided response reflects a "wait-and-see" attitude.

Special keys or features

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
705	0.774	(0.728)				0.707	0.838	0.728		
	71.0%	70.4%				67.3%	74.4%	70.4%		
	20.3%	18.4%				22.6%	18.1%	18.4%		
717	1.163	(0.954)				1.283	1.054	0.954		
	85.9%	78.9%				90.1%	82.1%	78.9%		
	7.8%	10.6%				3.9%	11.3%	10.6%		
FD41	0.589	0.680	0.625	0.696	0.030					
	67.5%	71.0%	67.5%	73.9%	48.5%					
	23.0%	22.0%	20.9%	17.3%	42.5%					
AL146	0.181	0.319	0.357	-0.636	-0.036					
	51.1%	54.3%	58.3%	24.2%	42.8%					
	31.1%	22.3%	26.9%	63.7%	39.3%					
AL153	0.044	0.064	0.278	-0.333	-0.536					
	41.2%	39.3%	53.0%	27.3%	14.2%					
	33.0%	31.9%	25.2%	45.5%	53.5%					
RP447	-0.071	0.127	-0.051	-0.414	-0.385					
	43.2%	49.0%	42.9%	37.9%	33.3%					
	38.8%	32.3%	38.8%	51.7%	46.1%					
RP448	-0.235	0.069	-0.357	-0.690	-0.385					
	35.4%	46.1%	27.6%	24.1%	35.9%					
	42.5%	35.3%	44.9%	58.6%	43.6%					
MS586	-0.092	-0.248	-0.070	0.267	0.0					
	39.6%	34.3%	37.5%	56.7%	50.0%					
	39.7%	46.7%	36.0%	30.0%	40.6%					

<u>Summary: Use of Calculators</u>

- Professional samples in general were much more supportive of increasing emphasis on calculators than are lay samples. For example, 51% of the AT and MT samples would increase emphasis on calculators, while only 16% of the PT sample would do so.
- The use of calculators to develop ideas and concepts was supported by more than 80% of the SP and TE samples; acceptance by the PR, SB, and PT samples was lower, ranging from 42.5% to 55.4%.
- Moderately strong support was given for using the calculator to develop ideas and to explore values of algebraic expressions and limits of sequences.
- The use of calculators to help children learn basic facts was given very little support, apparently reflecting the belief that basic facts should be learned before calculators are used.
- Using calculators to learn why an algorithm works received moderate support (65.1%).
- Checking answers is a non-controversial use of calculators, ranking first among possible uses of calculators in almost every area.
- Use of calculators for solving word problems was strongly supported by the SP and TE groups and given moderate support by the AT, MT, JC, and MA samples. However, the lay samples were not supportive of the idea; in particular, the PT sample tended to opposed it.
- Using calculators for doing homework was <u>supported</u> by more than 85% of the SP and TE samples, and <u>opposed</u> by more than 70% of the PT sample.
- Support for the use of calculators to do homework depends upon the content area involved. It was strongest for the areas of probability and statistics, and ratio and proportion.

- There was very little support for using calculators to take tests, except for the area of probability and statistics. In general, the PT sample expressed strong disapproval (73.7% disagreed).
- Solving equations with the use of a calculator was given strong support for geometric formulas, but minimal support for algebra.
- The MT sample gave moderately strong support (67.3%) to use of a calculator in solving systems of linear equations, and minimal support (56.4%) for calculator use in evaluating a formula. They were divided regarding the use of calculators for "finding the solution of an equation".
- Using a calculator to do a chain of calculations involving different operations was perceived favorably by all samples.
- Using a calculator to compute area received general support, although this support was much stronger when the problem is more complex or when decimals are involved.
- Using calculators in making graphs was given moderately strong support by the JC, MA, SP, and TE samples. However, there was a lower level of support for this idea by the AT and MT samples.
- Use of calculators in trigonometry was given very strong support by all groups.
- Classroom availability of four-function calculators and programmable calculators was supported by more than 70% of the samples.
- The use of calculators to allow slower students "to keep up with the rest of the class" was generally opposed.
- When several items are involved in addition, the use of calculators was strongly supported (80.3%). But the use of calculators for subtraction was not favored (49% to 74% disagreed).
- Use of calculators for multiplication generally received minimal support

(above 50%) unless the problems were perceived as "easy". There was similar support for using calculators for division.

- The general idea of calculators that have special displays or capabilities was given moderate to strong support by the SP, TE, and PR samples. However, results were divided when specific features were suggested.

Use of Computers

Two introductory items requested reactions to the amount of emphasis that should be given to the use of computers in the 1980s. One, UF6, pertained to the "use of computers and other technology"; 74.4% of the professional samples and 80.2% of the lay samples queried indicated that increased emphasis should be given to this topic, with 3.5% and 5.2%, respectively, indicating less emphasis, and 22.1% and 14.6% undecided or neutral. The MT and PR samples were more supportive than other samples. The second item, UF39, pertained to "computer literacy"; 77.6% of the professional samples indicated that this topic should be given increased emphasis, 4.1% thought it should receive less emphasis, and 22.3% were undecided or neutral. The SP and TE samples, followed by the MT sample, favored increased emphasis more strongly than did other samples.

Specific items pertaining to computers were clustered in the computer literacy portion of the survey, but some items appeared on other strands. Items from across strands and clusters have been considered in the following sections:

(1) Instructional materials for use with computers

(2) Writing programs

(3) Computer languages

(4) Power and uses of computers

(5) Computer courses: Literacy

(6) Computer courses: Other

(7) Computer components

(8) Equipment: Computers or computer access

(9) Equipment: Computers with specific characteristics

Emphasis on computers or computer literacy

	Total	AT	MT	JC	MA	SP	TE	Total	PR	SB	PT
UF6	0.960	0.897	1.101			0.829	0.882	1.068	1.149	0.957	0.976
	74.4%	71.9%	80.4%			67.1%	72.3%	80.2%	85.6%	71.0%	78.0%
	3.6%	3.4%	3.9%			3.9%	2.6%	5.2%	4.0%	4.3%	12.2%
UF39	0.988	0.832	1.076	0.510	0.719	1.256	1.092				
	77.6%	67.3%	81.6%	59.1%	66.7%	87.2%	85.5%				
	4.1%	7.5%	4.2%	6.1%	3.5%	2.6%	2.3%				

Instructional materials for use with computers

Providing probability and statistics materials for use with computers [PS386] is supported by 76.0%, with the AT sample favoring such materials by a lower percentage (62.9%) and the JC sample giving them strong support (91.2%). Instruction on the history of computing devices [CL625] is only favored by 56.0%, but having workbooks with algorithms simulating computer processes [CL640] received more support (63.0%). Studying cases where the computer is misused [CL641] and reading formal presenations of computer ideas [CL642] receives little support (42.5% and 31.3% respectively), while giving the teacher detailed notes [CL648] received more support (63.1%). Individual projects [CL645] were also given some support at the 68.1% level, but having students spend more than 50% of their time with individual study materials was approved by only 42.8%. It is unfortunate that, because so few items pertaining to materials for specific content areas were included, there is really little indication of what materials would be used: we know more about what the samples would not use than what they would use.

Instructional materials for use with computers

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PS386	0.844	0.526	0.973	1.176	1.038					
	76.0%	62.9%	80.5%	91.2%	84.6%					
	10.7%	18.6%	8.0%	2.9%	3.8%					
CL625	0.493	0.437	0.487	0.500	0.317	0.596	0.633			
	56.0%	50.0%	56.3%	56.3%	56.1%	59.6%	63.4%			
	15.9%	17.0%	17.6%	12.5%	19.6%	11.5%	13.3%			
CL640	0.630	0.698	0.633	0.576	0.455					
	63.0%	67.0%	61.4%	60.7%	57.5%					
	16.7%	15.1%	15.6%	15.1%	27.3%					
CL641	0.236	0.087	0.243	0.324	0.576					
	42.5%	33.0%	44.8%	45.9%	60.6%					
	24.3%	27.2%	24.3%	21.6%	18.2%					
CL642	-0.146	-0.162	-0.236	-0.081	0.121					
	31.3%	26.6%	33.0%	27.0%	45.5%					
	40.2%	40.0%	44.4%	35.1%	33.4%					
CL645	0.738	0.618	0.785	0.892	0.788					
	68.1%	59.8%	71.9%	75.7%	72.7%					
	11.1%	11.8%	12.1%	8.1%	9.1%					
CL648	0.688	0.843	0.776	0.514	0.121					
	63.1%	71.6%	66.4%	56.7%	33.3%					
	14.3%	10.7%	13.1%	18.9%	24.3%					
CL650	0.263	0.343	0.264	0.135	0.152					
	42.8%	46.1%	43.4%	35.1%	39.4%					
	23.4%	18.6%	23.6%	27.0%	33.3%					

Writing programs

Strong agreement (above 80%) is expressed across samples for writing programs using BASIC [CL618] and for flow charting [CL623]. Some support (63.5%) is given to the use of computer-assisted tutorial instruction to teach programming [CL644], with the need to teach methods for debugging programs [CL620] at approximately the same level (60.4%). Having students spend at least 50% of their time in computer courses writing programs [CL649] is also given support at the 63.1% level; however, the AT sample is far less positive about this item than are other groups.

Little support (44.1%) is given to the use of a trial-and-error discovery-oriented approach to writing programs [CL643]. Few (32.2%) believe that writing programs should be a requirement for high school graduation [CL655], and almost no one (22.8%) believes that programming should be introduced in the elementary school [AL86]. However, 64.7% of the lay samples support the idea that at least one course in mathematics for college-bound students should make extensive use of the computer [780].

Writing programs

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
CL618	1.298	1.116	1.294	1.344	1.415	1.500	1.367			
	87.5%	80.4%	84.9%	93.8%	95.1%	92.3%	93.3%			
	4.8%	9.8%	4.2%	3.1%	0.0%	0.0%	5.0%			
CL623	1.132	1.018	1.235	1.062	0.927	1.269	1.200			
	82.0%	75.0%	88.2%	81.2%	80.5%	86.5%	80.0%			
	3.8%	3.6%	3.4%	3.1%	9.7%	1.9%	3.3%			
CL644	0.661	0.760	0.617	0.514	0.667					
	63.5%	64.0%	65.4%	62.1%	57.5%					
	13.3%	8.0%	15.0%	18.9%	18.2%					
CL620	0.622	0.500	0.695	0.656	0.610	0.827	0.517			
	60.4%	54.4%	63.6%	62.5%	65.9%	65.4%	56.7%			
	18.1%	23.2%	17.0%	6.2%	19.5%	9.6%	23.3%			
CL649	0.693	0.420	0.832	0.865	0.879					
	63.1%	49.0%	68.2%	70.2%	81.8%					
	13.7%	17.0%	14.0%	5.4%	12.1%					
CL643	0.161	0.235	0.150	0.216	-0.091					
	44.1%	45.1%	44.8%	45.9%	36.3%					
	34.4%	31.4%	35.5%	29.7%	45.4%					
CL655	-0.194	-0.505	-0.373	0.033	-0.394	0.308	0.197			
	32.3%	19.4%	25.5%	36.7%	27.2%	52.0%	49.2%			
	49.6%	56.3%	59.8%	40.0%	54.6%	36.6%	34.5%			
AL86	-0.437	-0.526				-0.271	-0.459			
	22.8%	18.9%				28.8%	23.0%			
	52.1%	54.8%				49.1%	50.8%			

Writing programs (continued)

780	0.646	0.641	0.618	0.735
	63.8%	62.7%	67.4%	65.3%
	17.4%	17.7%	20.2%	10.2%

Computer languages

Across samples, the use of BASIC [CL618] is approved (by 87.5%). The use of languages like FORTRAN or COBOL [CL629] is given minimal support (57.2%), while non-computational languages like PLATO [CL626] are considered worthwhile by only a small percentage (31.0%). Surprisingly, the use of machine language [CL624] is approved by a slightly higher percentage (40.8%) of almost all samples, and by a particularly high percentage of the AT sample. It may be that "machine language" is an unfamiliar term to many persons, for it seems strange that the use of a language internal to computer operation would seem essential for mathematics studies, especially in elementary school.

It is interesting to note the relatively large percentage of the samples that express neither support nor non-support for different languages. This is especially true of item CL626, where undecided or neutral response range from 48.1% to 27.9%. Across samples, 41.1% of the respondents fall in this category.

Computer languages

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
CL624	0.240	0.911	0.277	-0.063	-0.341	0.038	-0.350			
	50.8%	75.0%	53.8%	43.8%	31.7%	32.7%	31.7%			
	31.5%	9.8%	30.3%	46.9%	51.2%	34.6%	50.0%			
CL626	0.038	0.232	0.034	-0.219	-0.024	0.019	-0.115			
	31.0%	35.7%	27.9%	25.0%	34.1%	26.9%	32.8%			
	27.9%	19.7%	26.2%	34.4%	36.6%	25.0%	39.3%			
CL629	0.565	0.604	0.630	0.531	0.561	0.538	0.410			
	57.2%	54.9%	59.7%	62.6%	56.1%	59.6%	52.5%			
	16.8%	15.3%	14.3%	12.5%	19.5%	17.3%	24.6%			
CL618	1.298	1.116	1.294	1.344	1.415	1.500	1.367			
	87.5%	80.4%	84.9%	93.8%	95.1%	92.3%	93.3%			
	4.8%	9.8%	4.2%	3.1%	0.0%	0.0%	5.0%			

Power and uses of computers

The goal of understanding the use and power of computers is seen as being more appropriate (60.1%) for algebra [AL144] than for probability and statistics [PS375, 54.5%]. Strongly supported (88.5%) was teaching about the roles of computers in society [CL619], although (somewhat surprisingly) less concern (66.3%) was noted for privacy and security issues [CL621]. Studying about the types of problems computers can solve [CL628] received very strong support (91.3%), while the goal of introducing alternative techniques for solving problems was approved by only 70.4% [CL633]. At this same lower level of support was concern about teaching about computers to prepare for the twenty-first century [CL632], understanding the information-accessing capability of the computer [CL634], and the use of field trips to observe computers being used in business and industry [CL647].

Power and uses of computers

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL144	0.649	0.562	0.661	0.683	0.276	0.845	0.718			
	60.1%	55.2%	60.3%	63.4%	51.7%	68.9%	60.6%			
	9.9%	14.5%	9.9%	7.3%	27.5%	1.7%	4.2%			
PS375	0.531	0.476	0.707	0.500	0.455	0.567	0.344			
	54.5%	56.1%	62.6%	52.9%	51.5%	51.7%	44.3%			
	14.7%	15.9%	11.1%	14.7%	21.3%	15.0%	14.7%			
CL619	1.371	1.225	1.319	1.250	1.293	1.596	1.667			
	88.5%	81.0%	89.1%	90.6%	85.3%	96.2%	95.0%			
	4.8%	7.2%	5.8%	6.3%	4.8%	0.0%	1.7%			
CL621	0.779	0.554	0.798	0.656	0.683	1.077	1.033			
	66.3%	59.8%	64.7%	65.7%	65.9%	76.9%	73.3%			
	13.9%	21.5%	11.8%	12.5%	17.1%	5.8%	10.0%			
CL628	1.353	1.241	1.398	1.469	1.244	1.404	1.443			
	91.3%	89.3%	91.5%	96.9%	85.3%	96.1%	91.8%			
	1.5%	2.7%	1.7%	0.0%	0.0%	0.0%	1.6%			
CL632	1.082	0.905	1.200	1.250	1.231	1.123	0.957			
	81.1%	75.3%	82.7%	80.6%	89.7%	84.2%	80.0%			
	4.4%	7.6%	1.8%	5.6%	2.6%	3.5%	4.3%			
CL633	0.817	0.733	1.000	0.657	0.487	0.893	0.857			
	70.4%	64.8%	78.2%	71.4%	51.3%	75.0%	72.8%			
	8.1%	9.5%	3.6%	17.1%	7.7%	10.7%	7.1%			
CL634	0.988	0.972	1.018	1.029	1.026	0.982	0.929			
	78.9%	77.3%	81.9%	77.1%	84.6%	79.0%	74.3%			
	5.3%	5.6%	4.5%	5.7%	7.7%	8.8%	1.4%			

Powers and uses of computers (continued)

CL647	0.935	1.137	0.963	0.811	0.364
	74.1%	83.4%	74.8%	64.8%	54.6%
	7.6%	4.9%	7.4%	5.4%	18.2%

Computer courses: Literacy

There is virtually no support (6.3%) for teaching computer literacy courses primarily within the social studies curriculum [CL651]. Minimal support (53.0%) is given by the professional samples to requiring a computer literacy course [CL652], but the even less support (34%) was given by the PR, SB, and PT samples [757]. On the other hand, a larger proportion of the lay samples (79%) support integration K-12 of computer literacy topics [754] than do professional samples [CL656]; however, it should be noted that the AT sample, plus the MT and JC samples, account for the lowered percentage (67.7%).

Computer courses: Literacy

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
CL651	-1.094	-0.816	-1.311	-1.067	-1.515	-0.942	-1.115			
	6.3%	10.7%	1.9%	10.0%	0.0%	9.6%	4.9%			
	81.2%	69.9%	88.4%	76.7%	96.9%	80.7%	81.9%			
CL652	0.323	0.272	0.108	0.733	0.273	0.519	0.426			
	53.0%	50.5%	44.1%	63.3%	51.5%	61.5%	60.6%			
	31.7%	36.0%	37.3%	13.3%	36.3%	25.0%	27.9%			
757	-0.087							-0.035	-0.269	0.091
	34.2%							34.1%	32.3%	38.6%
	41.9%							38.7%	51.6%	34.1%
CL656	0.700	0.340	0.588	0.533	0.970	1.103	1.000			
	67.7%	53.4%	64.7%	63.3%	81.8%	84.5%	74.6%			
	17.1%	23.3%	21.5%	23.3%	6.0%	10.3%	9.8%			
754	0.939							1.029	0.839	0.800
	78.9%							82.3%	75.3%	73.4%
	10.2%							7.4%	14.0%	13.4%

Computer courses: Other

Some support (67.2%) is given for teaching data processing for business applications [CL630] and the goal of acquiring computer skills necessary for vocational training [CL631] was given similar support (63.9%). Less than half (46.5%) of the populations sampled supported having separate computer courses for vocational and college-bound students [CL657]. The reasons for this are unclear; perhaps the need for differing data-processing applications for students preparing for different careers is not considered important. Having all students receive some computer training before graduation is, however, given strong support: 88.9% disagreed that training should be given to specialists only after graduation [CL658], although it has been noted elsewhere (under "writing programs") that there is very little support for requiring students to write programs [CL655]. Respondents are divided about whether computer courses should be strictly elective [CL659]. Some support (57.7%) was given to requiring interaction with computers as early as the primary grades [CL653].

Having a separate computer science department [CL654] was accepted by only 27.4%. And having instruction with a wide variety of hardware as a major element of the course [CL660] was also accepted by only a small percentage (28.3%).

Computer courses: Other

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
CL630	0.692	0.955	0.731	0.531	0.341	0.635	0.500			
	67.2%	78.3%	67.3%	62.5%	53.6%	67.3%	58.3%			
	15.2%	10.8%	12.6%	12.6%	19.5%	17.3%	25.0%			
CL631	0.672	0.858	0.909	0.667	0.462	0.404	0.357			
	63.9%	71.7%	76.4%	58.3%	61.6%	45.6%	51.4%			
	11.5%	8.5%	3.6%	11.1%	20.5%	19.3%	17.2%			
CL657	0.225	0.520	0.412	0.000	-0.182	0.224	-0.183			
	46.5%	57.8%	52.9%	30.0%	30.3%	48.3%	33.8%			
	30.3%	22.5%	21.6%	36.7%	36.4%	31.0%	47.9%			
CL658	-1.287	-1.068	-1.157	-1.267	-1.515	-1.534	-1.493			
	6.3%	7.8%	9.8%	6.7%	0.0%	3.4%	4.2%			
	88.9%	85.4%	83.3%	93.3%	96.9%	93.1%	93.0%			
CL659	-0.035	0.146	0.255	-0.500	-0.152	-0.293	-0.254			
	35.5%	37.8%	49.0%	10.0%	30.3%	31.1%	29.6%			
	40.3%	31.1%	33.4%	46.6%	39.4%	51.7%	52.1%			
CL653	0.454	0.194	0.471	0.467	0.606	0.654	0.607			
	57.7%	49.6%	57.9%	53.3%	69.7%	61.5%	63.9%			
	24.4%	34.0%	24.5%	20.0%	15.2%	21.1%	18.0%			
CL654	-0.371	0.087	-0.176	-0.567	-1.000	-0.784	-0.689			
	27.4%	44.7%	32.3%	13.4%	12.2%	9.8%	19.7%			
	51.6%	33.0%	45.1%	56.7%	72.8%	66.7%	67.2%			
CL660	-0.283	-0.049	-0.029	-0.767	-1.000	-0.259	-0.471			
	28.3%	33.1%	38.2%	10.0%	15.1%	29.3%	20.0%			
	47.0%	35.9%	35.3%	70.0%	72.8%	48.3%	57.1%			

Computer components

Three questions regarding teaching about specific computer components were given to the professional samples. Approval at the 73.4% level was given for teaching procedures for accessing or operating a computer system [CL616], but "memory storage or access systems" [CL617] was given only minimal support (58.6%), possibly because the item was not sufficiently specific. Learning about the functioning of microprocessor units [CL622] was approved by only a small percentage (34.2%). In each case, the SP sample was more supportive than were other samples.

Computer components

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
CL616	0.964	0.919	1.085	0.812	0.780	1.173	0.833			
	73.4%	68.4%	79.7%	68.8%	70.8%	84.6%	65.0%			
	11.6%	9.9%	10.2%	12.5%	19.5%	5.7%	16.7%			
CL617	0.561	0.679	0.559	0.437	0.293	0.769	0.417			
	58.6%	59.8%	57.7%	59.4%	48.8%	69.3%	55.0%			
	16.1%	13.4%	13.6%	18.8%	24.4%	11.5%	23.3%			
CL622	0.127	0.161	0.101	-0.156	-0.268	0.673	0.067			
	34.2%	32.1%	32.8%	34.4%	24.4%	52.0%	31.6%			
	27.0%	23.3%	27.7%	43.8%	41.5%	5.8%	31.7%			

Equipment: Computers or computer access

There is strong support (94.7%) by the SP and TE samples, and a high level of support (86.0%) by the PR sample, for having computers or computer access at the secondary school level [724]. In elementary schools, the support is less but nevertheless substantial (at the 75% level) across the the same three samples [712].

The other items are characterized by divergence in percentages of agreement. When asked about having computers available for every two students [AL151], minimal support (64.2%) is given, with relatively close agreement across samples. Using computers for exploration of problems [PB511] was supported by 79.0%, with increasing support from AT to MT to JC to MA samples. When the term "computing devices" is used [AL159], only 45.9% expressed support; however, this may be because the item referred to the development of basic ideas. Consistently across samples, over 70% favored the inclusion of computers (or programmable calculators) for whole-number computation [WN218]. An even larger percentage (83.6%) supported having minicomputers in each class [CL638]; it might be noted that 100% of the MA sample agreed.

The use of terminals connected to a large computer [CL637] was approved by 80.0%; the MT sample was particularly positive about this resource. In contrast, only 56.1% supported the use of batch processing [CL639], with the MT sample giving it slightly higher support (66.1%). These two modes of computer processing have been widely used, which may account for the response of the MT sample.

Having CAI, plus videotape cartridge players, in individual study carrels was supported by 71.6% [AL147]. It is difficult, however, to determine to what aspect of the item the samples are responding. In item CL660, the use of a wide variety of hardware is proposed as the major emphasis of a computer course; the lack of support (28.3%) may indicate disagreement with instruction in the use of hardware, but it may or may not reflect on the availability of a wide variety of hardware.

Equipment: Computers or computer access

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
724	1.522	(1.219)				1.618	1.435	1.219		
	94.7%	86.0%				94.8%	94.6%	86.0%		
	1.3%	4.6%				2.0%	0.6%	4.6%		
712	0.955	(0.899)				1.040	0.875	0.899		
	76.5%	73.8%				79.4%	73.8%	73.8%		
	12.5%	10.7%				8.6%	16.3%	10.7%		
AL151	0.661	0.611	0.652	0.758	0.750					
	64.2%	61.1%	65.2%	69.7%	64.3%					
	17.4%	16.8%	18.3%	9.1%	25.0%					
PB511	1.016	0.871	0.924	1.375	1.367					
	79.0%	71.8%	77.1%	93.8%	90.0%					
	11.5%	11.8%	15.3%	0.0%	10.0%					
AL159	0.270	0.461	0.243	0.121	-0.057					
	45.9%	54.9%	44.1%	45.4%	25.8%					
	22.4%	15.7%	22.5%	33.3%	31.5%					
WN218	0.785	0.804	0.715	0.821	0.941					
	72.7%	72.1%	71.6%	74.4%	76.5%					
	14.6%	11.4%	17.1%	18.0%	11.8%					
CL638	1.199	1.113	1.211	1.061	1.576					
	83.6%	79.2%	83.5%	81.8%	100.0%					
	6.0%	10.4%	3.7%	6.0%	0.0%					
CL637	1.146	0.868	1.426	1.091	1.182					
	80.0%	68.9%	89.8%	78.8%	84.9%					
	8.6%	14.1%	2.8%	6.1%	12.1%					

Equipment: Computers or computer access (continued)

CL639	0.464	0.362	0.743	0.424	-0.091		
	56.1%	51.4%	66.1%	51.5%	42.5%		
	20.7%	21.9%	12.9%	21.2%	42.4%		
AL147	0.786	0.705	0.791	1.000	0.786		
	71.6%	67.4%	72.2%	81.8%	71.4%		
	15.5%	19.0%	15.7%	9.1%	10.7%		
CL660	-0.283	-0.049	-0.029	-0.767	-1.000	-0.259	-0.471
	28.3%	33.1%	38.2%	10.0%	15.1%	29.3%	20.0%
	47.0%	35.9%	35.3%	70.0%	72.8%	48.3%	57.1%

Equipment: Computers with specific characteristics

Computer-driven graphing and plotting equipment [AL155] received slightly more support (53.9% vs. 45.9%) than the more general "machines for plotting graphs" [RP451], while having computer-generated graphics for geometry [GM306] was given much stronger support (69.3%), especially by the MT, JC, and MA samples.

Having computers (or calculators) programmed to handle the three types of percentage problems [RP448] was only accepted by 35.4%.

Wall-sized demonstration screens for video output of computer data [CL636] were favored by 77.9%, while simulations of how a computer works by using large-scale devices [CL646] were given only minimal support (54.1%).

In general, there is little strong feeling about the need for the specific equipment described.

Equipment: Computers with specific characteristics

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL155	0.343	0.021	0.400	0.667	0.821					
	53.9%	37.9%	57.4%	69.7%	75.0%					
	23.6%	30.5%	22.6%	15.1%	14.3%					
RP451	0.090	-0.088	0.112	0.345	0.308					
	45.9%	39.2%	48.0%	51.7%	53.8%					
	35.1%	43.1%	33.6%	24.1%	25.7%					
GM306	0.790	0.468	0.916	0.853	1.075					
	69.3%	54.4%	75.8%	73.6%	80.0%					
	12.9%	20.2%	8.5%	11.7%	10.0%					
RP448	-0.235	0.069	-0.357	-0.690	-0.385					
	35.4%	46.1%	27.6%	24.1%	35.9%					
	42.5%	35.3%	44.9%	58.6%	43.6%					
CL636	1.060	0.755	1.294	1.000	1.333					
	77.9%	66.0%	85.4%	78.7%	91.0%					
	8.2%	15.1%	4.6%	3.0%	3.0%					
CL646	0.520	0.578	0.551	0.459	0.303					
	54.1%	58.8%	56.1%	45.9%	42.4%					
	13.6%	13.7%	14.0%	8.1%	18.2%					

Summary: Use of Computers

- Nearly 75% of the professional samples and 80% of the lay samples believed that the use of computers and other technology should be increased during the 1980's.
- The emphasis upon computer literacy should be increased according to 77.6% of the samples.
- Instructional materials for computers which received moderately strong support include materials for individual projects, workbooks with algorithms simulating computer processes, detailed notes for teacher presentations, and probability and statistics materials for use with computers.
- Flow charting and writing computer programs using BASIC were strongly supported (above the 80% level).
- Almost no one (22.8%) believed that programming should be introduced in the elementary school, and very few (32.2%) believed that the ability to write programs should be a requirement for high school graduation.
- Although the use of BASIC was strongly supported (by 87.5%), the use of other languages such as FORTRAN, COBOL, PLATO, or machine language received very little support.
- Teaching about the roles of computers in society was strongly supported (88.5%). Although less concern was noted for teaching about privacy and security issues, these still received moderately strong support (66.3%)
- Understanding the use and power of computers was seen as being more appropriate for algebra (60.1%) than for probability and statistics (54.5%).
- Studying about the types of problems computers can solve received very strong support (91.3%).
- Requiring a computer literacy course of all students was given minimal support (53.0%) by the professional samples and essentially no support

by the lay samples. However, lay samples did give moderately strong support (79%) to the integration of computer literacy topics within the existing K-12 mathematics curriculum.

- The idea that knowledge of computers is only needed by specialists was strongly opposed (by 88.9%).
- Having computers or computer access for students was very strongly supported (94.7%) at the secondary school level and given moderately strong support (76.5%) at the elementary school level. Strong support (83.6%) was shown for having several small, personal mini-computers for each class.
- Wall size demonstration screens for video-output of computer data received more support (77.9%) than other devices (e.g., graphing and plotting equipment).

Estimation and Approximation

Respondents were asked to react to two goal statements pertaining to estimation and approximation. For one in probability and statistics [PS373], the influence of giving "experience in dealing with estimation and approximation" was given strong support (82.7%), with the TE sample more positive (90.1%) than other samples. Another item [MS580] concerned the teaching of measurement "to develop and practice estimation skills": it received very strong support (88.1%), with the TE, SP, and JC samples all supporting it above the 90% level.

Estimation and approximation: Goals

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PS373	1.136	1.136	1.162	0.971	1.091	1.100	1.246			
	82.7%	80.2%	83.8%	82.3%	78.8%	78.3%	90.1%			
	3.5%	8.6%	1.0%	2.9%	3.0%	5.0%	0.0%			
MS580	1.269	1.127	1.176	1.371	1.111	1.507	1.437			
	88.1%	82.4%	87.0%	91.4%	83.3%	92.0%	95.3%			
	1.4%	1.0%	2.3%	0.0%	5.6%	0.0%	0.0%			

Estimation and approximation: Specific content

A number of other items concerned inclusion of particular aspects of estimation or approximation in the curriculum. Support for including estimation was strongest with measurement and whole number content. In measurement, it was slightly stronger (93.3%) at the elementary level [MS559] than at the secondary level [MS569], where the percentage was 88.9%. The SP and TE samples were especially positive. On whole numbers [WN187] support averaged 91.7% for teaching techniques of estimation, with the MA sample least positive (79.5%).

For fractions [FD6] and decimals [FD16], teaching division by first estimating the magnitude of the answer received support at the 74% and 79% levels, respectively.

On the remaining four items, however, support was minimal. Starting with an approximation and working backwards to solve a problem received slightly more support (54.3%) at the elementary level [PB487] than at the secondary level [PB497], where it was supported by only 42% of the respondents. One algebra item on approximating graphed data with best-fit polynomials [AL129] was accorded moderate support (67%) from the SP sample, but was only supported by 40% to 45% of the other samples. Another algebra item [AL134], on approximating the roots to higher degree polynomial equations, was not given particular support by any sample.

Estimation and approximation: Specific content

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD6	1.032	0.857	0.870	1.000	0.786	1.333	1.133			
	73.9%	67.4%	62.9%	76.2%	57.2%	90.2%	78.4%			
	8.8%	12.3%	7.5%	4.8%	21.4%	3.9%	10.0%			
FD16	1.096	1.106	0.806	1.048	0.733	1.136	1.423			
	79.3%	80.9%	71.7%	81.0%	73.3%	74.5%	90.2%			
	9.3%	10.6%	13.5%	4.8%	6.7%	10.2%	5.6%			
AL129	0.234		0.231	0.054	0.143	0.592	0.100			
	46.4%		42.1%	45.9%	42.8%	67.3%	40.0%			
	30.2%		28.9%	32.4%	35.7%	24.5%	33.4%			
AL134	-0.068		0.041	-0.459	0.071	0.020	-0.183			
	37.2%		42.6%	21.6%	39.3%	36.7%	35.0%			
	40.8%		37.7%	54.0%	35.7%	38.8%	43.3%			
WN187	1.474	1.484	1.193	1.541	1.103	1.763	1.781			
	91.7%	92.7%	87.2%	94.6%	79.5%	97.3%	96.9%			
	3.4%	4.3%	5.6%	2.7%	5.2%	0.0%	1.6%			
PB487	0.429	0.398				0.412	0.492			
	54.3%	53.1%				51.0%	59.0%			
	21.5%	22.5%				21.5%	19.7%			
PB497	0.082		-0.198	0.071	0.375	0.102	0.408			
	42.0%		34.2%	28.5%	50.0%	40.7%	57.7%			
	37.6%		49.5%	21.4%	29.1%	35.6%	29.5%			
MS559	1.576	1.262				1.833	1.852			
	93.3%	85.4%				100.0%	100.0%			
	4.5%	9.7%				0.0%	0.0%			

Estimation and approximation: Specific content (continued)

MS569	1.376	1.194	1.073	1.086	1.763	1.704
	88.9%	84.5%	78.0%	85.7%	98.3%	97.1%
	6.6%	11.7%	9.8%	8.6%	0.0%	0.0%

Summary: Estimation and Approximation

- Development of estimation skills and experience in dealing with estimation and approximation were strongly supported (above 82%) as goals for measurement and for probability and statistics.
- Support for including estimation was strongest with measurement and whole number content.
- Approximation techniques in algebra were given minimal support.

Laboratory Activity-based Approaches

In the introductory item which asked how much emphasis should be given to mathematics laboratories in the 1980s [UF14], 48.2% indicated that they should be given increased emphasis, while a substantial proportion (34.2%) opted for the same amount of emphasis as at present. Very few (1.3%) would give laboratories "much less emphasis", but 16.3% would give them "somewhat less emphasis".

	Total	AT	MT	JC	MA	SP	TE
UF14	0.427	0.512	0.163			0.426	0.639
	48.2%	53.6%	37.5%			45.5%	57.7%
	17.6%	19.1%	27.0%			12.9%	11.3%

Introducing ideas through laboratory investigations was minimally supported (55%) for fractions and decimals [FD58] and algebra [AL160], while more support (73%) was given for geometry [GM319] and measurement [MS594]. About 20% to 25% responded "undecided" to most items.

On the generic (general) items, SP and TE samples supported the introduction of basic ideas through "laboratory investigations or experiments with materials". Their strong level of support (87%) at the elementary level [681] was slightly less than their level of support (89%) at the secondary level [697]. There was less support for this method by the lay samples (63.5%), although their question [789] did not differentiate between elementary and secondary levels. Only 59.9% supported the use of laboratory investigations outside the school for problem solving [PB519].

On the other hand, strong support (96.2%) by professional samples was found for experiments with dice, cards, and games of chance [PS397]. Support was less (81.7%) for experiments to illustrate ratio, proportion, and percent in a laboratory setting [RP456]. Introducing proportions with science experiments [RP425] received far less support (46.6%); 28% checked "undecided". The use of ready-made data bases [PS399] was only supported by 53.1%, while again one-quarter of the respondees were undecided.

Finally, the professional samples were asked if laboratory experiences might themselves be a goal of the teaching of measurement [MS573]. About 65% expressed agreement, although this goal was ranked below most others.

Laboratory experiences and experiments

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
MS573	0.752	0.891	0.629	0.514	0.361	1.000	0.844			
	65.2%	71.2%	59.0%	54.3%	50.0%	74.7%	71.9%			
	6.8%	6.9%	4.5%	14.3%	19.4%	1.3%	6.2%			
FD58	0.479	0.680	0.352	0.512	0.314					
	57.0%	66.1%	52.3%	53.6%	51.4%					
	20.2%	14.6%	24.2%	12.2%	31.5%					
AL160	0.456	0.725	0.342	0.152	0.314					
	55.2%	66.7%	49.5%	45.5%	48.6%					
	20.6%	13.8%	23.4%	36.4%	17.1%					
GM319	0.944	1.195	0.870	0.706	0.788					
	75.1%	82.9%	73.0%	64.7%	72.8%					
	9.6%	7.3%	12.0%	8.8%	9.1%					
MS594	0.944	0.943	0.962	1.000	0.824					
	73.1%	71.4%	77.0%	69.4%	67.7%					
	9.5%	10.5%	6.9%	2.8%	5.9%					
681	1.241					1.276	1.208			
	86.9%					86.9%	86.9%			
	4.7%					4.6%	4.8%			
697	1.274					1.253	1.294			
	89.1%					89.3%	88.8%			
	3.5%					3.3%	3.7%			
789	0.617							0.603	0.558	0.816
	63.5%							62.3%	63.9%	71.4%
	14.3%							14.7%	16.3%	8.2%

Laboratory experiences and experiments (continued)

PB519	0.544	0.647	0.438	0.625	0.533		
	59.9%	67.0%	55.2%	56.2%	60.0%		
	17.1%	14.2%	22.9%	9.4%	13.3%		
PS397	1.210	1.190	1.209	1.250	1.250		
	86.2%	87.0%	86.4%	89.3%	79.2%		
	4.2%	6.0%	4.5%	0.0%	4.2%		
RP456	1.109	1.178	1.027	1.091	1.206		
	81.7%	83.3%	80.9%	75.7%	85.3%		
	5.6%	4.4%	6.3%	9.1%	2.9%		
RP425	0.259	0.177	0.255	0.464	0.355	0.283	0.230
	46.6%	40.7%	45.3%	57.2%	51.6%	51.6%	45.9%
	25.4%	26.0%	22.7%	21.5%	22.6%	30.0%	27.9%
PS399	0.363	0.120	0.464	0.357	0.917		
	53.1%	45.0%	55.5%	50.0%	79.2%		
	21.7%	33.0%	14.5%	17.9%	12.5%		

Physical materials and models

In general, the degree of support for the use of laboratory experiments, manipulative materials, and physical models for use in a laboratory setting was strong (62% to 98%). Analysis of the data indicates that, frequently, about the same percentages were supporting an item with a "would be nice to have" response as were responding "would definitely want". Fluctuations in the level of support shown in the professional samples may be attributable to minor changes in emphasis in the wording of the items. For example, WN221, speaking of using "geometric pictures" as models for computation, elicits stronger response from the JC and MA samples than from the AT and MT samples, while the pattern is almost reversed for WN215, which talks of using physical materials such as rods and blocks to model whole-number algorithms. This response pattern also holds for the case of fractions [FD46, FD51].

The highest level of support was for item PB517, in which materials were to be used for modeling problems; it was supported by 83.0% of the combined AT, MT, JC, and MA samples. A slightly lower percentage (74.0%) agreed that problems should be given for which physical materials aid in the solution [PB538]. The research evidence indicates that the use of materials aids students in attaining problem solutions, or at least that problems with which aids are used are easier (Suydam and Higgins, 1977).

What is of particular interest is how much more strongly the SP, TE, and PR samples agreed with the generic (general) items on the use of physical materials and models [682, 698, 709, 721, 767]. Their support ranged from 93% to 98%, and was especially strong (98%) at the elementary level [682, 709]. The professional samples responded to similar questions within content areas, and their support ranged from a low of 62% for whole numbers [WN225] to a high of 83% for problem solving [PB517]. Thus, lay groups tended to support the use of laboratory experiments and physical materials more than those who are more directly involved in classroom instruction. (One might also conclude that the idea of laboratory materials is much more attractive in general than when considered for specific mathematics topics.) However, the AT sample supported the use of materials more strongly than did the remaining three samples. AT support was weakest in the areas of whole numbers and fractions; possible interpretations will occur to most readers. It is of interest to note that the research evidence supports the use of manipulative materials, but indicates that most teachers do not use them, particularly above the third-grade level (Suydam and Higgins, 1977; Suydam and Osborne, 1977; Weiss, 1978).

With respect to fractions, the use of slide rules, graphs, and charts to solve problems was not well-perceived; 41.6% and 42.1% indicated disagreement with their use at elementary [FD4] and secondary [FD14] levels, respectively. Over one-fourth were uncertain, while the remainder were distributed on the positive side. Certain words ("slide rules", "to solve problems") possibly cued this comparatively negative response.

Physical materials

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD46	0.759	1.150	0.667	0.500	0.273					
	66.9%	79.0%	64.2%	54.4%	57.6%					
	15.7%	11.0%	14.1%	17.3%	33.3%					
AL150	0.948	1.160	0.896	0.606	0.857					
	76.3%	84.1%	76.6%	63.7%	64.2%					
	10.4%	8.5%	10.5%	18.2%	7.2%					
WN215	0.850	1.082	0.691	0.974	0.618					
	70.6%	77.4%	65.8%	74.3%	64.7%					
	10.9%	10.3%	9.7%	10.3%	17.7%					
WN225	0.678	0.928	0.589	0.634	0.436					
	61.8%	72.2%	57.9%	61.0%	51.2%					
	15.5%	13.2%	14.9%	17.1%	20.5%					
WN228	0.959	1.345	0.778	1.051	0.526					
	74.0%	85.7%	70.4%	74.4%	57.9%					
	8.1%	3.6%	8.3%	7.7%	18.4%					
GM315	0.968	1.291	0.863	0.824	0.700					
	74.2%	82.3%	71.6%	76.5%	62.5%					
	8.9%	6.3%	7.4%	17.7%	10.0%					
RP453	1.075	1.196	0.969	0.931	1.128					
	80.2%	82.4%	76.3%	79.3%	84.6%					
	6.8%	6.9%	6.2%	13.8%	2.6%					
PB517	1.206	1.419	1.057	1.094	1.233					
	83.0%	89.6%	77.1%	81.3%	86.6%					
	5.5%	4.7%	5.8%	6.3%	6.7%					

Physical materials (continued)

PB538	0.836	1.050	0.709	0.781	0.625					
	74.0%	83.1%	70.0%	68.8%	62.5%					
	8.4%	4.0%	11.9%	9.4%	8.3%					
709	1.797	(1.680)				1.834	1.761	1.680		
	98.1%	97.6%				97.3%	98.8%	97.6%		
	1.3%	0.6%				2.6%	0.0%	0.6%		
721	1.556	(1.234)				1.592	1.524	1.234		
	95.0%	86.6%				95.4%	94.6%	86.6%		
	2.5%	5.2%				2.0%	3.0%	5.2%		
767	1.419							1.546	1.176	1.422
	93.2%							96.5%	86.8%	93.3%
	3.2%							1.7%	5.5%	4.4%

Physical models

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD51	0.918	0.980	0.875	0.902	0.914					
	73.2%	72.5%	71.9%	78.1%	74.3%					
	6.9%	5.9%	7.1%	4.9%	11.4%					
AL162	0.719	0.843	0.613	0.545	0.857					
	67.6%	73.6%	63.1%	57.6%	74.3%					
	10.0%	9.8%	10.8%	9.1%	8.6%					
WN221	0.774	0.500	0.796	0.927	1.128					
	63.7%	48.8%	65.7%	68.3%	84.6%					
	7.8%	8.5%	7.4%	7.3%	7.7%					
682	1.450					1.526	1.381			
	95.6%					98.1%	93.4%			
	1.6%					0.7%	2.4%			
698	1.461					1.467	1.456			
	94.9%					96.7%	93.2%			
	0.9%					0.7%	1.2%			

Slide rules and graphs

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD4	-0.220	-0.327	-0.222	-0.190	-0.571	-0.176	-0.098			
	31.6%	24.5%	35.2%	38.1%	35.7%	29.4%	32.8%			
	41.6%	38.7%	37.1%	47.6%	57.1%	39.2%	44.2%			
FD14	-0.257	0.021	-0.493	-0.429	-0.533	-0.203	-0.155			
	32.2%	38.3%	25.4%	23.8%	40.0%	28.8%	38.1%			
	42.1%	29.8%	50.8%	47.6%	53.3%	38.9%	40.8%			

Tools for measuring

Six samples responded to the goal statement, "To learn to use specific tools for measurement" [MS575]. About 80% supported the goal, with the AT, MT, and SP samples expressing the strongest support.

The samples also gave moderately strong support (73% to 80.5%) to the need for providing measuring devices as a resource for fractions and decimals [FD45], geometry [GM307], and measurement [MS581], the only content areas in which the item was included. As with the goal, the support was about evenly divided between "might be nice to have" and "definitely would want".

However, when the AT, MT, JC, and MA samples were asked about providing electronic measuring tools as a resource [MS584], support was far less: only 7.1% responded "definitely would want" and 38.0% indicated they "might be nice to have". Over 25% were uncertain. It may be that the inclusion of "on a digital display similar to that of a calculator" influenced the response, or it may be that many respondees had not seen such devices, or it may be that their estimate of the cost (probably higher than for non-electronic devices) may have influenced the decision.

An item on drafting tables [GM312] had very limited appeal to any group; only 5.7% indicated they "definitely would want" these and 27.5% thought they "might be nice to have".

