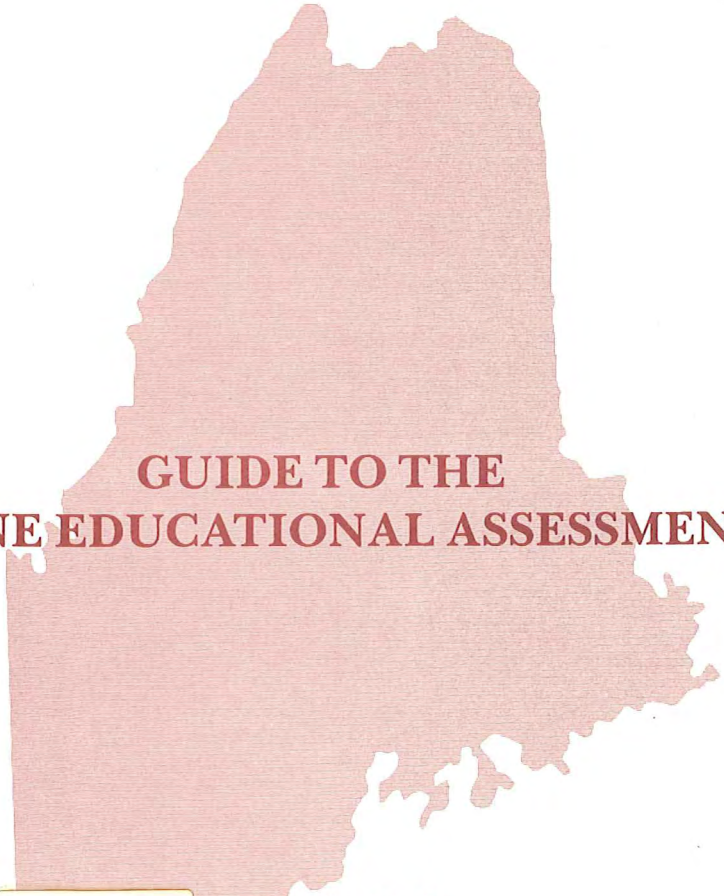

# GUIDE TO THE MAINE EDUCATIONAL ASSESSMENT

## 1987-88



Department of Educational and Cultural Services
Division of Educational Assessment

# FOREWORD

This past year, the second year of the Maine Educational Assessment, we continued to receive a great deal of cooperation and support from all levels of the education community. As the policies relating to the program have been refined and school teachers and administrators have become more familiar with the program, it has been most gratifying to see many schools recognize and take advantage of the wealth of information the MEA provides on curriculum and instruction. My staff and I have spent a considerable portion of our time in schools throughout the state and have readily seen that school personnel examine their test results seriously and use them, along with other information, to improve their programs. During the 1987-88 school year, we intend to continue refining and improving the MEA by incorporating into the program many recommendations from local school personnel. We will also continue to provide assistance to schools both through large workshops and through the consulting services of the MEA staff. If you have any questions at all about the program or if you wish to request technical assistance in the interpretation and use of test results for instructional/curricular improvement, please call us. I am looking forward to another rewarding and productive year.

Randy Walker

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## Background

The Maine Educational Assessment is a program growing out of the Educational Reform Act of 1984. That legislation called for a comprehensive set of reforms directed toward school improvement. This year (the third year of the program), the assessment will proceed in much the same way it has during the previous two years, with a few refinements.

The assessment program is administered by the Division of Educational Assessment of the Department of Educational and Cultural Services, with the cooperation of the Division of Curriculum and the Division of Special Education. Assisting state personnel is the contractor for the 1987-88 assessment, Advanced Systems in Measurement and Evaluation, Inc. of Dover, New Hampshire.

The Maine Educational Assessment is a more comprehensive statewide testing program than previously operated in Maine, and one with aspects making it unique among testing programs nationally. The question-and-answer section of this guide is intended to provide general information about the assessment program and more specific information regarding test content to educators and interested persons throughout the state.