Tools for measuring

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
MS575	1.016	1.098	1.136	0.829	0.556	1.120	0.875			
	80.2%	80.4%	86.3%	74.2%	61.1%	84.0%	76.6%			
	4.3%	5.9%	1.6%	8.6%	13.9%	1.3%	3.1%			
FD45	1.030	1.360	0.924	0.935	0.545					
	76.5%	87.0%	71.4%	76.0%	63.6%					
	8.7%	6.0%	10.1%	4.3%	18.2%					
GM307	0.903	1.114	0.642	1.059	0.975					
	73.0%	77.2%	63.2%	79.4%	82.5%					
	16.9%	12.7%	24.2%	11.7%	12.5%					
MS581	1.075	1.343	1.023	0.867	0.625					
	80.5%	89.2%	77.4%	83.3%	62.5%					
	10.3%	6.9%	10.9%	10.0%	18.8%					
MS584	0.142	0.124	0.156	0.233	0.062					
	45.1%	46.7%	44.5%	46.6%	40.7%					
	29.8%	33.4%	28.9%	20.0%	31.3%					
GM312	-0.178	-0.076	-0.179	-0.294	-0.282					
	33.2%	34.2%	36.9%	23.5%	30.8%					
	42.9%	39.3%	44.2%	44.2%	46.1%					

Booklets of experiments

There is support above the 80% level for providing booklets of experiments for the three content areas considered, probability and statistics [PS394], ratio and proportion [RP449], and measurement [MS588]. In each case, the support was greater for "might be nice to have" than for "definitely would want". Essentially, the four samples were in agreement, although the JC sample tended to be slightly more positive than the AT, MT, and MA samples. Booklets for probability and statistics were rated lower than booklets for measurement or ratio and proportion.

Slightly lower percentages of respondents (an average of 77.4%) supported resources for teachers in the form of curriculum materials for probability and statistics which would include use of laboratory equipment and other print and non-print materials [PS392].

Booklets of experiments

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PS394	0.904	0.804	0.920	1.088	0.962					
	80.0%	75.3%	79.5%	91.1%	84.6%					
	8.5%	11.4%	9.7%	0.0%	3.8%					
RP449	1.112	1.010	1.173	1.207	1.154					
	85.1%	82.4%	84.7%	93.1%	87.2%					
	7.1%	9.8%	7.1%	6.9%	0.0%					
MS588	1.095	1.198	1.078	1.100	0.812					
	83.1%	86.8%	82.1%	86.6%	71.9%					
	5.8%	3.7%	8.6%	0.0%	6.3%					
FS392	0.922	0.959	1.009	0.765	0.615					
	77.4%	80.4%	81.4%	70.6%	57.7%					
	9.2%	8.3%	9.7%	8.8%	11.5%					

Small-group work

Provision for activities for which the class would be divided into small discussion groups [GM322, RP461] is given minimal support by the AT sample (less than 58%), and less support by the MT and JC samples (58% to 38%). Response by the MA sample to these items is evenly divided. The JC sample supports the idea more strongly for ratio and proportion than for geometry. The SP and TE samples give moderate support (66%) to the item at both elementary [685] and secondary [701] levels. The SB sample is similarly supportive (68.2%), while the PT sample (75.0%) and particularly the PR sample (85.1%) are very supportive [759].

Having students work in small groups to solve problems [PB526] is given a high degree of support (70% to 80%) by the AT, MT, and JC samples, while the MA sample gives it little support (43.5%).

Small-group work

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
GM322	0.264	0.506	0.230	0.147	-0.121					
	48.0%	57.9%	49.0%	38.3%	30.3%					
	24.4%	18.1%	28.0%	23.5%	30.3%					
RP461	0.300	0.478	0.191	0.485	0.000					
	46.1%	54.4%	41.8%	57.6%	26.5%					
	21.8%	16.6%	24.5%	24.2%	23.5%					
685	0.759					0.821	0.702			
	65.5%					67.6%	63.6%			
	11.3%					12.0%	10.7%			
701	0.741					0.700	0.780			
	66.1%					64.0%	68.0%			
	13.6%					11.3%	15.7%			
759	1.033							1.194	0.693	1.068
	78.9%							85.1%	68.2%	75.0%
	7.8%							5.1%	14.8%	4.5%
PB526	0.883	1.050	0.814	1.031	0.304					
	73.6%	80.0%	72.1%	81.3%	43.5%					
	12.1%	7.0%	16.1%	3.1%	26.0%					

Summary: Laboratory Activity-based Approaches

- Little support (48.2%) was given to increasing the emphasis given to mathematics laboratories in the 1980's. However, a substantial proportion (34.2%) opted for the same amount of emphasis as at present.
- There was strong support (above 87%) for introducing basic ideas through laboratory investigations or experiments with materials at both the elementary and secondary levels.
- Lay samples gave stronger support (above 93%) to the use of physical materials and models than did professional samples.
- The need for providing measuring devices as resources for fractions and decimals, geometry, and measurement was given moderately strong support (73% to 80.5%). However, support was far less for electronic measuring devices.
- Booklets of experiments for the three content areas considered (probability and statistics, ratio and proportion, and measurement) received strong support (above 80%).
- Having students work in small groups to solve problems was given a higher degree of support (70% to 80%) than dividing the class into small discussion groups (38% to 58%).

Use of Out-of-Class Activities and Projects

A topic presented in the methods clusters inquired whether materials that included activities requiring students to go outside the classroom (perhaps on field trips) would influence the respondent to buy or use the materials. First, the response patterns of the SP and TE samples to the generic (general) items for the elementary [680] and secondary [696] levels were examined. Both samples were positively influenced by this characteristic of materials, with support at approximately the 65% level. To be noted is the fact that roughly the same level of influence obtains for both the elementary (66.9%) and secondary (67.0%) levels. The lay samples gave a similar response (64.6%) on the general item 786.

On the analogous items for the AT, MT, JC, and MA samples, there appears to have been a distinction made in terms of the mathematical content. Probability and statistics [PS396], measurement [MS591], and computer literacy [CL647] are perceived as more suitable for out-of-classroom activities, with support from 70% to 75% for these content areas, but ranging from only 52% to 60% for whole numbers [WN229], geometry [GM316], ratio and proportion [RP460], and problem solving [PB519].

The MA sample was more negative about using out-of-class activities than were other samples, while the AT sample was most positive. The greatest degree of agreement across samples was found on the probability and statistics item [PS396].

Activities outside the classroom

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN229	0.576	1.024	0.491	0.487	-0.077					
	58.7%	76.5%	56.5%	56.4%	28.2%					
	20.0%	11.7%	21.3%	23.1%	30.8%					
GM316	0.566	0.915	0.460	0.471	0.121					
	58.6%	70.8%	57.0%	50.0%	42.5%					
	21.7%	18.3%	22.0%	14.7%	36.4%					
PS396	0.954	1.061	0.855	1.036	0.875					
	75.8%	79.8%	72.7%	75.0%	75.0%					
	12.6%	11.1%	16.3%	3.6%	12.5%					
RP460	0.397	0.689	0.400	0.091	-0.088					
	52.1%	65.5%	49.1%	42.4%	35.3%					
	24.0%	17.8%	23.6%	30.4%	35.3%					
PB519	0.544	0.647	0.438	0.625	0.533					
	59.9%	67.0%	55.2%	56.2%	60.0%					
	17.1%	14.2%	22.9%	9.4%	13.3%					
MS591	0.780	0.838	0.746	0.750	0.765					
	70.5%	74.3%	70.0%	63.9%	67.7%					
	16.1%	17.1%	16.1%	16.7%	11.8%					
CL647	0.935	1.137	0.963	0.811	0.364					
	74.1%	83.4%	74.8%	64.8%	54.6%					
	7.6%	4.9%	7.4%	5.4%	18.2%					
680	0.781					0.783	0.780			
	66.9%					66.4%	67.2%			
	9.1%					9.9%	8.3%			

Activities outside the classro.. (continued)

696	0.718					0.687	0.748			
	67.0%					64.0%	69.8%			
	10.1%					11.3%	8.8%			
786	0.673							0:654	0.674	0.800
	64.6%							63.5%	67.5%	68.0%
	12.6%							12.8%	13.9%	8.0%
	64.8%	73.9%	62.2%	58.4%	51.9%	65.2%	68.5%	63.5%	67.5%	68.0%

Student projects

A number of items concerned the development of ideas through long-term, real-life projects designed either for individuals or teams of students. The results must be interpreted with care, because reactions could have been keyed primarily by either the words "long-term" or "real-life", rather than by both in relation to the actual focus, projects.

The SP and TE samples responded to generic (general) items at the elementary [684] and secondary [700] levels. The degree of support at both levels by both samples was similar (59.8% and 58.7%).

The items involving projects for the AT, MT, JC, and MA samples were embedded within content areas. Moderate to strong support (averaging 65.9%) for project work was shown by each sample, except for their use with fractions and decimals [FD56] and algebra [AL163], where the support is only 27.3% and 39.1%, respectively.

Surprisingly, the TE sample is least appreciative of methods employing a project approach, followed closely by the MA sample and then the SP sample. The remaining samples were in closer agreement at approximately the 68% level.

Student projects

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
684	0.583					0.715	0.464			
	59.8%					64.9%	55.4%			
	16.6%					11.2%	21.5%			
700	0.594					0.607	0.581			
	58.7%					59.3%	58.1%			
	16.2%					14.0%	18.2%			
FD56	-0.221	-0.126	-0.344	-0.122	-0.171					
	27.3%	30.1%	24.2%	31.7%	25.8%					
	45.3%	44.7%	49.3%	43.9%	34.3%					
AL163	0.114	0.333	-0.009	0.152	-0.171					
	39.1%	45.1%	36.0%	51.5%	20.0%					
	31.3%	25.5%	36.0%	33.3%	31.4%					
GM325	0.624	0.747	0.750	0.176	0.394					
	65.6%	67.5%	75.0%	41.2%	57.5%					
	14.8%	14.4%	12.0%	23.5%	15.2%					
PS384	1.052	0.907	1.195	1.118	0.885					
	79.3%	73.2%	82.3%	88.3%	76.9%					
	7.4%	11.3%	4.4%	2.9%	11.5%					
PS404	0.965	1.030	0.991	0.929	0.625					
	78.0%	82.8%	78.9%	78.5%	54.2%					
	8.5%	10.1%	6.5%	7.1%	12.5%					
RP458	1.015	1.267	0.964	0.848	0.676					
	78.6%	90.0%	77.3%	69.7%	61.8%					
	6.3%	2.2%	8.2%	9.1%	8.8%					

Student projects (continued)

PB535	1.175	1.347	1.120	1.062	0.875		
	83.9%	89.1%	80.4%	90.7%	70.8%		
	3.3%	1.0%	3.4%	3.1%	12.5%		
MS592	1.187	1.210	1.192	1.139	1.147		
	86.9%	86.6%	87.0%	86.2%	88.2%		
	4.3%	3.9%	5.4%	2.8%	2.9%		
CL645	0.738	0.618	0.785	0.892	0.788		
	68.1%	59.8%	71.9%	75.7%	72.7%		
	11.1%	11.8%	12.1%	8.1%	9.1%		
	65.9%	69.4%	68.1%	68.2%	58.7%	62.1%	56.8%

Homework

When asked in an introductory question whether or not mathematics homework should be increased [UF36], 82% of the JC and MA samples favored an increase. The other samples gave weaker support to increasing homework, ranging from 50.0% (for the SB sample) to 68.1% (for the MT sample).

However, the lay samples strongly indicated the desirability of text materials which included daily homework problems [792]. Their support ranged from 67.4% for the PT sample to 90.6% for the SB sample.

Emphasis on homework

	Total	AT	MT	JC	MA	SP	TE	Total	PR	SB	PT
UF36	0.978	0.593	0.966	1.229	1.273	0.600	0.574	0.741	0.790	0.591	0.653
	71.3%	55.5%	68.1%	82.4%	82.6%	55.0%	60.6%	55.7%	57.7%	50.0%	51.1%
	4.3%	7.4%	2.5%	0.6%	1.9%	10.0%	13.1%	2.0%	1.7%	3.4%	2.0%
792	1.149								1.209	1.163	0.694
	84.1%								84.3%	90.7%	67.4%
	5.6%								4.3%	4.7%	16.3%

Summary: Out-of-Class Activities and Projects

- Instructional materials that include activities which require students to go outside the classroom were given moderately strong support by the SP, TE, and lay samples.
- Probability and statistics, measurement, and computer literacy were perceived as more suitable for out-of-classroom activities than were whole numbers, geometry, ratio and proportion, or problem-solving.
- The TE and MA samples were least appreciative of the process of developing ideas through long-term real-life projects. Remaining samples were in closer agreement at approximately the 68% level.
- There was moderately strong support for project work in the areas of ratio and proportion, geometry, and probability and statistics. Project work for fractions and decimals, and for algebra was not supported.
- The JC and MA samples strongly favored (82%) increasing homework. Other samples give weaker support, ranging from 50% (for the SB sample) to 68.1% (for the MT sample).

Reading and Textbooks

Three goals specifically addressed the point of teaching particular content in order to "learn to read mathematics". Support ranged from 77.7% for algebra [AL137] to 73.6% for problem solving [PB504] to 70.4% for whole numbers [WN210]. In each case a larger percentage checked the response indicating they would be "somewhat influenced" by this goal than checked "strongly" influenced. On a related goal in geometry about learning to "read and interpret mathematical arguments" [GM301], strong support (82.2%) was found. Even stronger support (94.8%) was given to the goal of enabling students to read and think critically about graphs and data in other subject areas [PS372].

Goals: Reading mathematics

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL137	1.034	1.115	0.909	1.024	1.103	1.051	1.099			
	77.7%	76.0%	73.6%	70.7%	82.8%	83.0%	84.5%			
	4.8%	0.0%	11.6%	4.8%	6.9%	1.7%	1.4%			
PB504	0.922	0.844	1.143	1.036	0.903	0.684	0.857			
	73.6%	70.9%	83.8%	75.0%	77.5%	63.2%	68.6%			
	6.0%	9.4%	4.8%	3.6%	3.2%	7.0%	4.3%			
WN210	0.837	0.869	0.836	0.730	0.658	0.865	0.934			
	70.4%	70.1%	70.9%	64.8%	55.2%	75.0%	78.7%			
	8.1%	6.6%	5.4%	16.2%	15.8%	11.5%	3.2%			
GM301	1.107	0.921	1.222	0.972	1.244	1.040	1.219			
	82.2%	69.6%	88.1%	83.3%	82.9%	78.7%	92.2%			
	5.2%	6.7%	2.6%	8.3%	2.4%	10.7%	1.6%			
PS372	1.462	1.407	1.384	1.441	1.515	1.583	1.525			
	94.8%	91.3%	94.0%	94.1%	100.0%	98.3%	95.1%			
	1.6%	4.9%	2.0%	0.0%	0.0%	0.0%	0.0%			

Reading formal presentations

A set of items on methods queried the importance of having students read formal presentations of basic ideas in algebra, geometry, probability and statistics, ratio and proportion, problem solving, and computer literacy before classroom activities were devoted to those ideas. In all instances, support was low [AL165, GM317, PS400, RP463, PB537, CL642, 679, 695], indicating that this is not preferred by 70% to 80% of the respondees. The MA and MT samples were most in favor of the idea, and even they supported the idea at only the 30% level.

However, when the lay samples were asked in general about the appropriateness of students reading about mathematical ideas before working on related classroom activities [790], they gave weak support at the 49.6% level.

Reading formal presentations

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PR
AL165	-0.321	-0.495	-0.216	-0.333	-0.143					
	27.1%	16.8%	33.3%	27.3%	37.1%					
	49.2%	53.5%	45.9%	42.4%	54.2%					
GM317	-0.349	-0.614	-0.220	-0.091	-0.333					
	25.3%	20.5%	27.0%	30.3%	27.3%					
	52.7%	63.9%	46.0%	36.4%	60.6%					
PS400	-0.576	-0.990	-0.373	-0.321	-0.083					
	17.2%	7.0%	23.6%	17.8%	29.1%					
	58.4%	76.0%	50.9%	42.9%	37.5%					
RP463	-0.397	-0.567	-0.182	-0.606	-0.441					
	25.1%	16.7%	33.6%	18.2%	26.5%					
	49.4%	55.5%	41.8%	54.6%	52.9%					
PB537	-0.387	-0.743	-0.179	-0.250	-0.083					
	25.1%	11.9%	34.1%	31.3%	29.2%					
	52.2%	63.3%	44.4%	56.3%	37.5%					
CL642	-0.146	-0.162	-0.236	-0.081	0.121					
	31.3%	26.6%	33.0%	27.0%	45.5%					
	40.2%	40.0%	44.4%	35.1%	33.4%					
679	-0.497					-0.533	-0.464			
	20.0%					20.4%	19.7%			
	54.1%					57.2%	51.2%			
695	-0.410					-0.387	-0.431			
	23.3%					22.7%	23.8%			
	52.3%					49.4%	55.0%			

Reading formal presentations (continued)

790	0.339	0.320	0.384	0.396
	47.6%	46.4%	52.3%	47.9%
	21.0%	21.1%	23.2%	16.7%

Minimal reading requirements

On the items indicating support for having materials with minimal reading requirements available [AL154, 716, 728], responses across samples differed widely. The AT sample gave it moderate support (67.4%), as did the TE sample (68.7%), with the SP and PR samples slightly higher (above 70%). The MT sample gave weak support (47%), while the JC sample was lower (39%) and the MA sample virtually rejected the idea. Such dispersion has not happened frequently in this questionnaire; however, it is possibly apparent to most readers that the MA sample, in particular, is responding in terms of a belief that all students (especially at the level at which they teach) should be able to read (anything). Teachers in schools know that the problem of teaching mathematics to children with low reading levels nevertheless exists, and there is some desire to do something to cope with the problem.

The idea of deemphasizing reading by presenting problems orally or with pictures and charts [PB529] is not supported (54.1% disagree). The respondees may be not be responding to the idea of presenting problems in this fashion as much as they are to the words "to deemphasize reading". Charts for reading percentages visually [RP446], a skill that is needed regardless of word-reading skills, is supported by a moderate percentage (62.4%). As in other instances, however, the MA sample, along with the JC sample, gives less support to this item. Finally, the lay samples disagree (69.1%) with the general idea that reading should be deemphasized in textbooks and other materials [763].

Minimal reading requirements

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL154	0.273	0.789	0.235	-0.515	-0.393					
	49.1%	67.4%	47.0%	30.3%	17.8%					
	28.1%	14.8%	27.0%	54.5%	46.4%					
716	0.785 (0.848)					0.887	0.688	0.848		
	70.7%	70.9%				72.8%	68.7%	70.9%		
	15.4%	14.6%				11.9%	18.8%	14.6%		
728	0.793 (0.913)					0.841	0.750	0.913		
	69.6%	73.6%				69.5%	69.6%	73.6%		
	12.5%	13.0%				11.9%	13.1%	13.0%		
PB529	-0.416	0.119	-0.692	-0.500	0.167					
	28.1%	48.6%	18.8%	15.7%	4.2%					
	54.1%	36.7%	63.2%	56.3%	79.1%					
RP446	0.545	0.755	0.592	0.138	0.179					
	62.4%	69.6%	64.3%	48.2%	48.8%					
	22.0%	15.6%	21.4%	41.3%	25.7%					
763	-0.784							-0.702	-0.912	-0.837
	22.3%							25.2%	17.6%	20.9%
	69.1%							66.6%	74.8%	67.4%

Textbooks

The desire for probability and statistics textbooks emphasizing projects and activities [PS384] was moderately supported (79.3%). A similar percentage (76.2%) supported having textbook modules for teaching appropriate problem-solving strategies at every grade level [PB512].

Textbooks

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
PS384	1.052	0.907	1.195	1.118	0.885					
	79.3%	73.2%	82.3%	88.3%	76.9%					
	7.4%	11.3%	4.4%	2.9%	11.5%					
PB512	0.972	1.128	0.848	1.000	0.933					
	76.2%	84.9%	71.5%	78.2%	66.6%					
	8.3%	4.7%	10.5%	12.5%	6.7%					

Detailed notes for teacher

A set of resource items concerned the need to provide detailed notes "to guide the teacher in oral presentations of lessons". The SP sample give good support (77.7%) for the idea for the elementary level [676], their support at the secondary level [692] is only slight lower (72.7%). The TE sample give less support (59.5% and 64.4%, respectively). The SB sample is at a comparable level (64.4%) on the general (generic) item [765]. The response of the PR sample (78.7%), however, is more like that of the SP sample, while the PT sample is even higher (81.8%).

Professional samples, asked to react to detailed teaching notes for the areas of fractions and decimals [FD59], geometry [GM324], probability and statistics [PS402], ratio and proportion [RP465], measurement [MS599], and computer literacy [CL648], give lower levels of support. The need is seen as greater in computer literacy (63.1%) and probability and statistics (62.5%) than in other content areas, where the level of support is 50% to 60%. In general levels of support are highest for the AT sample (ranging from 57% to 72%) and lowest for the MA sample, where support is less than 40% (with the exception of 52.1% for teaching notes for probability and statistics). When asked if they would want to have descriptions of teaching methods appropriate for probability and statistics [PS390], 76.6% of the professional samples supported the idea. Again, the MA sample give weak support (57.7%).

On two items related in intent but worded differently, differing levels of support are also found. "Outlines of outstanding presentations in probability and statistics" [395] are given minimal support (56.0%), with the AT sample least positive about this item. The need to have "presentations an' liscussion of measurement techniques" before students actively measure [MS593] is given stronger support (78.7%), with the MA sample least supportive.

The SP and TE samples were asked about providing teachers with "a syllabus that suggests topics and methods for each grade level with specific times they should be introduced". At the elementary level [714], the support was 70.9%; at the secondary level [726], the support was 56.6%. In both cases, the SP sample was more supportive than the TE sample. Other professional samples were asked the same question, but with specific reference to probability and statistics [PS381]. The support (87.8%) was even stronger than that of the SP and TE samples. In a similar vein, in-service materials to teach teachers the content of probability and statistics [PS383] were supported by 84.8% of the professional groups sampled. In-service training on problem-solving methods for all mathematics teachers [PB513] was supported by 83.4%.

Detailed notes for teacher

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
676	0.759					1.020	0.524			
	68.1%					77.7%	59.5%			
	10.3%					4.6%	15.5%			
692	0.735					0.860	0.619			
	68.3%					72.7%	64.4%			
	13.5%					10.0%	16.9%			
765	0.877							0.966	0.578	1.136
	75.0%							78.7%	64.4%	81.8%
	13.9%							10.9%	23.3%	6.8%
FD59	0.466	0.631	0.397	0.415	0.286					
	49.9%	61.1%	45.3%	46.3%	37.1%					
	17.4%	17.5%	19.9%	14.6%	11.5%					
GM324	0.514	0.768	0.540	0.353	-0.030					
	55.4%	72.0%	52.0%	41.2%	39.4%					
	16.8%	14.7%	15.0%	11.8%	33.4%					
PS402	0.680	0.724	0.809	0.179	0.478					
	62.5%	66.3%	69.1%	32.1%	52.1%					
	12.3%	11.2%	9.1%	17.8%	26.1%					
RP465	0.449	0.411	0.573	0.485	0.118					
	54.7%	57.8%	57.3%	54.6%	38.3%					
	18.0%	20.0%	12.7%	21.2%	26.5%					
MS599	0.675	0.838	0.623	0.778	0.265					
	59.3%	69.6%	56.1%	61.1%	38.3%					
	9.2%	6.7%	10.8%	5.6%	14.7%					

Detailed notes for teacher (continued)

CL648	0.688	0.843	0.776	0.514	0.121			
	63.1%	71.6%	66.4%	56.7%	33.3%			
	14.3%	10.7%	13.1%	18.9%	24.3%			
PS390	0.981	1.010	1.080	0.765	0.731			
	76.6%	76.3%	83.2%	70.6%	57.7%			
	7.0%	5.2%	4.5%	11.7%	19.2%			
PS395	0.404	0.175	0.513	0.529	0.615			
	56.0%	48.5%	61.1%	58.8%	57.7%			
	23.3%	34.0%	17.7%	17.6%	15.4%			
MS593	1.089	1.038	1.132	1.222	0.941			
	78.7%	76.2%	81.5%	86.1%	67.7%			
	5.3%	6.7%	4.6%	2.8%	5.9%			
714	0.682	(1.135)				0.901	0.475	1.135
	65.6%	80.6%				70.9%	60.6%	80.6%
	19.6%	10.0%				14.5%	24.4%	10.0%
726	0.484	(1.072)				0.658	0.327	1.072
	56.6%	78.8%				63.1%	50.6%	78.8%
	20.9%	8.0%				17.1%	24.4%	8.0%
PS381	1.274	1.361	1.319	1.059	1.038			
	87.8%	87.6%	90.2%	82.4%	84.6%			
	5.2%	6.2%	2.7%	8.8%	7.7%			
PS383	1.167	1.206	1.150	1.176	1.077			
	84.8%	88.7%	84.0%	85.3%	73.1%			
	9.2%	8.3%	9.7%	8.8%	11.5%			
PB513	1.265	1.372	1.076	1.469	1.400			
	83.4%	88.4%	75.3%	90.7%	90.0%			
	7.1%	7.0%	8.6%	3.1%	6.7%			

Summary: Reading and Textbooks

- "Learning to read mathematics" as a goal for whole numbers, algebra, and problem solving received moderately strong support (70.4% to 77.7%).
- Reading a formal presentation of basic ideas before trying classroom activities was generally opposed by all samples.
- The availability of special materials with minimal reading requirements was given moderately strong support by the AT, SP, TE, and PR samples. However, the MT sample gave weaker support, and the JC and MA samples tended to oppose the idea.
- De-emphasizing reading by presenting problems orally or with pictures and charts was not supported (54.1% disagree).
- The idea that reading should be de-emphasized in textbooks and other materials was opposed by the lay samples (69.1% disagree).
- Textbook modules for teaching appropriate problem-solving strategies at every grade level received strong support.
- Probability and statistics textbooks that emphasize projects and activities were moderately supported.
- The need for detailed notes to guide the teacher in oral presentations of lessons was seen as greater for computer literacy and for probability and statistics (over 62%) than in other content areas, where the level of support was 50% to 60%.
- Providing teachers with a syllabus that suggests topics and methods for each grade level with specific times they should be introduced received moderately strong support (70.9%) at the elementary level from the SP and TE samples. However, support for the same idea at the secondary level was minimal (56.6%).

Use of Audio/Visual Aids

Questions related to the choice and use of audio/visual aids can be grouped into two clusters, on films and videotapes and on large-scale demonstration devices. The generic (general) items related to each of these clusters were:

706, 718: Films or videotapes on concepts or processes (resources)

710, 722: Large-scale demonstration models and devices

Items on manipulative materials or laboratory equipment clearly intended for student use are analyzed in another category, Laboratory/Activity-based Approaches.

Films and videotapes

Response patterns on the use of films or videotapes indicated strong to moderately strong support, ranging from 71% to 88%, for all samples and all content areas. The PR sample was most supportive (88.3%), while the MA sample was least supportive (71.2%). The lowest level of support (71.6%) was on AL147, but this item differed from others in the set, for it pertained to individual study carrels equipped with CAI terminals and videotape cartridge players. There is no way of knowing which component had the least support.

Audiotapes [WN214, PS385] and 35 mm slides [GM314] were also explored as potential resources. The interesting contrast between responses to the two items concerning audiotapes resulted from the implied nature of the tapes and their use. In WN214, the tapes were to be for verbal drill and practice, and this received support at the 65% level from all but the MA sample. In PS385, the tapes were to be of lectures on probability and statistics by eminent statisticians, and this was negatively received by all samples (the coefficient of agreement was -0.359). It might be noted that federal funds have been allotted to develop such materials for other areas: apparently, however, no group would consider them particularly useful. The use of 35 mm slides in geometry [GM314] was supported at the 69% level, with the AT sample most strongly accepting (81.0%).

Films and videotapes

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD42	0.909	1.060	0.840	1.087	0.455					
	76.9%	80.0%	73.9%	89.2%	60.6%					
	14.1%	13.0%	16.8%	6.5%	18.2%					
AL147	0.786	0.705	0.791	1.000	0.786					
	71.6%	67.4%	72.2%	81.8%	71.4%					
	15.5%	19.0%	15.7%	9.1%	10.7%					
WN212	0.826	0.938	0.724	1.026	0.647					
	75.5%	78.3%	74.0%	79.5%	67.7%					
	13.3%	12.4%	14.7%	10.3%	14.7%					
GM308	1.032	1.241	0.874	0.971	1.050					
	82.3%	88.6%	75.8%	82.3%	85.0%					
	8.8%	7.6%	11.6%	8.8%	5.0%					
PS382	1.185	1.186	1.248	1.235	0.846					
	87.0%	87.6%	90.3%	85.3%	73.1%					
	6.3%	6.2%	5.4%	0.0%	19.2%					
RP455	0.989	1.127	1.020	0.621	0.821					
	80.2%	83.3%	81.6%	69.0%	76.9%					
	11.2%	7.8%	8.2%	24.1%	17.9%					
MS582	0.911	1.087	0.836	0.867	0.687					
	78.5%	87.4%	74.2%	76.7%	68.8%					
	9.6%	4.9%	12.5%	3.3%	18.8%					
MS589	0.939	1.000	0.976	0.833	0.687					
	77.2%	80.0%	79.5%	70.0%	65.7%					
	10.9%	8.6%	9.5%	16.6%	18.8%					

Films and videotapes[a] (continued)

706	1.003 (1.353)					1.026	0.981	1.353
	80.7% 88.3%					78.8%	82.6%	88.3%
	10.3% 4.7%					9.3%	11.3%	4.7%
718	1.006 (1.237)					1.053	0.964	1.237
	83.1% 88.3%					83.5%	82.7%	88.3%
	6.6% 4.6%					5.9%	7.2%	4.6%
	80.8%	81.6%	77.7%	79.2%	71.2%	81.2%	82.7%	88.3%

Audiotapes and slides

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN214	0.659	0.732	0.699	0.769	0.176					
	65.1%	66.0%	69.9%	71.8%	38.2%					
	18.4%	17.5%	17.1%	18.0%	26.4%					
PS385	-0.359	-0.670	-0.159	-0.206	-0.269					
	26.0%	16.5%	33.6%	26.4%	26.9%					
	49.7%	67.0%	39.8%	38.3%	42.3%					
GM314	0.685	0.949	0.579	0.588	0.500					
	69.4%	81.0%	63.2%	70.6%	60.0%					
	18.5%	11.4%	23.2%	17.6%	22.5%					

Large-scale demonstration devices

With respect to the use of large-scale demonstration devices, the response patterns indicated, in general, rather strong support for their use (usually over 75%), with the SP, TE, and PR samples most supportive. A lower level of support, particularly from the JC and MA samples, was found on RP446, "charts for reading percents visually", which differed from other items in this category, at least in its specificity. Support was minimal for CL646, pertaining to the use of simulations to demonstrate how a computer works. Perhaps the word "simulations" was the cause of this lower level of support: the samples may prefer the real thing.

A markedly higher level of support was given by the MA sample on CL636, for the availability of wall-sized demonstration screens connected to computers for video output; they were more supportive of this item than of any others in the set.

One item somewhat related to the category of large-scale demonstration devices, "machines for plotting graphs" [RP451], received very little support, although the MA and JC samples were more in favor of this resource than were other samples.

Large-scale demonstration devices

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
FD48	0.896	1.200	0.808	0.870	0.333					
	74.6%	84.0%	73.4%	76.1%	48.5%					
	11.0%	5.0%	12.5%	10.9%	24.3%					
GM313	0.923	1.165	0.895	0.882	0.550					
	77.8%	84.8%	75.8%	82.3%	65.0%					
	10.9%	7.6%	10.6%	8.8%	20.0%					
RP446	0.545	0.755	0.592	0.138	0.179					
	62.4%	69.6%	64.3%	48.2%	48.8%					
	22.0%	15.6%	21.4%	41.3%	25.7%					
MS587	1.007	1.086	0.930	1.100	0.968					
	78.3%	81.9%	75.8%	80.0%	74.2%					
	9.5%	7.6%	11.7%	6.7%	9.7%					
CL636	1.060	0.755	1.294	1.000	1.333					
	77.9%	66.0%	85.4%	78.7%	91.0%					
	8.2%	15.1%	4.6%	3.0%	3.0%					
CL646	0.520	0.578	0.551	0.459	0.303					
	54.1%	58.8%	56.1%	45.9%	42.4%					
	13.6%	13.7%	14.0%	8.1%	18.2%					
710	1.194	(1.335)				1.245	1.145	1.335		
	86.8%	88.3%				88.1%	85.5%	88.3%		
	5.8%	5.9%				3.3%	8.2%	5.9%		
722	1.194	(1.185)				1.243	1.149	1.185		
	86.6%	85.7%				85.5%	87.5%	85.7%		
	5.0%	5.4%				4.6%	5.4%	5.4%		

Large-scale demonstration devices (continued)

RP451	0.090	-0.088	0.112	0.345	0.308
	45.9%	39.2%	48.0%	51.7%	53.8%
	35.1%	43.1%	33.6%	24.1%	25.7%

Summary: Use of Audio/Visual Aids

- Response patterns on the use of films or videotapes indicated strong to moderately strong support from all samples, ranging from 71% to 88%.
- Use of audiotapes for drill and practice received support at the 65% level from all but the MA sample. However, tapes of lectures were negatively perceived by all samples.
- Large-scale demonstration devices were rather strongly supported (usually over 75%), with the SP, TE, and PR samples most supportive.

Logic, Deductive Methods, and Structure

Several introductory items related to aspects of logic, deductive methods, and structure. On UF19, reactions to the amount of emphasis in the 1980s that should be placed on "curricula based on the logic of mathematics" were obtained. Relatively little support (44.9%) was given to increasing emphasis on this item, with the TE sample giving particularly low support (27.1%). Support was decidedly weak for UF15, "formal axiomatic structures". All samples indicated that this was not a topic to receive increased emphasis; only 14.4% favored increased emphasis, while 31.7% favored decreased emphasis. Support was also low for UF13, "proof", with 34.2% of the samples supporting the item. The JC level of support was only 18.1%.

	Total	AT	MT	JC	MA	SP	TE
UF19	0.421	0.424	0.494			0.610	0.034
	44.9%	47.2%	46.2%			54.3%	27.1%
	10.3%	10.4%	7.7%			6.8%	20.4%
UF15	-0.192	-0.275	-0.250			-0.080	-0.175
	14.4%	12.5%	9.6%			17.0%	18.5%
	31.7%	32.5%	29.8%			31.0%	34.0%
UF13	0.281	0.0	0.125	-0.033	0.617	0.396	0.592
	34.2%	22.5%	26.0%	18.1%	46.8%	44.5%	46.9%
	15.6%	26.3%	15.4%	19.7%	4.3%	17.9%	8.1%

Logical reasoning

For four statements on developing logical thinking ability as a course goal [WN204, GM303, PB502, 730], a very high level of support (90% or above) was accorded across samples. When asked if computer literacy should be taught to develop logical thinking abilities [CL635], the level of support was only 80%, still high but nevertheless lower than for the goal when it was in the context of whole numbers, geometry, or problem solving, or when it was a general (generic) item responded to by the lay samples [730].

Logical Reasoning

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
WN204	1.364	1.509	1.189	1.189	1.263	1.558	1.426			
	89.7%	94.4%	82.8%	86.5%	92.1%	92.3%	91.8%			
	3.0%	0.9%	6.3%	0.0%	2.6%	1.9%	3.2%			
GM303	1.517	1.584	1.556	1.444	1.634	1.493	1.344			
	94.0%	94.4%	97.5%	91.7%	97.6%	92.0%	89.0%			
	0.7%	1.1%	0.9%	0.0%	0.0%	0.0%	1.6%			
PB502	1.588	1.642	1.524	1.714	1.710	1.561	1.529			
	95.4%	94.8%	94.3%	100.0%	93.5%	94.7%	97.1%			
	1.6%	0.0%	3.9%	0.0%	0.0%	3.5%	0.0%			
CL635	1.084	1.160	1.036	1.000	0.895	1.123	1.157			
	80.0%	81.1%	77.3%	77.1%	76.4%	84.2%	82.8%			
	7.4%	7.6%	10.0%	11.5%	5.2%	7.1%	2.9%			
730	1.655							1.616	1.742	1.705
	94.8%							93.6%	97.8%	95.8%
	2.1%							2.9%	1.1%	0.0%
	90.8%	91.2%	88.0%	88.8%	89.9%	90.8%	90.2%	93.6%	97.8%	95.8%

Reasoning

Several items pertain to reasoning. RP439 is a goal statement which proposes that ratio be taught to provide "the foundation for a powerful reasoning process", while FD21 and FD31 indicate that teaching fractions or decimals should illustrate "reasoning techniques". GM257 indicates that the content of "logical reasoning principles including axioms and proofs" should be included in the elementary school curriculum, while GM271 proposes the same content for all secondary school students. There is moderate agreement on the first three items (with percentages ranging from 70% to 82%). Support at the 61% level is given to including logical reasoning principles in the secondary school [GM271], but very little support for including this content in the elementary school [GM257]. Perhaps the inclusion of the phrase "including axioms and proofs" served as a deterrent to support.

Reasoning

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
RP439	0.859	0.793	0.890	0.967	0.968	0.915	0.761			
	70.0%	68.4%	71.0%	73.3%	74.2%	71.2%	66.2%			
	9.1%	10.9%	10.0%	10.0%	3.2%	6.8%	9.8%			
FD21	1.046	1.082	1.205	1.349	1.444	0.579	0.771			
	80.1%	79.6%	85.5%	88.4%	88.9%	68.4%	72.8%			
	15.6%	16.3%	11.1%	7.0%	7.4%	26.3%	21.4%			
FD31	1.127	1.184	1.085	0.929	1.423					
	82.4%	85.7%	78.9%	80.9%	88.5%					
	12.4%	11.2%	14.4%	11.9%	7.6%					
GM257	-0.577	-0.141				-0.797	-0.958			
	23.0%	37.0%				17.0%	9.8%			
	58.6%	44.6%				62.7%	73.2%			
GM271	0.543	0.345	0.785	0.553	0.939	0.186	0.517			
	61.1%	54.7%	71.0%	60.5%	75.8%	45.7%	60.0%			
	28.1%	32.1%	19.6%	31.6%	15.2%	42.4%	28.3%			

Logic and proofs

Two items dealt with symbolic logic and truth tables. There was minimal support (51.4%) for including such content for college-bound students who will not be science or mathematics majors [GM284], but very little support (31.0%) for including such content for all students [GM279]. Weak support (25.5%) was also given for having all secondary students prove algebraic generalizations [AL113]. Support was higher (58.1%) for having college-bound students (who will not be science or mathematics majors) learn a variety of proof formats [GM287]. Moderate support (65.7%), however, was given to the goal of learning to make proofs [GM299], while the goal of learning to read and interpret mathematical arguments [GM301] was well supported (82.2%). The TE sample expressed the highest level of support for proofs and mathematical arguments.

Logic and proofs

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL113	-0.477	-0.299	-0.741	-0.750	-0.516	-0.375	-0.300			
	25.5%	29.9%	20.4%	17.9%	25.9%	30.4%	25.7%			
	58.6%	47.7%	70.4%	78.6%	61.3%	55.4%	50.0%			
GM279	-0.369	-0.214	-0.481	-0.100	-0.103	-0.586	-0.525			
	31.0%	33.3%	26.8%	42.5%	43.6%	24.2%	26.2%			
	54.4%	46.5%	57.4%	47.5%	43.6%	63.8%	62.3%			
GM284	0.286	—	0.351	0.059	0.450	0.125	0.343			
	51.4%		52.1%	44.1%	60.0%	42.9%	55.7%			
	28.6%		24.5%	41.2%	22.5%	32.2%	28.5%			
GM287	0.432		0.309	0.471	0.175	0.571	0.614			
	58.1%		55.3%	55.8%	45.0%	66.0%	64.2%			
	24.9%		28.7%	23.5%	30.0%	25.0%	17.2%			
GM299	0.674	0.506	0.819	0.528	0.516	0.676	0.797			
	65.7%	55.1%	69.9%	63.9%	61.0%	66.2%	76.6%			
	15.7%	20.3%	11.2%	19.5%	29.3%	14.9%	7.9%			
GM301	1.107	0.921	1.222	0.972	1.244	1.040	1.219			
	82.2%	69.6%	88.1%	83.3%	82.8%	78.7%	92.2%			
	5.2%	6.7%	2.6%	8.3%	2.4%	10.7%	1.6%			

Structure and properties

The study of structural properties of number systems received higher support (68.5% versus 52.8%) at the elementary level [AL92] than at the secondary level [AL111]. And when the study of properties of classes of numbers (e.g., integers, rationals, reals) was specified [AL115], support dropped to the 49% level.

The goal of teaching mathematics in order to understand the structure of mathematics was given a high level of support (82.4%) for whole numbers [WN203] and considerable support (74.9%) on a generic (general) item [733]. Teaching whole number concepts and skills to develop fundamental understandings on which other mathematical learning can be built [WN208] also received strong support (91.6%).

Developing multiplication and division [WN193] or addition and subtraction [WN199] simultaneously in order to emphasize the relationship between them each received moderate support at the 72% level.

Inferring algebraic relationships from the general patterns of arithmetic [AL158] was supported at a slightly higher level (78.7%). The method of using deductive sequences to develop new ideas and structural characteristics [AL161, 687, 703] was supported at a moderate level (58% to 68%) across groups, with the SP sample most supportive on the generic (general) items. Less support (35.7%) was given to justification of each step of an algorithm by relating it to basic number properties [WN191].

The study of axiomatic structures as an advanced geometry topic for college-bound non-mathematics majors [GM295] was not supported; only 29.7% of the samples were positive toward this item, although the SP sample was more positive at 42.0%. Study of algebraic structures by all high school graduates [AL123] received even less support (20.3%), with both the SP and TE samples giving it slightly higher support than other samples.

Structure and properties

	Total	AT	MT	JC	MA	SP	TE	PR	SB	PT
AL92	0.667	0.698				0.288	0.984			
	68.5%	67.7%				57.7%	80.3%			
	18.0%	18.8%				27.1%	8.2%			
AL111	0.245	0.607	0.028	-0.143	0.161	0.339	0.143			
	52.8%	67.3%	49.1%	35.7%	45.2%	57.2%	42.9%			
	33.5%	22.4%	43.5%	50.0%	35.5%	30.3%	30.0%			
AL115	0.208	0.290	0.250	0.036	0.129	0.143	0.171			
	49.1%	54.2%	50.9%	39.2%	48.4%	44.7%	45.7%			
	34.0%	39.9%	38.0%	39.3%	45.2%	32.1%	28.6%			
WN203	1.144	1.165	1.027	1.243	1.077	1.231	1.230			
	82.4%	81.7%	78.3%	83.7%	79.5%	86.5%	88.5%			
	4.9%	4.6%	9.0%	2.7%	5.1%	0.0%	3.3%			
733	0.923							0.870	0.983	1.105
	74.9%							73.4%	78.4%	76.8%
	7.8%							8.1%	8.3%	5.3%
WN208	1.466	1.509	1.333	1.432	1.538	1.654	1.443			
	91.6%	93.6%	87.4%	91.9%	97.4%	98.1%	86.9%			
	2.5%	1.9%	6.3%	0.0%	0.0%	0.0%	1.6%			
WN193	0.883	1.053	0.633	1.083	0.795	0.987	0.875			
	71.7%	77.7%	64.2%	77.7%	64.1%	76.3%	71.9%			
	11.5%	9.6%	13.8%	11.1%	12.8%	7.9%	14.0%			
WN199	0.938	1.095	0.743	1.135	0.949	0.974	0.875			
	72.1%	77.9%	68.8%	78.4%	66.7%	72.4%	68.8%			
	12.6%	8.5%	15.6%	13.5%	7.7%	13.2%	15.6%			

Structure and properties (continued)

AL158	1.053	0.980	1.180	1.091	0.829		
	78.7%	77.5%	82.8%	78.8%	68.5%		
	2.2%	3.9%	0.9%	0.0%	2.9%		
AL161	0.594	0.676	0.559	0.576	0.486		
	58.4%	58.8%	56.7%	66.7%	54.2%		
	12.4%	6.9%	13.5%	21.2%	17.1%		
687	0.552					0.632	0.423
	60.7%					67.7%	54.1%
	16.9%					14.4%	19.1%
703	0.661					0.773	0.556
	68.4%					74.0%	63.1%
	13.2%					10.0%	16.3%
WN191	-0.150	-0.032	-0.413	-0.270	0.538	-0.342	0.000
	35.7%	42.1%	23.9%	35.1%	53.9%	26.4%	46.9%
	44.7%	42.1%	53.1%	54.0%	20.5%	48.7%	39.0%
GM295	-0.201		-0.274	-0.235	-0.100	0.036	-0.338
	29.7%		27.4%	23.5%	30.0%	41.0%	26.5%
	41.3%		40.0%	44.2%	37.5%	35.7%	48.5%
AL123	-0.598		-0.689	-0.811	-0.786	-0.286	-0.450
	20.3%		16.4%	18.9%	10.7%	28.6%	26.7%
	63.2%		63.9%	78.4%	71.4%	51.0%	58.3%

Summary: Logic, Deductive Methods, and Structures

- Increasing the emphasis on curricula based on the logic of mathematics was given relatively little support (44.9%).
- There was essentially no support for increasing the emphasis on proof or formal axiomatic structures. For the latter, a higher percentage favored decreasing emphasis (31.7%) than increasing emphasis (14.4%).
- Developing logical thinking ability as a goal for whole numbers, geometry, and probability and statistics received very strong support (over 90%) from most professional samples. As a goal for computer literacy, support was only slightly less (80%).
- Developing logical thinking ability as a general goal for mathematics received very strong support (over 93%) from all lay samples.
- Emphasizing reasoning techniques for ratio, fractions, decimals, and secondary geometry received moderately strong support (61% to 82%). However, emphasizing logical reasoning principles in elementary geometry was not supported for elementary school (44.6% oppose).
- Symbolic logic as a topic for all students received very little support (31%), but did receive minimal support (51.4%) for college-bound students (who will not be science or mathematics majors).
- The goal of learning to read and interpret mathematical arguments was strongly supported.
- The goal of teaching mathematics in order to understand the structure of mathematics was strongly supported (82.4%) for whole numbers and moderately supported (74.9%) as a generic (general) item.
- The study of structural properties of number systems received higher support at the elementary level (68.5%) than at the secondary level (52.8%).

Chapter IV

Priorities Survey

In this section data are presented and discussed for the priority (second) survey. The organization of this section follows closely the organization of the priority questionnaire (which was not item-sampled). For the many questions on the priority questionnaire, respondents were asked to rank choices according to their own priorities. A typical table entry is displayed as follows:

0.120 — coefficient of agreement
(2) -- rank of this response for this sample
32.0% — percent giving the item highest rank
26.0% — percent giving the item lowest rank

The coefficient of agreement is calculated in the same manner described in the previous two sections. Note that the percentages for the highest and lowest rank are given — these percentages are not summed for the two highest and two lowest as in previous sections. Follow-up questions asked participants to choose a reason best explaining their highest rank and lowest rank. Therefore, percentages for the highest and lowest ranks have added meaning in interpreting data for subsequent items. Populations used in the priority survey were the same as those used in the preference survey (as noted in chapter I, the JC and MA samples were not included). However, in the second survey, data from the school board member sample and the PTA president sample were combined as a single population, SB/PT.

The primary interpretation for items in this section is based on coefficients of agreement, since responses are forced choices in most cases. As before, the percentages give indications of the "depth of response", which may vary from the implied rank given by the coefficients of agreement.

Items on the priority questionnaire were grouped according to focus. The discussion in this section is organized according to these groups, and a summary is found at the end of each group.

Development of new materials (elementary areas)

If there is only a limited amount of money that can be spent in the 1980s for the development of new materials in five specified content areas, how should it be spent? The results from the combined samples indicated that the order of priorities was:

(1) Problem solving [VP02]

(2) Decimals (concepts and computation) [VP05]

(3) Whole-number computation [VP01]

(4) Measurement [VP03]

(5) Fractions (concepts and computation) [VP04]

All samples strongly agreed that the number one priority is problem solving. Second in priority, but with a decidedly lower level of support across samples, is decimals. Based on coefficients of agreement, the AT, MT, SP, and TE samples gave positive support to the development of materials on decimals, while the PR and SB/PT samples gave less support.

For the third-ranking area, whole-number computation, the pattern is nearly reversed. The MT, SP, and TE samples gave it lower priority than did the lay samples and the AT sample. Little support was given to spending money for the development of materials for measurement or fractions. The SP and TE samples place measurement relatively higher in priority, and fractions relatively lower in priority, than do other samples. In fact, it is interesting to note that the SP and TE samples have high agreement on their rankings of priorities, as do the lay samples.

Why do people feel that problem solving should have highest priority? When we look at the 66.8% of the combined samples that ranked it highest, we find that over half of them (56.0%) did so because they consider it an absolutely crucial skill. A secondary reason, cited by 22.0%, is that it is a major area of difficulty for teachers. The PR sample differed from other samples in that a larger percentage favor the first reason and a lower percentage favor the second reason, compared with other samples.

At this point, we could note the reasons cited by those giving lowest priority to this area. However, readers should note that the percentages in this and the following four tables are percentages of respondents who ranked the designated content area as highest and lowest. Thus, while 51.9% indicated that problem solving is not as important a skill as other skills, this figure actually represents 51.9% of the 2.8% who ranked problem solving lowest -- that is, only 1.4% of the total samples. Because of this factor, only data which appear to be meaningful will be discussed.

Not many people would give decimals the highest or the lowest priority (5.8% and 8.3%, respectively). In contrast, 20.1% would give whole-number computation the highest priority, while 29.6% would give whole-number computation the lowest priority. Of those giving this content area the highest priority, an overwhelming 90.2% say that it is because whole number computation is an absolutely crucial skill. Of those giving it the lowest priority, 61.4% believe that adequate instructional materials on whole numbers already exist, although the PR sample and, to a lesser extent, the MT sample tend to demur on this point. An additional 27.5% believe that this area presents little problem for most teachers; the PR sample identified this reason most often, with the MT sample tending to agree. Almost no one (less than 1%) felt that this area was less important.

Approximately one-fourth of the samples (23.5%) gave the lowest priority to measurement; about one-third (31.9%) of these persons believe that adequate materials already exist, while one-third (34.3%) believe it is not as important for students to develop skills in this area as in other areas. Lowest priority was given to fractions by 34.2%, and almost two-thirds of these persons (64.7%) said that it is because the importance of fractions is diminishing, while an additional 21.2% indicated they believe it is not as important as other skills.

It should be noted that the assignment of highest and lowest priorities was from reasonably consistent rationales.

Development of new materials (elementary areas)

		Total	AT	MT	SP	TE	PR	SB/PT
VP01	Whole numbers	-0.140 (3)	0.120 (2)	-0.344 (4)	-0.348 (4)	-0.452 (4)	0.165 (2)	0.606 (2)
	Highest	20.1%	32.0%	21.0%	9.6%	12.4%	27.1%	31.3%
	Lowest	29.6%	26.0%	34.9%	28.8%	35.5%	27.1%	16.2%
VP02	Problem solving	1.368 (1)	1.126 (1)	0.935 (1)	1.733 (1)	1.602 (1)	1.245 (1)	1.273 (1)
	Highest	66.8%	54.3%	52.2%	82.5%	76.3%	61.2%	61.6%
	Lowest	2.8%	3.0%	4.8%	0.4%	0.7%	4.8%	7.1%
VP03	Measurement	-0.436 (4)	-0.518 (4)	-0.924 (5)	-0.112 (3)	-0.234 (3)	-0.468 (5)	-0.727 (5)
	Highest	3.1%	2.5%	3.3%	3.2%	3.3%	3.2%	3.0%
	Lowest	23.5%	24.1%	40.2%	10.8%	17.4%	26.6%	36.4%
VP04	Fractions	-0.675 (5)	-0.625 (5)	0.016 (3)	-1.253 (5)	-0.870 (5)	-0.356 (3)	-0.643 (4)
	Highest	5.3%	5.0%	15.6%	1.2%	3.3%	6.4%	1.0%
	Lowest	34.2%	38.0%	16.1%	53.4%	38.8%	22.3%	20.4%
VP05	Decimals	-0.039 (2)	0.045 (3)	0.333 (2)	0.020 (2)	0.020 (2)	-0.436 (4)	-0.490 (3)
	Highest	5.8%	8.5%	8.6%	3.6%	5.0%	5.9%	3.1%
	Lowest	8.3%	6.0%	3.8%	5.2%	5.7%	17.6%	19.4%

Reasons for lowest and highest priorities for problem solving (VP02)

		Total	AT	MT	SP	TE	PR
VP85	Lowest (2.8%)*						
	a. Adequate materials	25.9%	50.0%	33.3%	0.0%	0.0%	11.1%
	b. Little problem	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	c. Not as important	51.9%	33.3%	55.6%	0.0%	0.0%	77.8%
	d. Materials inefficient	14.8%	0.0%	11.1%	0.0%	100.0%	11.1%
	e. Importance diminishing	7.4%	16.7%	0.0%	100.0%	0.0%	0.0%
VP86	Highest (66.8%)						
	a. Fewer good materials	10.9%	13.9%	10.3%	12.1%	10.1%	7.8%
	b. Major problem	22.0%	23.1%	23.7%	21.7%	23.3%	17.4%
	c. Crucial skill	56.0%	54.6%	54.6%	55.1%	52.0%	67.8%
	d. New ideas	2.0%	2.8%	3.1%	1.9%	2.2%	0.0%
	e. Importance increasing	9.2%	5.6%	8.2%	9.2%	12.3%	7.0%

* Entries are percentages of samples that ranked the item the lowest or highest. Thus, 25.9% of 2.8% selected option (a); this represents only 0.7% of the total sample. All entries in the tables indicating reasons should be interpreted accordingly.

Reasons for lowest and highest priorities for decimals (VP05)

		Total	AT	MT	SP	TE	PR
VP85	Lowest (8.3%)						
	a. Adequate materials	29.5%	33.3%	28.6%	33.3%	41.2%	20.0%
	b. Little problem	17.9%	25.0%	14.3%	25.0%	5.9%	20.0%
	c. Not as important	29.5%	16.7%	14.3%	8.3%	29.4%	46.7%
	d. Materials inefficient	9.0%	8.3%	28.6%	8.3%	11.8%	3.3%
	e. Importance diminishing	14.1%	16.7%	14.3%	25.0%	11.8%	10.0%
VP86	Highest (5.8%)						
	a. Fewer good materials	4.4%	11.8%	6.3%	0.0%	0.0%	0.0%
	b. Major problem	7.4%	17.6%	0.0%	11.1%	0.0%	9.1%
	c. Crucial skill	38.2%	35.3%	43.8%	55.6%	26.7%	36.4%
	d. New ideas	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	e. Importance increasing	50.0%	35.3%	50.0%	33.3%	73.3%	54.5%

Reasons for lowest and highest priorities for whole-number computation [VP01]

		Total	AT	MT	SP	TR	PR
VP85	Lowest (29.6%)						
	a. Adequate materials	61.4%	73.1%	53.1%	65.3%	67.0%	43.1%
	b. Little problem	27.5%	19.2%	42.2%	20.8%	16.0%	51.0%
	c. Not as important	0.9%	0.0%	1.6%	0.0%	0.9%	2.0%
	d. Materials inefficient	6.1%	5.8%	1.6%	11.1%	7.5%	2.0%
	e. Importance diminishing	4.1%	1.9%	1.6%	2.8%	8.5%	2.0%
VP86	Highest (20.1%)						
	a. Fewer good materials	1.4%	1.6%	2.6%	4.2%	0.0%	0.0%
	b. Major problem	6.5%	9.4%	0.0%	4.2%	8.3%	7.7%
	c. Crucial skill	90.2%	87.5%	97.4%	83.3%	91.7%	90.4%
	d. New ideas	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	e. Importance increasing	1.9%	1.6%	0.0%	8.3%	0.0%	1.9%

Reasons for lowest and highest priorities for measurement (VP03)

		Total	AT	MT	SP	TE	PR
VP85	Lowest (23.5%)						
	a. Adequate materials	31.9%	41.7%	27.0%	37.0%	36.5%	22.0%
	b. Little problem	23.1%	20.8%	23.0%	25.9%	21.2%	26.0%
	c. Not as important	34.3%	22.9%	41.9%	18.5%	30.8%	46.0%
	d. Materials inefficient	8.0%	12.5%	5.4%	18.5%	5.8%	4.0%
	e. Importance diminishing	2.8%	2.1%	2.7%	0.0%	5.8%	2.0%
VP86	Highest (5.3%)						
	a. Fewer good materials	11.1%	20.0%	16.7%	0.0%	10.0%	14.3%
	b. Major problem	13.9%	20.0%	0.0%	12.5%	30.0%	0.0%
	c. Crucial skill	50.0%	40.0%	50.0%	62.5%	40.0%	57.1%
	d. New ideas	2.8%	0.0%	0.0%	12.5%	0.0%	0.0%
	e. Importance increasing	22.2%	20.0%	33.3%	12.5%	20.0%	28.6%

Reasons for lowest and highest priorities for fractions (VP04)

		Total	AT	MT	SP	TE	PR
VP85	Lowest (34.2%)						
	a. Adequate materials	7.6%	5.3%	10.0%	3.8%	10.5%	13.6%
	b. Little problem	1.3%	0.0%	0.0%	1.5%	0.9%	4.5%
	c. Not as important	21.2%	25.0%	30.0%	16.5%	14.9%	38.6%
	d. Materials inefficient	5.3%	2.6%	3.3%	5.3%	5.3%	11.4%
	e. Importance diminishing	64.7%	67.1%	56.7%	72.9%	68.4%	31.8%
VP86	Highest (5.3%)						
	a. Fewer good materials	1.6%	0.0%	0.0%	33.3%	0.0%	0.0%
	b. Major problem	44.4%	40.0%	46.4%	66.7%	50.0%	33.3%
	c. Crucial skill	54.0%	60.0%	53.6%	0.0%	50.0%	66.7%
	d. New ideas	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	e. Importance increasing	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Use of additional fifteen minutes each day

Suppose that an additional 15 minutes per day could be spent on mathematics in elementary schools: how would the respondents use this time? They gave the highest priority to solving word problems [VP06], and the next highest priority to studying applications of mathematics [VP09]. Third in order of priority was drill and practice on basic number skills [VP07], while exploring enrichment topics [VP08] and building an intuitive base for algebra and geometry [VP10] ranked fourth and fifth, respectively.

Not all samples agreed on these rankings. Differences are relatively small, however, except for drill and practice on basic number skills. The MT, PR, and SB/PT samples gave highest priority to this topic, while other samples ranked it lower. Note that 39.5% of the TE sample and 34.0% of the SP sample gave drill on basic number skills the lowest priority.

Use of additional fifteen minutes each day

		Total	AT	MT	SP	TE	PR	SB/PT
VP06	Solving problems	0.810 (1)	0.843 (1)	0.661 (2)	0.952 (1)	0.807 (1)	0.873 (2)	0.556 (2)
	Highest	31.6%	33.3%	26.7%	37.2%	36.3%	26.5%	18.2%
	Lowest	3.6%	4.5%	3.3%	2.4%	4.3%	1.1%	7.1%
VP07	Drill on basics	0.251 (3)	0.581 (2)	0.678 (1)	-0.356 (4)	-0.505 (5)	1.039 (1)	1.192 (1)
	Highest	33.2%	38.4%	46.7%	17.6%	14.7%	53.0%	57.6%
	Lowest	23.4%	14.1%	17.8%	34.0%	39.5%	8.3%	5.1%
VP08	Enrichment	-0.477 (4)	-0.434 (4)	-0.721 (4)	-0.160 (3)	-0.277 (3)	-0.840 (4)	-0.867 (4)
	Highest	10.4%	9.6%	7.8%	14.8%	13.0%	5.5%	6.1%
	Lowest	26.0%	23.2%	35.2%	15.2%	22.3%	36.5%	33.7%
VP09	Applications	0.343 (2)	0.183 (3)	0.206 (3)	0.641 (2)	0.438 (2)	0.182 (3)	0.163 (3)
	Highest	19.3%	13.7%	14.4%	27.5%	24.1%	13.8%	14.3%
	Lowest	5.9%	7.1%	8.3%	3.6%	7.4%	1.1%	9.2%
VP10	Intuitive base	-0.871 (5)	-1.106 (5)	-0.756 (5)	-1.024 (5)	-0.421 (4)	-1.182 (5)	-1.010 (5)
	Highest	5.9%	4.5%	6.1%	3.2%	11.7%	2.2%	4.1%
	Lowest	40.1%	50.0%	34.4%	43.4%	25.4%	51.9%	44.9%

Development of new materials, grades 7-12

Respondents were asked to assign priorities to the development of new materials at the secondary school level in the areas of algebra [VP11], probability [VP12], geometry [VP13], computer literacy [VP14], and statistics [VP15]. Except for the SB/PT sample, respondents agreed that computer literacy should have the highest priority. Interestingly, the SB/PT sample gave their strongest support to algebra, which the total group ranked second. Geometry, statistics, and probability were ranked third, fourth, and fifth, respectively. However, the SP sample disagreed, ranking statistics and probability higher than geometry and algebra. The TE sample also gives a higher ranking to statistics (but not to probability).

Of the total sample, 41.0% gave the highest priority to computer literacy, and more than half of these persons (58.2%) indicated it was because they believe the importance of the area will increase during the 1980s. Over 35% of the respondents gave algebra the highest priority, with 75.1% of these indicating that it is absolutely crucial that more students develop skills in this area. Approximately 26% gave algebra the lowest priority; 79.4% of these persons believe that adequate materials already exist in this area.

Of the 17.7% who gave lowest priority to geometry, nearly one-half (47.2%) believe that we already have adquate materials. Approximately 23% of the respondents gave lowest priority to statistics; 79.3% of these persons consider that it is not as important to develop skills in this area as in other areas on the list. The same reason is given by approximately 80% of the 23.7% of the respondents who assigned probability the lowest priority.

Development of new materials, grades 7-12

		Total	AT	MT	SP	TE	PR	SB/PT
VP11	Algebra	0.206 (2)	0.459 (2)	0.508 (2)	-0.421 (5)	-0.168 (4)	0.653 (2)	1.041 (1)
	Highest	35.6%	41.3%	43.3%	19.4%	29.0%	45.5%	52.0%
	Lowest	26.1%	21.9%	21.4%	38.9%	34.0%	15.3%	6.1%
VP12	Probability	-0.490 (5)	-0.619 (5)	-0.798 (5)	-0.280 (3)	-0.366 (5)	-0.506 (4)	-0.510 (4)
	Highest	5.7%	5.1%	1.6%	6.1%	6.4%	6.8%	10.2%
	Lowest	23.7%	27.4%	30.3%	17.5%	20.8%	24.4%	26.5%
VP13	Geometry	-0.125 (3)	-0.066 (3)	-0.043 (3)	-0.372 (4)	-0.105 (3)	-0.051 (3)	0.031 (3)
	Highest	8.3%	10.7%	5.3%	6.5%	12.5%	6.8%	4.1%
	Lowest	17.7%	19.3%	12.2%	21.1%	18.6%	15.9%	17.3%
VP14	Computer literacy	0.692 (1)	0.561 (1)	0.743 (1)	1.004 (1)	0.689 (1)	0.691 (1)	0.121 (2)
	Highest	41.0%	33.2%	42.6%	54.1%	39.2%	41.7%	25.3%
	Lowest	9.0%	6.1%	10.1%	7.3%	9.8%	8.6%	15.2%
VP15	Statistics	-0.267 (4)	-0.354 (4)	-0.419 (4)	0.085 (2)	-0.030 (2)	-0.669 (5)	-0.684 (5)
	Highest	9.2%	8.2%	6.5%	13.8%	12.8%	1.1%	8.2%
	Lowest	23.2%	25.1%	25.8%	15.9%	16.2%	33.7%	35.7%

Reasons for lowest and highest priorities for computer literacy (VP14)

		Total	AT	MT	SP	TE	PE
VP87	Lowest (9.0%)*						
	a. Adequate materials	10.8%	16.7%	5.3%	10.8%	13.8%	0.0%
	b. Little problem	5.4%	25.0%	5.3%	5.4%	0.0%	0.0%
	c. Not as important	66.7%	58.3%	78.9%	66.7%	65.5%	73.3%
	d. Materials inefficient	16.1%	0.0%	10.5%	16.1%	17.2%	26.7%
	e. Importance diminishing	1.1%	0.0%	0.0%	1.1%	3.4%	0.0%
VP88	Highest (41.0%)						
	a. Fewer good materials	10.7%	15.6%	8.8%	9.0%	10.3%	12.3%
	b. Major problem	4.7%	6.3%	5.0%	6.0%	3.4%	2.7%
	c. Crucial skill	19.1%	12.5%	18.8%	21.1%	21.6%	17.8%
	d. New ideas	7.3%	3.1%	7.5%	6.0%	11.2%	6.8%
	e. Importance increasing	58.2%	62.5%	60.0%	57.9%	53.4%	60.3%

* Entries are percentages of samples that ranked the item the lowest or highest. Thus, 66.7% of 9.0% selected option (c); this represents only 6.0% of the total sample. All entries in the tables indicating reasons should be interpreted accordingly.

Reasons for lowest and highest priorities for algebra (VP11)

		Total	AT	MT	SP	TE	PR
VP87	Lowest (26.1%)						
	a. Adequate materials	79.4%	81.0%	77.5%	80.2%	81.2%	70.4%
	b. Little problem	12.1%	7.1%	20.0%	13.5%	9.9%	11.1%
	c. Not as important	3.3%	4.8%	0.0%	1.0%	4.0%	11.1%
	d. Materials inefficient	3.9%	4.8%	2.5%	4.2%	4.0%	3.7%
	e. Importance diminishing	1.3%	2.4%	0.0%	1.0%	1.0%	3.7%
VP88	Highest (35.6%)						
	a. Fewer good materials	7.5%	16.0%	3.7%	10.4%	3.5%	5.1%
	b. Major problem	7.2%	8.6%	2.5%	6.3%	9.4%	8.9%
	c. Crucial skill	75.1%	59.3%	82.7%	70.8%	82.4%	78.5%
	d. New ideas	4.8%	9.9%	3.7%	6.3%	2.4%	2.5%
	e. Importance increasing	5.3%	6.2%	7.4%	6.3%	2.4%	5.1%

Reasons for lowest and highest priorities for geometry (VP1[illegible])

		Total	AT	MT	SP	TE	PR
VP87	Lowest (17.7%)						
	a. Adequate materials	47.2%	42.1%	47.8%	55.8%	48.1%	35.7%
	b. Little problem	5.6%	5.3%	0.0%	3.8%	11.1%	3.6%
	c. Not as important	34.4%	39.5%	34.8%	34.6%	24.1%	46.4%
	d. Materials inefficient	9.2%	7.9%	8.7%	5.8%	13.0%	10.7%
	e. Importance diminishing	3.6%	5.3%	8.7%	0.0%	3.7%	3.6%
VP88	Highest (8.3%)						
	a. Fewer good materials	18.1%	19.0%	20.0%	18.8%	18.9%	10.0%
	b. Major problem	36.2%	33.3%	50.0%	43.8%	35.1%	20.0%
	c. Crucial skill	24.5%	38.1%	20.0%	12.5%	21.6%	30.0%
	d. New ideas	19.1%	9.5%	10.0%	25.0%	21.6%	30.0%
	e. Importance increasing	2.1%	0.0%	0.0%	0.0%	2.7%	10.0%

Reasons for lowest and highest priorities for statistics (VP15)

		Total	AT	MT	SP	TE	PR
VP87	Lowest (23.2%)						
	a. Adequate materials	8.7%	10.2%	12.5%	5.1%	6.3%	8.6%
	b. Little problem	4.1%	4.1%	2.1%	7.7%	4.2%	3.4%
	c. Not as important	79.3%	79.6%	81.3%	69.2%	81.3%	82.8%
	d. Materials inefficient	6.2%	2.0%	2.1%	15.4%	8.3%	5.2%
	e. Importance diminishing	1.7%	4.1%	2.1%	2.6%	0.0%	0.0%
VP88	Highest (9.2%)						
	a. Fewer good materials	20.8%	18.8%	16.7%	23.5%	21.1%	0.0%
	b. Major problem	4.0%	0.0%	0.0%	2.9%	7.9%	0.0%
	c. Crucial skill	36.6%	43.8%	41.7%	29.4%	36.8%	100.0%
	d. New ideas	2.0%	0.0%	0.0%	5.9%	0.0%	0.0%
	e. Importance increasing	36.6%	37.5%	41.7%	38.2%	34.2%	0.0%

Reasons for lowest and highest priorities for probability (VP12)

		Total	AT	MT	SP	TE	PR
VP87	Lowest (23.7%)						
	a. Adequate materials	12.5%	13.2%	10.5%	16.3%	14.8%	7.0%
	b. Little problem	1.9%	0.0%	3.5%	2.3%	3.3%	0.0%
	c. Not as important	80.2%	83.0%	82.5%	74.4%	72.1%	90.7%
	d. Materials inefficient	3.5%	1.9%	3.5%	4.7%	6.6%	0.0%
	e. Importance diminishing	1.9%	1.9%	0.0%	2.3%	3.3%	2.3%
VP88	Highest (5.7%)						
	a. Fewer good materials	29.3%	20.0%	33.3%	26.7%	31.6%	36.4%
	b. Major problem	8.6%	20.0%	33.3%	0.0%	10.5%	0.0%
	c. Crucial skill	31.0%	40.0%	33.3%	26.7%	15.8%	54.5%
	d. New ideas	3.4%	0.0%	0.0%	13.3%	0.0%	0.0%
	e. Importance increasing	27.6%	20.0%	0.0%	33.3%	42.1%	9.1%

One added course, secondary level

If one new or extensively revised course could be added to the high school curriculum, which should it be? Respondents indicated that their order of priority would be:

(1) A course that helps students make decisions about buying and selling [VP18] (consumer decisions)

(2) A course that helps students understand how calculators and computers handle mathematics [VP19]

(3) A course that helps students understand the mathematics used in specific vocations and careers [VP20]

(4) A course that helps students handle statistical data and make predictions [VP17]

(5) A course that helps students develop a feeling for ideas from calculus [VP16]

The groups agreed that calculus should have the lowest priority, but their responses tended to vary for other choices across samples. The TE sample gave less support than other groups to consumer decisions. On calculators/computers, the SB/PT group gave far less support than other groups, although the PR sample was also less supportive than the professional groups. On the other hand, the SP and TE samples gave strong support to this topic. The same two samples (SP and TE) gave lower support to the vocations/careers course than did other samples. Statistics received more support from the TE sample than any other, with particularly low support from the lay samples and the AT sample.

One added course, secondary level

		Total	AT	MT	SP	TE	PR	SB/PT
VP16	Calculus	-1.240 (5)	-1.363 (5)	-1.065 (5)	-1.467 (5)	-1.178 (5)	-1.192 (5)	-1.040 (5)
	Highest	5.5%	4.7%	6.5%	4.5%	4.8%	5.1%	10.1%
	Lowest	61.4%	65.8%	54.3%	71.5%	57.9%	59.3%	55.6%
VP17	Statistics	0.058 (4)	-0.223 (4)	0.027 (4)	0.275 (3)	0.620 (2)	-0.494 (4)	-0.556 (4)
	Highest	17.4%	8.8%	17.2%	20.2%	31.9%	7.3%	3.0%
	Lowest	9.0%	9.3%	10.8%	6.5%	4.7%	13.5%	16.2%
VP18	Consumer decisions	0.607 (1)	0.928 (1)	0.398 (1)	0.684 (1)	0.137 (3)	0.966 (1)	0.920 (2)
	Highest	30.2%	39.7%	25.8%	30.8%	16.7%	41.8%	37.0%
	Lowest	7.2%	4.6%	12.4%	4.5%	11.3%	4.0%	3.0%
VP19	Calculators/ computers	0.387 (2)	0.264 (3)	0.371 (2)	0.679 (2)	0.662 (1)	0.073 (3)	-0.323 (3)
	Highest	25.4%	21.8%	24.7%	32.9%	33.1%	16.3%	8.1%
	Lowest	8.9%	7.8%	8.1%	4.9%	6.1%	15.7%	18.2%
VP20	Vocations	0.216 (3)	0.428 (2)	0.278 (3)	-0.113 (4)	-0.259 (4)	0.730 (2)	0.990 (1)
	Highest	22.3%	26.3%	26.7%	13.3%	12.9%	30.3%	42.0%
	Lowest	13.7%	12.4%	15.5%	12.5%	20.4%	6.7%	8.0%

Attention to five areas

How much attention should be given to a unified approach to mathematical topics [VP21], computer literacy for everyone [VP22], applications of mathematics [VP23], structure in mathematics [VP24], and interdisciplinary approaches [VP25] during the 1980s? Respondents clearly indicated that the highest priority should be given to applications, and the next highest in priority should be computer literacy. They also agreed that structure in mathematics should have the lowest priority. Third and fourth priorities were given to unified and interdisciplinary approaches, respectively. A unified approach was given a higher level of support from the SB/PT sample than it was given by other samples.

It might be noted that the discrepancy in rankings of interdisciplinary approach and applications could indicate that respondents do not see a relationships between the two.

Attention to five areas

		Total	AT	MT	SP	TE	PR	SB/PT
VP21	Unified approach	-0.046 (3)	-0.015 (3)	-0.080 (4)	-0.244 (3)	-0.017 (3)	-0.050 (3)	0.370 (2)
	Highest	20.6%	18.0%	23.0%	16.8%	21.7%	17.7%	32.0%
	Lowest	19.6%	18.6%	21.9%	23.6%	17.4%	20.4%	12.0%
VP22	Computer literacy	0.350 (2)	0.128 (2)	0.409 (2)	0.659 (2)	0.495 (2)	0.133 (2)	-0.140 (3)
	Highest	26.1%	20.0%	28.5%	32.5%	30.2%	21.7%	13.0%
	Lowest	12.1%	16.4%	11.8%	5.6%	9.3%	15.6%	23.0%
VP23	Applications	0.869 (1)	0.825 (1)	0.674 (1)	0.920 (1)	0.773 (1)	1.089 (1)	1.080 (1)
	Highest	36.3%	37.1%	27.8%	35.2%	31.3%	48.3%	47.0%
	Lowest	2.9%	2.1%	3.2%	2.8%	3.0%	3.3%	3.0%
VP24	Structure	-0.760 (5)	-0.492 (5)	-0.914 (5)	-0.904 (5)	-0.910 (5)	-0.483 (4)	-0.677 (5)
	Highest	7.7%	14.0%	6.4%	5.6%	7.7%	8.3%	2.0%
	Lowest	38.8%	33.2%	42.8%	42.6%	46.2%	28.3%	29.3%
VP25	Interdisciplinary	-0.393 (4)	-0.405 (4)	-0.075 (3)	-0.452 (4)	-0.316 (4)	-0.644 (5)	-0.596 (4)
	Highest	9.2%	11.3%	13.9%	9.2%	9.0%	4.4%	6.1%
	Lowest	25.9%	28.2%	19.8%	25.6%	23.3%	31.7%	31.3%

Attention to five additional areas

When an additional give areas were considered, the order of priorities was:

(1) Career or vocation orientation [VP26]

(2) Consumer orientation [VP27]

(3) Computer orientation [VP30]

(4) College preparatory orientation [VP28]

(5) Recreation or leisure-time orientation [VP29]

Every sample ranked the recreational orientation fifth, but there was discrepancy in the rankings across samples for the other areas. In particular, the SP and TE samples did not give vocations as high a degree of support as did the other samples. Interestingly, the SP sample ranked the consumer orientation number one, while the TE sample ranked college prepratory orientation first. Both the SP and TE samples gave higher priority to a computer orientation than did the other samples.

Attention to five additional areas

		Total	AT	MT	SP	TE	PR	SB/PT
VP26	Vocations	0.602 (1)	0.869 (1)	0.508 (1)	0.284 (3)	0.315 (3)	0.984 (1)	1.190 (1)
	Highest Lowest	26.4% 5.0%	32.8% 2.0%	22.2% 4.3%	17.6% 9.2%	18.1% 7.0%	38.2% 2.2%	46.0% 1.0%
VP27	Consumer	0.570 (2)	0.822 (2)	0.403 (3)	0.699 (1)	0.232 (4)	0.758 (2)	0.720 (2)
	Highest Lowest	28.9% 3.8%	36.0% 2.0%	25.3% 3.8%	32.1% 3.2%	20.5% 7.4%	34.9% 1.6%	27.0% 2.0%
VP28	College preparatory	0.154 (4)	-0.056 (3)	0.438 (2)	-0.193 (4)	0.477 (1)	0.048 (3)	0.140 (3)
	Highest Lowest	19.2% 10.9%	14.6% 13.1%	28.1% 7.0%	10.0% 16.9%	29.2% 8.4%	11.8% 9.7%	19.0% 8.0%
VP29	Recreational	-1.477 (5)	-1.459 (5)	-1.591 (5)	-1.373 (5)	-1.466 (5)	-1.516 (5)	-1.515 (5)
	Highest Lowest	1.7% 68.2%	0.5% 64.3%	1.6% 75.3%	4.0% 66.3%	1.0% 67.4%	0.5% 67.7%	3.0% 70.7%
VP30	Computer	0.172 (3)	-0.126 (4)	0.237 (4)	0.594 (2)	0.468 (2)	-0.253 (4)	-0.505 (4)
	Highest Lowest	23.7% 11.7%	16.6% 17.1%	22.6% 10.2%	35.3% 4.8%	31.4% 9.0%	14.5% 17.7%	5.1% 18.2%

Types of students

What is the priority for addressing the needs of different types of students? All respondents agreed that students with mathematics learning problems and other handicaps [VP34] should have first priority, and that inner-city or urban-area students [VP32] should have second priority. The overall ranking for the remainder of the items is: students of ethnic minority background [VP33], third; students whose first language is not English [VP31], fourth; and female students [VP35], fifth. However, the SP and TE samples would rank females third, and students whose first language is not English, fifth.

Fully 63% of the respondents gave students with learning problems the highest priority. Approximately one-half of these people (45.4%) felt that such students have special needs which should be addressed through curriculum.

Approximately 20% of the respondents gave the highest priority to urban students, with 61.3% of these feeling that this type of student makes up such a large fraction of the school population that we should devote significant resources to meeting his or her specialized needs.

It is interesting that the priority for ethnic minority students was not higher. Of the 13.4% who gave these students the lowest priority, about one half (46.9%) felt that this type of student had no special needs in mathematics. The reasons for the priority assigned second-language students are well-distributed over the five choices. For female students, however, lowest priority was assigned because the respondents (71.0%) felt that these students had no special needs in mathematics.

Types of students

		Total	AT	MT	SP	TE	PR	SB/PT
VP31	Second language	-0.602 (4)	-0.446 (4)	-0.408 (3)	-0.848 (5)	-0.891 (5)	-0.413 (4)	-0.097 (3)
	Highest	4.4%	5.2%	6.7%	2.9%	2.7%	6.4%	4.3%
	Lowest	28.9%	26.4%	24.0%	37.4%	35.8%	22.7%	10.8%
VP32	Urban	0.524 (2)	0.578 (2)	0.475 (2)	0.641 (2)	0.525 (2)	0.462 (2)	0.309 (2)
	Highest	20.2%	20.8%	16.2%	24.5%	23.4%	15.8%	12.8%
	Lowest	4.2%	4.2%	4.5%	3.3%	4.7%	2.3%	7.4%
VP33	Ethnic minority	-0.406 (3)	-0.368 (3)	-0.480 (4)	-0.559 (4)	-0.389 (4)	-0.170 (3)	-0.430 (4)
	Highest	3.6%	4.1%	2.3%	0.8%	6.1%	5.3%	1.1%
	Lowest	13.4%	10.4%	13.0%	16.7%	15.4%	9.4%	12.9%
VP34	Learning problems	1.260 (1)	1.273 (1)	1.236 (1)	1.312 (1)	1.047 (1)	1.383 (1)	1.571 (1)
	Highest	63.0%	64.9%	63.7%	60.3%	52.5%	70.3%	82.7%
	Lowest	4.1%	3.6%	4.9%	3.2%	6.4%	2.3%	2.0%
VP35	Female	-0.750 (5)	-1.041 (5)	-0.844 (5)	-0.498 (3)	-0.260 (3)	-1.208 (5)	-1.312 (5)
	Highest	9.4%	4.1%	11.7%	11.8%	16.1%	2.3%	1.1%
	Lowest	49.2%	54.9%	55.0%	38.4%	38.0%	61.8%	66.7%

Reasons for lowest and highest priorities for students with learning problems (VP34)

		Total	AT	MT	SP	TE	PR
VP89	Lowest (4.1%)*						
	a. Curriculum	4.3%	0.0%	0.0%	0.0%	5.6%	25.0%
	b. No special needs	6.5%	0.0%	0.0%	12.5%	11.1%	0.0%
	c. Small group	8.7%	0.0%	11.1%	0.0%	16.7%	0.0%
	d. Not in my classroom	2.2%	0.0%	0.0%	0.0%	0.0%	25.0%
	e. Other approaches	78.3%	100.0%	88.9%	87.5%	66.7%	50.0%
VP90	Highest (63.0%)						
	a. Very special needs	45.4%	49.2%	40.0%	45.3%	46.1%	45.9%
	b. Fewer materials	16.5%	8.7%	19.1%	23.6%	15.6%	14.8%
	c. Large group	18.5%	15.1%	19.1%	12.8%	26.6%	18.0%
	d. Many in my classroom	6.5%	11.9%	8.7%	3.4%	2.6%	7.4%
	e. Pressure on schools	13.1%	15.1%	13.0%	14.9%	9.1%	13.9%

* Entries are percentages of samples that ranked the item the lowest or highest. Thus, 78.3% of 4.1% selected option (e); this represents only 3.2% of the total sample. All entries in the tables indicating reasons should be interpreted accordingly.

Reasons for lowest and highest priorities for urban students (VP32)

		Total	AT	MT	SP	TE	PR
VP89	Lowest (4.2%)						
	a. Curriculum	18.6%	25.0%	12.5%	12.5%	21.4%	20.0%
	b. No special needs	27.9%	25.0%	37.5%	25.0%	28.6%	20.0%
	c. Small group	4.7%	0.0%	0.0%	0.0%	0.0%	40.0%
	d. Not in my classroom	20.9%	50.0%	25.0%	0.0%	21.4%	0.0%
	e. Other approaches	27.9%	0.0%	25.0%	62.5%	28.6%	20.0%
VP90	Highest (20.2%)						
	a. Very special needs	19.1%	22.5%	13.8%	23.3%	17.4%	14.8%
	b. Fewer materials	6.7%	7.5%	6.9%	3.3%	5.8%	14.8%
	c. Large group	61.3%	55.0%	51.7%	61.7%	68.1%	63.0%
	d. Many in my classroom	3.6%	7.5%	10.3%	1.7%	1.4%	0.0%
	e. Pressure on schools	9.3%	7.5%	17.2%	10.0%	7.2%	7.4%

Reasons for lowest and highest priorities for ethnic minority students (VP33)

		Total	AT	MT	SP	TE	PR
VP89	Lowest (13.4%)						
	a. Curriculum	19.3%	10.0%	17.4%	24.4%	24.4%	6.3%
	b. No special needs	46.9%	35.0%	56.5%	41.5%	44.4%	68.8%
	c. Small group	12.4%	20.0%	4.3%	14.6%	15.6%	0.0%
	d. Not in my classroom	4.1%	10.0%	13.0%	0.0%	0.0%	6.3%
	e. Other approaches	17.2%	25.0%	8.7%	19.5%	15.6%	18.8%
VP90	Highest (3.6%)						
	a. Very special needs	32.5%	62.5%	50.0%	0.0%	23.5%	22.2%
	b. Fewer materials	35.0%	25.0%	25.0%	50.0%	35.3%	44.4%
	c. Large group	17.5%	0.0%	0.0%	0.0%	29.4%	22.2%
	d. Many in my classroom	7.5%	0.0%	0.0%	50.0%	5.9%	11.1%
	e. Pressure on schools	7.5%	12.5%	25.0%	0.0%	5.9%	0.0%

Reasons for lowest and highest priorities for second-language students (VP31)

		Total	AT	MT	SP	TE	PR
VP89	Lowest (28.9%)						
	a. Curriculum adequate	6.1%	3.9%	2.3%	11.0%	4.9%	5.3%
	b. No special needs	18.7%	23.5%	20.9%	12.1%	23.3%	13.2%
	c. Small group	27.9%	25.5%	25.6%	35.2%	23.3%	28.9%
	d. Not in my classroom	11.3%	13.7%	18.6%	5.5%	9.7%	18.4%
	e. Other approaches	35.9%	33.3%	32.6%	36.3%	38.8%	34.2%
VP90	Highest (4.4%)						
	a. Very special needs	26.5%	30.0%	8.3%	14.3%	25.0%	50.0%
	b. Fewer materials	49.0%	50.0%	58.3%	57.1%	62.5%	25.0%
	c. Large group	8.2%	0.0%	8.3%	14.3%	12.5%	8.3%
	d. Many in my classroom	4.1%	10.0%	0.0%	14.3%	0.0%	0.0%
	e. Pressure on schools	12.2%	10.0%	25.0%	0.0%	0.0%	16.7%

Reasons for lowest and highest priorities for female students (VP35)

		Total	AT	MT	SP	TE	PR
VP89	Lowest (49.2%)						
	a. Curriculum	22.0%	13.5%	21.2%	33.3%	27.3%	15.7%
	b. No special needs	71.0%	80.8%	74.7%	58.1%	63.6%	76.9%
	c. Small group	0.4%	1.0%	0.0%	1.1%	0.0%	0.0%
	d. Not in my classroom	0.6%	1.9%	0.0%	0.0%	0.0%	0.9%
	e. Other approaches	6.0%	2.9%	4.0%	7.5%	9.1%	6.5%
VP90	Highest (9.4%)						
	a. Very special needs	18.5%	37.5%	19.0%	13.8%	17.4%	25.0%
	b. Fewer materials	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	c. Large group	75.0%	50.0%	66.7%	82.8%	78.3%	75.0%
	d. Many in my classroom	2.8%	0.0%	4.8%	0.0%	4.3%	0.0%
	e. Pressure on schools	3.7%	12.5%	9.5%	3.4%	0.0%	0.0%

Teacher education

What priorities should be given to addressing areas within teacher education? Methods [VP37] was the number one choice, given first priority by all groups except the SB/PT sample, by whom it was ranked second. Second choice across samples was sensitivy to student needs [VP39], with less support for this by the MT sample than by other samples. Content [VP36] was ranked third, being supported more strongly by the MT and TE samples than by the AT and SP samples. Interestingly, the percentages ranking methods and content highest differ comparatively little, but the percentages ranking the two areas lowest differ markedly.

Diagnostic and remediation strategies [VP40] was ranked fourth, with some variance across samples; about the same percentages ranked the topic highest and lowest. The development of materials [VP38] was given fifth priority by all samples.

Thus, methods is the only clear positive priority and materials the only clear negative priority. Perhaps if level (elementary or secondary) had been specified, the pattern might have been different. It is possible that in some cases the distributions could be the result of some persons responding for one level and some for the other level.

Teacher education

		Total	AT	MT	SP	TE	PR	SB/PT
VP36	Content	0.012 (3)	-0.090 (4)	0.280 (2)	-0.121 (4)	0.318 (2)	-0.349 (4)	-0.194 (3)
	Highest Lowest	29.5% 28.6%	25.6% 28.6%	34.9% 22.6%	24.3% 28.7%	40.1% 26.5%	22.2% 37.6%	21.4% 28.6%
VP37	Methods	0.618 (1)	0.563 (1)	0.447 (1)	0.872 (1)	0.639 (1)	0.529 (1)	0.515 (2)
	Highest Lowest	29.7% 5.8%	32.2% 7.5%	23.4% 7.4%	37.2% 2.8%	28.5% 6.3%	30.2% 5.3%	21.2% 6.1%
VP38	Materials	-0.685 (5)	-0.637 (5)	-0.711 (5)	-1.096 (5)	-0.500 (5)	-0.468 (5)	-0.667 (5)
	Highest Lowest	5.5% 32.7%	3.5% 31.3%	9.6% 37.4%	3.6% 47.0%	6.6% 25.5%	5.9% 22.3%	3.0% 32.3%
VP39	Sensitivity	0.103 (2)	0.229 (2)	-0.085 (4)	0.135 (3)	-0.196 (3)	0.312 (2)	0.633 (1)
	Highest Lowest	20.7% 13.8%	23.9% 12.4%	16.5% 19.1%	17.5% 10.4%	15.3% 18.3%	24.9% 10.6%	38.8% 7.1%
VP40	Diagnosis/ remediation	0.003 (4)	0.055 (3)	0.085 (3)	0.235 (2)	-0.201 (4)	0.0 (3)	-0.222 (4)
	Highest Lowest	15.6% 18.1%	17.9% 17.9%	16.0% 12.8%	18.3% 10.8%	10.7% 22.4%	16.4% 23.3%	16.2% 24.2%

Across areas

When the focus of each of the five broad areas addressed in previous sets of questions were compared, how did respondents assign priority? Of great interest is that the ranking for each area is the same for the AT, MT, SP, and TE samples. Their rankings were:

(1) Improved preservice and in-service education for teaching mathematics [VP43]

(2) Improvement of methods and techniques for teaching mathematics [VP45]

(3) Development of special mathematics materials for students with special needs [VP42]

(4) Development of non-text materials for teaching mathematics [VP44]

(5) Improved mathematics content for textbooks [VP41]

On the other hand, the lay samples gave highest priority to methods and lowest priority to non-text materials. They differed in their rankings of the remaining three areas.

Of the 38.4% of the respondents who ranked pre- and in-service education highest, almost three-fourths (74.1%) indicated that they believed it would have far-reaching impact on mathematics education generally. A similar percentage (71.0%) of the 22.5% who gave highest priority to improved methods also selected this reason.