## What Are the Goals of the Program?

As mandated by the legislation, the assessment program is designed to achieve these goals:

> provide information on the academic achievement and progress of Maine students;

> establish a process for continuing evaluation of state educational goals and aid in the development of educational policies, standards and programs;

> provide school officials with information to assess the quality, effectiveness and appropriateness of educational materials, methods and curriculum needs, including remediation and enrichment;

> provide school staffs with information about individual students which may be used, with other information, to meet individual educational needs of the student;

> identify year-to-year trends in student achievement; and

> provide parents with information about the achievement of their children on the assessment tests.

## How and When Will the Tests Be Administered?

At various times during this school year, Advanced Systems, the contractor

for the assessment, will contact superintendents and building principals to collect the information necessary to conduct the testing. The tests are designed to be administered by teachers and will require a total testing time of approximately four to five hours divided among several separate testing sessions. Manuals for test coordinators and administrators will provide detailed instructions for the processing of materials and the administration of the tests. Additionally, training sessions will be conducted in various locations in Maine prior to the testing dates at the different grade levels.

The testing periods for the 1987-88 school year are:

Grade 8 — October 26 to November 6, 1987
Grade 4 — January 25 to February 5, 1988
Grade 11 — March 28 to April 8, 1988

The actual dates of testing within these periods are to be determined by district personnel. They may schedule testing sessions any time during the first week of the two-week period provided they adhere to the guidelines provided in the instruction manuals. The second week should be reserved for make-up testing of students absent during the regular testing sessions.

## Who Will Take the Tests?

All Maine public school students in grades 4, 8, and 11, and students approved for tuition purposes, will be tested. Exceptional students requiring testing modifications will be tested in accordance with the policies outlined in the handbook titled "Maine Educational Assessment: Manual on Policies and Procedures for Students Requiring Assessment Modifications." Exclusions from testing will be minimized and well-documented.

## What Kind of Tests Are Being Used?

The program combines aspects of standardized achievement testing and program assessment. A set of "common questions," administered to all students at a grade in the state, will yield reliable individual student test and subtest scores in reading, writing, and mathematics. The common item set, however, does not provide the broad coverage of content areas and program evaluation capability afforded by the former statewide testing program, the Maine Assessment of Educational Progress (MAEP). Therefore, other questions, called "matrix sampled" questions, are distributed over many booklets so that each of these questions will be answered by a sample of students. Matrix sampled questions are used in reading, mathematics, science, social studies, and the humanities. Many different test forms are used at each grade level tested; each contains the common items and a fraction of the matrix sampled questions. The matrix sampling technique allows for broader assessment of many content areas at the school level using a minimum amount of testing time.

The tests are tailored to objectives frameworks developed by various

advisory committees made up of Maine teachers, administrators, and curriculum experts. All areas except writing will be tested with multiple choice questions; writing will be tested directly through writing prompts eliciting samples of students' writing. In addition, students will be administered up to twenty open-ended reading and mathematics questions. These items will assist in measuring higher order thinking skills.

Student, teacher, and principal questionnaires will assess a variety of background, experiential, attitudinal, and instructional variables. The information obtained from these instruments will play an important role in the reporting and interpretation of the assessment results.

## How Will the MEA Be Different in 1987-88?

There will be two major changes in the MEA this year. First, the number of science and social studies test questions will be doubled. In the past, approximately one hundred questions in these areas produced very accurate school results in broad reporting categories. (For example, scores were reported in science for life sciences, physical sciences, etc., and in social studies for history, geography, etc.) Because school personnel requested more detailed reporting in these two subject areas, the coverage of the areas is being doubled so that scores can be provided for more specific reporting categories. These categories are listed on pages 14 and 15 of this booklet. Within life sciences, for example, school scores will be reported for several categories. Thus, information reported to schools in science and social studies will be more diagnostic, still at the program level and still tested entirely through the use of matrix sampled test questions distributed across the different test forms.

The second major change in the MEA affects the testing of writing. Each student will produce only one writing sample instead of two as in the past. There will still be two different writing prompts administered in every school, however; half the students will respond to the first and half the students will respond to the second. The testing procedures for writing will remain the same: each student will have a full hour to produce the writing sample and will be able to complete prewriting activities and the writing of a first draft.

These changes—the increased coverage of two subject areas and the use of twelve different test forms at a grade level instead of sixteen—ordinarily would result in increased testing time. Because each student is producing only one writing sample, however, there will be a net reduction in the total testing time of approximately fifteen minutes.

## How Will Results Be Reported?

### Student Results

Individual student results will be based on the common items and will be reported in two ways. First, students' scores in reading, mathematics, various

subdomains of reading and mathematics, and writing will be provided in a form suitable for mailing to parents as well as on gummed labels for inclusion in permanent school files. Second, data summaries reporting each student's response to each common test question will be provided to the schools. These summaries will also show school and state average percents correct for each of these items.

## School Results

The School Report will be in the form of a booklet. Results will be laser printed on preprinted formats, and narrative description will aid in interpretation of the data.

The School Report will include:

> the number of students tested, the number of students with handicapping conditions tested, etc.

> an average test score and student score distributions for each of the six content areas, including the areas covered only by matrix sampled questions. The scores will be scaled scores so that they will be comparable from area to area and from year to year. In fact, the report format will accommodate several years of results so that school personnel can monitor changes in performance over time.

> information on a school's status relative to the district and the state, based on background factors such as parental education and size and type of community. More importantly, this information will be used to produce comparison score bands which will enable school personnel to compare the performance of their students to that of students in comparable schools across the state, rather than all schools statewide.

> scaled scores for the performance of a school in subcategories of each content area. For example, performance will be reported for areas of mathematics such as computation, geometry, and measurement.

Additionally, achievement results for subgroups of students defined by responses to student questionnaire items will be reported. This will help to identify the variables that seem to be more highly correlated with student achievement.

## State Reports

Various interpretive summaries of statewide performance in the different curricular areas, highlights brochures, and a technical report will also be produced. Interpretations, conclusions, and recommendations presented in

these documents will result from collaborative reviews of the data by curriculum advisory committees, state department staff members, and the contractor for the assessment.

## What Kinds of Changes Can One Expect to Find in School Scores from Year to Year?

The variability in performance among Maine schools is relatively small compared to that in many other states. Nevertheless, the use of scaled scores based on Maine norms (as opposed to national norms) appears to spread school scores out. The scale for 1985-86 (base year) school scores had a mean of 250 and a standard deviation of 50. The scores for a particular school accurately represented the performance of students in that school in 1985-86. Because of the variability of achievement levels of classes of students passing through a school and because of the homogeneity of Maine schools, it would not be unusual for a school to experience seemingly large shifts in scores across years (e.g., 40 or 50 points) even without making any changes in curricular/instructional programs. A particular class of students is just one sample from all the classes that pass through the school. For this reason, data from more than one year should be examined for purposes of program evaluation. This year's school reports will show the scores for 1985-86, 1986-87, and 1987-88, and they will also give three-year averages. Enough test items will be reused from year to year so that comparisons can be made over time and different years' tests can be linked statistically. If statewide performance changes, the statewide averages will also change. The 1986-87 statewide averages in many areas, for example, were not 250 as they were in the first year of the program. This is true for all areas except writing.

## How Reliable Can Results Be Since Matrix Sampled Items May Only Be Answered by a Few Students in a School?

The technique of matrix sampling as used in Maine produces school scores that are more reliable and more valid for purposes of program evaluation than traditional methodologies. Test length is one factor that affects test reliability. Matrix sampling involves the construction of a large number of test questions and distributing them across several nonequivalent test forms so that not every question is answered by every student. Large numbers of questions, however, are answered in any school. Validity is enhanced because of the more complete coverage of the content domains provided by the large number of test items used. Last year, not counting the common items in reading and math which also contributed to school scores, the matrix sampled items administered at a grade level in just one class period included approximately 180 reading items, 150

math items, and 100 items in each of the four other curricular areas tested by multiple choice questions.