Lowest priority by 25.0% of the respondents was given to non-text materials becuase these were considered (by 41.7%) to have less impact on mathematics education; a secondary reason, given by 35.0%, was that sufficient materials, methods, or understanding were already available. This reason was also given by 66.1% of the 44.1% who gave lowest priority to improved textbook content. The potential for far-reaching impact was cited by 56.1% of the 14.2% who gave this area highest priority.

Across areas

		Total	AT	MT	SP	TE	PR	SB/PT
VP41	Textbook content	-0.656 (5)	-0.772 (5)	-0.406 (5)	-1.064 (5)	-0.699 (5)	-0.546 (4)	0.072 (3)
	Highest	14.2%	13.2%	21.4%	7.2%	12.7%	14.6%	24.7%
	Lowest	44.1%	47.2%	36.9%	57.2%	43.8%	41.1%	24.7%
VP42	Special pupils	-0.062 (3)	0.106 (3)	-0.144 (3)	-0.159 (3)	-0.324 (3)	0.292 (3)	0.133 (2)
	Highest	17.5%	20.6%	17.6%	13.5%	11.7%	27.6%	20.4%
	Lowest	15.3%	14.1%	19.1%	13.5%	18.1%	11.9%	13.3%
VP43	Teacher education	0.714 (1)	0.548 (1)	0.503 (1)	1.072 (1)	1.117 (1)	0.323 (2)	0.070 (4)
	Highest	38.4%	37.2%	27.8%	52.2%	49.3%	23.1%	22.0%
	Lowest	7.4%	11.6%	9.6%	2.8%	2.3%	11.8%	13.0%
VP44	Non-text materials	-0.477 (4)	-0.192 (4)	-0.305 (4)	-0.558 (4)	-0.532 (4)	-0.591 (5)	-0.788 (5)
	Highest	8.4%	13.1%	12.3%	4.4%	7.4%	7.5%	6.1%
	Lowest	25.0%	16.7%	25.1%	22.3%	26.3%	29.0%	37.4%
VP45	Methods	0.526 (2)	0.389 (2)	0.337 (2)	0.713 (2)	0.500 (2)	0.629 (1)	0.566 (1)
	Highest	22.5%	18.7%	20.9%	22.7%	19.5%	29.6%	28.3%
	Lowest	7.5%	9.6%	9.6%	3.6%	8.4%	4.8%	11.1%

Reasons for lowest and highest priorities for pre- and in-service education (VP43)

		Total	AT	MT	SP	TE	PR
VP91	Lowest (7.4%)*						
	a. Sufficient materials	32.5%	34.8%	16.7%	42.9%	71.4%	27.3%
	b. Few problems	18.2%	21.7%	22.2%	14.3%	14.3%	13.6%
	c. Importance diminishing	2.6%	0.0%	0.0%	0.0%	0.0%	9.1%
	d. Less impact	36.4%	39.1%	33.3%	42.9%	0.0%	45.5%
	e. Not very important	10.4%	4.3%	27.8%	0.0%	14.3%	4.5%
VP92	Highest (38.4%)						
	a. Insufficient materials	10.4%	10.8%	11.8%	8.4%	8.9%	19.0%
	b. Many problems	7.0%	8.1%	2.0%	5.3%	5.5%	21.4%
	c. Importance increasing	1.8%	2.7%	2.0%	1.5%	2.1%	0.0%
	d. Non-implemented	6.8%	6.8%	0.0%	3.8%	10.3%	11.9%
	e. Far-reaching impact	74.1%	71.6%	84.3%	80.9%	73.3%	47.6%

* Entries are percentages of samples that ranked the item the lowest or highest. Thus, 36.4% of 7.4% selected option (d); this represents only 2.7% of the total sample. All entries in the tables indicating reasons should be interpreted accordingly.

Reasons for lowest and highest priorities for improved methods (VP45)

		Total	AT	MT	SP	TE	PR
VP91	Lowest (7.5%)						
	a. Sufficient materials	60.8%	47.4%	41.2%	66.7%	76.0%	77.8%
	b. Few problems	24.1%	52.6%	23.5%	11.1%	8.0%	22.2%
	c. Importance diminishing	1.3%	0.0%	0.0%	11.1%	0.0%	0.0%
	d. Less impact	11.4%	0.0%	29.4%	11.1%	12.0%	0.0%
	e. Not very important	2.5%	0.0%	5.9%	0.0%	4.0%	0.0%
VP92	Highest (22.5%)						
	a. Insufficient materials	7.8%	16.2%	0.0%	7.0%	8.6%	7.4%
	b. Many problems	12.2%	10.8%	15.4%	14.0%	10.3%	11.1%
	c. Importance increasing	2.9%	2.7%	0.0%	3.5%	1.7%	5.6%
	d. Non-implemented	6.1%	5.4%	2.6%	7.0%	12.1%	1.9%
	e. Far-reaching impact	71.0%	64.9%	82.1%	68.4%	67.2%	74.1%

Reasons for lowest and highest priorities for special materials for special students (VP42)

		Total	AT	MT	SP	TE	PR
VP91	Lowest (15.3%)						
	a. Sufficient materials	35.4%	39.3%	33.3%	44.1%	25.9%	43.5%
	b. Few problems	12.0%	21.4%	2.8%	11.8%	9.3%	21.7%
	c. Importance diminishing	2.3%	0.0%	2.8%	2.9%	3.7%	0.0%
	d. Less impact	45.7%	35.7%	47.2%	41.2%	57.4%	34.8%
	e. Not very important	4.6%	3.6%	13.9%	0.0%	3.7%	0.0%
VP92	Highest (17.5%)						
	a. Insufficient materials	33.0%	26.8%	21.2%	38.2%	34.3%	41.2%
	b. Many problems	36.6%	41.5%	45.5%	32.4%	31.4%	33.3%
	c. Importance increasing	4.6%	2.4%	6.1%	5.9%	2.9%	5.9%
	d. Non-implemented	3.1%	4.9%	0.0%	2.9%	2.9%	3.9%
	e. Far-reaching impact	22.7%	24.4%	27.3%	20.6%	28.6%	15.7%

Reasons for lowest and highest priorities for non-text materials (VP44)

		Total	AT	MF	SP	TE	PR
VP91	Lowest (25.0%)						
	a. Sufficient materials	35.0%	36.4%	40.4%	34.5%	32.1%	34.0%
	b. Few problems	12.8%	9.1%	6.4%	12.7%	12.8%	20.8%
	c. Importance diminishing	0.8%	3.0%	0.0%	1.8%	0.0%	0.0%
	d. Less impact	41.7%	45.5%	38.3%	45.5%	38.5%	43.4%
	e. Not very important	9.8%	6.1%	14.9%	5.5%	16.7%	1.9%
VP92	Highest (8.4%)						
	a. Insufficient materials	35.1%	32.0%	47.8%	36.4%	27.3%	30.8%
	b. Many problems	27.7%	16.0%	21.7%	36.4%	36.4%	38.5%
	c. Importance increasing	2.1%	0.0%	4.3%	0.0%	0.0%	7.7%
	d. Non-implemented	9.6%	24.0%	4.3%	0.0%	4.5%	7.7%
	e. Far-reaching impact	25.5%	28.0%	21.7%	27.3%	31.8%	15.4%

Reasons for lowest and highest priorities for improved textbook content (VP41)

		Total	AT	MT	SP	TE	PR
VP91	Lowest (44.1%)						
	a. Sufficient materials	66.1%	74.2%	68.1%	65.0%	68.7%	52.0%
	b. Few problems	17.0%	18.3%	15.9%	16.1%	12.2%	26.7%
	c. Importance diminishing	1.8%	1.1%	0.0%	2.1%	2.3%	2.7%
	d. Less impact	13.7%	6.5%	15.9%	14.7%	16.0%	14.7%
	e. Not very important	1.4%	0.0%	0.0%	2.1%	0.8%	4.0%
VP92	Highest (14.2%)						
	a. Insufficient materials	13.5%	15.4%	17.5%	22.2%	2.6%	15.4%
	b. Many problems	13.5%	26.9%	7.5%	11.1%	13.2%	11.5%
	c. Importance increasing	8.1%	3.8%	10.0%	11.1%	10.5%	3.8%
	d. Non-implemented	8.8%	15.4%	5.0%	5.6%	13.2%	3.8%
	e. Far-reaching impact	56.1%	38.5%	60.0%	50.0%	60.5%	65.4%

General problems

How do respondents rank general problems — that is, problems not specific to mathematics classrooms? Somewhat surprisingly, there is a fair degree of agreement across samples on how such problems are ranked. The following list indicates the rank ordering for the combined samples, with the range noted.

(1) Unmotivated students [VP52] - range 1 to 3; ranked first by all except the TE and SB/PT samples.

(2) Reading difficulties [VP51] - range 1 to 4, with the SB/PT sample giving it first priority.

(3) Classroom discipline [VP46] - range 1 to 5, with the TE sample ranking it first.

(4) No commitment to homework [VP53] - range 3 to 5.

(5) Lowering of school academic standards [VP47] - range 2 to 6, with the MT sample giving it second highest priority.

(6) Irregular attendance of students [VP48] - range 5 to 6, with only the SP sample ranking it fifth.

(7) Increased teacher workloads [VP58] - range 7 to 8 for all samples except the SB/PT sample, who ranked it thirteenth.

(8) Emphasis on non-academic school [VP59] - range 7 to 10.

(9) Increasing class size [VP56] - range 7 to 10, with the AT sample ranking it seventh.

(10) Mixing of students with differing abilities [VP55] - range 10 to 12.

(11) Lack of community support) [VP50] - range 7 to 14; the SB/PT sample ranked it seventh, while the MT sample placed it fourteenth. [Note that the item had one word omitted, which may have affected the responses.]

(12) Decline in student abilities [VP54] - range 10 to 14, with the MT sample ranking it tenth.

(13) Governmental or administrative restrictions [VP49] - range 8 to 14, with the SB/PT sample ranking it eighth, much higher than other samples.

(14) Too much free time for students [VP57] - range 11 to 14.

(15) Restrictions on instructional materials [VP60] - excellent agreement, with all samples ranking it last.

It should be noted that the levels of agreement were positive for the first seven items, and negative for the final eight.

General problems

		Total	AT	MT	SP	TE	PR	SB/PT
VP46	Discipline	0.912 (3)	0.855 (2)	0.610 (5)	1.016 (2)	1.169 (1)	0.541 (4)	1.263 (2)
	Highest	41.0%	43.0%	31.6%	42.0%	45.4%	31.9%	56.6%
	Lowest	5.8%	8.5%	9.6%	2.8%	1.4%	10.3%	6.1%
VP47	Lowering of standards	0.730 (5)	0.732 (4)	1.037 (2)	0.472 (6)	0.932 (4)	0.449 (5)	0.717 (4)
	Highest	29.8%	31.8%	36.7%	18.8%	35.1%	25.4%	32.3%
	Lowest	4.5%	4.5%	2.7%	4.8%	2.7%	8.1%	6.1%
VP48	Attendance	0.444 (6)	0.335 (6)	0.590 (6)	0.696 (5)	0.399 (6)	0.391 (6)	-0.031 (6)
	Highest	20.6%	18.8%	26.1%	26.8%	15.4%	21.7%	11.2%
	Lowest	7.2%	6.6%	4.8%	6.4%	4.4%	12.5%	14.3%
VP49	Governmental restrictions	-0.506 (13)	-0.624 (14)	-0.392 (12)	-0.538 (12)	-0.331 (12)	-0.816 (14)	-0.347 (8)
	Highest	7.5%	6.1%	9.7%	7.2%	5.1%	8.1%	13.3%
	Lowest	27.0%	32.5%	22.0%	27.5%	16.2%	41.6%	28.6%
VP50	Lack of community support	-0.319 (11)	-0.431 (12)	-0.456 (14)	-0.150 (8)	-0.201 (11)	-0.617 (12)	-0.071 (7)
	Highest	6.5%	6.6%	4.9%	8.5%	4.1%	4.4%	15.3%
	Lowest	19.3%	23.9%	23.1%	13.4%	12.9%	26.1%	24.5%
VP51	Reading difficulties	0.954 (2)	0.825 (3)	0.947 (4)	0.816 (3)	0.946 (3)	1.076 (2)	1.370 (1)
	Highest	31.5%	28.0%	31.6%	22.8%	28.2%	40.2%	54.0%
	Lowest	1.6%	3.5%	1.6%	1.6%	0.7%	0.5%	2.0%

General problems (continued)

		Total	AT	MT	SP	TE	PR	SB/PT
VP52	Unmotivated students	1.196 (1)	1.278 (1)	1.172 (1)	1.248 (1)	1.163 (2)	1.211 (1)	1.020 (3)
	Highest	43.5%	42.9%	43.5%	48.8%	38.3%	44.3%	45.5%
	Lowest	1.2%	0.5%	0.0%	0.8%	1.4%	2.7%	3.0%
VP53	Homework	0.746 (4)	0.706 (5)	0.979 (3)	0.697 (4)	0.732 (5)	0.720 (3)	0.602 (5)
	Highest	26.5%	24.9%	37.2%	25.5%	24.2%	25.8%	20.4%
	Lowest	3.8%	3.0%	3.7%	3.6%	3.0%	4.8%	6.1%
VP54	Decline in abilities	-0.472 (12)	-0.131 (11)	-0.117 (10)	-0.820 (14)	-0.556 (14)	-0.627 (13)	-0.412 (11)
	Highest	5.4%	10.1%	8.5%	2.0%	3.4%	3.8%	8.2%
	Lowest	24.5%	14.6%	14.4%	33.6%	30.0%	23.2%	26.8%
VP55	Mixed abilities	-0.253 (10)	-0.124 (10)	-0.133 (11)	-0.320 (11)	-0.198 (10)	-0.427 (10)	-0.418 (12)
	Highest	7.9%	10.0%	8.5%	7.2%	5.4%	8.1%	11.2%
	Lowest	16.4%	17.4%	11.7%	20.0%	10.1%	20.5%	25.5%
VP56	Class size	-0.040 (9)	0.129 (7)	0.133 (9)	-0.155 (9)	0.104 (9)	-0.292 (9)	-0.384 (10)
	Highest	14.2%	20.9%	16.5%	15.5%	10.7%	11.4%	9.1%
	Lowest	14.5%	10.9%	9.0%	17.5%	9.1%	21.6%	27.3%
VP57	Free time	-0.510 (14)	-0.442 (13)	-0.431 (13)	-0.672 (13)	-0.399 (13)	-0.562 (11)	-0.622 (14)
	Highest	4.5%	6.0%	3.2%	2.8%	4.7%	5.4%	6.1%
	Lowest	23.5%	21.6%	22.3%	30.4%	17.1%	24.9%	28.6%

General problems (continued)

		Total	AT	MT	SP	TE	PR	SB/PT
VP58	Teacher workloads	0.041 (7)	0.090 (8)	0.255 (7)	-0.004 (7)	0.229 (7)	-0.216 (8)	-0.434 (13)
	Highest	11.9%	11.4%	16.5%	13.5%	11.1%	7.6%	10.1%
	Lowest	11.8%	8.0%	8.0%	13.5%	6.7%	15.7%	30.3%
VP59	Non-academic	-0.025 (8)	-0.030 (9)	0.181 (8)	-0.244 (10)	0.215 (8)	-0.130 (7)	-0.374 (9)
	Highest	13.6%	12.6%	22.9%	8.4%	13.1%	13.5%	13.1%
	Lowest	14.4%	14.1%	11.7%	17.2%	8.1%	17.8%	25.3%
VP60	Restrictions on materials	-0.872 (15)	-0.853 (15)	-0.818 (15)	-0.956 (15)	-0.599 (15)	-1.161 (15)	-1.071 (15)
	Highest	3.4%	1.5%	4.8%	5.2%	2.7%	2.7%	3.1%
	Lowest	39.5%	38.1%	35.8%	43.0%	27.6%	54.3%	48.0%

Importance of each type of problem

Respondents were asked to indicate whether or not the general problems that face teachers deserve priority over those problems specific to the teaching and learning of mathematics [VP61]. "Yes" was the response of 60.9%, ranging from a high of 71.0% for the PR sample to a low of 48.3% for the TE sample. About one-fourth (25.7%) indicated that the general problems were not more important, ranging from 31.9% for the SP sample to 19.3% for the MT sample. A portion of the sample (13.2%) indicated that they were undecided.

Distribution of research funds

How should research funds be distributed during the 1980s? There was clear agreement that first priority should be given to how students learn [VP62], second priority should be given to teaching methods [VP64], and third priority to teacher education [VP65]. The AT, MT, and TE samples would give fourth priority to research on varying types of materials [VP66], and fifth priority to longitudinal assessment of achievement [VP63]. The SP, PR, and SB/PT samples would reverse this order.

Distribution of research funds

		Total	AT	MT	SP	TE	PR	SB/PT
VP62	Learning	0.728 (1)	0.626 (1)	0.654 (1)	0.904 (1)	0.674 (1)	0.765 (1)	0.717 (1)
	Highest	41.8%	39.9%	43.6%	44.2%	39.5%	42.6%	41.4%
	Lowest	8.8%	14.1%	13.3%	4.4%	6.3%	8.2%	9.1%
VP63	Longitudinal assessment	-0.813 (5)	-0.620 (5)	-0.809 (5)	-0.916 (4)	-1.007 (5)	-0.632 (4)	-0.704 (4)
	Highest	5.6%	7.5%	5.3%	6.0%	5.4%	6.0%	1.0%
	Lowest	39.1%	33.0%	36.7%	42.4%	47.2%	35.2%	30.6%
VP64	Methods	0.525 (2)	0.417 (2)	0.473 (2)	0.602 (2)	0.458 (3)	0.612 (2)	0.6[illegible] (2)
	Highest	19.0%	14.6%	18.8%	19.9%	16.7%	23.5%	25.0%
	Lowest	4.5%	5.0%	4.3%	4.4%	5.0%	4.4%	3.0%
VP65	Teacher education	0.287 (3)	0.096 (3)	0.242 (3)	0.398 (3)	0.510 (2)	0.066 (3)	0.210 (3)
	Highest	24.0%	24.7%	19.9%	25.1%	28.7%	18.6%	23.0%
	Lowest	10.9%	13.1%	10.6%	8.0%	10.7%	12.0%	13.0%
VP66	Materials	-0.683 (4)	-0.485 (4)	-0.543 (4)	-0.944 (5)	-0.591 (4)	-0.754 (5)	-0.838 (5)
	Highest	9.3%	12.5%	12.8%	5.2%	8.6%	9.3%	8.1%
	Lowest	35.4%	33.0%	35.6%	40.0%	28.9%	38.8%	41.4%

Methods of attacking problems

How do respondents assign priorities to methods of attacking problems in mathematics education? There is fair agreement on most items listed, with closer agreement on several. The rank ordering for the combined samples is indicated on the following list, with the range noted.

(1) Support in-service education of teachers [VP73] - range 1 to with all samples giving it highest priority except the PR sample.

(2) Support preservice education of teachers [VP81] - range 2 to 5, with agreement on second priority by the professional samples, but lower ranking by the lay samples.

(3) Support evaluation of mathematics learning and achievement [VP74] - range 3 to 6.

(4) Give grants to local schools to improve their mathematics programs [VP72] - range 1 to 10, with the PR sample ranking it first and the TE sample placing it tenth.

(5) Establish a few coordinated, long-term research projects [VP68] - range 3 to 12, with the SP and TE samples ranking it third, while the SB/PT sample placed it twelfth.

(6) Create a project to develop innovative teaching methods [VP75] - range 5 to 8.

(7) Fund small, local curriculum development projects [VP69] - range 3 to 9, with the PR and SP samples ranking it third and fourth, respectively.

(8) Establish mathematics education clearinghouses for the collection of innovative materials [VP79] - range 6 to 9, with the AT sample most supportive.

(9) Create many small, basic research projects [VP67] - range 4 to 11, with the TE sample placing it fourth and the PR sample placing it

eighth, but other samples in close agreement.

(10) Fund professional mathematics education organizations to publicize innovative ideas [VP78] - range 7 to 13, with the SP and TE samples ranking it seventh.

(11) Support the development of non-text materials [VP76] - range 9 to 13, with the AT and SB/PT samples ranking it ninth.

(12) Fund research fo. study of general classroom problems [VP77] - range 8 to 13, with the SB/PT sample placing it eighth, diverging from the other samples.

(13) Give grants to individual teachers for development of materials [VP80] - range 10 to 14, with the AT, MT, and PR samples ranking it highest.

(14) Create a large curriculum development project with a nationwide influence [VP70] - range 13 to 14.

(15) Give grants to commercial firms for publishing innovative curriculum materials [VP71] - all samples ranked it fifteenth.

The samples recognize a number of legitimate ways of solving problems, accepting 13 of the 15 solutions to some extent. Clearly, however, in-service and preservice education receive the strongest support.

Interestingly, despite the previous indication on item VP61 that general problems were of more concern than problems specific to mathematics instruction, research on this topic falls twelfth on the list.

Methods of attacking problems

		Total	AT	MT	SP	TE	PR	SB/PT
VP67	Small basic research projects	0.450 (9)	0.368 (11)	0.314 (11)	0.406 (10)	0.694 (4)	0.444 (8)	0.258 (10)
	Highest	18.8%	15.0%	14.9%	18.1%	23.9%	20.6%	16.5%
	Lowest	5.6%	8.8%	5.3%	4.0%	2.7%	8.3%	8.2%
VP68	Long-term research projects	0.717 (5)	0.554 (8)	0.654 (4)	0.932 (3)	0.956 (3)	0.590 (6)	0.103 (12)
	Highest	25.7%	22.3%	21.3%	32.4%	34.6%	16.9%	12.4%
	Lowest	3.9%	5.2%	4.8%	0.8%	3.4%	2.8%	11.3%
VP69	Local curriculum projects	0.585 (7)	0.731 (4)	0.604 (6)	0.532 (9)	0.386 (9)	0.772 (3)	0.657 (6)
	Highest	26.8%	30.1%	25.7%	27.2%	19.1%	36.1%	28.3%
	Lowest	5.4%	3.6%	6.4%	6.0%	5.7%	6.1%	3.0%
VP70	National curriculum projects	-0.054 (14)	-0.140 (14)	-0.144 (14)	0.277 (13)	-0.088 (13)	-0.089 (14)	-0.392 (14)
	Highest	14.0%	13.0%	8.6%	21.7%	11.5%	15.6%	11.3%
	Lowest	12.2%	15.0%	12.3%	8.8%	10.1%	12.8%	20.6%
VP71	Grants to commercial firms	-0.924 (15)	-0.819 (15)	-0.824 (15)	-0.952 (15)	-1.217 (15)	-0.770 (15)	-0.633 (15)
	Highest	3.4%	4.7%	2.7%	4.4%	1.0%	3.9%	6.1%
	Lowest	41.5%	39.4%	34.2%	42.4%	51.5%	39.3%	30.6%
VP72	Grants to local schools	0.731 (4)	0.841 (3)	0.677 (3)	0.639 (6)	0.372 (10)	1.196 (1)	1.082 (2)
	Highest	30.3%	33.3%	29.6%	28.9%	14.9%	49.7%	40.8%
	Lowest	4.0%	3.6%	3.2%	4.4%	6.1%	1.7%	3.1%

Methods of attacking problems (continued)

		Total	AT	MT	SP	TE	PR	SB/PT
VP73	In-service education	1.314 (1)	1.237 (1)	1.122 (1)	1.508 (1)	1.431 (1)	1.144 (2)	1.293 (1)
	Highest	49.6%	49.5%	37.8%	61.6%	53.5%	42.2%	43.4%
	Lowest	1.1%	2.0%	1.6%	0.4%	0.0%	2.2%	1.0%
VP74	Evaluation of learning.	0.753 (3)	0.721 (5)	0.615 (5)	0.880 (4)	0.640 (6)	0.767 (4)	1.071 (3)
	Highest	20.9%	17.3%	14.4%	24.0%	18.9%	23.9%	33.7%
	Lowest	2.9%	2.5%	3.7%	2.0%	3.4%	3.3%	2.0%
VP75	Grants for innovative methods	0.598 (6)	0.571 (7)	0.505 (8)	0.644 (5)	0.674 (5)	0.500 (7)	0.660 (5)
	Highest	19.9%	18.9%	18.1%	21.6%	20.5%	18.9%	20.6%
	Lowest	3.9%	5.1%	4.8%	2.8%	1.7%	6.7%	4.1%
VP76	Non-text materials	0.299 (11)	0.462 (9)	0.261 (12)	0.308 (12)	0.331 (11)	0.100 (13)	0.296 (8)
	Highest	10.9%	14.9%	12.2%	11.6%	9.4%	7.8%	9.2%
	Lowest	8.8%	7.2%	10.6%	8.4%	6.0%	15.6%	6.1%
VP77	Research on general problems	0.274 (12)	0.385 (12)	0.207 (13)	0.328 (11)	0.205 (12)	0.183 (11)	0.427 (8)
	Highest	16.9%	17.9%	15.4%	20.0%	13.1%	17.8%	19.8%
	Lowest	8.7%	6.2%	9.0%	9.2%	7.4%	13.3%	7.3%
VP78	Fund professional organizations	0.397 (10)	0.276 (13)	0.489 (9)	0.600 (7)	0.554 (7)	0.111 (12)	-0.010 (13)
	Highest	12.7%	9.2%	13.8%	17.2%	15.8%	7.8%	6.2%
	Lowest	6.3%	6.6%	3.2%	4.0%	5.0%	10.6%	13.4%

Methods of attacking problems (continued)

		Total	AT	MT	SP	TE	PR	SB/PT
VP79	Establish clearinghouses	0.518 (8)	0.577 (6)	0.569 (7)	0.560 (8)	0.487 (8)	0.422 (9)	0.469 (7)
	Highest	15.6%	15.3%	19.1%	18.0%	11.4%	14.4%	17.7%
	Lowest	4.6%	4.6%	4.8%	3.2%	4.7%	5.6%	5.2%
VP80	Grants to teachers	0.130 (18)	0.416 (10)	0.399 (10)	-0.132 (14)	-0.131 (14)	0.271 (10)	0.245 (11)
	Highest	13.0%	17.8%	16.5%	9.2%	5.4%	18.2%	20.4%
	Lowest	9.2%	6.1%	6.9%	11.6%	10.1%	9.4%	11.2%
VP81	Preservice education	0.943 (2)	0.908 (2)	0.766 (2)	1.084 (2)	1.071 (2)	0.762 (5)	0.939 (4)
	Highest	35.0%	32.1%	22.3%	44.2%	42.8%	26.5%	33.7%
	Lowest	3.2%	3.1%	4.8%	2.8%	2.4%	3.9%	3.1%

Accommodation of talented or gifted students

If more mathematics were offered to talented or gifted students [VP82], all samples would first choose "a broad selection of topics" (60.0%), and would next choose work on computers and numerical analysis (22.9%). Third choice would be topics in calculus and analysis (10.6), while additional topics in algebra (with 4.1%) and geometry (with 2.4%) would be the last choices.

Accommodation of talented or gifted students

	Total	AT	MT	SP	TE	PR	SB/PT
VP82							
a. Geometry	2.4%	1.5%	1.6%	0.8%	5.7%	1.2%	2.0%
b. Calculus and analysis	10.6%	10.6%	13.3%	8.1%	6.7%	11.6%	22.0%
c. Algebra	4.1%	4.0%	4.3%	2.0%	4.7%	5.8%	4.0%
d. Computers/ numerical analysis	22.9%	16.2%	22.3%	28.6%	21.7%	24.9%	23.0%
e. Enrichment	60.0%	67.7%	58.5%	60.5%	61.2%	56.6%	49.0%

Comparison of mathematics with other programs

Respondents were asked to compare mathematics programs with other academic programs in their school systems [VP83]. Across groups, about the same percentages indicated that the mathematics program was "about the same" as other programs (46.0%) or "better" (42.9%). Very few indicated that the mathematics programs were inferior (5.3%). The MT and SP samples responded above the 50% level to "better", while the lay samples responded above the 50% level to "about the same". The 11.2% response for the "inferior" option by the SB/PT sample was greater than that of other samples. Interestingly, 14.0% of the TE sample had "no opinion".

Comparison of mathematics with other programs

	Total	AT	MT	SP	TE	PR	SB/PT
VP83							
a. Better	42.9%	42.0%	51.9%	56.4%	37.0%	34.1%	27.6%
b. About the same	46.0%	48.7%	40.9%	37.3%	42.9%	59.7%	56.1%
c. Inferior	5.3%	4.1%	4.4%	3.3%	6.2%	5.7%	11.2%
d. No opinion	5.6%	5.2%	2.8%	2.9%	14.0%	0.6%	5.1%

Need for most improvement

Which areas of the mathematics program need the most improvement [VP84]? The answer is clearly mathematics for general education first (61.4%), followed by mathematics for vocational students (24.2%). Last, with only 13.9% indicating highest priority, is mathematics for the college-bound student.

Need for most improvement

	Total	AT	MT	SP	TE	PR	SB/PT
VP84							
a. General education	61.4%	58.2%	48.6%	74.6%	62.1%	60.6%	57.3%
b. College-bound	13.9%	9.0%	18.3%	5.8%	23.0%	8.2%	21.9%
c. Vocational	24.2%	32.3%	33.1%	19.6%	13.3%	30.6%	19.8%

Summary: Development of new materials (elementary areas)

- Problem-solving received strong endorsement from all samples as the number one area for development of new materials. Respondents noted that it is a crucial skill for students and a major area of difficulty for teachers.
- Decimals was ranked second as an area for the development of new materials, with the AT, MT, SP, and TE samples giving positive support.
- Whole numbers was ranked third as an area for development of new materials, with highest priorities coming from the AT and lay samples. Those who give lesser support to whole numbers tended to believe that adequate instructional materials already exist.
- Little support was given to spending money for the development of materials for measurement or fractions.

Summary: Use of additional fifteen minutes each day

- Solving word problems received highest priority for the use of an additional fifteen minutes per day for mathematics in elementary schools. The next highest priority went to studying applications of mathematics.
- Additional time for drill on basics was ranked very high by the MT and lay samples, while the SP and TE samples gave it much lower rankings.

Summary: Development of new materials, grades 7-12

- Computer literacy was ranked as the area that should receive highest priority for the development of new materials in grades 7-12. Most of the respondents who ranked computer literacy first indicated it was because they thought the importance of the area would increase during the 1980's.
- Statistics was ranked much higher in priority for materials development by SP and TE samples than by all other samples. Its total ranking by all samples was fourth.
- Algebra received second ranking for materials development, with those ranking it highest indicating that it was important for more students to develop skills in this area. The SB/PT samples were particularly strong in their support for algebra.
- Probability received the lowest priority for materials development. Those who ranked it lowest indicated that it is not as important for students to develop skills in this area as in other areas on the list.

Summary: One added course, secondary level.

- A course that helps students make decisions about buying and selling received highest priority among five suggested new (or extensively revised) courses for the high school curriculum. Support for this course was weakest among the TE sample.
- A course that helps students understand how calculators and computers handle mathematics received second priority for addition to the high school curriculum. However, the SB/PT samples gave far less support to this choice than did the other sampled groups.
- All groups agreed that an additional calculus course should have the lowest priority.

Summary: Attention to five areas

- Respondents indicated that more attention should be given to applications of mathematics and to computer literacy (in that order) than to unified or interdisciplinary approaches or to structure in mathematics.
- A unified approach to mathematics received higher support from the SB/PT samples than from other samples.

Summary: Attention to five additional areas

- Orienting mathematics to careers (vocations) and to consumers were given higher priorities than orienting mathematics to computers, college preparatory work, or recreational purposes.
- SP and TE samples gave a higher priority to computer orientation and a lower priority to vocational orientation than did other samples.

Summary: Types of students

- Students with mathematics learning problems and other handicaps should have priority over four other types of students according to all survey samples. Many felt that this type of student has special needs that should be addressed through curriculum.
- Second priority was given to inner city or urban area students by all survey samples. Most of those who gave highest priority to these students felt that they make up such a large fraction of the school population that significant resources should be devoted to meeting their needs.
- Female students received the lowest priority ranking of the five groups. Many respondents felt that these students had no special needs in mathematics. SP and TE samples ranked this group higher than other samples do, however.
- Neither ethnic minorities or students whose first language is not English received particularly high priorities for special help in mathematics, ranking third and fourth respectively.

Summary: Teacher education

- Within teacher education, methods was given first priority and materials last priority by all samples.
- Sensitivity to student needs was ranked second for teacher education. There was less support for this area by the MT samples than by other samples.
- Emphasizing mathematics content in teacher education was ranked third, receiving more support from the teacher educator sample and the MT sample than from other samples.

Summary: Across areas

- Improved preservice and in-service teacher education was given top priority by AT, MT, SP, and TE samples. Most who ranked this highest indicated they believed it would have the most far-reaching impact on mathematics education generally.
- Lay samples gave highest rating to the improvement of methods and techniques for teaching mathematics (professional samples rated this second).
- Lowest priority by lay samples was given to the development of non-text materials. Most who rated this lowest felt it would have less impact on mathematics education, although many also felt that sufficient materials, methods, and understandings were already available for non-text materials.
- Lowest ranking by professional samples (AT, MT, SP, TE) was given to improved mathematics content for textbooks, with many feeling that sufficient materials, methods and understandings were already available.

Summary: General problems

- Problems not specific to mathematics classrooms which are of greatest concern were unmotivated students, reading difficulties, and classroom discipline.
- The problem of least concern to all samples was restrictions on instructional materials.
- Lowering of academic standards and lack of commitment to homework were of greater concern to the MT samples than to other samples.
- The SB/PT sample tend to be more concerned about governmental restrictions (ranking it eighth) and less concerned about teacher workloads (ranking it thirteenth) than are other samples.
- Sixty percent felt that general problems that face teachers deserve priority over those problems specific to the teaching of mathematics. The sample of principals was most certain of this (71%); the teacher educator sample was least sure (48.3%).

Summary: Distribution of research funds

- There was clear agreement that first priority for the distribution of research funds should be given to studies of how children learn. Second and third priorities were given to teaching methods and teacher education, respectively.

Summary: Methods of attacking problems

- In-service education and preservice education were ranked highest as methods for attacking problems in mathematics education. Evaluation of learning, grants to local schools, and long-term research projects were ranked third, fourth, and fifth, respectively.
- National curriculum projects and grants to commercial firms were ranked lowest as methods for attacking problems in mathematics education.
- Although most people saw general problems of education as more critical than specific problems of mathematics education, support for research on general education ranked only twelfth out of fifteen items.
- Funding for local, small-scale projects was generally given priority over large-scale national projects.

Summary: Accommodation of talented or gifted students

- If more mathematics were offered to talented or gifted students, first choice would be a broad selection of enrichment topics, followed by work on computers or numerical analysis.

Summary: Comparison of mathematics with other programs

- Lay samples felt that mathematics programs in their schools were "about the same" in evaluation as other academic programs.
- Professional samples were almost evenly divided between evaluating the mathematics program as "better" or "about the same" as other academic programs in their schools.

Summary: Need for most improvement

- Mathematics for general education was seen as most in need of improvement by more than 60% of the respondents. This was followed by mathematics for the vocational student (24.2%). Only 13.9% saw mathematics for the college-bound students as most in need of improvement.

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APPENDIX A.1

List of Items: Demographic

Demographic Items

DEMO1 I have taught:

a) less than 3 years
b) 3-8 years
c) 9-14 years
d) 15-20 years
e) more than 20 years

DEMO2 The majority of students in my school are residents of:

a) urban/metropolitan (population greater than 150,000)
b) urban fringe/suburban
c) small city population (25,000 to 150,000)
d) town (population less than 25,000)
e) rural/farm

DEMO3 I teach students who are in:

a) grades K-3
b) grades 4-6
c) grades 7-8
d) grades 9-12
e) other

DEMO4 I have taken the following number of mathematics content courses for college credit:

a) 0-1
b) 2-4
c) 5-9
d) 10-15
e) more than 15

DEMO5 With respect to the way schools are organized and children are taught, I am:

a) very satisfied
b) somewhat satisfied
c) undecided
d) somewhat dissatisfied
e) very dissatisfied

DEMO6 Have you taught mathematics at the secondary level?

a) yes b) no

DEMO7 The school at which I teach is best characterized as:

a) a community college
b) a technical school
c) a branch campus of a four-year institution
d) an independent two-year college
e) other

DEMO8 The majority of the mathematics that I am teaching this year is best described in terms of:

a) technical mathematics of a service nature for specific vocational programs
b) remedial help for students with deficiencies
c) meeting general education/liberal arts program requirements
d) a portion of a curriculum enabling transfer to a four-year degree program
e) other

DEMO9 If you consider only the background of students in your classes as a factor, would you conclude that among the following their primary source of difficulty is:

a) computational proficiency and skills with algebra and number
b) conceptual understanding of algebra and number
c) understanding of and proficiency with geometry
d) study habits for doing mathematics
e) motivation for mathematics

DEM10 If you consider only the background of students in your classes as a factor, you would conclude that among the following their primary strength is:

a) computational proficiency and skills with algebra and number
b) conceptual understanding of algebra and number
c) understanding of and proficiency with geometry
d) study habits for doing mathematics
e) motivation for mathematics

DEM11 My professional responsibilities now are best characterized as:

a) teaching undergraduate courses for majors in mathematics, statistics or computer science
b) teaching undergraduate courses serving other departments
c) teaching graduate level mathematics
d) applied mathematics in an industrial setting
e) research

DEM12 The school at which I teach is best characterized as:

a) a college
b) a university
c) a branch campus of a four-year institution
d) a two-year college
e) other

DEM13 Do you work <u>most frequently</u> with:

a) preservice teacher education programs
b) in-service teacher education programs
c) both preservice and in-service programs
d) none of the above since my responsibilities are not primarily in teacher education

DEM14 My responsibilities in teacher education are <u>mostly</u> in terms of:

a) the professional components of methods and field experiences
b) the mathematics content component
c) both a) and b) above
d) none of the above; my responsibilities are not described in a) or b)

DEM15 My work in teacher education is directed <u>primarily</u> toward teachers at the following levels:

a) elementary (K-6)
b) secondary (7-12)
c) both (K-12)
d) neither

DEM16 My professional responsibilities include supervising teachers at:

a) the elementary school level
b) the secondary school level
c) both the elementary and secondary school levels
d) other

DEM17 The percent of my time spent directly in supervising teachers is approximately:

a) 100%
b) 75%
c) 50%
d) 25%
e) 0%

DEM18 My supervisory responsibilities are to teachers in:

a) a single building
b) a small local school district
c) a large local school district
d) a regional or county district
e) a state

DEM19 I am:

a) under 25 years old
b) 25 to 34
c) 35 to 44
d) 45 to 54
e) 55 or over

DEM20 I have:

a) children in elementary school only
b) children in high school only
c) children in both
d) no children currently in K-12
e) no children

DEM21 Check the statement that best describes your formal educational experience:

a) not completed high school

b) high school graduate

c) some schooling beyond high school

d) college graduate

e) more than one college degree

<u>Experience prior to this year:</u>

DEM22 I was a teacher:

a) yes

b) no

DEM23 I was a school board member:

a) yes

b) no

DEM24 I was a teacher's aide:

a) yes, paid

b) yes, volunteer

c) no

DEM25 I was a member of a parents school organization:

a) yes

b) no

DEM26 I have been a teacher of secondary school mathematics?

a) yes

b) no

DEM27 I have a secondary school teaching certificate:

a) yes

b) no

DEM28 I have an elementary school teaching certificate:

a) yes

b) no

DEM29 I have been a principal for:

a) 0-5 years
b) 5-10 years
c) 10-15 years
d) more than 15 years

DEM30 Check the statement that best describes your formal educational experience:

a) bachelor's degree
b) masters degree
c) academic work between masters and doctorate
d) doctorate

APPENDIX A.2

List of Items: Introductory

Introductory Items

Consider the mathematics program from kindergarten through twelfth grade. Below are several phrases indicating areas of the program that could receive more or less emphasis during the coming decade. Mark each with the response that best describes your feeling concerning what should be the trend.

a. should receive much more emphasis
b. should receive somewhat more emphasis
c. should receive about the same emphasis as now
d. should receive somewhat le s emphasis
e. should receive much less emphasis

UF1	Basic skills
UF2	Diagnosis and remediation
UF3	Competency based education
UF4	Minimal competency testing
UF5	Use of calculators
UF6	Use of computers and other technology
UF7	Individualization
UF8	Applications of mathematics
UF9	Interdisciplinary programs
UF10	Unified mathematics program
UF11	Mastery learning curricula
UF12	Problem solving
UF13	Proof
UF14	Mathematics laboratories
UF15	Formal axiomatic structures
UF16	Computer-managed instruction
UF17	National mathematics curriculum
UF18	Curricula based on the psychology of learning mathematics
UF19	Curricula based on the logic of mathematics
UF20	Decimals
UF21	Elementary mathematics specialists
UF22	Women in mathematics
UF23	Minorities and mathematics
UF24	Gifted students
UF25	Urban education
UF26	Secondary mathematics specialists

UF27	Norm-referenced testing
UF28	Mathematics and careers
UF29	Geometry
UF30	Probability and statistics
UF31	Fractions
UF32	Metric measure
UF33	Research on mathematics learning
UF34	Large-scale curriculum development projects
UF35	Curricula based on teacher experiences
UF36	Daily homework
UF37	Calculus at the high school level
UF38	Mathematics in history and culture
UF39	Computer literacy
UF40	Low achievers
UF41	Functions and analytic geometry
UF42	Algebra
UF43	Vectors
UF44	Mathematics for consumers
UF45	Measurement

APPENDIX A.3

List of Items: Preference Survey

Preference Survey Professional Items

FD1A

Listed below are several ways that fractions and decimals could be treated in the curriculum. Which of the following should be included at some point in kindergarten through grade six (before grade 7)?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

1. All fractions should be written as decimals so that the operations on them can be performed with a calculator.

2. Operations with fractions should be taught only for fractions with small denominators (e.g., 12 or less).

3. Tables of common denominators (factors and multiples) should be given to students.

4. Students should use slide rules, graphs, and charts (nomographs) to solve problems involving fractions.

5. Least common multiple and greatest common divisor should be stressed as basic ideas related to fractions.

6. Students should be taught to solve a division problem by first estimating whether the answer will be larger or smaller than the number being divided.

7. Fractions should be presented as answers to division problems; for example, 7/12 means seven divided by 12.

8. Decimals should be introduced by relating them exclusively to money.

9. Decimals should be developed as a means of naming numbers between numbers (e.g., 2.4 is between 2 and 3; 2.41 is between 2.4 and 2.5).

10. Fractions should be developed as measures of lengths.

FD1B

Listed below are several ways that fractions and decimals could be treated in the curriculum. Which of the following should be included <u>after grade six</u> (grades seven through twelve)?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

FD1B (cont)

11. All fractions should be written as decimals so that the operations on them can be performed with a calculator.

12. Operations with fractions should be taught only for fractions with small denominators (e.g., 12 or less).

13. Tables of common denominators (factors and multiples) should be given to students.

14. Students should use slide rules, graphs, and charts (nomographs) to solve problems involving fractions.

15. Least common multiple and greatest common divisor should be stressed as basic ideas related to fractions.

16. Students should be taught to solve a division problem by first estimating whether the answer will be larger or smaller than the number being divided.

17. Fractions should be presented as answers to division problems; for example, 7/12 means seven divided by 12.

18. Decimals should be introduced by relating them exclusively to money.

19. Decimals should be developed as a means of naming numbers between numbers (e.g., 2.4 is between 2 and 3; 2.41 is between 2.4 and 2.5).

20. Fractions should be developed as measures of lengths.

FD2A

Below are several statements that give reasons for including work with common fractions (e.g., 2/3) and decimals (e.g., 0.6666) in the school mathematics curriculum. Pelase indicate your reaction to each of them.

a. A very important reason
b. Somewhat important
c. Undecided
d. Not an important reason
e. Definitely not a reason

21. Determining how to add, subtract, multiply, and divide common fractions illustrates basic mathematical processes and reasoning techniques.

22. Fractions are interpreted as measurements; for example, 7/12 is the length of a stick found by using a ruler.

23. Common fractions are a traditional part of the curriculum.

24. Decimals provide solutions to algebraic equations or number sentences.

25. Common fractions are used in college-level mathematics.

FD2A (cont)

26. Decimals are used in many vocations such as auto mechanics, carpentry, plumbing, and so on.

27. Common fractions are simple ways to illustrate division.

28. Operations with decimals provide mental exercise.

29. Rational numbers need to be contrasted to the sets of the whole numbers, integers and real numbers.

30. Consumers need decimals to compute "best buys".

FD2B

Below are several statements that give reasons for including work with common fractions (e.g., 2/3) and decimals (e.g., 0.6666) in the school mathematics curriculum. Please indicate your reaction to each of them.

a. A very important reason
b. Somewhat important
c. Undecided
d. Not an important reason
e. Definitely not a reason

31. Determining how to add, subtract, multiply, and divide decimals illustrates basic mathematical processes and reasoning techniques.

32. The metric system of measurement uses decimals almost exclusively.

33. Decimals are a traditional part of the curriculum.

34. Common fractions provide solutions to algebraic equations or number sentences; for example, 7/12 is the solution of 12x = 7.

35. Decimals are used in college-level mathematics.

36. Common fractions are used in many vocations such as auto mechanics, carpentry, plumbing, and so on.

37. Decimals provide simple ways to illustrate division.

38. Operations with common fractions provide mental exercise.

39. Decimals are used in money.

40. Consumers need common fractions to compute "best buys".

FD3

During the 1980s it may be possible to add to each classroom several different resources for teaching fractions and decimals. To what extent would you want to have each of the following?

a. I would definitely want this
b. This might be nice to have
c. Undecided
d. I'd rather not be bothered by this
e. I definitely would not want this

41. A calculator designed so that fractions could be input and the answer would be displayed as a fraction.

42. Films and videotapes on fraction and decimal concepts.

43. Masters of worksheets and activities for fractions and decimals.

44. Individual study materials for fractions and decimals.

45. Student sets of measuring devices.

46. Manipulative materials such as fraction bars, strips, et cetera.

47. Drill and practice materials.

48. Large-scale demonstration devices.

49. Resource booklets with applications of fractions and decimals.

50. "Magic response paper" to give immediate feedback by revealing the correct answer just after students have written their answers.

FD4

Imagine that there are available several sets of instructional materials for fractions and decimals. Each set of materials emphasizes one of the teaching strategies listed below. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which the incorporation of this particular teaching strategy would be a positive or negative influence in your decision to purchase or use the materials.

51. Geometric pictures of physical models are used to represent computational algorithms for fractions and decimals.

52. More than 50% of the instructional time is devoted to drill and practice in lessons on fractions and decimals.

53. Operations with fractions are developed within the context of applications problems.

54. Student worksheets are included for drill and practice on fractions and decimal topics at the conclusion of each lesson.

FD4 (cont)

55. Slower students are allowed to use calculators so they may keep up with the rest of the class.

56. Basic operations with fractions and decimals are developed through long-term student projects.

57. More than 50% of the instructional time is devoted to student use of individual study materials to develop and extend fraction and decimal use.

58. Basic fraction and decimal ideas are introduced through laboratory investigations.

59. Detailed notes are provided to guide the teacher in oral presentations of lessons on fractions and decimals.

60. Specific objectives, criterion referenced testing, and other materials are included to encourage use of a mastery learning or an individually paced model.

FD5

A committee of parents and teachers is working on a mathematics syllabus for your school. They have developed the following general statements. Please indicate your reaction to each of them.

a. I agree completely
b. I tend to agree
c. Undecided
d. I tend to disagree
e. I strongly disagree

61. Less attention should be given to the addition and subtraction of fractions.

62. More attention should be given to operations with decimals than operations with fractions.

63. Division of fractions should be omitted from the curriculum except for very bright children.

64. Work with fractions should be delayed until seventh or eighth grade.

65. Operations with decimals should be introduced before operations with fractions.

66. All students should master operations with decimals, but not all should be expected to master operations with fractions.

67. Operations with decimals should be included in the first or second grade mathematics program (the earlier the better).

FD5 (cont)

68. Fractions should be omitted from the curriculum.

69. Only college-bound students should be taught fractions (e.g., in algebra courses).

70. Students should be taught fractions with small denominators useful in various vocations.

FD6

How appropriate is it for students to use hand-held calculators when doing each of the following activities?

a. Very appropriate
b. Only in special circumstances
c. Undecided
d. Almost never appropriate
e. Should not be allowed

71. Homework involving problems with common fractions.

72. Homework involving problems with decimals.

73. Developing ideas about common fractions.

74. Developing ideas about decimals.

75. Finding equivalent forms of a given fraction (i.e., 2/3 = 6/9 = 24/36).

76. Reducing fractions

77. Taking a test involving fractions.

78. Taking a test involving decimals.

79. Reducing all quantities in a recipe by one-third.

80. Finding the area of a lot whose length is 73.28 units and whose width is 35.92 units.

ALIE

A parent-teacher committee in your school is developing a list of algebraic concepts that should be included in the mathematics curriculum of the 1980s for grades K-6. Which of the following should be included in <u>elementary school mathematics</u>?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

81. Solving open number sentences

82. Evaluating formulas

83. Operating with signed numbers

84. Graphing of number sentences

85. Using exponents (including scientific notation)

86. Writing computer programs

87. Multiplying expressions like (+ 3) x (- 5)

88. Making generalizations about numerical patterns

89. Writing algebraic expressions

90. Study of simple mathematical functions or mappings

91. Writing equations to solve word problems

92. Studying structural properties of number systems (e.g., the commutative property)

93. Using set notation

94. Inequalities

95. Studying finite systems (e.g., clock arithmetic)

ALIES

Your school system has decided that <u>every</u> graduating student should have some experiences in algebra. (Specialized algebraic skills necessary for work in higher mathematics will be available in courses offered to college-bound students.) Which of the following algebraic topics should be taught to <u>all</u> students?

a. Definitely should be taught to all students
b. Probably should be taught to all students
c. Undecided
d. Probably should not be taught to all students
e. Definitely should not be taught to all students

96. Solving linear equations

97. Work with signed numbers

98. Use of exponents (including scientific notation)

99. Multiplying expressions like (a + 3) X (b - 5)

100. Right-triangle trigonometry

101. Writing equations to solve word problems

102. Using quantifiers and set notation

103. Studying finite systems (e.g., clock arithmetic)

104. Solving systems of equations (e.g., two or more equations with two or more unknowns)

105. Sequences and series

ALIES 2

Your school system has decided that <u>every</u> graduating student should have some experiences in algebra. (Specialized algebraic skills necessary for work in higher mathematics will be available in courses offered to college-bound students.) Which of the following algebraic topics should be taught to <u>all</u> students?

a. Definitely should be taught to all students
b. Probably should be taught to all students
c. Undecided
d. Probably should not be taught to all students
e. Definitely should not be taught to all students

106. Evaluating formulas

107. Graphing of number sentences

108. Writing computer programs

109. Making generalizations about number patterns

110. Study of simple mathematical functions or mappings

111. Studying structural properties of number systems (e.g., the commutative property)

112. Inequalities

113. Proving algebraic generalizations

114. Adding, subtracting, multiplying and dividing polynomial expressions

115. Properties of classes of numbers (e.g., integers, rationals, reals)

The majority of college-bound students will not be science or mathematics majors. Which of the following advanced algebraic topics should be included in the secondary school curriculum for these students?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

116. Matrix algebra (e.g., linear systems)

117. Finite mathematics (e.g., combinatorics)

118. Probability functions (e.g., probability theory)

119. The system of complex numbers

120. Trigonometric functions and their inverses

121. Theory of equations (e.g., fundamental theorem, solvability)

122. Analytic geometry (e.g., conic sections)

123. Algebraic structures (e.g., groups, rings, fields)

124. Categories of functions (e.g., algebraic, exponential, transcendental)

125. Introductory calculus

126. Limits and continuity

127. Sequences and series

128. Exponential and logarithmic functions

129. Approximating graphed data with best-fit polynomials

130. Vectors and vector spaces

131. Mathematical models

132. Systems of non-linear equations

133. Transformations applied to graphing

134. Approximating the roots to higher degree polynomial equations

135. Trigonometric identities and equations

AL 2

Imagine that there are available several sets of instructional materials for algebraic concepts and skills. The materials differ in that each emphasizes one of the curricular goals listed below even at the expense of other goals. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which emphasis on the stated goal would be a positive influence on the decision to use or to buy these curricular materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

Algebraic concepts and skills are taught:

136. To consolidate arithmetic skills.

137. To learn to read mathematics.

138. To preserve options with respect to career and vocational choice.

139. To assure adequate scientific manpower.

140. To gain skills necessary for work and vocations.

141. To gain an appreciation for a type of mathematics that is more powerful and versatile than arithmetic.

142. To prepare for college.

143. To build the background for taking more mathematics.

144. To understand the use and power of computers.

145. To learn how to apply mathematics.

AL 3

During the 1980s it may be possible to add to each classroom several different resources for teaching algebraic topics. To what extent would you want to have each of the following?

a. I would definitely want this
b. This might be nice to have
c. Undecided
d. I'd rather not be bothered by this
e. I definitely would not want this

146. Calculators that can display the equation of a line given the coordinates of two points

147. Individual study carrels equipped with computer assisted instruction terminals and videotape cartridge players

148. Booklets of algebraic applications to contemporary problems

149. Masters of worksheets and activities

150. Physical materials and equipment for laboratory experiments

151. Personal computers for every two students

152. Booklets of games and recreational activities that can be analyzed algebraically

153. Calculators that will display the roots of a linear or quadratic equation when the coefficients are input

154. Materials with minimal reading requirements

155. Computer-driven graphing and plotting equipment

Imagine that there are available several sets of instructional materials for algebraic topics. Each set of materials emphasizes one of the teaching strategies listed below. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which the incorporation of this particular teaching strategy would be a positive or negative influence in your decision to purchase or use the materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

156. Problems that arise in the social or natural sciences are used to extract and develop algebraic concepts.

157. Student worksheets are included for drill and practice on algebraic topics at the conclusion of each lesson.

158. Algebraic concepts are inferred from the general patterns of arithmetic.

159. Basic algebraic ideas are developed using computing devices.

160. Basic algebraic ideas are introduced through laboratory investigations.

161. Deductive sequences are used to develop new algebraic ideas and structural characteristics.

162. Geometric models, simple machines, and other applications are used to develop algebraic concepts.

163. Ideas are introduced through long-term, realistic student projects.

164. More than 50% of the instructional time is devoted to student use of individual study materials to develop and extend algebraic ideas.

165. It is expected that students will read formal presentations of basic algebraic ideas before classroom activities are devoted to these ideas.

The mathematics curriculum committee of your school system is considering the possibility of placing topics from algebra at different points in the curriculum. Please react to their following suggestions.

a. I agree completely
b. I tend to agree
c. Undecided
d. I tend to disagree
e. I strongly disagree

166. Every student graduating from high school should be required to take a full-year algebra course.

167. Algebra should be studied for two years before taking a course in geometry.

168. A special algebra course for vocational students should be offered.

169. For many students, a "historical and cultural mathematics" course should be substituted for algebra.

170. The theme for algebra courses should be functions.

171. Algebra should be combined with geometry and other mathematical areas instead of being taught in separate courses.

172. Different algebra courses should be offered for students with different interests and abilities.

173. By 1990, the skills and concepts of the traditional beginning algebra course of the 1970s should be acquired before students enter ninth grade.

174. Trigonometry should not be included in algebra courses at any level.

175. Formal work with algebra should be dropped from the school curriculum since it bears so little relation to real world problems.

AL6

How appropriate is it for students to use hand-held calculators when doing each of the following activities?

a. Very appropriate
b. Only in special circumstances
c. Undecided
d. Almost never appropriate
e. Should not be allowed

176. Taking an algebra test.

177. Making a graph from a given equation.

178. Finding the solution of an equation.

179. Finding the value of d, when $d=\frac{1}{2}gt^2$, if $g=32$ and $t=5$.

180. Working algebra work problems.

181. Demonstrating that $(a + b)^2 = a^2 + b^2$ for several specific values of a and b.

182. Solving systems of linear equations (two or more equations with two or more unknowns).

183. Checking answers.

184. Simplifying expressions containing irrational numbers (e.g., $\frac{\sqrt{2} \times \sqrt{5}}{\sqrt{6}}$).

185. Working with limits of sequences.

Listed below are several topics related to whole numbers that could be treated in the curriculum. Which of the following should be included in elementary school mathematics?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

186. Several different algorithms (methods) for each of the four basic operations so that children can choose the method they prefer

187. Techniques of estimation

188. Specific strategies for solving word problems

189. Mathematical puzzles and games

190. Operations with signed numbers or integers

191. Justification of each step of an algorithm by relating it to basic number properties

192. Mental calculations without the aid of paper and pencil or calculator

193. Multiplication and division developed simultaneously to emphasize relationships between them

194. Specific instructions for operating a four-function calculator

195. Tests of divisibility

196. Only the most efficient algorithm (method) for each operation is taught.

197. A paper-and-pencil algorithm (method) for calculating square roots

198. Computational and/or checking shortcuts (e.g., casting out nines)

199. Addition and subtraction developed simultaneously to emphasize relationships between them

200. Specific consumer skills like balancing a checkbook and calculating best buys

WN 2

Imagine that there are available several sets of instructional materials for whole number concepts and skills. The materials differ in that each emphasizes one of the curricular goals listed below even at the expense of other goals. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which emphasis on the stated goal should be a positive influence on the decision to use or to buy these curricular materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

Whole number concepts and skills are taught:

201. To acquire the qualifications necessary for obtaining many jobs.

202. To be able to do well on standardized tests.

203. To understand the structure of mathematics.

204. To develop logical thinking ability.

205. To gain an appreciation for the beauty of numbers.

206. To develop disciplined work habits.

207. To acquire the skills necessary for consumer decisions.

208. To develop the fundamental understandings upon which other mathematics learning is built.

209. To preserve a traditional emphasis in the curriculum.

210. To learn to read mathematics.

WN 3

During the 1980s it may be possible to add to each classroom several different resources for teaching whole number concepts and skills. To what extent would you want to have each of the following?

a. I would definitely want this
b. This might be nice to have
c. Undecided
d. I'd rather not be bothered by this
e. I definitely would not want this

211. A calculator for every student

212. Short videotapes to illustrate basic computational algorithms

213. "Magic response paper" to give immediate feedback by revealing the correct answer just after students have written their answers

214. Audiotapes for verbal drill and practice

215. Physical materials for each student to use in modeling basic operations and algorithms

216. Masters of worksheets and activities

217. Resource books compiling examples of arithmetic applied to real-life situations

218. Small programmable calculators or computers

219. Packages of materials for individual student study

220. Standardized practice tests for basic skills

WN 4

Imagine that there are available several sets of instructional materials for whole numbers. Each set of materials emphasizes one of the teaching strategies listed below. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which the incorporation of this particular teaching strategy would be a positive or negative influence in your decision to purchase or use the materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

221. Geometric pictures are used as models for computation.

222. Calculators are used instead of teaching paper and pencil algorithms.

223. More than 50% of the instructional time is devoted to drill and practice when teaching the basic facts.

224. The introduction of calculators is postponed until students have learned both the meaning of the operations and the paper and pencil algorithms for them.

225. Physical materials, such as rods and area blocks, are given to every student to use to model whole number algorithms and generate answers.

226. Slower students are allowed to use calculators in order to keep up with the rest of the class.

227. Specific objectives, criterion-referenced testing, and other materials are included to encourage use of a mastery learning or an individually paced model.

228. Manipulative materials are used in a mathematics laboratory at least once a week.

229. Activities are included which require going outside the classroom (perhaps on field trips) so that whole number operations may be illustrated with real-life examples.

230. More than 50% of the instructional time is devoted to student use of individual study materials to develop and extend whole number ideas.

WN 5

The following statements regarding whole number computation were generated at a recent parent-teacher meeting at your school. Please indicate your reaction to each of them.

a. I agree completely
b. I tend to agree
c. Undecided
d. I tend to disagree
e. I strongly disagree

231. Every student should master whole number computations with paper and pencil before graduating from high school.

232. College-bound high school students should spend at least three weeks of every school year reviewing whole number computation.

233. Students who cannot master paper-and-pencil computations by the end of grade 8 should be required to take a special ninth grade mathematics course on the use of the hand-held calculator.

234. The appropriate time to do remedial work with whole number computation is in an adult school or junior college after students can see the need and importance for calculating.

235. Algorithms for multi-digit computations should not be introduced until grade 7 when students are more mature.

WN 6

How appropriate is it for students to use hand-held calculators when doing each of the following arithmetic activities?

a. Very appropriate
b. Only in special circumstances
c. Undecided
d. Almost never appropriate
e. Should not be allowed

236. Learning basic number facts

237. Doing homework

238. Taking a test on whole number computation

239. Learning properties of different operations

240. Doing the division $641 \div 17$

241. Multiplying 782×59

242. Solving word problems

243. Subtracting 2,150 - 1,983

244. Multiplying 3 x 13

245. Checking answers

246. Calculating change from a five dollar bill

247. Doing a chain of calculations involving several different operations

248. Learning why the long division algorithm works

249. Adding the cost of several items in a grocery cart

250. Finding the divisors of a given number

GMIE

A parent-teacher committee in your school is developing a list of geometric concepts that should be included in the mathematics curriculum during the 1980s for grades K-6. Which of the following should be included in elementary school mathematics?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

251. Geometry of tesselations (tiling)

252. Geometry of distance and direction (vector geometry)

253. The geometry of shadows (projective geometry)

254. Constructions with a straightedge and compass

255. Similar figures (magnification and reduction)

256. Congruence by transformations (slides, flips and turns with movement of figures to match)

257. Logical reasoning principles including axioms and proofs

258. Properties of triangles and rectangles

259. Three-dimensional geometry

260. Parallel and perpendicular lines

261. Geometry on a sphere (globe)

262. Congruent (matching) figures by the methods of Euclid

263. Properties of circles

264. Geometry of symmetry

265. Coordinate geometry (associating number pairs with points)

GMIES-1

A parent-teacher committee in your school is studying the possibilities for revising geometry as it is presently offered in your secondary schools. Which of the following geometric topics should be studied by all students graduating from high school.

a. Definitely should be studied by all students
b. Probably should be studied by all students
c. Undecided
d. Probably should not be studied by all students
e. Definitely should not be studied by all students

266. Geometry of tesselations (tiling)

267. Geometry of distance and direction (vector geometry)

268. The geometry of shadows (projective geometry)

269. Similar figures (magnification and reduction)

270. Congruence by transformations (moving figures to match) or reflection

271. Logical reasoning principles including axioms and proofs

272. Properties of triangles and rectangles

273. Three-dimensional geometry

274. Geometry of the sphere (globe)

275. Congruent (matching) figures by the methods of Euclid

GMIES-2

276. Properties of circles

277. Coordinate geometry (associating number pairs with points)

278. Finite geometries (e.g., nine point geometry)

279. Symbolic logic and truth tables

280. Non-Euclidean geometries

GMIS

The majority of college-bound students will not be science or mathematics majors. Which of the following advanced geometric topics should be included in the secondary school curriculum for these students?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

281. Locus theorems

282. Straightedge and compass constructions

283. Coordinate (analytic) geometry

284. Symbolic logic and work with truth tables

285. Vectors

286. Transformational geometry

287. A variety of proof formats (e.g., paragraph, flow diagram, two-column)

288. Non-Euclidean geometry

289. Transformations by matrices

290. Finite geometries

291. Projective geometry

292. Geometry of the sphere

293. Solid geometry

294. Network theory

295. Study of axiomatic structures

GM2

Imagine that there are available several sets of instructional materials for geometry. The materials differ in that each emphasizes one of the curricular goals listed below even at the expense of other goals. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which emphasis on the stated goal should be a positive influence on the decision to use or to buy these curricular materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

Geometry is taught:

296. To motivate students who dislike computation.

297. To develop job-oriented skills.

298. To appreciate historical and cultural development.

299. To learn to make proofs.

300. To develop spatial intuitions about the real world.

301. To learn to read and interpret mathematical arguments.

302. To practice arithmetic and algebraic skills.

303. To develop logical thinking abilities.

304. To develop skills and knowledge needed by the consumer.

305. To acquire the knowledge needed for study of more mathematics.

During the 1980s it may be possible to add to each classroom several different resources for teaching geometric topics. To what extent would you want to have each of the following?

a. I would definitely want this
b. This might be nice to have
c. Undecided
d. I'd rather not be bothered by this
e. I definitely would not want this

306. Computer generated and animated graphics

307. A kit of measuring tools for every student

308. Short films or videotapes showing basic geometric concepts

309. Masters of worksheets and activities

310. Individual study materials for geometry

311. Resource books with applications of geometry to real problems

312. Drafting tables and equipment

313. Large-scale demonstration models and devices

314. 35 mm slides of basic geometric figures for blackboard projection

315. Manipulative materials and laboratory experiments

GM4

Imagine that there are available several sets of instructional materials for geometric topics. Each set of materials emphasizes one of the teaching strategies listed below. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which the incorporation of this particular teaching strategy would be a positive or negative influence in your decision to purchase or use the materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong positive influence

316. Activities are included that would require students to go outside the classroom to measure things.

317. Students are expected to read formal presentations of basic geometric ideas before classroom activities are devoted to these ideas.

318. Student worksheets are included for drill and practice on geometric topics at the conclusion of each lesson.

319. Basic geometric ideas are introduced through laboratory investigations.

320. Specific objectives, criterion-referenced testing, and other materials are included to encourage use of a mastery learning or an individually paced model.

321. More than 50% of the instructional time is devoted to student use of individual study materials to develop and extend geometric ideas.

322. Activities are included that anticipate the class being divided into small discussion groups.

323. Simulations, wherein each student plays the role of a consumer or worker using geometry in real world situations, are frequently included.

324. Detailed notes are provided to guide the teacher in oral presentation of geometry lessons.

325. Long-term projects are suggested that are designed to be assigned to individuals or to teams of students.

GM5

The mathematics curriculum committee of your school system is considering the possibility of placing topics from geometry at different points in the curriculum. Please react to the following suggestions.

a. I agree completely
b. I tend to agree
c. Undecided
d. I tend to disagree
e. I strongly disagree

326. A full-year course in geometry should be delayed until students have taken two years of algebra.

327. A full-year course in applied geometry (navigation, measurement, intuitive development of concepts) should be available as a high school elective course.

328. No geometric topics should be taught before seventh grade.

329. Separate courses in geometry should be abolished and geometry content integrated with other mathematics in grades K-12.

330. Geometry modules should be developed that could be inserted in present mathematics courses or combined to form short-courses lasting from two to twelve weeks.

331. The geometric topics presently taught in elementary schools form an adequate minimum knowledge of this area for high school graduation.

332. A second year of advanced geometry should be offered in high schools.

333. Much of the mathematics taught in grade 4 should be geometry allowing a "pause" in the development of arithmetic concepts until children can reach a new developmental level.

334. Intuitive geometric concepts are at least as important in grade 1 as number concepts.

335. More of the mathematics curriculum in grades 7 and 8 should be devoted to geometry.

GM6

How appropriate is it for students to use hand-held calculators in connection with each of the following types of geometric activities?

a. Very appropriate
b. Only in special circumstances
c. Undecided.
d. Almost never appropriate
e. Should not be allowed

336. Finding the midpoint of a line, if the coordinates of the endpoints are (2,3) and 7,1)

337. Computing the area of a trapezoid

338. Finding the length of the third side of a right triangle using the Pythagorean theorem

339. Finding the measure of the complement or supplement of a 57 angle

340. Doing geometry homework

341. Finding the circumference of a circle, given the diameter

342. Calculating the volume of a cone, when the diameter of the base is 6 cm and the height is 10 cm

343. Using trigonometry to find the length of a side of a triangle

344. Calculating the coordinates of the new vertices of a triangle after a given transformation

345. Taking a geometry test

PSIE

A parent-teacher committee in your school has suggested topics in probability and statistics that could be taught in the mathematics program for grades K-6 during the 1980s. React to the suggestions of the committee by indicating which topics should be included in elementary school mathematics.

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

346. Collection and organization of data (e.g., graphs, tables).

347. Predicting outcomes.

348. Reading and interpreting statistical information.

349. Measures of central tendency (e.g., mean, median, mode).

350. Measures of spread (e.g., range, quartiles, et cetera).

351. Calculating the probability of an event occurring.

352. Combinations and permutations.

353. Testing of conjectures and hypotheses.

354. Calculating probabilities of compound and conditional events.

355. Decision-making (e.g., for voting or consumer situations).

PSIS

Listed below are topics in probability and statistics which could be included in the secondary school mathematics curriculum. Identify the most inclusive group for whom you feel instruction on the topic is appropriate.

a. Noncollege-bound secondary school students
b. College-bound secondary school students
c. All secondary school students
d. Not appropriate for secondary school students
e. Undecided

356. Probability distributions (e.g., normal, binomial).

357. Predicting outcomes.

358. Curve fitting and prediction.

359. Measures of central tendency (e.g., mean, median, mode).

PSIS (cont)

360. Ranking procedures.

361. Calculating the probability of an event occurring.

362. Correlation.

363. Statistical testing of hypotheses.

364. Reading and interpreting statistical information.

365. Decision-making (e.g., for voting or consumer situations).

366. Measures of spread (e.g., range, quartiles).

367. Combinations and permutations.

368. Experimental design.

369. Collection and organization of data (e.g., graphs, tables).

370. Calculating probabilities of compound and conditional events.

PS 2

Imagine that there are available several sets of instructional materials for probability and statistics. The materials differ in that each emphasizes one of the curricular goals listed below even at the expense of other goals. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which emphasis on the stated goal should be a positive influence on the decision to use or to buy these curricular materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

Probability and statistics are taught:

371. To help consumers deal with statistical information.

372. To enable students to read and think critically about graphs and other data in other subjects such as science or social science.

373. To give experience in dealing with estimation and approximation.

374. To apply mathematics to other disciplines.

375. To understand the use and power of computers.

PS2 (cont)

376. To demonstrate how to organize, summarize and present data in easily interpretable forms.

377. To provide practice in such basic mathematical topics as sets, ratio, and graphing.

378. To teach skills necessary for employment.

379. To teach skills necessary for further study.

380. To provide practice in basic computational skills.

PS3

During the 1980s it may be possible to add to each classroom several different resources for teaching probability and statistics. To what extent would you want to have each of the following?

a. I would definitely want this
b. This might be nice to have
c. Undecided
d. I'd rather not be bothered by this
e. I definitely would not want this

381. A syllabus that suggests probability and statistics topics and methods for each grade level together with specific times when they should be introduced.

382. A series of short films ro videotapes that can be used to motivate and introduce specific probability and statistics concepts.

383. Inservice materials to teach teachers the content of probability and statistics.

384. Probability and statistics textbooks that emphasize projects and activities.

385. Audiotapes of lectures by eminent statisticians.

386. Probability and statistics materials for use with small computers.

387. Masters of worksheets and activities for probability and statistics.

388. Resource books with applications and problems from probability and statistics.

389. Individual study materials for students.

390. Descriptions of teaching methods appropriate for probability and statistics.

391. Standardized tests in probability and statistics which allow for comparison with students from other schools.

PS3 (cont)

392. Coordinated curriculum materials for probability and statistics encompassing textbooks, laboratory equipment, films, guides, et cetera

393. A test item bank with test items coordinated to behavioral objectives suitable for probability and statistics

394. Booklets of experiments and related laboratory equipment

395. Outlines of outstanding presentations in probability and statistics

PS4

Imagine that there are available several sets of instructional materials for probability and statistics. Each set of materials emphasizes one of the teaching strategies listed below. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which the incorporation of this particular teaching strategy would be a positive or negative influence in your decision to purchase or use the materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

396. Students are required to analyze data that they have gathered outside the classroom (e.g., street-corner interviews).

397. Students perform experiments with dice and cards and study games of chance.

398. Materials include many examples of real world data such as those taken from newspapers and periodicals.

399. Students are provided with ready-made data bases from previously completed experiments.

400. Students are expected to read formal presentations of basic probability and statistics ideas before classroom activities are devoted to these ideas.

401. Cases where statistics were misinterpreted or misused are studied.

402. Detailed notes are provided to guide the teacher in oral presentations of probability and statistics lessons.

403. Problems that arise in the social or natural sciences are used to extract and develop probability and statistics concepts.

404. Projects are suggested that are designed to be assigned to individuals or to teams of students.

405. Specific objectives, criterion-referenced testing, and other materials are included to encourage use of a mastery learning or an individually paced model.

The mathematics curriculum committee of your school system is considering the possibility of introducing topics in probability and statistics at different points in the curriculum. Please react to the following suggestions.

a. I agree completely
b. I tend to agree
c. Undecided
d. I tend to disagree
e. I strongly disagree

406. Probability and statistics should be a required course for all ninth graders.

407. Ideas from probability and statistics should be included in every mathematics textbook from grades 1-8.

408. A course in probability and statistics lasting at least one semester should be offered as a high school elective for students who have successfully completed one year of algebra.

409. Probability and statistics should only be considered as enrichment topics for mathematics.

410. Probability and statistics should be offered as part of the general mathematics or consumer mathematics course.

411. Probability and statistics should replace most of the traditional work with fractions in grades 6, 7, and 8.

412. Probability and statistics should be offered as a senior-level advanced course for high ability mathematics and science students.

413. Probability and statistics should be offered as part of an interdisciplinary course (e.g., with science or social studies).

414. Statistics belongs in the curriculum but probability does not.

415. Probability belongs in the curriculum but statistics does not.

PS6

How appropriate is it for students to use hand-held calculators when doing each of the following activities while studying probability and statistics?

a. Very appropriate
b. Only in special circumstances
c. Undecided
d. Almost never appropriate
e. Should not be allowed

416. Calculating the average of the numbers 5, 7, 12, 19 and 23

417. Making a graph from a number sentence or equation

418. Taking a probability and statistics test

419. Calculating the probability that several events will occur in a certain sequence

420. Doing homework in probability and statistics

Listed below are several ways that ratio, proportion, and/or percent could be treated in the curriculum. Which of the following treatments should be included in the school mathematics program?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

421. Ratio should be introduced as a measure of the "steepness" of different straight-line graphs (e.g., the slope of lines).

422. Percent should be introduced in a real-life context.

423. Direct and indirect variations should be identified as two different patterns when data are graphed.

424. Percent should be introduced in terms of merchandising (e.g., discount sales, percent of profit).

425. Proportions should be introduced with illustrations of simple chemistry and physics experiments.

426. A percent, such as 63%, should be converted to the ratio of 63/100.

427. Ratio should be introduced as a method for determining the "best buy" in a supermarket or sporting goods store.

428. Each percent problem should be solved by writing an appropriate number sentence.

429. Every percent problem should be solved by setting up a proportion.

430. Ratio should be developed as a special kind of fraction before applications of the concept are made.

431. Proportions should be introduced as ways to describe mixtures.

432. Proportions should not be dignified by special treatment but as simply a part of equation solving.

433. Shortcuts and memory devices should be taught (e.g., "the product of the means equals the product of the extremes").

434. Percent should be introduced as a special key on a calculator and the meaning of the concept should be discovered by examining the effects of that key.

435. Ratio and proportion should be developed in connection with similar geometric figures even in non-geometry courses.

Imagine that there are available several sets of instructional materials for ratio, proportion and percent. The materials differ in that each emphasizes one of the curricular goals listed below even at the expense of other goals. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which emphasis on the stated goal should be a positive influence on the decision to use or to buy these curricular materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

436. To preserve a traditional emphasis in the curriculum.

437. To provide a setting for practicing computational skills.

438. To acquire consumer skills such as using percent in analyzing the financing of a purchase such as a new car or a house.

439. To demonstrate that ratios provide the foundations for a powerful reasoning process.

440. To learn special techniques, such as direct and inverse variation, that are powerful tools in sciences such as physics and chemistry.

441. To develop proportional thinking as an important problem solving technique.

442. To identify students who possess mathematical talent.

443. To develop, apply, and extend the understanding of fractions.

444. To acquire skills necessary for applying mathematics in vocational settings.

445. To develop and practice disciplined work habits.

RP 3

During the 1980s it may be possible to add to each classroom several different resources for teaching ratio, proportion, and/or percent. To what extent would you want each of the following?

a. I would definitely want this
b. This might be nice to have
c. Undecided
d. I'd rather not be bothered by this
e. I definitely would not want this

446. Charts for reading percents visually

447. Calculators that allow three numbers of a proportion to be input, with the fourth number calculated and displayed when the "equals" key is pushed

448. Small computers or calculators programmed to handle all three types of percent problems automatically

449. A laboratory book of experiments illustrating ratio and proportion

450. Individualized study materials for ratio and percent

451. Machines for plotting graphs

452. Master copies for making activities and worksheets

453. Mathematics laboratory manipulative materials for ratio and percent

454. Resource books of applications of ratio and percent to real-life problems

455. Short films and videotapes illustrating basic concepts of ratio and percent

RP 4

Imagine that there are available several sets of instructional materials for ratio, proportion, and percent. Each set of materials emphasizes one of the teaching strategies listed below. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which the incorporation of this particular teaching strategy would be a positive or negative influence in your decision to purchases or use the materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

456. Simple physical experiments to illustrate ratio, proportion, and percent are done in a laboratory setting.

457. Student worksheets are included for drill and practice on ratio, proportion, and percent topics at the conclusion of each lesson.

458. Projects involving ratio, proportion, and percent are included for assignment to individuals and teams of students.

459. Specific objectives, criterion-referenced testing, and other materials are included to encourage the use of mastery learning or an individually paced model.

460. Field trips are taken in which students can observe the use of ratio, proportion, and percent in business and industry.

461. Activities are included that anticipate the class being divided into small discussion groups.

462. Graphs and charts are used to eliminate as much computation as possible.

463. Students are expected to read formal presentations of basic ideas of ratio, proportion, and/or percent before classroom activities are devoted to these ideas.

464. Each ratio, proportion, or percent topic is introduced by giving the class a problem.

465. Detailed notes are provided to guide the teacher in oral presentations of lessons about ratio, proportion, and percent.

RP 5

The following statements regarding the topics of ratio, proportion, and/or percents were generated at a recent parent-teacher meeting at your school. Please indicate your reaction to each of them.

a. I agree completely
b. I tend to agree
c. Undecided
d. I tend to disagree
e. I strongly disagree

466. Ratio and proportion should not be introduced until grade 9.

467. Only bright students should be taught all three types of percent problems.

468. The mastery of percent problems should be a condition for high school graduation.

469. More time should be devoted to ratio and proportion than is presently allowed in the school curriculum.

470. Most of the work with direct and indirect variation should be handled in science classes rather than mathematics classes.

RP 6

How appropriate is it for students to use hand-held calculators when doing each of the following types of ratio, proportion and/or percent activities?

a. Very appropriate
b. Only in special circumstances
c. Undecided
d. Almost never appropriate
e. Should not be allowed

471. Taking a test on ratio, proportion, and/or percent

472. Doing homework

473. Calculating the number of dollars saved if a $250 coat is purchased during a 30% discount sale

474. Checking answers

475. Solving the problem, "If 3 cans of corn cost 89¢ what would be the cost of 10 cans of corn?"

476. Finding the distance from Centerburg to Roseville if the length separating them on a map is 1½ inches and the map scale is ½ inch = 3 miles

477. Finding what percent of $3000 would yield $50 interest in a period of a year

478. Developing ideas about percents greater than 100%

479. Calculating the final amount owed if an item sells for $15 and the sales tax is 5%

480. Given that 4 hours work is needed to produce 17 finished brackets, finding how much time is needed to produce 25

PB1E

Listed below are several problem solving techniques that might be taught to elementary students. Which specific techniques should be included in the mathematics curriculum of the elementary school?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

481. Categorize problems into specific types (e.g., age, distance-rate-time), then teach a method of solution for each type.

482. Generate many possible answers using a calculator or computer, then check to see which one meets the conditions of the problem.

483. Write and solve a simpler problem; then extend the solution to the original problem.

484. Explore the problem by using flow charts.

485. Translate the problem into number sentences or equations.

486. Guess and test possible solutions.

487. Start with an approximate answer and work backwards.

488. Draw a picture diagram or graph to represent the problem situation.

489. Construct a table and search for patterns.

490. Teach primarily global problem solving ideas (e.g., read, plan, work, check).

PB1S

Listed below are several problem solving techniques that might be taught to all secondary students. Which specific techniques should be included in the mathematics curriculum of the secondary school?

a. Definitely should be included for all secondary students
b. Probably should be included for all secondary students
c. Undecided
d. Probably should not be included for all secondary students
e. Definitely should not be included for all secondary students

491. Categorize problems into specific types (e.g., age, distance-rate-time), then teach a method of solution for each type.

492. Generate many possible answers using a calculator or computer, then check to see which one meets the conditions of the problem.

493. Write and solve a simpler problem; then extend the solution to the original problem.

494. Explore the problem either by using flow charts or by writing a computer program.

495. Translate the problem into sentences or equations.

496. Guess and test possible solutions.

497. Start with an approximate answer and work backwards.

498. Construct a table and search for patterns.

499. Draw a picture diagram or graph to represent the problem situation.

500. Teach primarily global problem solving ideas (e.g., read, plan, work, check).

PB 2

Imagine that there are available several sets of instructional materials for problem solving. The marerials differ in that each emphasizes one of the curricular goals listed below even at the expense of other goals. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which emphasis on the stated goal should be a positive influence on the decision to use or to buy these curricular materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

Problem solving is taught:

501. To provide a setting for practicing computational skills.

502. To develop methods of thinking and logical reasoning.

503. To identify students who possess mathematical talent.

504. To learn how to read mathematics.

505. To apply recently taught mathematical ideas.

506. To acquire skills necessary for living in today's world.

507. To develop the skills to approach new topics in mathematics independently.

508. To develop creative thought processes.

509. To acquire problem solving techniques that are vital to having a well-rounded education.

510. To enhance the ability to apply mathematics in science.

During the 1980s it may be possible to add to each classroom several different resources for teaching problem solving. To what extent would you want to have each of the following?

a. I would definitely want this
b. This might be nice to have
c. Undecided
d. I'd rather not be bothered by this
e. I definitely would not want this

511. Computers for problem exploration

512. Textbook modules for teaching appropriate problem solving strategies (heuristics) at every grade level

513. Inservice training on problem solving methods for all teachers who teach mathematics

514. Supplementary materials which contain many more problems like those in textbooks

515. Resource books with problems that appeal to girls

516. Card files of problems

517. Materials in every class for modeling problems and problem solutions (e.g., graph paper, measuring devices, construction sticks, et cetera)

518. Materials for problem solving contests and competitions

519. Laboratory resources outside the school for problem investigation

520. Hand-held calculators for use in problem solving situations

521. Resource books of problems written especially for ethnic minority students

522. Textbooks with all verbal problems in a single chapter

523. More time for mathematics (e.g., longer class periods)

524. Practice tests similar to standardized problem solving tests

525. A resource guide to real-life problems

PB 4

Imagine that there are available several sets of instructional materials for problem solving. Indicate the degree to which the incorporation of each of the following strategies would be a positive or negative influence in your decision to purchase or use the materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

526. Students work in small groups to solve problems.

527. Problem assignments are designed to challenge students to think.

528. Students are required to create problems and exchange them with one another for solution.

529. Reading is de-emphasized by presenting problems orally or with pictures, charts, et cetera.

530. Problems are included which require more than a single class period to solve.

531. More than 50% of the instructional time is devoted to drill and practice on problem solving.

532. Problems are used to introduce mathematical topics.

533. Students are taught to solve problems according to types (e.g., mixture, time-rate-distance).

534. Only problems which students can answer quickly are assigned.

535. Projects that involve real life problem situations should be assigned to individuals or teams of students.

536. Students are shown how to solve a problem, then similar practice problems are assigned.

537. Students are expected to read formal presentations about problem solving methods before classroom activities are devoted to these ideas.

538. Problems are given in which the use of physical materials will aid in the solution.

539. Problems are given that do not have exactly one correct answer.

540. Specific objectives, criterion-referenced testing and other materials are included to encourage use of a mastery learning or individually paced model.

PB 5

A committee of parents and teachers is working on a problem solving curriculum guide for your school. They are considering the following general statements. Please indicate your reaction to each of them.

a. I agree completely
b. I tend to agree
c. Undecided
d. I tend to disagree
e. I strongly disagree

541. A separate problem solving course, lasting at least one semester, should be required of all students before high school graduation.

542. Problem solving is a function of intelligence and cannot really be taught except to gifted students.

543. Short problem solving units should be included after each mathematical topic is taught.

544. Most students should study practical applications of mathematics; only a few should study puzzles or esoteric mathematical problems.

545. Problem solving is important only for college-bound students.

546. Different problem solving courses should be offered for girls.

547. All problem solving should be done within existing mathematics courses.

548. An interdisciplinary problem-solving course should be offered.

549. Problem solving should not be taught in the elementary grades.

550. Students should be taught to <u>find</u> problems within situations.

Listed below are topics concerning measurement that could be included in the mathematics textbooks for the elementary school during the 1980s. Which of the following should be included in the elementary school mathematics program?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

551. Scientific notation (e.g., $5000 = 5 \times 10^3$)

552. The multiplication and division of units (e.g., $\frac{\text{miles}}{\text{hr}} \times \text{hr} = \text{miles}$)

553. Conversion between different measurement systems

554. The metric system

555. Significant digits

556. Formulas for areas of polygons and circles

557. Use of measurement devices (e.g., rulers, protractors, micrometers)

558. The use of both non-standard and standard units of measure

559. Estimation of measurements

560. History of measurement systems

MS1S

Listed below are topics concerning measurement that could be taught at some point in the secondary school (grades 7-12) mathematics program. Which are of sufficient significance to include for all students during the 1980s?

a. Definitely should be included for all students
b. Probably should be included for all students
c. Undecided
d. Probably should not be included for all students
e. Definitely should not be included for all students

561. Angle and arc measurement

562. The multiplication and division of units (e.g., $\frac{\text{miles}}{\text{hr}} \times \text{hr} = \text{miles}$)

563. Conversion between similar units in different systems

564. The metric system

565. Significant digits

566. Formulas for areas of polygons and circles

567. Formulas for distance on the coordinate plane

568. The use of arbitrary and standardized units of measure

569. Estimation and approximations of measures

570. History of measurement systems

MS2

Imagine that there are available several sets of instructional materials for measurement. The materials differ in that each emphasizes one of the curricular goals listed below even at the expense of other goals. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which emphasis on the stated goal should be a positive influence on the decision to use or to buy these curricular materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

Measurement is taught:

571. To develop skills that are prerequisite to other school work such as science or mathematics.

572. To give meanings to the numbers that are used in arithmetic.

573. To provide laboratory experiences.

574. To develop physical coordination.

575. To learn to use specific tools for measurement (e.g., protractors, rulers, micrometers, calipers, scales).

576. To relate mathematics to historical and cultural developments.

577. For everyday use in the home (e.g., comparisons, decisions).

578. To acquire skills necessary for living in today's world.

579. To develop job-oriented skills.

580. To develop and practice estimation skills.

MS3

During the 1980s it may be possible to add to each classroom several different resources for teaching measurement. To what extent would you want to have each of the following?

a. I would definitely want this
b. This might be nice to have
c. Undecided
d. I'd rather not be bothered by this
e. I definitely would not want this

581. A basic kit of measuring tools for each student

582. Films or videotapes showing basic measuring processes

583. Masters of worksheets and activities

584. Electronic measuring tools that show all measurements on a digital display similar to that of a calculator

585. Individual study materials for measruement

586. Calculators with special keys for converting between measurement systems

587. Large-scale measuring devices for teacher demonstrations

588. Student booklets of experiments or activities

589. Videotaped interviews with craftsmen and workers describing how they use measurement on the job

590. Resource books with problems involving the application of measurement concepts

MS4

Imagine that there are available several sets of instructional materials for measurement. Each set of materials emphasizes one of the teaching strategies listed below. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which the incorporation of this particular teaching strategy would be a positive or negative influence in your decision to purchase or use the materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

591. Activities are included that would require students to go outside the classroom to measure things.

592. Assignments for students or teams of students include projects that require measurement.

593. Presentations and discussions of measurement techniques are given before students actively measure.

594. Basic measurement ideas are introduced through laboratory investigations.

595. More than 50% of the instructional time is devoted to student use of individual study materials to develop and extend measurement ideas.

596. Simulations, wherein each student plays the role of a consumer or worker using measurement in real world situations, are frequently included.

597. Student worksheets are included for drill and practice on measurement topics at the conclusion of each lesson.

598. Each measruement topic is introduced by giving the class a problem.

599. Detailed notes are provided to guide the teacher in oral presentations of lessons about measurement.

600. Specific objectives, criterion-referenced testing, and other materials are included to encourage use of a mastery learning or an individually paced model.

MS5

The mathematics curriculum committee of your school system is considering the possibility of placing topics in measurement at different points in the curriculum. Please react to the following suggestions.

a. I agree completely
b. I tend to agree
c. Undecided
d. I tend to disagree
e. I strongly disagree

601. All work in measurement should be taught by science teachers or in the context of science lessons.

602. Work on measurement should appear at every level from K-8.

603. Topics in measurement should not be introduced before junior high school.

604. Measurement should be a major theme of geometry.

605. Measurement should be a strong focus of ninth grade general mathematics or consumer mathematics.

MS6

How appropriate is it for students to use hand-held calculators in connection with each of the following measurement activities?

a. Very appropriate
b. Only in special circumstances
c. Undecided
d. Almost never appropriate
e. Should not be allowed

606. Finding the number of gallons of water a swimming pool will hold

607. Taking a test on measurement

608. Converting from one system of units to another

609. Calculating the diameter of a tree after measuring its circumference

610. Doing homework problems involving measurements

611. Finding the volume of a rectangular shipping crate, 2 ft. x 4 ft. x 5 ft.

612. Finding the number of rolls of wallpaper necessary to cover the walls of a room whose dimensions are given

613. Checking answers

614. Finding the area of the opening of a fireplace 125 cm tall and 205 cm wide

615. Finding the total length of a road rally course given the odometer readings at various checkpoints

CL 1

As citizens of the 21st century, today's students will live in a world heavily influenced by computers and calculators. Which of the following topics should be included in the mathematics curriculum of the 1980s?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

616. Procedures for accessing or operating a computer system

617. Memory storage and access systems

618. Writing programs in a simple computer language such as BASIC

619. The roles of computers in society (record-keeping, simulation, et cetera)

620. Methods for debugging or correcting computer programs

621. Issues of privacy and security raised by computers

622. The functioning of microprocessor units

623. Flow charting

624. The use of machine language

625. History of computing devices

626. Languages for non-computational programs (e.g., Course Writer, PLATO)

627. Operation of a programmable calculator

628. The types of mathematical and non-mathematical problems that can be solved by a computer

629. Computational programming languages (e.g., FORTRAN, COBOL)

630. Data processing for business applications (e.g., billing, inventory control)

CL 2

Imagine that there are available several sets of instructional materials for computer literacy. The materials differ in that each emphasizes one of the curricular goals listed below even at the expense of other goals. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which emphasis on the stated goal should be a positive influence on the decision to use or to buy these curricular materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

Computer Literacy is taught:

631. To acquire fundamental computer techniques necessary for vocational training.

632. To prepare for the 21st century in which almost everyone will be interacting directly with a computer or programmable device.