It is important that anyone trying to understand matrix sampling put aside many of the notions associated with testing programs intended to produce individual student scores. The Maine Educational Assessment involves the sampling of both content (in terms of the coverage of a subject area) and students (since not every item is answered by every student). The sampling of content is far superior to that provided by other forms of testing, not only because of the number of items, but also because repeated measures of specific skills or concepts are not required as they might be to generate reliable student scores. The sampling of students is also outstanding. While any one student may answer only a limited number of questions in a subject area, a score for that student is not computed as an intermediate step toward the computation of a school score. School scores are complex aggregations of item results, not student results. With items in a reporting category (i.e., subtest) spread across the different test forms, it is reasonable to expect that most of the students in a school took one or more items in that category. Concerns that a difficult question might have been answered only by a few weak students and similar situations are invalid for two reasons. First, item difficulty is taken into account in the scaling techniques used in going from item results (percents correct) to school scores. Second, aspects of random sampling assure the distribution of items in a reporting category to a wide range of students in a school. In summary, a large number of items in an area are administered in a school, and most students in the school answer questions in any particular reporting category. In producing school scores, this situation is far preferable to having many fewer items administered with all students, instead of most students, answering each item.

Another question raised about the limited number of students taking a matrix sampled question concerns the limited number of values for item results that could occur. If four students answered a particular question, the possible percents correct could only be 100, 75, 50, 25, or 0. Thus, a school's percent correct on a matrix sampled item is likely not to be close to what it might be if all students were administered the item. This is not a problem since we are not interested in reporting school-level item results for matrix sampled items. Those items and the few students who answered them are contributing their bits of information to a much larger pool of information based on many items and students. School scores are the result of piecing all of these bits of information together. Besides, in testing programs producing student results, a single item is either answered correctly or incorrectly by the student — i.e., its contribution to the student's score is either 100 percent or 0 percent.

The Technical Summary for last year's assessment provides more complete information on matrix sampling, test reliability, etc.

## Can School Personnel Reproduce or Retain Copies of the Test Forms?

DEFINITELY NOT!!! After testing is completed in a school, all test forms must be returned to the assessment contractor along with other testing materials. Any schools that reproduce or retain copies of the test forms may be subject to having their test results declared invalid. Copies of the common items in reading, writing, and mathematics will be returned to the schools with the reports of results; copies of these questions may be reproduced for internal school use. However, the bulk of the test questions administered via matrix sampling must remain secure.

Department policy regarding test security is based on several considerations. First, some of the test questions in the MEA are reproduced with permission of the source agency with the provision that their security be maintained. Second, comparability of results across years is achieved by the use of test questions administered in two consecutive years. Many of the matrix sampled questions are new each year, but some are not. This comparability allows a school to interpret changes in scores from year to year as reflecting real change regardless of any changes in statewide averages. Given the MEA design to achieve data comparability, the need for test security is obvious.

The desire of local school personnel to examine specific test questions is often associated with a specific skill orientation. This may be appropriate at the local level where performance in a district's specific objectives might be the focus of evaluation. The MEA does not measure specific skills so much as performance in broader domains of skills and understandings. While the set of test questions in a reporting category must represent the range of material that the category encompasses, a very specific skill or concept may not be tested every year.

## What Content within the Different Subject Areas Do the Tests Cover?

Unlike other types of tests in which questions are selected to address ver specific skill-related objectives (e.g., mastery tests), the MEA tests a constructed to be consistent with broader conceptual frameworks developed the various advisory committees to the program. The following secti describe the objectives frameworks for the different content areas, rationale underlying them, and identify reporting categories—i.e., the sub

for which scores will be reported. The objectives and/or reporting categories are broad enough to apply, for the most part, to all three grade levels tested. In a few instances, categories may be combined or further broken down at a particular grade level in this year's reports.

In the matrix sampled areas of science, social studies, and the humanities, no test questions are released to schools with test results. It is difficult for school personnel, concerned about their results in one of these areas, to determine accurately what was covered in the tests. For this reason, this pamphlet contains an appendix which lists specific concepts, topics, and skills that characterize or define the domain corresponding to each reporting category. While items may change, the basic content of the tests will be consistent from year to year.

## Reading

The MEA cognitive tests and and questionnaires will address the broad objectives for students' reading skills described below.

### Objective I — Comprehends What Is Read

Comprehension is an interactive process by which readers construct meaning both from the passage and from the various kinds of background knowledge they bring to the reading experience. In measuring comprehension, two passage-related variables (type of material and passage length) and two reader-related variables (purpose for reading and prior knowledge) are considered.

Whenever people read, they analyze, interpret, and evaluate the material they are reading. Such activities are not necessarily separate from one another; some or all may take place as readers extend their comprehension of any particular passage. Examples of these activities are:

1. following the logic of an argument;
2. recognizing the emotional appeal;
3. identifying the characters' motivations;
4. identifying causes of a sequence of events;
5. relating concepts to personal experience and to other written works;
6. evaluating the usefulness or quality of a passage; and
7. judging success of a work against specific or general criteria.

Critical thinking skills (evaluating evidence, making inferences, drawing conclusions, recognizing assumptions, etc.) are of great interest in education. Many of these skills have traditionally been measured, although not always very effectively, in tests in all subject areas including reading. Items included in the MEA tests are consistent with the current views of critical thinking experts

about the nature of those skills and effective means of testing them. The open ended (non-multiple choice) questions used in the assessment are particularly effective tools for measuring critical thinking skills.

## Objective II — Manages the Reading Experience

Good readers develop many strategies to help them comprehend what they read. Readers increase their effectiveness as they develop metacognition: a personal awareness and conscious application of these strategies. Applied throughout the reading experience, these strategies vary according to the characteristics of particular passages, the reader's knowledge and experience with similar materials, and the reader's purpose for reading. Examples of these strategies include:

1. using the structure and organization of the text;
2. using reader's aids such as typography, layout, illustration and various kinds of listings and guides;
3. approaching reading material with flexibility (selecting and altering strategies to suit the purpose for reading);
4. accessing appropriate prior knowledge;
5. selecting reading materials appropriate to the purpose.

## Objective III — Values Reading

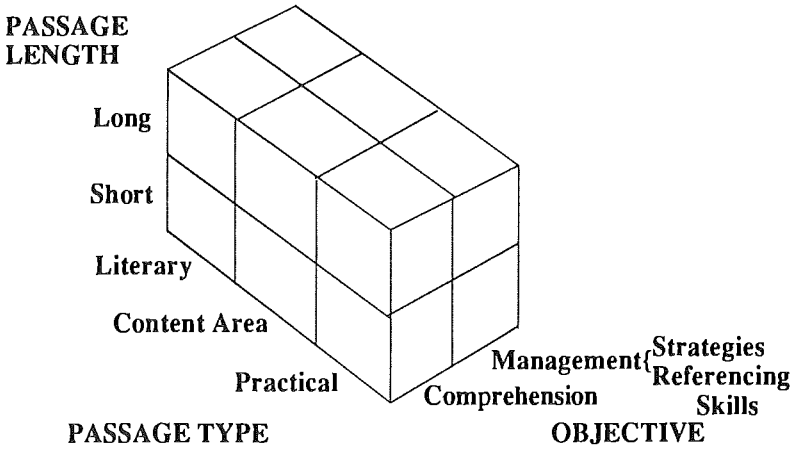
Students should acquire a growing appreciation of the ways reading can affect their lives. They should view reading as:

1. a source of enjoyment;
2. an opportunity to expand understanding and fulfill personal goals;
3. a means of acquiring knowledge and new skills;
4. an important influence on society.

Objective III will be addressed by the student questionnaires. The cognitive test items addressing Objectives I and II will be passage related, and the passages will be preceded by brief statements of the purpose for reading.

The research literature has failed to establish that the traditionally used subcategories of reading comprehension (literal, inferential, etc.) represent distinct skills. This failure is consistent with the Reading Advisory Committee's view of reading as a holistic, interactive process. Consequently, the reporting categories that will be used in the reporting of individual and school results are those shown in the figure below.