633. To introduce alternative techniques for solving problems, proving theorems, et cetera.

634. To understand the capability of the computer to provide access to large bodies of information (e.g., information retrieval systems).

635. To develop logical thinking abilities.

CL 3

During the 1980s it may be possible to add to each classroom several different resources for computer education programs. To what extent would you want to have each of the following?

a. I would definitely want this
b. This might be nice to have
c. Undecided
d. I'd rather not be bothered by this
e. I definitely would not want this

636. Wall-sized demonstration screens connected to computers for vodeo output

637. A terminal connected to a large computer

638. Several small, personal mini-computers for each class

639. Equipment for batch processing (e.g., card readers, paper tape punches, magnetic tape and disks)

640. Workbooks with paper and pencil algorithms simulation computer processes

CL 4

Imagine that there are available several sets of instructional materials for computer topics. Each set of materials emphasizes one of the teaching strategies listed below. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which the incorporation of this particular teaching strategy would be a positive or negative influence in your decision to purchase or use the materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong positive influence

641. Cases where the computer was misused are studied.

642. Students are expected to read formal presentations of computer ideas before classroom activities are devoted to these ideas.

643. Program writing is taught by a trial and error approach that emphasizes discovery of fundamental programming principles.

644. Programming techniques are taught by computer-assisted instruction in a tutorial mode.

645. Students are assigned individual projects to study different computer applications and the impact of these applications.

646. Computer ideas are taught by simulations using large scale devices to demonstrate how a computer works.

647. Field trips are taken in which students can observe the use of computers in business and industry.

648. Detailed notes are provided to guide the teacher in oral presentations of computer topics.

649. At least 50% of the instructional time is devoted to students writing computer programs.

650. More than 50% of the instructional time is devoted to student use of individual study materials to develop and ext nd computer ideas.

CL 5

A committee of parents and teachers is working on a blueprint for introducing computer literacy topics into your school's curriculum. Please react to each of the following statements being considered by the committee.

a. I agree completely
b. I tend to agree
c. Undecided
d. I tend to disagree
e. I strongly disagree

651. Computer literacy courses should be taught primarily within the social studies curriculum since it is the effect of computers upon society that is important.

652. At least one course whose major theme is computer literacy and which lasts for at least one semester should be required of all high school graduates.

653. Students should interact with a computer or computer terminal as early as the primary grades.

654. Separate computer science departments should be established in high schools to parallel mathematics departments and science departments.

655. All high school graduates should be able to write simple computer programs.

656. Computer literacy topics should be integrated within the present mathematics curriculum from grades K-12.

657. Because the computer techniques needed for vocational training are different from those needed by college-bound students, at least two different types of computer courses should be offered in every high school.

658. Knowledge of computers is only needed by specialists; they should receive courses and training in this area only after they leave high school.

659. Courses about computers should be strictly elective.

660. Computer courses should use a wide variety of hardware with instructions in the use of each type forming a major part of the course.

Preference Survey Lay and Generic Items

Generic Calculator Item:

How appropriate is it for students to use hand-held calculators when doing each of the following activities?

a. Very appropriate
b. Only in special circumstances
c. Undecided
d. Almost never appropriate
e. Should not be allowed

G661 Doing homework

G662 Developing ideas and concepts

G663 Taking a test

G664 Checking answers

G665 Solving word problems

G666 Doing a chain of calculations involving several different operations

G667 Learning why an algorithm works

G668 Learning basic number facts

G669 Making graphs

G670 Solving equations

G671 Computing area

G672 Using trigonometry

Generic Methods Item - Elementary:

Imagine that there are available several sets of instructional materials for a mathematical topic. Each set of materials emphasizes one of the teaching strategies listed below. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which the incorporation of this particular teaching strategy would be a positive or negative influence in your decision to purchase or use the materials at the elementary level.

a. Strong positive influence
b. Somewhat positive influence
c. Undecided or no influence
d. Somewhat negative influence
e. Strong negative influence

G673 More than 50% of the instructional time is devoted to drill and practice.

G674 Specific objectives, criterion referenced testing, and other materials are included to encourage use of a mastery learning or an individually paced model.

G675 Student worksheets are included for drill and practice at the conclusion of each lesson.

G676 Detailed notes are provided to guide the teacher in oral presentations of lessons.

G677 More than 50% of the instructional time is devoted to student use of individual study materials to develop and extend ideas.

G678 Slower students are allowed to use calculators so that they may keep up with the rest of the class.

G679 It is expected that students will read formal presentations of basic ideas before classroom activities are devoted to these ideas.

G680 Activities are included which require going outside the classroom (perhaps on field trips).

G681 Basic ideas are introduced through laboratory investigations or experiments with materials.

G682 Physical models are used to represent algorithms or develop concepts.

G683 Concepts or procedures are developed within the context of real-world or application problems.

G684 Ideas are developed through long-term real-life student projects designed to be assigned to individuals or to teams of students.

G685 Activities are included that anticipate the class being divided into small discussion groups.

G686 Simulations, wherein each student plays the role of consumer or worker using mathematics in real-world situations, are frequently included.

G687 Deductive sequences are used to develop new ideas and structural characteristics.

G688 The introduction of calculators is postponed until students have learned both the meaning of the operations and the paper-and-pencil algorithms for them.

Generic Methods Item - Secondary:

Imagine that there are available several sets of instructional materials for a mathematical topic. Each set of materials emphasizes one of the teaching strategies listed below. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which the incorporation of this particular teaching strategy would be a positive or negative influence in your decision to purchase or use the materials at the secondary level.

a. Strong positive influence
b. Somewhat positive influence
c. Undecided or no influence
d. Somewhat negative influence
e. Strong negative influence

G689 More than 50% of the instructional time is devoted to drill and practice.

G690 Specific objectives, criterion referenced testing, and other materials are included to encourage use of a mastery learning or an individually paced model.

G691 Student worksheets are included for drill and practice at the conclusion of each lesson.

G692 Detailed notes are provided to guide the teacher in oral presentations of lessons.

G693 More than 50% of the instructional time is devoted to student use of individual study materials to develop and extend ideas.

G694 Slower students are allowed to use calculators so that they may keep up with the rest of the class.

G695 It is expected that students will read formal presentations of basic ideas before classroom activities are devoted to these ideas.

G696 Activities are included which require going outside the classroom (perhaps on field trips).

G697 Basic ideas are introduced through laboratory investigations or experiments with materials.

G698 Physical models are used to represent algorithms or develop concepts.

G699 Concepts or procedures are developed within the context of real-world or application problems.

G700 Ideas are developed through long-term real-life student projects designed to be assigned to individuals or to teams of students.

G701 Activities are included that anticipate the class being divided into small discussion groups.

G702 Simulations, wherein each student plays the role of a consumer or worker using mathematics in real-world situations, are frequently included.

G703 Deductive sequences are used to develop new ideas and structural characteristics.

G704 The introduction of calculators is postponed until students have learned both the meaning of the operations and the paper-and-pencil algorithms for them.

Generic Resources Item - Elementary:

During the 1980's it may be possible to add to each classroom several different resources for teaching mathematics. To what extent would you want elementary classroom teachers to have each of the following?

a. I would definitely want them to have this.
b. This might be nice for them to have.
c. Undecided
d. I'd rather they not be bothered by this.
e. I definitely would not want them to have this.

G705 Calculators with special displays or capabilities (e.g., designed to handle fractions, equations of lines)

G706 Films or videotapes on concepts or processes

G707 Masters of worksheets and activities

G708 Individual study materials

G709 Manipulative materials or laboratory equipment for individual or small group use

G710 Large-scale demonstration models and devices

G711 Resource booklets on problems and applications

G712 Computers or computer access

G713 Standardized practice tests

G714 A syllabus that suggests topics and methods for each grade level with specific times when they should be introduced

G715 Materials for drill and practice

G716 Materials with minimal reading requirements

Generic Resources Item - Secondary:

During the 1980's it may be possible to add to each classroom resources for teaching mathematics. To what extent would you want secondary classroom teachers to have each of the following?

a. I would definitely want them to have this.
B. This might be nice for them to have.
c. Undecided
d. I'd rather they not be bothered by this.
e. I definitely would not want them to have this.

G717 Calculators with special displays or capabilities (e.g., designed to handle fractions, equations of lines)

G718 Films or videotapes on concepts or processes

G719 Masters of worksheets and activities

G720 Individual study materials

G721 Manipulative materials or laboratory equipment for individual or small group use

G722 Large-scale demonstration models and devices

G723 Resource booklets on problems and applications

G724 Computers or computer access

G725 Standardized practice tests

G726 A syllabus that suggests topics and methods for each grade level with specific times when they should be introduced

G727 Materials for drill and practice

G728 Materials with minimal reading requirements

Lay Items:

How important is each of the following purposes for teaching mathematics in schools?

a. Very important
b. Somewhat important
c. Undecided
d. Not important
e. Definitely not important

VS729 To solve problems in everyday life

VS730 To think logically

VS731 To assure an adequate supply of scientists and engineers

VS732 To preserve student options with respect to potential careers and vocational choices

VS733 To develop understanding of the structure of mathematics

VS734 To develop disciplined work habits

VS735 To prepare for college

VS736 To pass standardized tests

VS737 To gain skills necessary for employment

VS738 To make consumer decisions

VS739 To preserve a traditional part of schooling

VS740 To teach skills necessary for continued work in mathematics

VS741 How many years of high school mathematics (in grades 9 through 12) would you require for graduation?

a. 0
b. 1
c. 2
d. 3
e. 4

VS742 How many years of mathematics would you require for college-bound students in high school (grades 9 through 12)?

a. 0
b. 1
c. 2
d. 3
e. 4

A committee is working on a curriculum guide for mathematics during the 1980s for a school. The following statements were proposed by various committee members. Please react to each. Omit the item if you do not understand it.

a. I agree completely
b. I tend to agree
c. I am undecided
d. I tend to disagree
e. I strongly disagree

VS743 Operations with decimals should be included in the first- or second-grade mathematics program (the earlier the better).

VS744 Algebra should be combined with geometry and other mathematical areas instead of being taught separately.

VS745 A student should know whole-number computation with paper and pencil before graduating from high school.

VS746 A full-year course in applied geometry (for example, navigation, measurement) should be available in high school.

VS747 Knowing how to do percent problems should be a condition for high school graduation.

VS748 Mathematical problem solving is more important for college-bound students than for other students.

VS749 Work on measurement should be taught in the elementary school.

VS750 Work with decimals is more important than work with fractions.

VS751 Formal work with algebra should be dropped from the school curriculum since it bears so little relation to real-world problems.

VS752 Mental calculations, without the aid of paper and pencil or calculator, should be taught.

VS753 Dealing with statistical information should be taught only as an enrichment topic for mathematics.

VS754 Learning about what computers can and cannot do should be integrated within the present mathematics curriculum from grades K-12.

VS755 College-bound high school students should spend at least three weeks of every school year reviewing whole-number computation.

VS756 More of the mathematics curriculum in grades 7 and 8 should be devoted to geometry.

VS757 At least one course whose major theme is the role and uses of computers, lasting at least one semester, should be required for high school graduation.

A committee is working on a curriculum guide for mathematics during the 1980s for a school. The following statements were proposed by various committee members. Please react to each. Omit the item if you do not understand it.

a. I agree completely
b. I tend to agree
c. I am undecided
d. I tend to disagree
e. I strongly disagree

VS758 Student worksheets or workbooks are included for drill and practice at the conclusion of each lesson.

VS759 Activities are included that anticipate the class being divided into small groups.

VS760 Tests, homework, and specific objectives are included to encourage each student to attain a specified competency level.

VS761 Only problems which students can answer quickly are assigned.

VS762 The introduction of calculators is postponed until students have learned both the meaning of, and paper-and-pencil procedures for, whole-number computation.

VS763 Reading is de-emphasized in textbooks and other materials.

VS764 Ideas or procedures are developed through real-life problems situations, or activities.

VS765 Detailed notes are provided to guide the teacher in oral presentations of lessons.

VS766 Short problem-solving sections are included after each mathematical topic is taught.

VS767 Physical materials, which the students can manipulate to help them understand mathematical ideas, are included in many lessons.

How appropriate is it for students to use hand-held calculators when doing each of the following activities?

a. Very appropriate
b. Appropriate
c. Undecided
d. Almost never appropriate
e. Should not be allowed

VS768 Doing practice exercises in class

A committee is working on a curriculum guide for mathematics during the 1980s for a school. The following statements were proposed by various committee members. Please react to each. Omit the item if you do not understand it.

a. I agree completely
b. I tend to agree
c. I am undecided
d. I tend to disagree
e. I strongly disagree

VS769 All fractions should be written as decimals so that work with them can be done with a calculator.

VS770 A special algebra course for vocational students should be offered.

VS771 Several different procedures for doing addition, subtraction, multiplication, and division should be taught so that children can choose the method which they prefer.

VS772 Separate courses in geometry should be abolished and geometry content integrated with other mathematics in grades K-12.

VS773 Percent should be introduced in terms of merchandising (for example, discount sales, percent of profit).

VS774 A separate problem-solving course, lasting at least one semester should be required of all students before high school graduation.

VS775 Measurement should be a strong focus of consumer mathematics courses in high school.

VS776 Work with fractions should be delayed until grade 7 or 8.

VS777 A student graduating from high school should be required to take a full-year algebra course.

VS778 Students who do not know paper-and-pencil computation by the end of grade 8 should be required to take a ninth-grade mathematics course on the uses of the hand-held calculator.

VS779 Work with statistical information and making predictions (probability) should be offered as part of a consumer mathematics course.

VS780 At least one course in mathematics for college-bound students should make extensive use of the computer.

VS781 Specific consumer skills like balancing a checkbook and calculating best buys should be taught.

VS782 Problems should be realistic even though they might involve sensitive social issues.

VS783 Work with statistical information and making predictions (probability) should be offered as a twelfth-grade course for high-ability mathematics students.

You are a member of a committee which is selecting materials to purchase for a school. Indicate the degree that including each of the following teaching strategies would influence your decision.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

VS784 More than 50% of the instructional time is devoted to drill and practice.

VS785 Slower students are allowed to use calculators so that they may keep us with the rest of the class.

VS786 Activities are included which require going outside the classroom.

VS787 Each new mathematical topic is introduced with a problem to be solved.

VS788 More than 50% of the instructional time is devoted to student use of individual study materials to develop and extend ideas.

VS789 Basic ideas are introduced through laboratory investigations or experiments with materials.

VS790 Students are to read about mathematical ideas before classroom activities are devoted to these ideas.

VS791 Most lessons are designed to be conducted with a single large group.

VS792 Daily homework assignments are included.

VS793 Students are shown how to solve a problem and then similar practice problems are assigned.

APPENDIX A.4

List of Items: Priorities Survey

Priorities Survey Items

In the 1980s there will be a limited amount of money that can be spent for the development of new materials in the areas listed below. Please indicate the order in which you think the money should be spent by marking the answer sheet in the following way:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

VP01 Whole-number computation

VP02 Problem solving in mathematics

VP03 Measurement

VP04 Fractions (concepts and computation)

VP05 Decimals (concepts and computation)

Suppose that an additional 15 minutes each day could be spent on mathematics in your elementary school(s). In your opinion, how should this time be spent? Please rank the following ideas, using the choices:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

VP06 Solving word problems

VP07 Drill and practice on basic number skills

VP08 Exploring enrichment topics

VP09 Studying applications of mathematics

VP10 Building an intuitive base for algebra and geometry

Imagine that you have a limited amount of money to spend for the development of new materials for grades 7-12 in the areas listed below. Please indicate the order in which you think the money should be spent by making the answer sheet in the following way:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

VP11 Algebra

VP12 Probability

VP13 Geometry

VP14 Computer literacy

VP15 Statistics

Suppose that one new or extensively revised mathematics course could be added to the curriculum of your high school(s). In what order would you support the following choices?

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

VP16 A course that helps students develop a feeling for ideas from calculus

VP17 A course that helps students handle statistical data and make predictions

VP18 A course that helps students make decisions about buying and selling

VP19 A course that helps students understand how calculators and computers handle mathematics

VP20 A course that helps students understand the mathematics used in specific vocations and careers.

Of the five areas listed below, how should attention be given during the 1980s? Use the following responses to form a ranking:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

VP21 A unified approach to mathematical topics

VP22 Computer literacy (that is, understanding of the role and uses of computers) for everyone

VP23 Applications of mathematics

VP24 Structure in mathematics

VP25 Interdisciplinary approaches between mathematics and science, etc.

Of the five areas listed below, how should attention be given during the 1980s? Use the following responses to form a ranking:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

VP26 Career or vocation orientation

VP27 Consumer orientation

VP28 College preparatory orientation

VP29 Recreation or leisure-time orientation

VP30 Computer orientation

People have various opinions about the extent to which needs of various opinions about the extent to which needs of various types of students are being met. Please indicate the order in which you think the need should be addressed, using the following responses:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

VP31 Students whose first language is not English

VP32 Inner-city or urban-area students

VP33 Students of ethnic minority background

VP34 Students with mathematics learning problems and other handicaps.

VP35 Female students

In your opinion, in what order of priority should the following areas within teacher education be addressed during the 1980s?

a - highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

VP36 Mathematics content

VP37 Methods for teaching mathematics

VP38 Development of teaching materials

VP39 Sensitivity to student needs

VP40 Diagnostic and remediation strategies

In previous questions you have ranked priorities within the broad areas of mathematics content, students with special needs, and teacher education. To these areas might also be added the development of non-text teaching materials and the development of special teaching methods. In what order should these areas be studied or developed during the 1980s? Please indicate your priorities by marking the answer sheet in the following way:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

VP41 Improved mathematics content for textbooks

VP42 Development of special mathematics materials for students with special needs

VP43 Improved preservice and in-service education for teaching mathematics

VP44 Development of non-text materials for teaching mathematics

VP45 Improvement of methods and techniques for teaching mathematics

Many general problems face teachers of mathematics (as well as other teachers). Please react to each of the following problems using these responses:

a = Among the most serious problems on the list
b = A more serious problem than many on the list
c = Undecided or no basis for judgment
d = A less serious problem in comparison with others on the list
e = A minor problem in comparison with others on the list

VP46 Classroom discipline

VP47 Lowering of school academic standards

VP48 Irregular attendance of students

VP49 Governmental or administrative restrictions

VP50 Lack of community

VP51 Reading difficulties

VP52 Unmotivated students

VP53 No commitment to homework on the part of students or parents

VP54 Decline in student abilities

VP55 Mixing of students with differing abilities in the same classroom

VP56 Increasing class size

VP57 Too much free time for students

VP58 Increased teacher workloads

VP59 Emphasis on non-academic school

VP60 Restrictions on instructional materials

VP61 Do you think the general problems that face all teachers (of the type indicated in items 54 thru 68) deserve priority over those problems specific to the teaching and learning of mathematics?

a = yes
b = no
c = undecided

In your opinion, how should research funds be distributed among the following areas during the 1980s?

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter <u>only once</u> for the next five items.

VP62 How students learn

VP63 Longitudinal assessment of achievement

VP64 Teaching methods

VP65 Teacher education

VP66 Varying types of materials

In your opinion, how do the following methods for attacking problems in mathematics education compare in general importance, practicality, and efficiency? Please evaluate them by indicating your reactions in the following way?

a = A very good method
b = Probably a good method
c = Undecided
d = A questionable method
e = An undesirable method

VP67 Create many small, basic research projects

VP68 Establish a few coordinated, long-term research projects

VP69 Fund small, local curriculum development projects

VP70 Create a large curriculum development project with a nationwide influence

VP71 Give grants to commercial firms for publishing innovative curriculum materials

VP72 Give grants to local schools to improve their mathematics program

VP73 Support the in-service education of teachers

VP74 Support evaluation of mathematics learning and achievement

VP75 Create a project to develop innovative teaching methods

VP76 Support the development of non-text materials

VP77 Fund research for study of general classroom problems

VP78 Fund professional mathematics education organizations to publicize innovative ideas

VP79 Establish mathematics education clearinghouses for the collection of innovativematerials

VP80 Give grants to individual teachers for development of materials

VP81 Support preservice education of teachers

VP82 If more mathematics were offered to accomodate talented or gifted students at the high school level, which one of the following would be most important?

a = Additional topics in geometry

b = Topics in calculus and analysis

c = Additional topics in algebra

d = Computer/numerical analysis

e = A broad selection of enrichment topics

VP83 How would you evaluate the mathematics program in comparison to other academic programs in your school system?

a = The mathematics program is generally better than most other programs.

b = The mathematics program is about the same quality as other programs.

c = The mathematics program is inferior to other programs.

d = I have no opinion.

VP84 In which of the following areas do you feel your mathematics program needs the most improvement?

a = Mathematics for general education

b = Mathematics for the college-bound student

c = Mathematics for the vocational student

VP85 Consider the content area (questions VP01 through VP05) above that you ranked lowest (marked with an "e"). Of the following five ideas, which comes closest to the reason you gave this area lowest priority?

a = The materials we presently have in this area are more nearly adequate than the materials we have in the other four areas.

b = This area does not present many problems for most teachers.

c = It is not as important for students to develop skills in this area as it is in other areas in the list.

d = Changes are needed in this area, but new materials would be an inefficient way to promote such changes.

e = The importance of this area will diminish during the 1980s.

VP86 Consider the content area (questions VP01 through VP05) above that you ranked highest (marked with an "a"). Of the following five ideas, which best describes the reason you gave it highest priority?

a = We have fewer good materials to choose from in this area than in the other four areas.

b = This is a major problem area for many, many teachers.

c = It is absolutely crucial that all students develop skills in this area.

d = New ideas have been developed in this area that are not reflected in present materials.

e = The importance of this area will increase during the 1980s.

VP87 Consider the content area (questions VP11 through VR15) above that you ranked lowest (marked with an "e"). Of the following five ideas, which best describes the reason you gave it lowest priority?

a = The materials we presently have in this area are more nearly adequate than the materials we have in the other four areas.

b = This area does not present many problems for most teachers.

c = It is not as important for students to develop skills in this area as it is in other areas in the list.

d = Changes are needed in this area, but new materials would be an inefficient way to promote such changes.

e = The importance of this area will diminish during the 1980s.

VP88 Consider the content area (questions VP11 through VP15) above that you ranked highest (marked with an "a"). Of the following five ideas, which best describes the reason you gave it highest priority?

a = We have fewer good materials to choose from in this area than in the other four areas.

b = This is a major problem area for many, many teachers.

c = It is absolutely crucial that more students develop skills in this area.

d = New ideas have been developed in this area that are not reflected in present materials.

e = The importance of this area will increase during the 1980s.

VP89 Consider the type of student (questions VP31 through VP35) that you ranked lowest in terms of developing special mathematics curriculum materials. Of the following five ideas, which comes closest to the reason you gave this group lowest priority?

a = I believe this group has special needs in mathematics, but the curriculum more adequately addresses their needs.

b = I don't believe this group has special needs in mathematics.

c = This type of student makes up such a small fraction of the total school population that we cannot devote significant resources to meeting his or her specialized needs.

d = I do not have to deal with this type of student in my classroom.

e = The needs of this type of student must first be met with approaches different than special curriculum materials (e.g., special schools, special class groups, etc.)

VP90 Consider the type of student (questions VP31 through VP35) That you ranked highest in terms of developing special mathematics curriculum materials. Of the following five ideas, which comes closest to the reason you have this group highest priority?

a = This group has very special needs in mathematics which should be addressed through curriculum.

b = There are fewer appropriate curriculum materials for this type of student than for other groups.

c = This type of student makes up such a large fraction of the school population that we should devote significant resources to meeting his or her specialized needs.

d = I have to deal with many students of this type in my classroom.

e = There is great pressure on schools to provide programs for this type of student.

VP91 Consider the area above (questions ~~VP41~~ through VP45) that you ranked lowest (marked with an "e"). Of the following five ideas, which best describes the reason you gave it lowest priority?

a = The materials, methods, or understanding that we presently have for this area are more nearly sufficient.

b = This area does not present as many problems for most teachers.

c = The importance of this general area will diminish during the 1980s.

d = Changes in this area are likely to have relatively less general impact on mathematics education.

e = This area is not very important.

VP92 Consider the area above (questions VP41 through VP45) that you ranked highest (marked with an "a"). Of the following five ideas, which best describes the reason you gave it highest priority?

a = The materials, methods, or understanding that we presently have for this area are very insufficient.

b = This area presents many, many problems for teachers.

c = The importance of this general area will increase during the 1980s.

d = We have new knowledge that can be used in this area, but it has not yet been implemented.

e = Improvement in this area would have a far-reaching impact on mathematics education generally.

APPENDIX B.1

Sample Forms of Preference Surveys

NATIONAL COUNCIL OF
Teachers of Mathematics

NCTM

September, 1978

Dear NCTM Member:

The Board of Directors is trying to improve the services of NCTM to teachers and the schools. Looking ahead to the decade of the 1980s, they have begun to collect information about teachers' curricular preferences and priorities in an effort to make convention programs, publications and other services better fit your needs. The Board will also formulate a set of curricular recommendations for mathematics in the decade of the 1980s. The NCTM PRISM Project, supported by a grant from the National Science Foundation, is collecting the information to be used by the Board of Directors in these activities. The enclosed curricular preference survey is part of that information gathering activity. The Board hopes that you will help them in accomplishing the goal of improving services to teachers by responding to the questionnaire.

Two curriculum preference surveys are included. One is for you and is labeled with your name. The other is for you to give to a colleague down the hall. Please give it to a teacher who is not a member of NCTM.

You will note that your survey is not the same as the one for your colleague. The total number of items for which we would like answers is in excess of 660—too many to ask you to respond to given your time-consuming teaching responsibilities. We have broken the item pool into ten different questionnaires so that no one will have to respond to too many questions. (Groups of teachers responding to early versions of the questionnaire were able to complete the task in 25 to 30 minutes.) Do note that since you are responding to only part of the items, some curricular issues that you feel are very important may be missing from your questionnaire. We hope that these important issues are on another teachers questionnaire. Only by putting your responses together with those of other teachers will we be able to ascertain the profession's curricular preferences.

We hope that you will be futures-oriented in considering the alternatives for the questions. The NCTM will use your response to generate curricular recommendations for the 1980s. This is your opportunity to let your opinion be known and, hopefully, influence the course of curriculum development, in-service education and NCTM policy.

Respectfully,

Alan Osborne

Alan Osborne, Director
NCTM PRISM Project

Curriculum Survey
NCTM PRISM PROJECT

Part 1. General Information: Enter your responses in the box at the upper right of the response sheet. The box is labeled "General Information."

I. I have taught:

a. less than 3 years
b. 3-8 years
c. 9-14 years
d. 15-20 years
e. more than 20 years

II. The majority of students in my school are residents of:

a. urban/metropolitan (population greater than 150,000)
b. urban fringe/suburban
c. small city (population 25,000 to 150,000)
d. town (population less than 25,000)
e. rural/farm

III. I teach students who are in:

a. grades k-3
b. grades 4-6
c. grades 7-8
d. grades 9-12
e. other

IV. I have taken the following number of mathematics content courses for college credit:

a. 0-1
b. 2-4
c. 5-9
d. 10-15
e. more than 15

V. With respect to the way schools are organized and children are taught, I am:

a. very satisfied
b. somewhat satisfied
c. undecided
d. somewhat dissatisfied
e. very dissatisfied

The phrases listed below indicate several areas related to school mathematics that could receive more or less emphasis during the coming decade of the 1980s. Mark each with the response that best describes your feeling concerning what should be the trend.

a. should receive much more emphasis
b. should receive somewhat more emphasis
c. should receive about the same emphasis as now
d. should receive somewhat less emphasis
e. should receive much less emphasis

VI. Elementary mathematics specialists

VII. Women in mathematics

VIII. Minorities and mathematics

IX. Gifted students

X. Urban education

XI. Computer-managed instruction

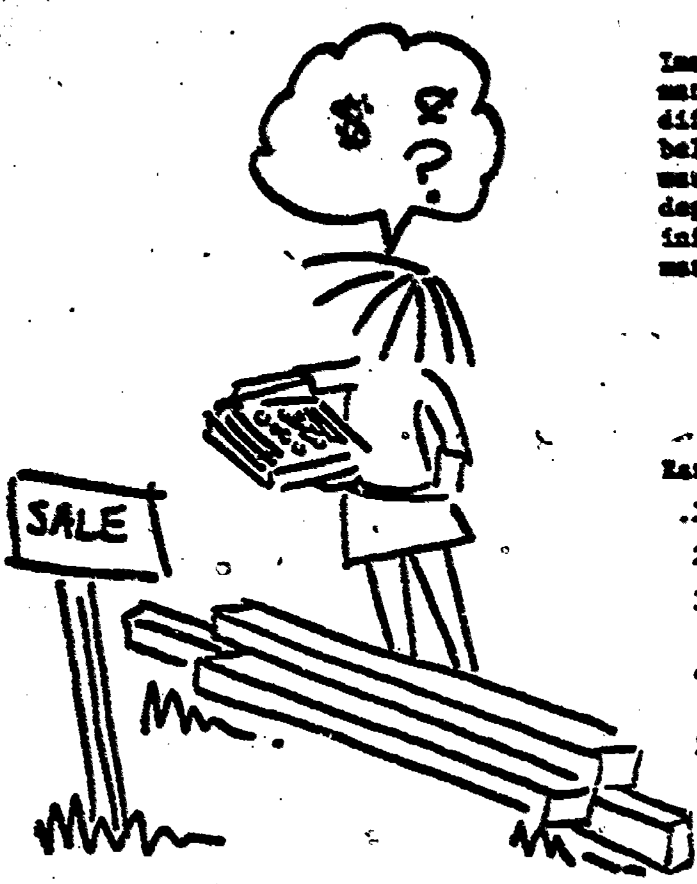
XII. National mathematics curriculum

XIII. Curricula based on the psychology of learning mathematics

XIV. Curricula based on the logic of mathematics

XV. Decimals

Part 2. The remaining questions are specific to major content areas of the curriculum. Enter your responses in the portion of the response sheet labeled "Curriculum Preference Survey."



Imagine that there are available several sets of instructional materials for ratio, proportion and percent. The materials differ in that each emphasizes one of the curricular goals listed below even at the expense of other goals. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which emphasis on the stated goal should be a positive influence on the decision to use or to buy these curricular materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

Ratio, proportion and percent are taught:

1. To preserve a traditional emphasis in the curriculum.
2. To provide a setting for practicing computational skills
3. To acquire consumer skills such as using percent in analyzing the financing of a purchase such as a new car or a house.
4. To demonstrate that ratios provide the foundation for a powerful reasoning process.
5. To learn special techniques, such as direct and inverse variation, that are powerful tools in such sciences as physics and chemistry.
6. To develop proportional thinking as an important problem solving technique.
7. To identify students who possess mathematical talent.
8. To develop, apply, and extend the understanding of fractions.
9. To acquire skills necessary for applying mathematics in vocational settings.
10. To develop and practice disciplined work habits.

A committee of parents and teachers is working on a blueprint for introducing computer literacy topics into your school's curriculum. Please react to each of the following statements being considered by the committee.

a. I agree completely
b. I tend to agree
c. Undecided
d. I tend to disagree
e. I strongly disagree

11. Computer literacy courses should be taught primarily within the social studies curriculum since it is the effect of computers upon society that is important.
12. At least one course whose major theme is computer literacy and which lasts for at least one semester should be required of all high school graduates.
13. Students should interact with a computer or computer terminal as early as the primary grades.
14. Separate computer science departments should be established in high schools to parallel mathematics departments and science departments.
15. All high school graduates should be able to write simple computer programs.
16. Computer literacy topics should be integrated within the present mathematics curriculum from grades K-12.
17. Because the computer techniques needed for vocational training are different from those needed by college-bound students, at least two different types of computer courses should be offered in every high school.
18. Knowledge of computers is only needed by specialists; they should receive courses and training in this area only after they leave high school.
19. Courses about computers should be strictly elective.
20. Computer courses should use a wide variety of hardware with instructions in the use of each type forming a major part of the course.

420E-1

Elementary

A parent-teacher committee in your school has suggested topics in probability and statistics that could be taught in the mathematics program for grades K-6 during the 1980s. React to the suggestions of the committee by indicating which topics should be included in elementary school mathematics.

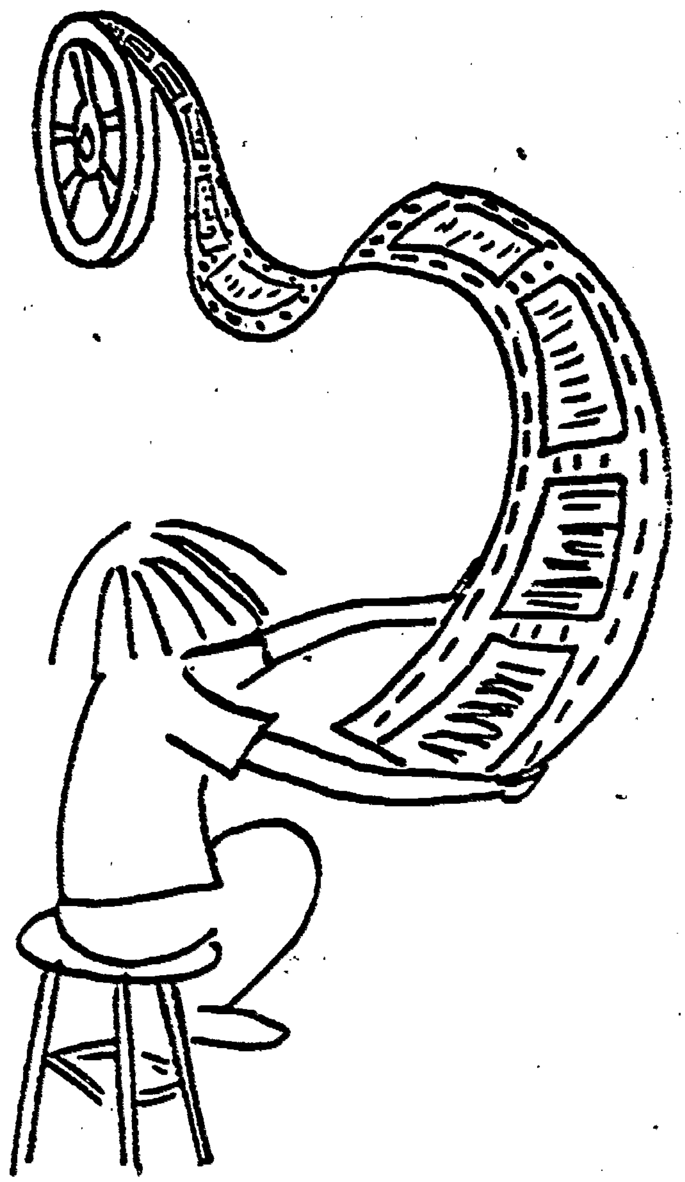
a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

21. Collection and organization of data (e.g., graphs, tables)
22. Predicting outcomes
23. Reading and interpreting statistical information
24. Measures of central tendency (e.g., mean, median, mode)
25. Measures of spread (e.g., range, quartiles, et cetera)
26. Calculating the probability of an event occurring
27. Combinations and permutations
28. Testing of conjectures and hypotheses
29. Calculating probabilities of compound and conditional events.
30. Decision-making (e.g., for voting or consumer situations)

During the 1980s it may be possible to add to each classroom several different resources for teaching probability and statistics. To what extent would you want to have each of the following?

a. I would definitely want this
b. This might be nice to have
c. Undecided
d. I'd rather not be bothered by this
e. I definitely would not want this

31. A syllabus that suggests probability and statistics topics and methods for each grade level together with specific times when they should be introduced
32. A series of short films or videotapes that can be used to motivate and introduce specific probability and statistics concepts
33. Inservice materials to teach teachers the content of probability and statistics
34. Probability and statistics textbooks that emphasize projects and activities
35. Audiotapes of lectures by eminent statisticians
36. Probability and statistics materials for use with small computers
37. Masters of worksheets and activities for probability and statistics
38. Resource books with applications and problems from probability and statistics
39. Individual study materials for students
40. Descriptions of teaching methods appropriate for probability and statistics
41. Standardized tests in probability and statistics which allow for comparison with students from other schools
42. Coordinated curriculum materials for probability and statistics encompassing textbooks, laboratory equipment, films, guides, et cetera
43. A test item bank with test items coordinated to behavioral objectives suitable for probability and statistics
44. Booklets of experiments and related laboratory equipment
45. Outlines of outstanding presentations in probability and statistics



4202-2

Imagine that there are available several sets of instructional materials for probability and statistics. Each set of materials emphasizes one of the teaching strategies listed below. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which the incorporation of this particular teaching strategy would be a positive or negative influence in your decision to purchase or use the materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

46. Students are required to analyze data that they have gathered outside the classroom (e.g., street-corner interviews).

47. Students perform experiments with dice and cards and study games of chance.

48. Materials include many examples of real world data such as those taken from newspapers and periodicals.

49. Students are provided with ready-made data bases from previously completed experiments.

50. Students are expected to read formal presentations of basic probability and statistics ideas before classroom activities are devoted to these ideas.

51. Cases where statistics were misinterpreted or misused are studied.

52. Detailed notes ar provided to guide the teacher in oral presentations of probability and statistics lessons.

53. Problems that arise in the social or natural sciences are used to extract and develop probability and statistics concepts.

54. Projects are suggested that are designed to be assigned to individuals or to teams of students.

55. Specific objectives, criterion-referenced testing, and other materials are included to encourage use of a mastery learning or an individually paced model.

Imagine that there are available several sets of instructional materials for probability and statistics. The materials differ in that each emphasizes one of the curricular goals listed below even at the expense of other goals. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which emphasis on the stated goal should be a positive influence on the decision to use or to buy these curricular materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

Probability and statistics are taught:

56. To help consumers deal with statistical information.

57. To enable students to read and think critically about graphs and other data in other subjects such as science or social science.

58. To give experience in dealing with estimation and approximation.

59. To apply mathematics to other disciplines.

60. To understand the use and power of computers.

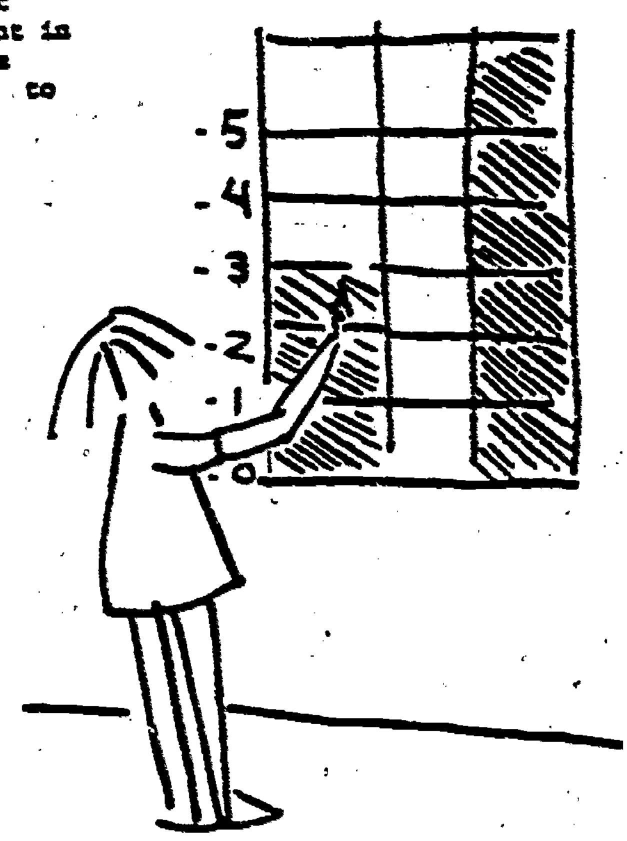
61. To demonstrate how to organize, summarize and present data in easily interpretable forms.

62. To provide practice in such basic mathematical topics as sets, ratio, and graphing.

63. To teach skills necessary for employment.

64. To teach skills necessary for further study.

65. To provide practice in basic computational skills.



420g-3

How appropriate is it for students to use hand-held calculators when doing each of the following activities while studying probability and statistics?

a. Very appropriate
b. Only in special circumstances
c. Undecided
d. Almost never appropriate
e. Should not be allowed

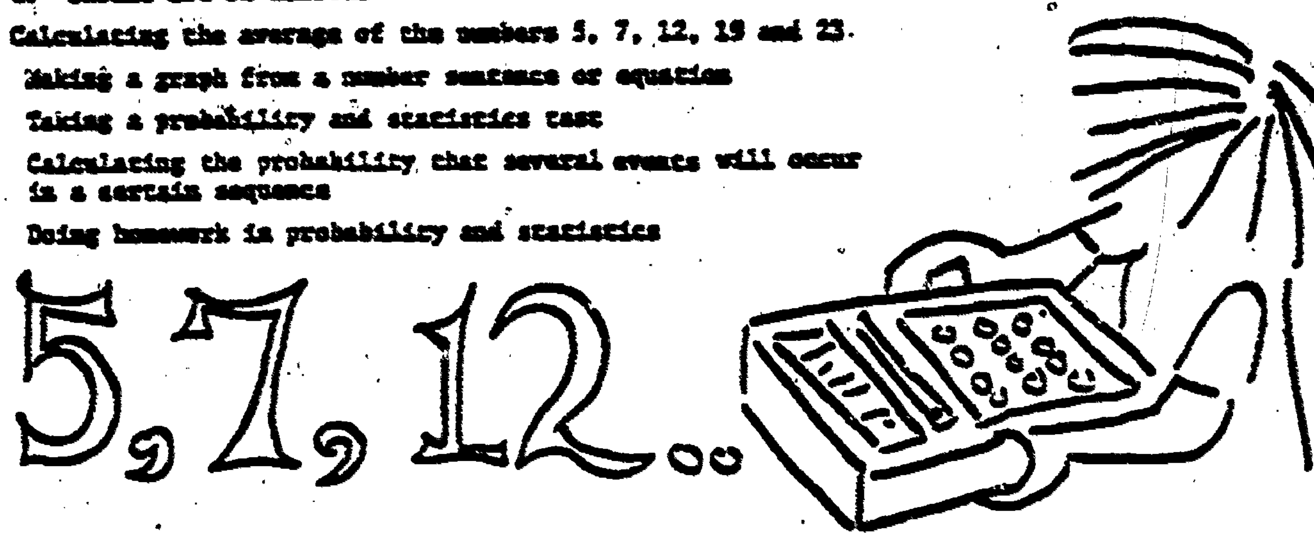
66. Calculating the average of the numbers 5, 7, 12, 19 and 23.

67. Making a graph from a number sentence or equation

68. Taking a probability and statistics test

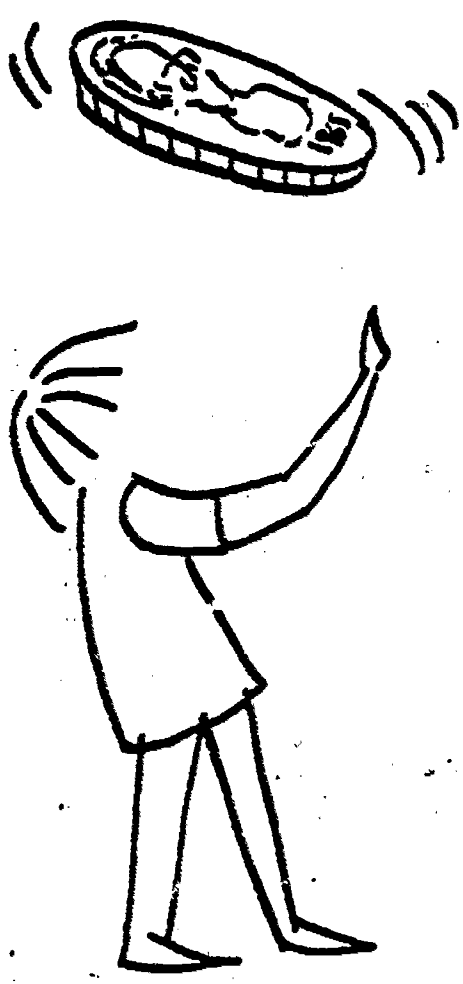
69. Calculating the probability that several events will occur in a certain sequence

70. Doing homework in probability and statistics



The mathematics curriculum committee of your school system is considering the possibility of introducing topics in probability and statistics at different points in the curriculum. Please react to the following suggestions.

a. I agree completely
b. I tend to agree
c. Undecided
d. I tend to disagree
e. I strongly disagree.



71. Probability and statistics should be a required course for all ninth graders.

72. Ideas from probability and statistics should be included in every mathematics textbook from grades 1-8.

73. A course in probability and statistics lasting at least one semester should be offered as a high school elective for students who have successfully completed one year of algebra.

74. Probability and statistics should only be considered as enrichment topics for mathematics.

75. Probability and statistics should be offered as part of the general mathematics or consumer mathematics course.

76. Probability and statistics should replace most of the traditional work with fractions in grades 6, 7, and 8.

77. Probability and statistics should be offered as a senior-level advanced course for high ability mathematics and science students.

78. Probability and statistics should be offered as part of an interdisciplinary course (e.g., with science or social studies).

79. Statistics belongs in the curriculum but probability does not.

80. Probability belongs in the curriculum but statistics does not.

Imagine that there are available several sets of instructional materials for geometric topics. Each set of materials emphasizes one of the teaching strategies listed below. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which the incorporation of this particular teaching strategy would be a positive or negative influence in the decision to purchase or use the materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong positive influence

81. Activities are included that would require students to go outside the classroom to measure things.

82. Students are expected to read formal presentations of basic geometric ideas before classroom activities are devoted to these ideas.

83. Student worksheets are included for drill and practice on geometric topics at the conclusion of each lesson.

84. Basic geometric ideas are introduced through laboratory investigations.

85. Specific objectives, criterion-referenced testing, and other materials are included to encourage use of a mastery learning or an individually paced model.

86. More than 50% of the instructional time is devoted to student use of individual study materials to develop and extend geometric ideas.

87. Activities are included that anticipate the class being divided into small discussion groups.

88. Simulations, wherein each student plays the role of a consumer or worker using geometry in real world situations, are frequently included.

89. Detailed notes are provided to guide the teacher in oral presentation of geometry lessons.

90. Long-term projects are suggested that are designed to be assigned to individuals or to teams of students.

During the 1980s it may be possible to add to each classroom several different resources for teaching algebraic topics. To what extent would you want to have each of the following?

a. I would definitely want this
b. This might be nice to have
c. Undecided
d. I'd rather not be bothered by this
e. I definitely would not want this

91. Calculators that can display the equation of a line given the coordinates of two points

92. Individual study carrels equipped with computer assisted instruction terminals and videotape cartridge players

93. Booklets of algebraic applications to contemporary problems

94. Masters of worksheets and activities

95. Physical materials and equipment for laboratory experiments

96. Personal computers for every two students

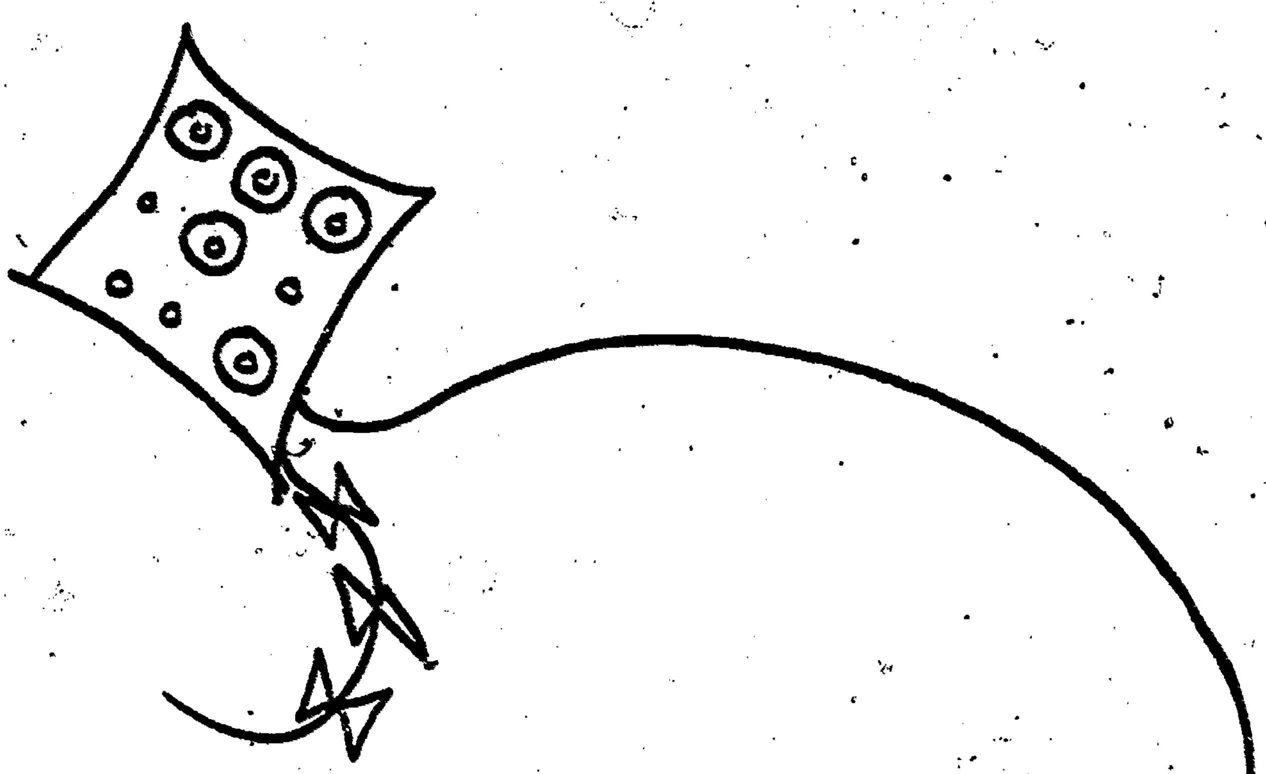
97. Booklets of games and recreational activities that can be analyzed algebraically

98. Calculators that will display the roots of a linear or quadratic equation when the coefficients are input

99. Materials with minimal reading requirements

100. Computer-driven graphing and plotting equipment

420X-5



Listed below are several problem solving techniques that might be taught to elementary students. Which specific techniques should be included in the mathematics curriculum of the <u>elementary school</u>?

- a. Definitely should be included
- b. Probably should be included
- c. Undecided
- d. Probably should not be included
- e. Definitely should not be included

101. Categorize problems into specific types (e.g., age, distance-rate-time), then teach a method of solution for each type.

102. Generate many possible answers using a calculator or computer, then check to see which one meets the conditions of the problem.

103. Write and solve a simpler problem; then extend the solution to the original problem.

104. Explore the problem by using flow charts.

105. Translate the problem into number sentences or equations.

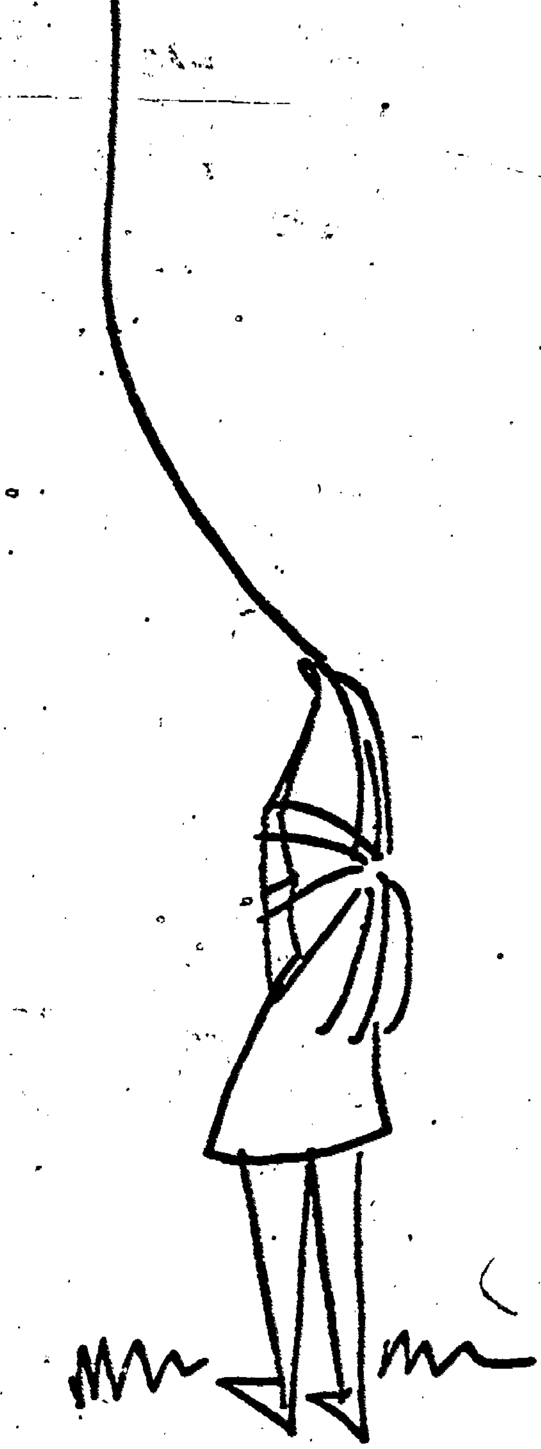
106. Guess and test possible solutions.

107. Start with an approximate answer and work backwards.

108. Construct a table and search for patterns.

109. Draw a picture diagram or graph to represent the problem situation.

110. Teach primarily global problem solving ideas (e.g., read, plan, work, check).



NATIONAL COUNCIL OF
Teachers of Mathematics

NCTM

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You will note that your survey is not the same as the one for your colleague. The total number of items for which we would like answers is in excess of 660--too many to ask you to respond to given your time-consuming teaching responsibilities. We have broken the item pool into ten different questionnaires so that no one will have to respond to too many questions. (Groups of teachers responding to early versions of the questionnaire were able to complete the task in 25 to 30 minutes.) Do note that since you are responding to only part of the items, some curricular issues that you feel are very important may be missing from your questionnaire. We hope that these important issues are on another teachers questionnaire. Only by putting your responses together with those of other teachers will we be able to ascertain the profession's curricular preferences.

We hope that you will be futures-oriented in considering the alternatives for the questions. The NCTM will use your response to generate curricular recommendations for the 1980s. This is your opportunity to let your opinion be known and, hopefully, influence the course of curriculum development, in-service education and NCTM policy.

Respectfully,

Alan Osborne

Alan Osborne, Director
NCTM PRISM Project

Curriculum Survey
NCTM PRISM PROJECT

Part 1. General Information: Enter your responses in the box at the upper right of the response sheet. The box is labeled "General Information."

I. I have taught:

a. less than 3 years
b. 3-8 years
c. 9-14 years
d. 15-20 years
e. more than 20 years

II. The majority of students in my school are residents of:

a. urban/metropolitan (population greater than 150,000)
b. urban fringe/suburban
c. small city (population 25,000 to 150,000)
d. town (population less than 25,000)
e. rural/farm

III. I teach students who are in:

a. grades k-3
b. grades 4-6
c. grades 7-8
d. grades 9-12
e. other

IV. I have taken the following number of mathematics content courses for college credit:

a. 0-1
b. 2-4
c. 5-9
d. 10-15
e. more than 15

V. With respect to the way schools are organized and children are taught, I am:

a. very satisfied
b. somewhat satisfied
c. undecided
d. somewhat dissatisfied
e. very dissatisfied

The phrases listed below indicate several areas related to school mathematics that could receive more or less emphasis during the coming decade of the 1980s. Mark each with the response that best describes your feeling concerning what should be the trend.

a. should receive much more emphasis
b. should receive somewhat more emphasis
c. should receive about the same emphasis as now
d. should receive somewhat less emphasis
e. should receive much less emphasis

VI. Mastery learning curricula

VII. Problem solving

VIII. Proof

IX. Mathematics laboratories

X. Formal axiomatic structures

XI. Use of computers and other technology

XII. Individualization

XIII. Applications of mathematics

XIV. Interdisciplinary programs

XV. Unified mathematics

Part 2. The remaining questions are specific to major content areas of the curriculum. Enter your responses in the portion of the response sheet labeled "Curriculum Preference Survey."

2 CS

Imagine that there are available several sets of instructional materials for computer literacy. The materials differ in that each emphasizes one of the curricular goals listed below even at the expense of other goals. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which emphasis on the stated goal should be a positive influence on the decision to use or to buy these curricular materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

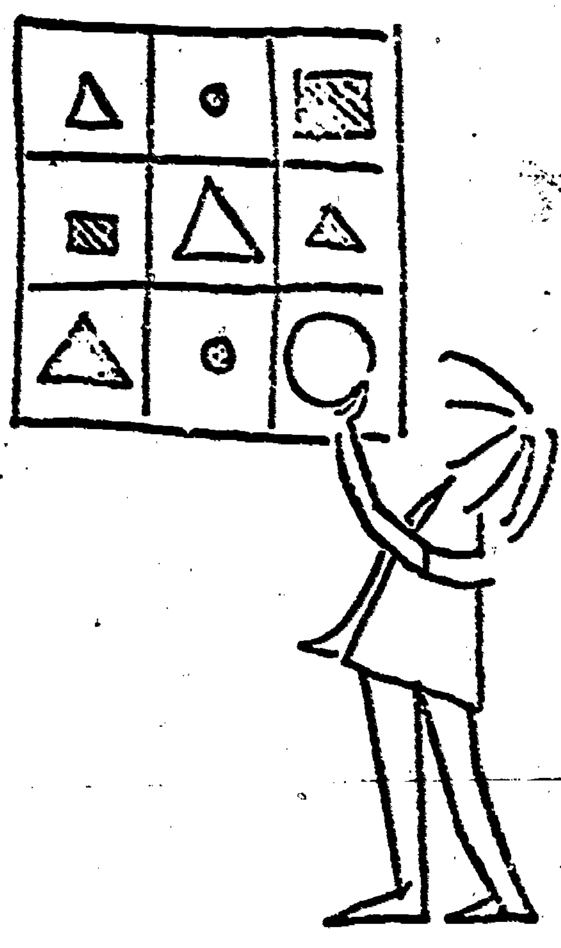
Computer Literacy is taught:

1. To acquire fundamental computer techniques necessary for vocational training.
2. To prepare for the 21st century in which almost everyone will be interacting directly with a computer or programmable device.
3. To introduce alternative techniques for solving problems, proving theorems, et cetera.
4. To understand the capability of the computer to provide access to large bodies of information (e.g., information retrieval systems).
5. To develop logical thinking abilities.

A committee of parents and teachers is working on a problem solving curriculum guide for your school. They are considering the following general statements. Please indicate your reaction to each of them.

a. I agree completely
b. I tend to agree
c. Undecided
d. I tend to disagree
e. I strongly disagree

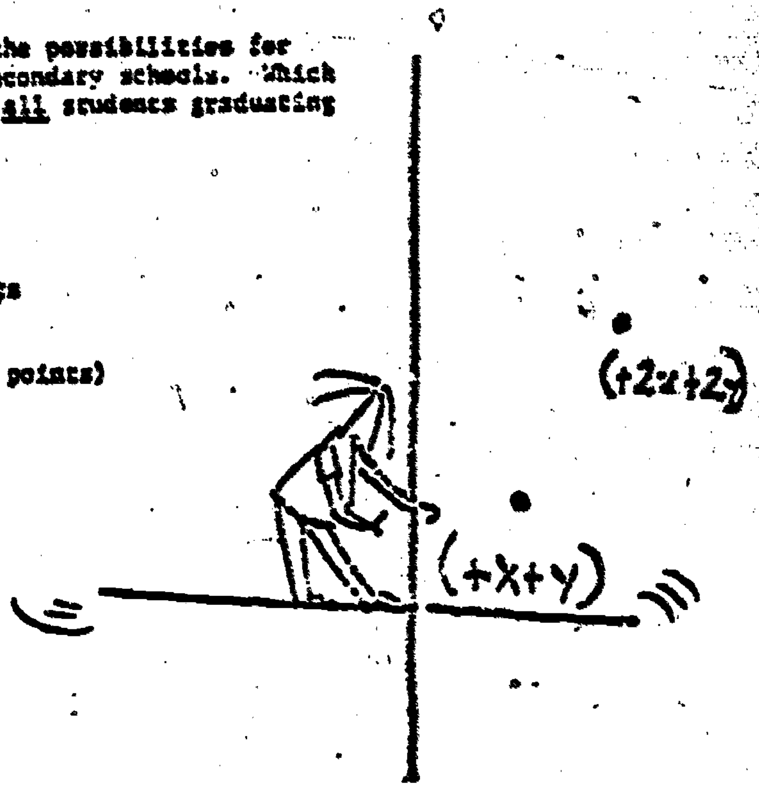
6. A separate problem solving course, lasting at least one semester, should be required of all students before high school graduation.
7. Problem solving is a function of intelligence and cannot really be taught except to gifted students.
8. Short problem solving units should be included after each mathematical topic is taught.
9. Most students should study practical applications of mathematics; only a few should study puzzles or esoteric mathematical problems.
10. Problem solving is important only for college-bound students.
11. Different problem solving courses should be offered for girls.
12. All problem solving should be done within existing mathematics courses.
13. An interdisciplinary problem-solving course should be offered.
14. Problem solving should not be taught in the elementary grades.
15. Students should be taught to find problems within situations.

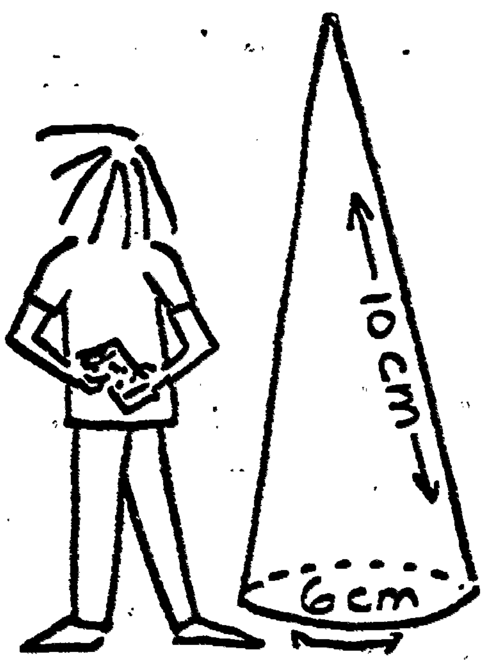


A parent-teacher committee in your school is studying the possibilities for revising geometry as it is presently offered in your secondary schools. Which of the following geometric topics should be studied by all students graduating from high school?

a. Definitely should be studied by all students
b. Probably should be studied by all students
c. Undecided
d. Probably should not be studied by all students
e. Definitely should not be studied by all students

16. Properties of circles
17. Coordinate geometry (associating number pairs with points)
18. Nine-point geometry (finite geometries)
19. Symbolic logic and truth tables
20. Non-Euclidean geometries

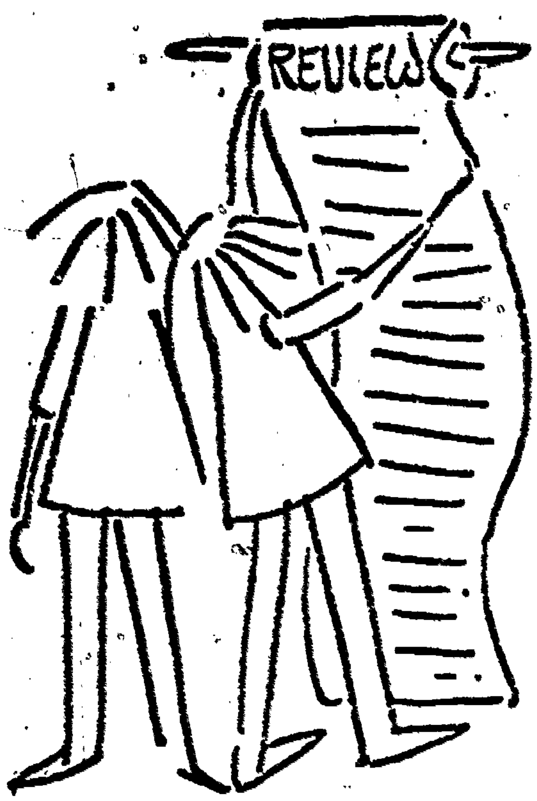




How appropriate is it for students to use hand-held calculators in connection with each of the following types of geometric activities?

a. Very appropriate
b. Only in special circumstances
c. Undecided
d. Almost never appropriate
e. Should not be allowed

21. Finding the midpoint of a line, if the coordinates of the endpoints are (2,3) and (7,1)
22. Computing the area of a trapezoid
23. Finding the length of the third side of a right triangle using the Pythagorean theorem
24. Finding the measure of the complement or supplement of a 57° angle
25. Doing geometry homework
26. Finding the circumference of a circle, given the diameter
27. Calculating the volume of a cone, when the diameter of the base is 6 cm and the height is 10 cm
28. Using trigonometry to find the length of a side of a triangle
29. Calculating the coordinates of the new vertices of a triangle after a given transformation
30. Taking a geometry test



The following statements regarding whole number computations were generated at a recent parent-teacher meeting at your school. Please indicate your reaction to each of them.

a. I agree completely
b. I tend to agree
c. Undecided
d. I tend to disagree
e. I strongly disagree

31. Every student should master whole number computations with paper and pencil before graduating from high school.

32. College-bound high school students should spend at least three weeks of every school year reviewing whole number computation.

33. Students who cannot master paper-and-pencil computations by the end of grade 8 should be required to take a special ninth grade mathematics course on the use of the hand-held calculator.

34. The appropriate time to do remedial work with whole number computation is in an adult school or junior college after students can see the need and importance for calculating.

35. Algorithms for multi-digit computations should not be introduced until grade 7 when students are more mature.

Listed below are several topics related to whole numbers that could be treated in the curriculum. Which of the following should be included in <u>elementary school</u> mathematics?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

36. Several different algorithms (methods) for each of the four basic operations so that children can choose the method they prefer

37. Techniques of estimation

38. Specific strategies for solving word problems

39. Mathematical puzzles and games

40. Operations with signed numbers or integers

41. Justification of each step of an algorithm by relating it to basic number properties

42. Mental calculations without the aid of paper and pencil or calculator

43. Multiplication and division developed simultaneously to emphasize relationships between them

44. Specific instructions for operating a four-function calculator

45. Tests of divisibility

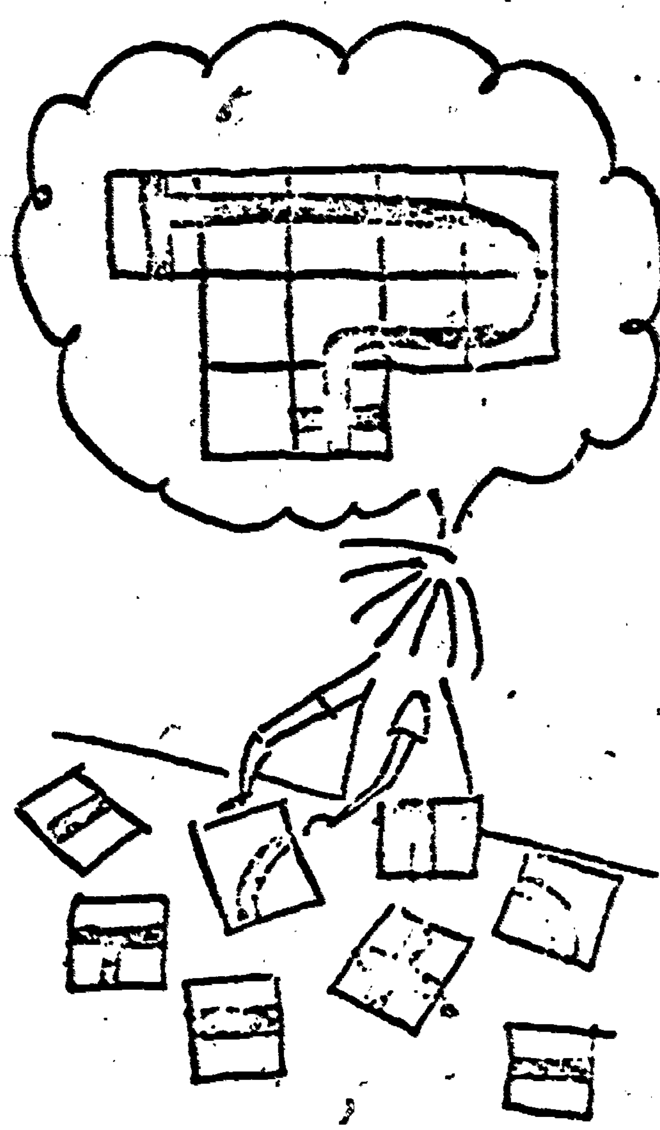
46. Only the most efficient algorithm (method) for each operation is taught.

47. A paper-and-pencil algorithm (method) for calculating square roots

48. Computational and/or checking shortcuts (e.g., casting out nines)

49. Addition and subtraction developed simultaneously to emphasize relationships between them

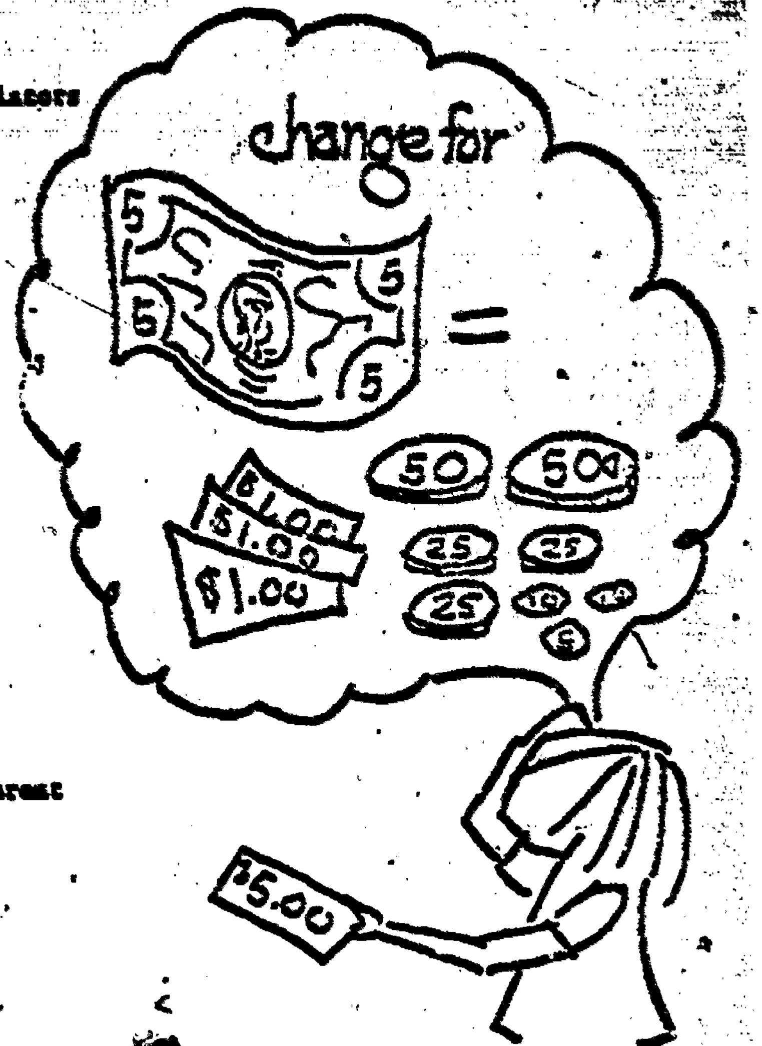
50. Specific consumer skills like balancing a checkbook and calculating best buys



How appropriate is it for students to use hand-held calculators when doing each of the following arithmetic activities?

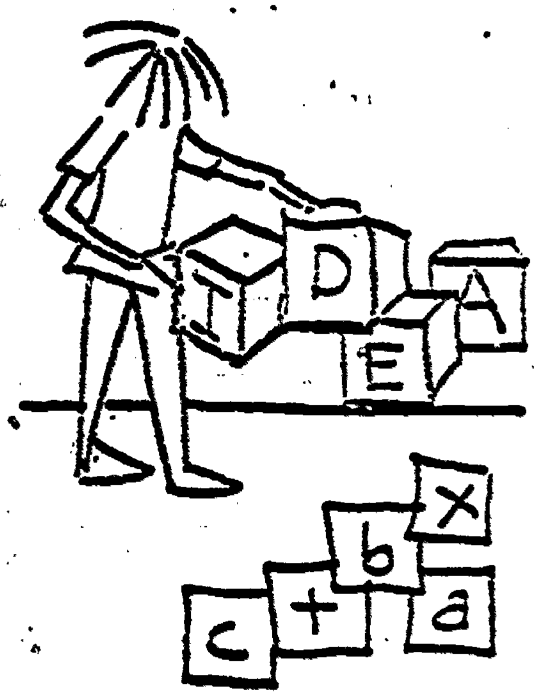
a. Very appropriate
b. Only in special circumstances
c. Undecided
d. Almost never appropriate
e. Should not be allowed

51. Learning basic number facts
52. Doing homework
53. Taking a test on whole number computation
54. Learning properties of different operations
55. Doing the division 641 ÷ 17
56. Multiplying 782 X 59
57. Solving word problems
58. Subtracting 2,150 - 1,983
59. Multiplying 3 X 13
60. Checking answers
61. Calculating change from a five dollar bill
62. Doing a chain of calculations involving several different operations
63. Learning why the long division algorithm works
64. Adding the cost of several items in a grocery cart
65. Finding the divisors of a given number



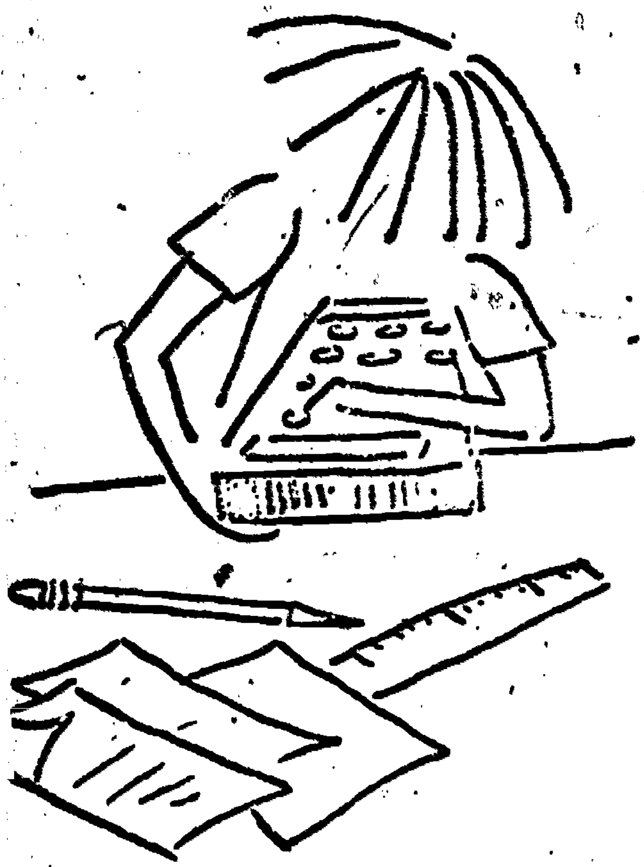
Imagine that there are available several sets of instructional materials for whole number concepts and skills. The materials differ in that each emphasizes one of the curricular goals listed below even at the expense of other goals. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which emphasis on the stated goal should be a positive influence on the decision to use or to buy these curricular materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence



Whole number concepts and skills are taught:

66. To acquire the qualifications necessary for obtaining many jobs.
67. To be able to do well on standardized tests.
68. To understand the structure of mathematics.
69. To develop logical thinking ability.
70. To gain an appreciation for the beauty of numbers.
71. To develop disciplined work habits.
72. To acquire the skills necessary for consumer decisions.
73. To develop the fundamental understandings upon which other mathematics learning is built.
74. To preserve a traditional emphasis in the curriculum.
75. To learn to read mathematics.



Imagine that there are available several sets of instructional materials for whole numbers. Each set of materials emphasizes one of the teaching strategies listed below. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which the incorporation of this particular teaching strategy would be a positive or negative influence in your decision to purchase or use the materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

76. Geometric pictures are used as models for computation.

77. Calculators are used instead of teaching paper and pencil algorithms.

78. More than 50% of the instructional time is devoted to drill and practice when teaching the basic facts.

79. The introduction of calculators is postponed until students have learned both the meaning of the operations and the paper and pencil algorithms for them.

80. Physical materials, such as rods and area blocks, are given to every student to use to model whole number algorithms and generate answers.

81. Slower students are allowed to use calculators in order to keep up with the rest of the class.

82. Specific objectives, criterion-referenced testing, and other materials are included to encourage use of a mastery learning or an individually paced model.

83. Manipulative materials are used in a mathematics laboratory at least once a week.

84. Activities are included which require going outside the classroom (perhaps on field trips) so that whole number operations may be illustrated with real-life examples.

85. More than 50% of the instructional time is devoted to student use of individual study materials to develop and extend whole number ideas.

During the 1980s it may be possible to add to each classroom several different resources for teaching whole number concepts and skills. To what extent would you want to have each of the following?

a. I would definitely want this
b. This might be nice to have
c. Undecided
d. I'd rather not be bothered by this
e. I definitely would not want this

86. A calculator for every student

87. Short videotapes to illustrate basic computational algorithms

88. "Magic response paper" to give immediate feedback by revealing the correct answer just after students have written their answers

89. Audiotapes for verbal drill and practice

90. Physical materials for each student to use in modeling basic operations and algorithms

91. Masters of worksheets and activities

92. Resource books compiling examples of arithmetic applied to real-life situations

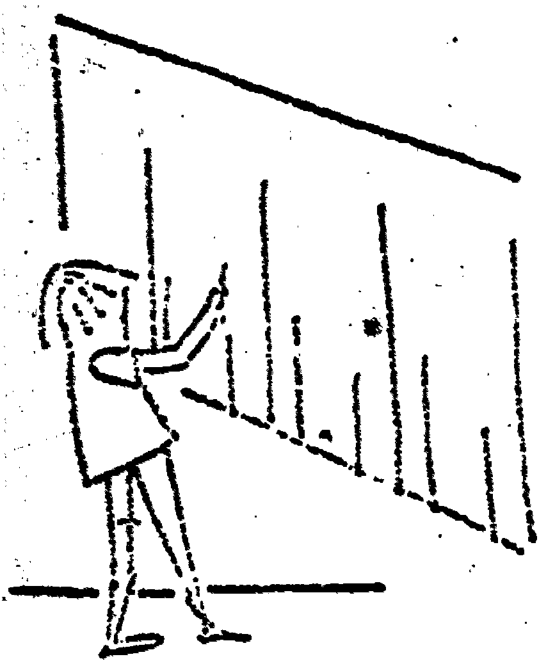
93. Small programmable calculators or computers

94. Packages of materials for individual student study

95. Standardized practice tests for basic skills

Listed below are topics in probability and statistics which could be included in the secondary school mathematics curriculum. Identify the most inclusive group for whom you feel instruction on the topic is appropriate.

a. Noncollege-bound secondary school students
b. College-bound secondary school students
c. All secondary school students
d. Not appropriate for secondary school students
e. Undecided

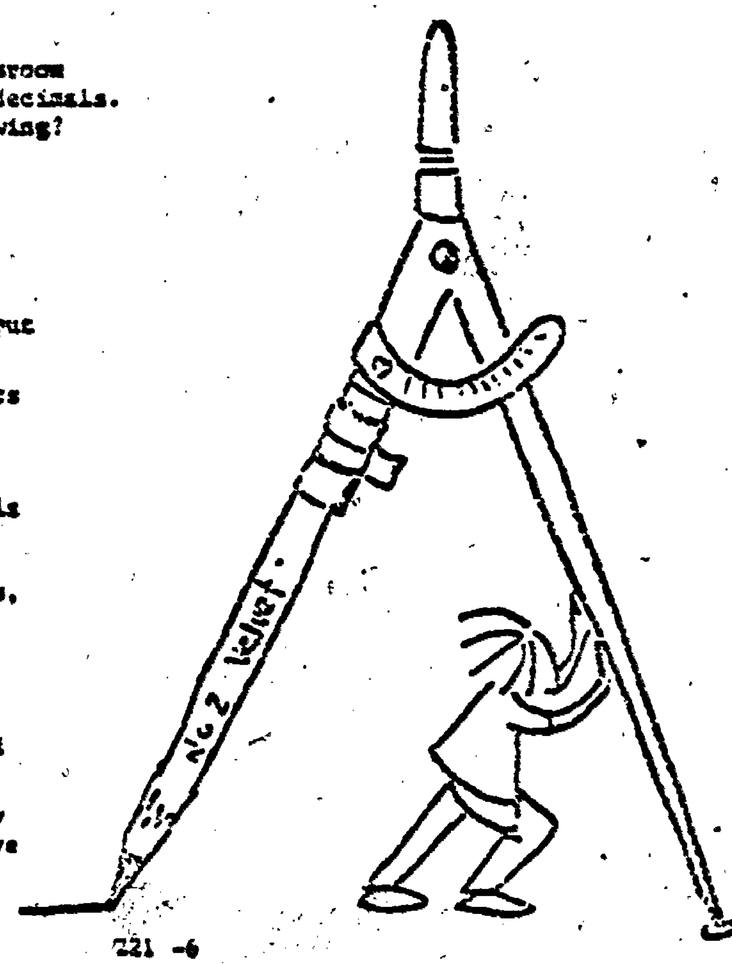


96. Probability distributions (e.g., normal, binomial)
97. Predicting outcomes
98. Curve fitting and prediction
99. Measures of central tendency (e.g., mean, median, mode)
100. Ranking procedures
101. Calculating the probability of an event occurring
102. Correlation
103. Statistical testing of hypotheses
104. Reading and interpreting statistical information
105. Decision-making (e.g., for voting or consumer situations)
106. Measures of spread (e.g., range, quartiles)
107. Combinations and permutations
108. Experimental design
109. Collection and organization of data (e.g., graphs, tables)
110. Calculating probabilities of compound and conditional events

During the 1980s it may be possible to add to each classroom several different resources for teaching fractions and decimals. To what extent would you want to have each of the following?

a. I would definitely want this
b. This might be nice to have
c. Undecided
d. I'd rather not be bothered by this
e. I definitely would not want this

111. A calculator designed so that fractions could be input and the answer would be displayed as a fraction
112. Films and videotapes on fraction and decimal concepts
113. Masters of worksheets and activities for fractions and decimals
114. Individual study materials for fractions and decimals
115. Student sets of measuring devices
116. Manipulative materials such as fraction bars, strips, et cetera
117. Drill and practice materials
118. Large-scale demonstration devices
119. Resource booklets with applications of fractions and decimals
120. "Magic response paper" to give immediate feedback by revealing the correct answer just after students have written their answers



NATIONAL COUNCIL OF

Teachers of Mathematics

NCTM

December 1978

Dear Supervisor of Mathematics:

The NCTM Board of Directors is in the process of formulating a set of curricular recommendations for school mathematics for the coming decade of the 1980s. The recommendations will be formulated to incorporate the judgement of many groups, ranging from professionals like yourself through lay groups such as parents. The information gathering for this process is being accomplished by the NCTM PRISM Project which is funded by the National Science Foundation. Enclosed is a survey form designed to collect the judgement of supervisors concerning a variety of curricular issues about mathematics learning and teaching.

The survey was designed around a large number of issues. The resulting item pool contains over 600 items -- too many to respond to for any single person. Consequently, we are using an item sampling technique to keep response time reasonable. Other professionals have found completing the form takes about 25 minutes. The disadvantage is that some issues you feel important may be on another supervisor's questionnaire but not on yours.

Please fill in the response form using a pencil. Only the response form need be returned in the enclosed envelope. If you feel strongly about any question and would like to write us a note about the item please do so on the back of the response form.

Do note that some of the questions on the survey form are specific to the elementary school and others are specific to the secondary school mathematics program. If a question does not specify a level, it concerns the entire K to 12 curriculum.

Supervisors as a group are one of the few groups that have an informed opinion concerning the entire range of the curriculum. Therefore, we feel it is most important to have a good response rate and urge you to complete the form and return it as soon as possible. We do need your judgement and experience in order that the NCTM can be oriented to the needs of the future decade of the 1980s as curricular recommendations and supportive policies are formulated.

We are mailing this survey to arrive during the holiday break in the hopes that you will find it convenient to complete it prior to your school responsibilities re-asserting themselves. We are looking forward to your response.

Respectfully,

Alan Osborne

Alan Osborne, Director
NCTM PRISM Project

AO:mgl

Enclosure

Curriculum Survey
NCTM PRISM Project

Part 1. General Information: Enter your responses in the box at the upper right of the response sheet. The box is labeled "General Information."

I. My professional responsibilities include supervising teachers at:

a. the elementary school level
b. the secondary school level
c. both the elementary and secondary school levels
d. other

II. The percent of my time spent directly in supervising teachers is approximately:

a. 100%
b. 75%
c. 50%
d. 25%
e. 0%

III. My supervisory responsibilities are to teachers in:

a. a single building
b. a small local school district
c. a large local school district
d. a regional or county district
e. a state

IV. With respect to the way schools are organized and students are taught, I am:

a. very satisfied
b. somewhat satisfied
c. undecided
d. somewhat dissatisfied
e. very dissatisfied

Consider the mathematics program from kindergarten through twelfth grade. Below are several phrases indicating areas of the program that could receive more or less emphasis during the coming decade. Mark each with the response that best describes your feeling concerning what should be the trend.

a. should receive much more emphasis
b. should receive somewhat more emphasis
c. should receive about the same emphasis as now
d. should receive somewhat less emphasis
e. should receive much less emphasis

V. Elementary mathematics specialists

VI. Women in mathematics

VII. Minorities and mathematics

VIII. Gifted students

IX. Urban education

X. Secondary mathematics specialists

XI. Norm-referenced testing

XII. Mathematics and careers

XIII. Geometry

XIV. Probability and statistics

XV. Algebra

The remaining questions are specific to major content areas of the curriculum. Enter yo... sponses in the portion of the response sheet labeled "Curriculum Preference Survey."

SCI

Imagine that there are available several sets of instructional materials for number concepts and skills. The materials differ in that each emphasizes one of the curricular goals listed below even at the expense of other goals. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which emphasis on the stated goal should be a positive influence on the decision to use or to buy these curricular materials.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

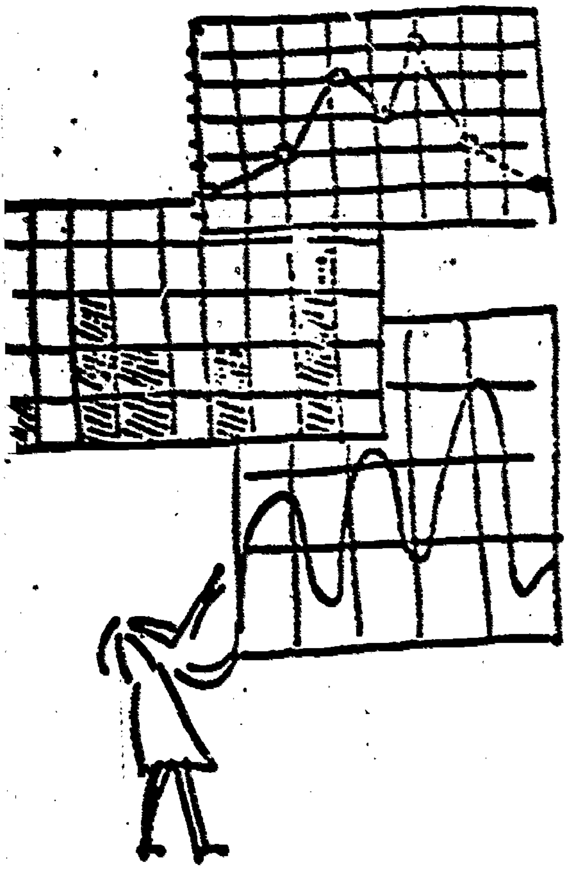
Number concepts and skills are taught:

1. To acquire the qualifications necessary for obtaining many jobs.
2. To be able to do well on standardized tests.
3. To understand the structure of mathematics.
4. To develop logical thinking ability.
5. To gain an appreciation for the beauty of numbers.
6. To develop disciplined work habits.
7. To acquire the skills necessary for consumer decisions.
8. To develop the fundamental understandings upon which other mathematics learning is built.
9. To preserve a traditional emphasis in the curriculum.
10. To learn to read mathematics.