The reading portions of the MEA tests require students to read both long and short passages from literature, the content areas, and practical sources.




Literary passages represent a variety of forms — biography, drama, essay, novel, poetry, short story. Content passages are clearly informational and are taken from such sources as science and social studies textbooks as well as from information-dense articles in newspapers and magazines. Practical passages are functional materials leading the reader to an immediate action — directions, reference tools, manuals.

Reading management is broken down into two major categories. Referencing skills include many of the things that might be covered in a traditional test of study skills — identifying appropriate resources, using dictionaries and tables of contents, etc. The category "Strategies" covers the metacognitive aspects of reading management, such as using structural or organizational cues in text and selecting appropriate strategies for different purposes and types of material.

It is perhaps in reading that the MEA tests are most nontraditional. In recent years, traditional reading tests have been increasingly criticized for a variety of reasons—e.g., the contrived nature of the reading passages which make them unlike the types of materials students would encounter in nontesting situations, the emphasis on specific comprehension skills resulting in asking questions that are frequently literal and often not important to the structure of the text, and the general inconsistency between testing practices and good reading instruction. The MEA reading tests have been commended for their consistency with current theory and research in reading and with good instructional practices in terms of prereading activities, the nature of the reading material, and the types and format of questions asked of students. Some

features of the MEA reading tests include:

* the use of purpose-setting statements intended to assist the reader in activating appropriate prior knowledge, selecting appropriate reading strategies, and reading for a purpose;
* the selection of passages of considerable length that provide a complete or intact text and more closely approximate materials students might be assigned in other situations;
* the emphasis on visual appeal (via artwork), high reader interest, completeness of text (even if excerpted), and quality writing (accomplished by extensive review of published materials);
* the use of several genres within the literary, content, and practical passage types;
* a focus on questions important for students to answer to fully comprehend or appreciate each passage and stressing inferential, rather than literal, comprehension; and
* attention to the metacognitive aspects of reading in the test questions.

## Writing

The objectives used to develop the tests and questionnaires for the Maine Educational Assessment are:

### Objective I — Comprehends and Manages the Writing Experience

> The writer will demonstrate the ability to generate a piece of writing and apply strategies that help him/her to produce and refine that writing.

> The writer will demonstrate the ability to organize and present information so that the writing fulfills its purpose and makes sense to its intended audience.

### Objective II — Makes an Individual Response

> The writer's voice is evident, and the writing demonstrates the writer's interest and involvement in the piece.

### Objective III — Conforms to Conventions

> The writer will aid others in reading his/her writing by using the conventions of standard edited American English: punctuation, usage, spelling, legibility, format, paragraphing, margins.

## Objective IV — Values Writing

Students will acquire an appreciation for the ways that writing can affect their lives by serving as:

> a source of enjoyment;
> an opportunity to expand understanding and fulfill personal goals;
> a means of acquiring knowledge and learning new skills;
> a major contributor to school and job success;
> an important influence on society.

The MEA tests will address the objectives above in a variety of ways. Students' writing skills will be measured directly through writing prompts eliciting samples of the students' writing. The student questionnaire will collect information on students' attitudes toward writing.

Each student will respond to one of the two prompts selected for each grade level. In previous years, writing prompts have called for narrative, descriptive, informational, expository, and persuasive writing. Each prompt clearly states a purpose and an audience, and some prompts specify prewriting activities. A full hour (45 minutes at grade 4) is devoted to producing each piece, and students have the opportunity to plan their writing strategy. The students are allowed to prepare a draft and edit it before transferring it to the booklet that is ultimately scored. Reference aids such as dictionaries and thesauruses are available to the students.

Writing samples are scored by Maine teachers and administrators at 3-day sessions. Each composition is scored in six attributes — topic development, organization, supporting detail, sentence variety, wording, and global mechanics — on a scale of 1 to 6 by two independent readers. Differences greater than one in the corresponding ratings of the two scorers are adjudicated by the table leader.