Listed below are several ways that fractions and decimals could be treated in the curriculum. Which of the following should be included at some point in kindergarten through grade six (before grade 7)?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

11. All fractions should be written as decimals so that the operations on them can be performed with a calculator.
12. Operations with fractions should be taught only for fractions with small denominators (e.g., 12 or less).
13. Tables of common denominators (factors and multiples) should be given to students.
14. Students should use slide rules, graphs, and charts (nomographs) to solve problems involving fractions.
15. Least common multiple and greatest common divisor should be stressed as basic ideas related to fractions.
16. Students should be taught to solve a division problem by first estimating whether the answer will be larger or smaller than the number being divided.
17. Fractions should be presented as answers to division problems; for example, 7/12 means seven divided by 12.
18. Decimals should be introduced by relating them exclusively to money.
19. Decimals should be developed as a means of naming numbers between numbers (e.g., 2.4 is between 2 and 3; 2.41 is between 2.4 and 2.5).
20. Fractions should be developed as measures of lengths.



Listed below are several problem solving techniques that might be taught to elementary students. Which specific techniques should be included in the mathematics curriculum of the elementary school?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

21. Categorize problems into specific types (e.g., age, distance-rate-time), then teach a method of solution for each type.

22. Generate many possible answers using a calculator or computer, then check to see which one meets the conditions of the problem.

23. Write and solve a simpler problem; then extend the solution to the original problem.

24. Explore the problem by using flow charts.

25. Translate the problem into number sentences or equations.

26. Guess and test possible solutions.

27. Start with an approximate answer and work backwards.

28. Construct a table and search for patterns.

29. Draw a picture diagram or graph to represent the problem situation.

30. Teach primarily global problem solving ideas (e.g., read, plan, work, check).

The majority of college-bound students will not be science or mathematics majors. Which of the following advanced algebraic topics should be included in the secondary school curriculum for these students?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

31. Matrix algebra (e.g., linear systems)

32. Finite mathematics (e.g., combinatorics)

33. Probability functions (e.g., probability theory)

34. The system of complex numbers

35. Trigonometric functions and their inverses.

36. Theory of equations (e.g., fundamental theorem, solvability)

37. Analytic geometry (e.g., conic sections)

38. Algebraic structures (e.g., groups, rings, fields)

39. Categories of functions (e.g., algebraic, exponential, transcendental)

40. Introductory calculus

41. Limits and continuity

42. Sequences and series

43. Exponential and logarithmic functions

44. Approximating graphed data with best-fit polynomials

45. Vectors and vector spaces

46. Mathematical models

47. Systems of non-linear equations

48. Transformations applied to graphing

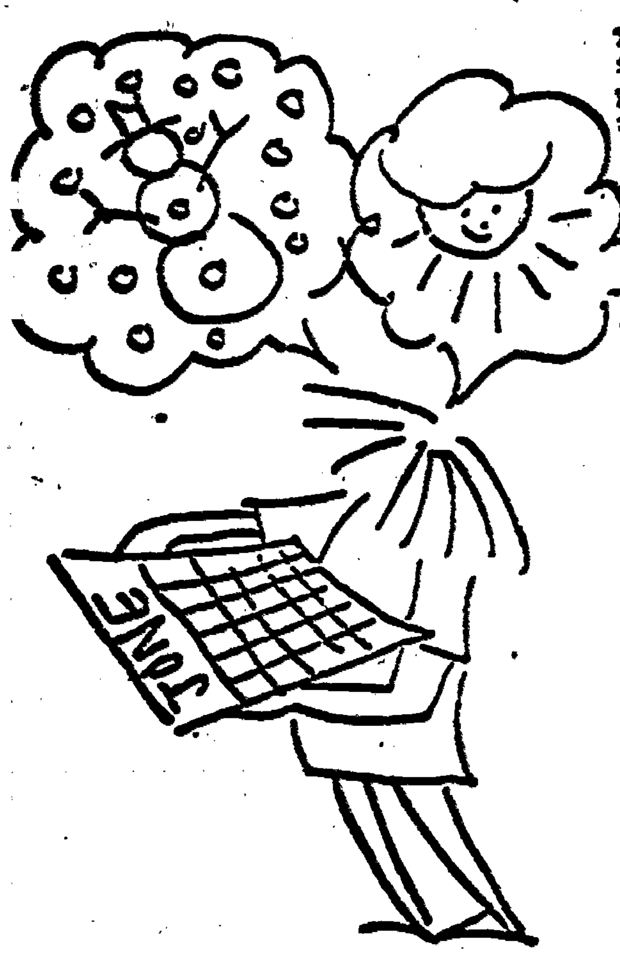
49. Approximating the roots to higher degree polynomial equations

50. Trigonometric identities and equations

As citizens of the 21st century, today's students will live in a world heavily influenced by computers and calculators. Which of the following topics should be included in the mathematics curriculum of the 1980s?

a. Definitely should be included
b. Probably should be included
c. Undecided
d. Probably should not be included
e. Definitely should not be included

51. Procedures for accessing or operating a computer system
52. Memory storage and access systems
53. Writing programs in a simple computer language such as BASIC
54. The roles of computers in society (record-keeping, simulation, et cetera)
55. Methods for debugging or correcting computer programs
56. Issues of privacy and security raised by computers
57. The functioning of microprocessor units
58. Flow charting
59. The use of machine language
60. History of computing devices
61. Languages for non-computational programs (e.g., Course Writer, PLATO)
62. Operation of a programmable calculator
63. The types of mathematical and non-mathematical problems that can be solved by a computer
64. Computational programming languages (e.g., FORTRAN, COBOL)
65. Data processing for business applications (e.g., billing, inventory control)



The mathematics curriculum committee of your school system is considering the possibility of introducing topics in probability and statistics at different points in the curriculum. Please react to the following suggestions.

a. I agree completely
b. I tend to agree
c. Undecided
d. I tend to disagree
e. I strongly disagree

66. Probability and statistics should be a required course for all ninth graders.
67. Ideas from probability and statistics should be included in every mathematics textbook from grades 1-8.
68. A course in probability and statistics lasting at least one semester should be offered as a high school elective for students who have successfully completed one year of algebra.
69. Probability and statistics should only be considered as enrichment topics for mathematics.
70. Probability and statistics should be offered as part of the general mathematics or consumer mathematics course.
71. Probability and statistics should replace most of the traditional work with fractions in grades 6, 7, and 8.
72. Probability and statistics should be offered as a senior-level advanced course for high ability mathematics and science students.
73. Probability and statistics should be offered as part of an interdisciplinary course (e.g., with science or social studies).
74. Statistics belongs in the curriculum but probability does not.
75. Probability belongs in the curriculum but statistics does not.

A committee of parents and teachers is working on a blueprint for introducing computer literacy topics into your school's curriculum. Please react to each of the following statements being considered by the committee.

a. I agree completely
b. I tend to agree
c. Undecided
d. I tend to disagree
e. I strongly disagree

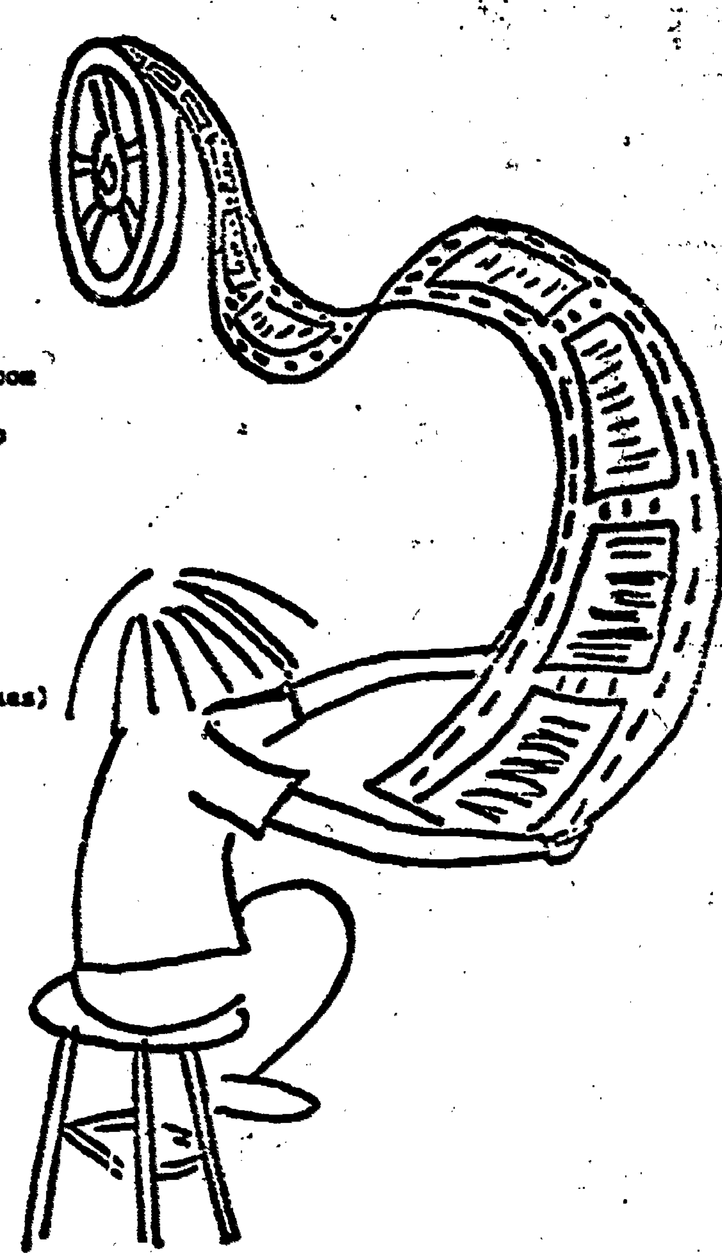
76. Computer literacy courses should be taught primarily within the social studies curriculum since it is the affect of computers upon society that is important.

77. At least one course whose major theme is computer literacy and which lasts for at least one semester should be required of all high school graduates.

78. Students should interact with a computer or computer terminal as early as the primary grades.

79. Separate computer science departments should be established in high schools to parallel mathematics departments and science departments.

80. All high school graduates should be able to write simple computer programs.



During the 1980s it may be possible to add to each classroom several different resources for teaching mathematics. To what extent would you want secondary classroom teachers to have each of the following?

a. I would definitely want them to have this
b. This might be nice for them to have
c. Undecided
d. I'd rather they not be bothered by this
e. I definitely would not want them to have this

81. Calculators with special displays or capabilities (e.g., designed to handle fractions, equations of lines)

82. Films or videotapes on concepts or processes

83. Masters of worksheets and activities

84. Individual study materials

85. Manipulative materials or laboratory equipment for individual or small group use

86. Large-scale demonstration models and devices

87. Resource booklets on problems and applications

88. Computers or computer access

89. Standardized practice tests

90. A syllabus that suggests topics and methods for each grade level with specific times when they should be introduced

91. Materials for drill and practice

92. Materials with minimal reading requirements

Imagine that there are available several sets of instructional materials for a mathematical topic. Each set of materials emphasizes one of the teaching strategies listed below. Suppose that the materials are equivalent in terms of other factors. Indicate the degree to which the incorporation of this particular teaching strategy would be a positive or negative influence in your decision to purchase or use the materials at the elementary level.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

93. More than 50% of the instructional time is devoted to drill and practice.

94. Specific objectives, criterion referenced testing, and other materials are included to encourage use of a mastery learning or an individually paced model.

95. Student worksheets are included for drill and practice at the conclusion of each lesson.

96. Detailed notes are provided to guide the teacher in oral presentations of lessons.

97. More than 50% of the instructional time is devoted to student use of individual study materials to develop and extend ideas.

98. Slower students are allowed to use calculators so that they may keep up with the rest of the class.

99. It is expected that students will read formal presentations of basic ideas before classroom activities are devoted to these ideas.

100. Activities are included which require going outside the classroom (perhaps on field trips).

101. Basic ideas are introduced through laboratory investigations or experiments with materials.

102. Physical models are used to represent algorithms or develop concepts.

103. Concepts or procedures are developed within the context of real-world or application problems.

104. Ideas are developed through long-term real-life student projects designed to be assigned to individuals or to teams of students.

105. Activities are included that anticipate the class being divided into small discussion groups.

106. Simulations, wherein each student plays the role of a consumer or worker using mathematics in real-world situations, are frequently included.

107. Deductive sequences are used to develop new ideas and structural characteristics.

108. The introduction of calculators is postponed until students have learned both the meaning of the operations and the paper and pencil algorithms for them.

How appropriate is it for students to use hand-held calculators when doing each of the following activities?

a. Very appropriate
b. Only in special circumstances
c. Undecided
d. Almost never appropriate
e. Should not be allowed

109. Doing homework

110. Developing ideas and concepts

111. Taking a test

112. Checking answers

113. Solving word problems

114. Doing a chain of calculations involving several different operations.

115. Learning why an algorithm works

116. Learning basic number facts

117. Making graphs

118. Solving equations

119. Computing area

120. Using trigonometry

NATIONAL COUNCIL OF
Teachers of Mathematics

NCTM

March 1979

Dear NCTM Member:

The NCTM Board of Directors is in the process of formulating a set of curricular recommendations for school mathematics for the coming decade of the 1980s. The recommendations will be formulated to incorporate the judgement of many groups, ranging from professionals like yourself through lay groups such as parents. The information gathering for this process is being accomplished by the NCTM PRISM Project which is funded by the National Science Foundation. Enclosed is a second-round survey form designed to collect the judgement of priorities relative to a variety of curricular issues about mathematics learning and teaching.

The survey was designed around a large number of issues. The resulting item pool contains too many items for any single person to react to. Consequently, we are using an item sampling technique to keep response time reasonable. Other professionals have found completing the form takes about 25 minutes. The disadvantage is that some issues you feel important may be on another professional's questionniare but not on yours.

Please fill in the response form using a pencil. Only the response form need be returned in the enclosed envelope. If you feel strongly about any question and would like to write us a note about the item please do so on the back of the response form.

Do note that some of the questions on the survey form are specific to the elementary school and others are specific to the secondary school mathematics program. If a question does not specify a level, it concerns the entire K to 12 curriculum.

This is a second-round questionnaire. The items are a refinement of some issues identified as important in the first-round. Therefore, we feel it is most important to have a good response rate and urge you to complete the form and return it as soon as possible. We do need your judgement and experience in order that the NCTM can be oriented to the needs of the future decade of the 1980s as curricular recommendations and supportive policies are formulated.

Respectfully,

Alan Osborne, Director
NCTM PRISM Project

AO/kmc

Enclosure

Curriculum Survey
NCTM PRISM PROJECT

Part 1. General Information: Enter your responses in the box at the upper right of the response sheet. The box is labeled "General Information."

I. I have taught:

a. less than 3 years
b. 3-8 years
c. 9-14 years
d. 15-20 years
e. more than 20 years

II. The majority of students in my school are residents of:

a. urban/metropolitan (population greater than 150,000)
b. urban fringe/suburban
c. small city (population 25,000 to 150,000)
d. town (population less than 25,000)
e. rural/farm

III. I teach students who are in:

a. grades k-3
b. grades 4-6
c. grades 7-8
d. grades 9-12
e. other

IV. With respect to the way schools are organized and children are taught, I am:

a. very satisfied
b. somewhat satisfied
c. undecided
d. somewhat dissatisfied
e. very dissatisfied

Consider the mathematics program from kindergarten through twelfth grade. Below are several phrases indicating areas of the program that could receive more or less emphasis during the coming decade. Mark each with the response that best describes your feeling concerning what should be the trend.

a. should receive much more emphasis
b. should receive somewhat more emphasis
c. should receive about the same emphasis as now
d. should receive somewhat less emphasis
e. should receive much less emphasis

V. Basic skills

VI. Problem solving

VII. Measurement

VIII. Mathematics for consumers

IX. Applications of mathematics

X. Elementary mathematics specialists

XI. Gifted students

XII. Diagnosis and remediation

XIII. Mathematics and careers

XIV. Mastery learning curricula

XV. Computer literacy

Part 2. The remaining questions are specific to major content areas of the curriculum. Enter your responses in the portion of the response sheet labeled "Curriculum Preference Survey."

In the 1980s there will be a limited amount of money that can be spent for the development of new materials in the areas listed below. Please indicate the order in which you think the money should be spent by marking the answer sheet in the following way:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter <u>only once</u> for the next five items.

1. Whole-number computation
2. Problem solving in mathematics
3. Measurement
4. Fractions (concepts and computation)
5. Decimals (concepts and computation)

6. Consider the content area (questions 1 thru 5) above that you ranked lowest (marked with an "e"). Of the following five ideas, which comes <u>closest</u> to the reason you gave this area lowest priority?

   a = The materials we presently have in this area are more nearly adequate than the materials we have in the other four areas.

   b = This area does not present many problems for most teachers.

   c = It is not as important for students to develop skills in this area as it is in other areas in the list.

   d = Changes are needed in this area, but new materials would be an inefficient way to promote such changes.

   e = The importance of this area will diminish during the 1980s.

7. Consider the content area (questions 1 thru 5) above that you ranked highest (marked with an "a"). Of the following five ideas, which best describes the reason you gave it highest priority?

   a = We have fewer good materials to choose from in this area than in the other four areas.

   b = This is a major problem area for many, many teachers.

   c = It is absolutely crucial that all students develop skills in this area.

   d = New ideas have been developed in this area that are not reflected in present materials.

   e = The importance of this area will increase during the 1980s.

Suppose that an additional 15 minutes each day could be spent on mathematics in your elementary school(s). In your opinion, how should this time be spent? Please rank the following ideas, using the choices:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

8. Solving word problems

9. Drill and practice on basic number skills

10. Exploring enrichment topics

11. Studying applications of mathematics

12. Building an intuitive base for algebra and geometry

Imagine that you have a limited amount of money to spend for the development of new materials for grades 7-12 in the areas listed below. Please indicate the order in which you think the money should be spent by making the answer sheet in the following way:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

13. Algebra

14. Probability

15. Geometry

16. Computer literacy

17. Statistics

18. Consider the content area (questions 13 thru 17) above that you ranked lowest (marked with an "e"). Of the following five ideas, which best describes the reason you gave it lowest priority?

a = The materials we presently have in this area are more nearly adequate than the materials we have in the other four areas.

b = This area does not present many problems for most teachers.

c = It is not as important for students to develop skills in this area as it is in other areas in the list.

d = Changes are needed in this area, but new materials would be an inefficient way to promote such changes.

e = The importance of this area will diminish during the 1980s.

19. Consider the content area (questions 13 thru 17) above that you ranked highest (marked with an "a"). Of the following five ideas, which best describes the reason you gave it highest priority?

   a = We have fewer good materials to choose from in this area than in the other four areas.

   b = This is a major problem area for many, many teachers.

   c = It is absolutely crucial that more students develop skills in this area.

   d = New ideas have been developed in this area that are not reflected in present materials.

   e = The importance of this area will increase during the 1980s.

Suppose that one new or extensively revised mathematics course could be added to the curriculum of your high school(s). In what order would you support the following choices?

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

20. A course that helps students develop a feeling for ideas from calculus

21. A course that helps students handle statistical data and make predictions

22. A course that helps students make decisions about buying and selling

23. A course that helps students understand how calculators and computers handle mathematics

24. A course that helps students understand the mathematics used in specific vocations and careers

Of the five areas listed below, how should attention be given during the 1980s? Use the following responses to form a ranking:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

25. A unified approach to mathematical topics

26. Computer literacy (that is, understanding of the role and uses of computers) for everyone

27. Applications of mathematics

28. Structure in mathematics

29. Interdisciplinary approaches between mathematics and science, etc.

Of the five areas listed below, how should attention be given during the 1980s? Use the following responses to form a ranking:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

30. Career or vocation orientation

31. Consumer orientation

32. College preparatory orientation

33. Recreation or leisure-time orientation

34. Computer orientation

People have various opinions about the extent to which needs of various types of students are being met. Please indicate the order in which you think the need should be addressed, using the following responses:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

35. Students whose first language is not English

36. Inner-city or urban-area students

37. Students of ethnic minority background

38. Students with mathematics learning problems and other handicaps

39. Female students

40. Consider the type of student (questions 35 thru 39) that you ranked lowest in terms of developing special mathematics curriculum materials. Of the following five ideas, which comes closest to the reason you gave this group lowest priority?

a = I believe this group has special needs in mathematics, but the curriculum more adequately addresses their needs.

b = I don't believe this group has special needs in mathematics.

c = This type of student makes up such a small fraction of the total school population that we cannot devote significant resources to meeting his or her specialized needs.

d = I do not have to deal with this type of student in my classroom.

e = The needs of this type of student must first be met with approaches different than special curriculum materials (e.g., special schools, special class groupings, etc.)

41. Consider the type of student (questions 35 thru 39) that you ranked highest in terms of developing special mathematics curriculum materials. Of the following five ideas, which comes closest to the reason you gave this group highest priority?

a = This group has very special needs in mathematics which should be addressed through curriculum.

b = There are fewer appropriate curriculum materials for this type of student than for other groups.

c = This type of student makes up such a large fraction of the school population that we should devote significant resources to meeting his or her specialized needs.

d = I have to deal with many students of this type in my classroom.

e = There is great pressure on schools to provide programs for this type of student.

In your opinion, in what order of priority should the following areas within teacher education be addressed during the 1980s?

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

42. Mathematics content

43. Methods for teaching mathematics

44. Development of teaching materials

45. Sensitivity to student needs

46. Diagnostic and remediation strategies

In previous questions you have ranked priorities within the broad areas of mathematics content, students with special needs, and teacher education. To these areas might also be added the development of non-text teaching materials and the development of special teaching methods. In what order should these areas be studied or developed during the 1980s? Please indicate your priorities by marking the answer sheet in the following way:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

47. Improved mathematics content for textbooks

48. Development of special mathematics materials for students with special needs

49. Improved preservice and in-service education for teaching mathematics

50. Development of non-text materials for teaching mathematics

51. Improvement of methods and techniques for teaching mathematics

52. Consider the area above (questions 47 thru 51) that you ranked lowest (marked with an "e"). Of the following five ideas, which best describes the reason you gave it lowest priority?

a = The materials, methods, or understanding that we presently have for this area are more nearly sufficient.

b = This area does not present as many problems for most teachers.

c = The importance of this general area will diminish during the 1980s.

d = Changes in this area are likely to have relatively less general impact on mathematics education.

e = This area is not very important.

53. Consider the area above (questions 47 thru 51) that you ranked highest (marked with an "a"). Of the following five ideas, which best describes the reason you gave it highest priority?

a = The materials, methods, or understanding that we presently have for this area are very insufficient.

b = This area presents many, many problems for teachers.

c = The importance of this general area will increase during the 1980s.

d = We have new knowledge that can be used in this area, but it has not yet been implemented.

e = Improvement in this area would have a far-reaching impact on mathematics education generally.

Many general problems face teachers of mathematics (as well as other teachers). Please react to each of the following problems using these responses:

a = Among the most serious problems on the list
b = A more serious problem than many on the list
c = Undecided or no basis for judgment
d = A less serious problem in comparison with others on the list
e = A minor problem in comparison with others on the list

54. Classroom discipline

55. Lowering of school academic standards

56. Irregular attendance of students

57. Governmental or administrative restrictions

58. Lack of community

59. Reading difficulties

60. Unmotivated students

61. No commitment to homework on the part of students or parents

62. Decline in student abilities

63. Mixing of students with differing abilities in the same classroom

64. Increasing class size

65. Too much free time for students

66. Increased teacher workloads

67. Emphasis on non-academic school

68. Restrictions on instructional materials

69. Do you think the general problems that face all teachers (of the type indicated in items 54 thru 68) deserve priority over those problems specific to the teaching and learning of mathematics?

a = yes
b = no
c = undecided

In your opinion, how should research funds be distributed among the following areas during the 1980s?

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

70. How students learn

71. Longitudinal assessment of achievement

72. Teaching methods

73. Teacher education

74. Varying types of materials

In your opinion, how do the following methods for attacking problems in mathematics education compare in general importance, practicality, and efficiency? Please evaluate them by indicating your reactions in the following way?

a = A very good method
b = Probably a good method
c = Undecided
d = A questionable method
e = An undesirable method

75. Create many small, basic research projects

76. Establish a few coordinated, long-term research projects

77. Fund small, local curriculum development projects

78. Create a large curriculum development project with a nationwide influence

79. Give grants to commercial firms for publishing innovative curriculum materials

80. Give grants to local schools to improve their mathematics programs

81. Support the in-service education of teachers

82. Support evaluation of mathematics learning and achievement

83. Create a project to develop innovative teaching methods

84. Support the development of non-text materials

85. Fund research for study of general classroom problems

86. Fund professional mathematics education organizations to publicize innovative ideas

87. Establish mathematics education clearinghouses for the collection of innovative materials

88. Give grants to individual teachers for development of materials

89. Support preservice education of teachers

90. If more mathematics were offered to accomodate talented or gifted students at the high school level, which one of the following would be most important?

a = Additional topics in geometry
b = Topics in calculus and analysis
c = Additional topics in algebra
d = Computers/numerical analysis
e = A broad selection of enrichment topics

91. How would you evaluate the mathematics program in comparison to other academic programs in your school system?

a = The mathematics program is generally better than most other programs.

b = The mathematics program is about the same quality as other programs.

c = The mathematics program is inferior to other programs.

d = I have no opinion.

92. In which of the following areas do you feel your mathematics program needs the <u>most</u> improvement?

a = Mathematics for general education

b = Mathematics for the college-bound student

c = Mathematics for the vocational student

APPENDIX B.2

Sample Forms of Priorities Surveys

NATIONAL COUNCIL OF
Teachers of Mathematics

N C T M

February 1979

Dear President, Board of Education:

The National Council of Teachers of Mathematics (NCTM) is the largest professional organization that is exclusively concerned with the teaching and learning of mathematics in the elementary and secondary schools of the United States. The NCTM is in the process of formulating curricular recommendations for the mathematics programs of the elementary and secondary schools for the coming decade of the 1980s. The enclosed survey questionnaire asks you for your judgement and wisdom about the directions that the school mathematics program should take in the coming decade. The NCTM PRISM Project is collecting information about curricular preferences and priorities from several different groups ranging from parents through school board members but including teachers and mathematicians. Hopefully, by reflecting the concerns of a number of different groups with a stake in the performance of the school mathematics program, a sound set of curricular recommendations for the 1980s can be constructed.

Please fill in the enclosed response form using a pencil. Only the response form need be returned in the enclosed envelope. If you feel strongly about any question and would like to write us a note about it, please do so on the back of the response form.

Please note that several different survey forms are being used. Some issues and problems for which you have strong concerns may not be on your questionnaire. Hopefully, they will be on the questionnaire of another individual. We found in constructing the survey that there were more important issues deserving consideration than we could expect a busy person to respond to in a reasonable amount of time. The enclosed questionnaire has taken people like yourself about a half an hour to complete.

Thank you for giving us your time. We think the task we ask you to do is important. Children who are in school during the 1980s will live the majority of their productive lives during the next century. Consequently, we feel it is important for the NCTM to reflect your judgement, experience, and concerns in making recommendations for school mathematics programs.

Respectfully,

Alan Osborne

Alan Osborne, Director
NCTM PRISM PROJECT

AO:msl

Enclosure

Curriculum Survey
NCTM PRISM Project

Part 1. General Information: Enter your responses in the box at the upper right of the response sheet. The box is labeled "General Information."

I. The community in which I live is best described as

a. urban/metropolitan (population greater than 150,000)
b. urban fringe/suburban
c. small city (population 25,000 to 150,000)
d. town (population less than 25,000)
e. rural/farm

II. I am

a. under 25 years old
b. 25 to 34
c. 35 to 44
d. 45 to 54
e. 55 or over

III. I have

a. children in elementary school only (kindergarten through grade 6)
b. children in high school only (grades 7 through 12)
c. children in both elementary and high school
d. no children currently in kindergarten through grade 12
e. no children

IV. Check the statement that best describes your formal educational experience.

a. I have not completed high school.
b. I am a high school graduate.
c. I have some schooling beyond high school graduation.
d. I am a college graduate.
e. I have more than one college degree.

V. With respect to the way schools are organized and students are taught, I am

a. very satisfied
b. somewhat satisfied
c. undecided
d. somewhat dissatisfied
e. very dissatisfied

Indicate the type of experience you have had with schools prior to this year.

VI. I was a teacher.

a. Yes
b. No

VII. I was a school board member

a. Yes
b. No

VIII. I was a teacher's aide.

a. Yes, paid.
b. Yes, volunteer.
c. No

IX. I was a member of a parents school organization.

a. Yes
b. No

Part 2. The remaining questions concern the mathematics curriculum. Enter your responses in the portion of the response sheet that is labeled "Curriculum Preference Survey."

LPA1

Consider the mathematics program from kindergarten through grade 12. Below are several phrases indicating areas of the program that could receive more or less emphasis during the coming decade. Mark each with the response that best describes your feeling concerning what should be the trend. Omit the item if you do not understand the term.

a. Should receive much more emphasis
b. Should receive somewhat more emphasis
c. Should receive about the same emphasis as now
d. Should receive somewhat less emphasis
e. Should receive much less emphasis

1. Basic skills

2. Diagnosis and remedial work

3. Minimal competency testing (e.g., standards for graduation)

4. Use of calculators

5. Metric measurement

6. Individualization

7. Applications of mathematics

8. Problem solving

9. Daily homework

10. Elementary mathematics specialists

How important is each of the following purposes for teaching mathematics in schools?

a. Very important
b. Somewhat important
c. Undecided
d. Not important
e. Definitely not important

11. To solve problems in everyday life

12. To think logically

13. To assure an adequate supply of scientists and engineers

14. To preserve student options with respect to potential careers and vocational choices

15. To develop understanding of the structure of mathematics

16. To develop disciplined work habits

17. To prepare for college

18. To pass standardized tests

19. To gain skills necessary for employment

20. To make consumer decisions

21. To preserve a traditional part of schooling

22. To teach skills necessary for continued work in mathematics

23. How many years of high school mathematics (in grades 9 through 12) would you require for graduation?

a. 0
b. 1
c. 2
d. 3
e. 4

24. How many years of mathematics would you require for college-bound students in high school (grades 9 through 12)?

a. 0
b. 1
c. 2
d. 3
e. 4

A committee is working on a curriculum guide for mathematics during the 1980s for a school. The following statements were proposed by various committee members. Please react to each. Omit the item if you do not understand it.

a. I agree completely.
b. I tend to agree.
c. I am undecided.
d. I tend to disagree.
e. I strongly disagree.

25. All fractions should be written as decimals so that work with them can be done with a calculator.

26. A special algebra course for vocational students should be offered.

27. Several different procedures for doing addition, subtraction, multiplication, and division should be taught so that children can choose the method which they prefer.

28. Separate courses in geometry should be abolished and geometry content integrated with other mathematics in grades K-12.

29. Percent should be introduced in terms of merchandising (for example, discount sales, percent of profit).

30. A separate problem-solving course, lasting at least one semester, should be required of all students before high school graduation.

31. Measurement should be a strong focus of consumer mathematics courses in high school.

32. Work with fractions should be delayed until grade 7 or 8.

33. A student graduating from high school should be required to take a full-year algebra course.

34. Students who do not know paper-and-pencil computation by the end of grade 8 should be required to take a ninth-grade mathematics course on the uses of the hand-held calculator.

35. Work with statistical information and making predictions (probability) should be offered as part of a consumer mathematics course.

36. At least one course in mathematics for college-bound students should make extensive use of the computer.

37. Specific consumer skills like balancing a checkbook and calculating best buys should be taught.

38. Problems should be realistic even though they might involve sensitive social issues.

39. Work with statistical information and making predictions (probability) should be offered as a twelfth-grade course for high-ability mathematics students.

LPA3

You are a member of a committee which is selecting materials to purchase for a school. Indicate the degree that including each of the following teaching strategies would influence your decision.

a. Strong positive influence
b. Somewhat positive influence
c. No influence or undecided
d. Somewhat negative influence
e. Strong negative influence

Form A

40. More than 50% of the instructional time is devoted to drill and practice.

41. Slower students are allowed to use calculators so that they may keep up with the rest of the class.

42. Activities are included which require going outside the classroom.

43. Each new mathematical topic is introduced with a problem to be solved.

44. More than 50% of the instructional time is devoted to student use of individual study materials to develop and extend ideas.

45. Basic ideas are introduced through laboratory investigations or experiments with materials.

46. Students are to read about mathematical ideas before classroom activities are devoted to these ideas.

47. Most lessons are designed to be conducted with a single large group.

48. Daily homework assignments are included.

49. Students are shown how to solve a problem and then similar practice problems are assigned.

How appropriate is it for students to use hand-held calculators when doing each of the following activities?

a. Very appropriate
b. Appropriate
c. Undecided
d. Almost never appropriate
e. Should not be allowed

50. Doing homework

51. Developing ideas and concepts

52. Taking a test

53. Checking answers

54. Solving word problems

55. Doing practice exercises in class

LFA6

NATIONAL COUNCIL OF
Teachers of Mathematics

February 1979

Dear Principal:

The National Council of Teachers of Mathematics (NCTM) is the largest professional organization that is exclusively concerned with the teaching and learning of mathematics in the elementary and secondary schools of the United States. The NCTM is in the process of formulating curricular recommendations for the mathematics programs of the elementary and secondary schools for the coming decade of the 1980s. The enclosed survey questionnaire asks you for your judgement and wisdom about the directions that the school mathematics program should take in the coming decade. The NCTM PRISM Project is collecting information about curricular preferences and priorities from several different lay and professional groups.

We are particularly interested in principals' opinions and recognize that because of your responsibilities you are well-informed. Hopefully, by reflecting the concerns of a number of different groups with a stake in the performance of the school mathematics program, a sound set of curricular recommendations for the 1980s can be constructed.

Please fill in the enclosed response form using a pencil. Only the response form need be returned in the enclosed envelope. If you feel strongly about any question and would like to write us a note about it, please do so on the back of the response form. If you are uncomfortable in responding to a question, do feel free to omit it.

Please note that several different survey forms are being used. Some issues and problems for which you have strong concerns may not be on your questionnaire. Hopefully, they will be on the questionnaire of another individual. We found in constructing the survey that there were more important issues deserving consideration that we could expect a busy person to respond to in a reasonable amount of time. The enclosed questionnaire has taken people like yourself about a half an hour to complete.

Thank you for giving us your time. We think the task we ask you to do is important. Children who are in school during the 1980s will live the majority of their productive lives during the next century. Consequently, we feel it is important for the NCTM to reflect your judgement, experience, and concerns in making recommendations for school mathematics programs.

Respectfully,

Alan Osborne

Alan Osborne, Director
NCTM PRISM Project

AO:msl

Enclosure

Curriculum Survey
NCTM PRISM Project

Part 1. General Information: Enter your responses in the box at the upper right of the response sheet. The box is labeled "General Information".

I. My school serves a community that is best described as

a. urban/metropolitan (population greater than 150,000)
b. urban fringe/suburban
c. small city (population 25,000 to 150,000)
d. town (population less than 25,000)
e. rural/farm

II. I am

a. under 25 years old
b. 25 to 34
c. 35 to 44
d. 45 to 54
e. 55 or over

III. I have

a. children in elementary school only (kindergarten through grade 6)
b. children in high school only (grades 7 through 12)
c. children in both elementary and high school
d. no children currently in kindergarten through grade 12
e. no children

IV. Check the statement that best describes your formal educational experience.

a. bachelor's degree
b. masters degree
c. academic work between the masters and doctorate
d. doctorate

V. With respect to the way schools are organized and students are taught, I am

a. very satisfied
b. somewhat satisfied
c. undecided
d. somewhat dissatisfied
e. very dissatisfied

Indicate the types of experience you have had prior to this year:

VI. I have been a teacher of secondary school mathematics.

a. Yes
b. No

VII. I have a secondary school teaching certificate.

a. Yes
b. No

VIII. I have an elementary school teaching certificate.

a. Yes
b. No

IX. I have been a principal for

a. 0 to 5 years
b. 5 to 10 years
c. 10 to 15 years
d. more than 15 years

Part 2. The remaining questions concern the mathematics curriculum. Enter your responses in the portion of the response sheet that is labeled "Curriculum Preference Survey." Omit questions for which you do not feel qualified to give a response.

In the 1980s there will be a limited amount of money that can be spent for the development of new materials in the areas listed below. Please indicate the order in which you think the money should be spent by marking the answer sheet in the following way:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

1. Whole-number computation
2. Problem solving in mathematics
3. Measurement
4. Fractions (concepts and computation)
5. Decimals (concepts and computation)

6. Consider the content area (questions 1 thru 5) above that you ranked lowest (marked with an "e"). Of the following five ideas, which comes closest to the reason you gave this area lowest priority?

a = The materials we presently have in this area are more nearly adequate than the materials we have in the other four areas.

b = This area does not present many problems for most teachers.

c = It is not as important for students to develop skills in this area as it is in other areas in the list.

d = Changes are needed in this area, but new materials would be an inefficient way to promote such changes.

e = The importance of this area will diminish during the 1980s.

7. Consider the content area (questions 1 thru 5) above that you ranked highest (marked with an "a"). Of the following five ideas, which best describes the reason you gave it highest priority?

a = We have fewer good materials to choose from in this area than in the other four areas.

b = This is a major problem area for many, many teachers.

c = It is absolutely crucial that all students develop skills in this area.

d = New ideas have been developed in this area that are not reflected in present materials.

e = The importance of this area will increase during the 1980s.

Suppose that an additional 15 minutes each day could be spent on mathematics in your elementary school(s). In your opinion, how should this time be spent? Please rank the following ideas, using the choices:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

8. Solving word problems

9. Drill and practice on basic number skills

10. Exploring enrichment topics

11. Studying applications of mathematics

12. Building an intuitive base for algebra and geometry

Imagine that you have a limited amount of money to spend for the development of new materials for grades 7-12 in the areas listed below. Please indicate the order in which you think the money should be spent by making the answer sheet in the following way:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

13. Algebra

14. Probability

15. Geometry

16. Computer literacy

17. Statistics

18. Consider the content area (questions 13 thru 17) above that you ranked lowest (marked with an "e"). Of the following five ideas, which best describes the reason you gave it lowest priority?

a = The materials we presently have in this area are more nearly adequate than the materials we have in the other four areas.

b = This area does not present many problems for most teachers.

c = It is not as important for students to develop skills in this area as it is in other areas in the list.

d = Changes are needed in this area, but new materials would be an inefficient way to promote such changes.

e = The importance of this area will diminish during the 1980s.

19. Consider the content area (questions 13 thru 17) above that you ranked highest (marked with an "a"). Of the following five ideas, which best describes the reason you gave it highest priority?

a = We have fewer good materials to choose from in this area than in the other four areas.

b = This is a major problem area for many, many teachers.

c = It is absolutely crucial that more students develop skills in this area.

d = New ideas have been developed in this area that are not reflected in present materials.

e = The importance of this area will increase during the 1980s.

Suppose that one new or extensively revised mathematics course could be added to the curriculum of your high school(s). In what order would you support the following choices?

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

20. A course that helps students develop a feeling for ideas from calculus

21. A course that helps students handle statistical data and make predictions

22. A course that helps students make decisions about buying and selling

23. A course that helps students understand how calculators and computers handle mathematics

24. A course that helps students understand the mathematics used in specific vocations and careers

Of the five areas listed below, how should attention be given during the 1980s? Use the following responses to form a ranking:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

25. A unified approach to mathematical topics

26. Computer literacy (that is, understanding of the role and uses of computers) for everyone

27. Applications of mathematics

28. Structure in mathematics

29. Interdisciplinary approaches between mathematics and science, etc.

Of the five areas listed below, how should attention be given during the 1980s? Use the following responses to form a ranking:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

30. Career or vocation orientation

31. Consumer orientation

32. College preparatory orientation

33. Recreation or leisure-time orientation

34. Computer orientation

People have various opinions about the extent to which needs of various types of students are being met. Please indicate the order in which you think the need should be addressed, using the following responses:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

35. Students whose first language is not English

36. Inner-city or urban-area students

37. Students of ethnic minority background

38. Students with mathematics learning problems and other handicaps

39. Female students

40. Consider the type of student (questions 35 thru 39) that you ranked lowest in terms of developing special mathematics curriculum materials. Of the following five ideas, which comes closest to the reason you gave this group lowest priority?

a = I believe this group has special needs in mathematics, but the curriculum more adequately addresses their needs.

b = I don't believe this group has special needs in mathematics.

c = This type of student makes up such a small fraction of the total school population that we cannot devote significant resources to meeting his or her specialized needs.

d = I do not have to deal with this type of student in my classroom.

e = The needs of this type of student must first be met with approaches different than special curriculum materials (e.g., special schools, special class groupings, etc.)

41. Consider the type of student (questions 35 thru 39) that you ranked highest in terms of developing special mathematics curriculum materials. Of the following five ideas, which comes closest to the reason you gave this group highest priority?

a = This group has very special needs in mathematics which should be addressed through curriculum.

b = There are fewer appropriate curriculum materials for this type of student than for other groups.

c = This type of student makes up such a large fraction of the school population that we should devote significant resources to meeting his or her specialized needs.

d = I have to deal with many students of this type in my classroom.

e = There is great pressure on schools to provide programs for this type of student.

In your opinion, in what order of priority should the following areas within teacher education be addressed during the 1980s?

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

42. Mathematics content

43. Methods for teaching mathematics

44. Development of teaching materials

45. Sensitivity to student needs

46. Diagnostic and remediation strategies

In previous questions you have ranked priorities within the broad areas of mathematics content, students with special needs, and teacher education. To these areas might also be added the development of non-text teaching materials and the development of special teaching methods. In what order should these areas be studied or developed during the 1980s? Please indicate your priorities by marking the answer sheet in the following way:

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

47. Improved mathematics content for textbooks

48. Development of special mathematics materials for students with special needs

49. Improved preservice and in-service education for teaching mathematics

50. Development of non-text materials for teaching mathematics

51. Improvement of methods and techniques for teaching mathematics

52. Consider the area above (questions 47 thru 51) that you ranked lowest (marked with an "a"). Of the following five ideas, which best describes the reason you gave it lowest priority?

a = The materials, methods, or understanding that we presently have for this area are more nearly sufficient.

b = This area does not present as many problems for most teachers.

c = The importance of this general area will diminish during the 1980s.

d = Changes in this area are likely to have relatively less general impact on mathematics education.

e = This area is not very important.

53. Consider the area above (questions 47 thru 51) that you ranked highest (marked with an "a"). Of the following five ideas, which best describes the reason you gave it highest priority?

a = The materials, methods, or understanding that we presently have for this area are very insufficient.

b = This area presents many, many problems for teachers.

c = The importance of this general area will increase during the 1980s.

d = We have new knowledge that can be used in this area, but it has not yet been implemented.

e = Improvement in this area would have a far-reaching impact on mathematics education generally.

Many general problems face teachers of mathematics (as well as other teachers). Please react to each of the following problems using these responses:

a = Among the most serious problems on the list
b = A more serious problem than many on the list
c = Undecided or no basis for judgment
d = A less serious problem in comparison with others on the list
e = A minor problem in comparison with others on the list

54. Classroom discipline

55. Lowering of school academic standards

56. Irregular attendance of students

57. Governmental or administrative restrictions

58. Lack of community

59. Reading difficulties

60. Unmotivated students

61. No commitment to homework on the part of students or parents

62. Decline in student abilities

63. Mixing of students with differing abilities in the same classroom

64. Increasing class size

65. Too much free time for students

66. Increased teacher workloads

67. Emphasis on non-academic school

68. Restrictions on instructional materials

69. Do you think the general problems that face all teachers (of the type indicated in items 54 thru 68) deserve priority over those problems specific to the teaching and learning of mathematics?

a = yes
b = no
c = undecided

In your opinion, how should research funds be distributed among the following areas during the 1980s?

a = highest priority
b = second highest priority
c = middle-level priority
d = second lowest priority
e = lowest priority

Be sure to use each letter only once for the next five items.

70. How students learn

71. Longitudinal assessment of achievement

72. Teaching methods

73. Teacher education

74. Varying types of materials

In your opinion, how do the following methods for attacking problems in mathematics education compare in general importance, practicality, and efficiency? Please evaluate them by indicating your reactions in the following way?

a = A very good method
b = Probably a good method
c = Undecided
d = A questionable method
e = An undesirable method

75. Create many small, basic research projects

76. Establish a few coordinated, long-term research projects

77. Fund small, local curriculum development projects

78. Create a large curriculum development project with a nationwide influence

79. Give grants to commercial firms for publishing innovative curriculum materials

80. Give grants to local schools to improve their mathematics programs

81. Support the in-service education of teachers

82. Support evaluation of mathematics learning and achievement

83. Create a project to develop innovative teaching methods

84. Support the development of non-text materials

85. Fund research for study of general classroom problems

86. Fund professional mathematics education organizations to publicize innovative ideas

87. Establish mathematics education clearinghouses for the collection of innovative materials

88. Give grants to individual teachers for development of materials

89. Support preservice education of teachers

90. If more mathematics were offered to accomodate talented or gifted students at the high school level, which one of the following would be most important?

a = Additional topics in geometry
b = Topics in calculus and analysis
c = Additional topics in algebra
d = Computers/numerical analysis
e = A broad selection of enrichment topics

91. How would you evaluate the mathematics program in comparison to other academic programs in your school system?

a = The mathematics program is generally better than most other programs.

b = The mathematics program is about the same quality as other programs.

c = The mathematics program is inferior to other programs.

d = I have no opinion.

92. In which of the following areas do you feel your mathematics program needs the most improvement?

a = Mathematics for general education

b = Mathematics for the college-bound student

c = Mathematics for the vocational student