# Mathematics

The development of the mathematics portion of the MEA tests was guided by a content-by-process matrix. The content categories are listed below.

I. Numbers and Numeration

A. Numeration
B. Number Concepts
C. Operations - Whole Numbers
D. Operations - Fractions
E. Operations - Decimals

IV. Measurement

A. Appropriate Units
B. Unit Equivalents
C. Instrument Reading
D. Linear Measurement
E. Nonstandard Units

F. Operations - Integers
G. Percent
H. Properties

II. Variables and Relationships

A. Equations and Inequalities
B. Functions/Coordinate Systems

III. Geometry

A. Plane and Solid Shapes
B. Congruence and Similarity
C. Properties of Triangles
D. Properties of Quadrilaterals
E. Constructions
F. Sections of Solids
G. Perimeter, Area, and Volume
H. Rotations and Symmetry
I. Other Theorems and Relations

V. Problem Solving Skills

A. Understanding the Problem
B. Estimation/Reasonableness
C. Relevant Information
D. Strategies and Processes

VI. Other Topics

A. Probability
B. Statistics
C. Graphs, Tables, Charts
D. Logic
E. Operations w/Calculators

The cognitive process dimension includes computations, concepts, and routine and nonroutine applications. It serves primarily as a means of assuring that the items fitting into the content categories cover a range of cognitive processes and do not overemphasize processes at one level.

"Problem Solving Skills" does not mean simply word or story problems; they are included in most of the other content categories. Instead, it refers to a set of skills which may be applied while solving a problem, but which are not often tested themselves. "Strategies and Processes" includes questions asking students to identify the most appropriate strategies to use in situations without requiring them to actually solve the problems. Open ended, nonroutine word problems fitting other categories are hand-scored so that the strategies students use can be investigated.

Students will not be allowed to use calculators on the tests. A small scale study involving the actual use of calculators is planned for the fall of 1987 at Grade 8 and for the spring of 1988 at Grade 11.

The reporting categories for school level results include Numbers and Numeration, Variables and Relationships, Geometry, Measurement, Problem Solving, and Other Topics as well as the process categories of computation, concepts, routine applications and nonroutine applications. Individual student

scores will be reported for the process categories, with routine and nonroutine applications combined into one category.

## Science

The content outline used in the development of the science portion of the tests is shown below. These are also the reporting categories for the 1987-88 assessment.

I. Scientific Inquiry
   - A. Nature of Science/Scientific Investigation
   - B. Observing and Measuring
   - C. Analyzing and Interpreting Data

II. Life Sciences
   - A. Characteristics of Life
   - B. Systems/Functions
   - C. Ecology/Environment

III. Earth and Space Sciences
   - A. Astronomy
   - B. Climate and Weather
   - C. Geology/Oceanography

IV. Physical Sciences
   - A. Force and Motion
   - B. Energy
   - C. Matter

Again, a process dimension (knowledge, comprehension, application, and higher order) is used to assure that the test items cover a full range of cognitive processes. Since science will be assessed through matrix sampled questions only, individual student scores will not be reported. This year, because of the expanded coverage of science, scaled scores for schools will be reported for each of the categories and subcategories in the outline above. Also, within each of the four major categories, questions will be resorted and scores reported for two cognitive process levels — knowledge/comprehension and application/higher order.

## Social Studies

The reporting categories for school results in social studies have also been expanded. They include the categories and subcategories in the outline below:

I. Physical Environment (Geography)
   - A. Physical Geography
   - B. Cultural Geography

II. History
   - A. World History — Pre-19th Century
   - B. World History — 19th and 20th Century
   - C. U.S. History — Pre-20th Century
   - D. U.S. History — 20th Century

III. Political Science

A. Characteristics of Governmental Systems
B. Citizenship and Political Processes

IV. Economics

A. Concepts and Principles
B. Characteristics of Economic Systems

V. Sociology and Anthropology

A. Social Issues
B. Cultural Studies

VI. Process Skills

A. Reading and Translating Information
B. Analyzing and Evaluating Information

School scores will be produced for three additional categories — two process categories (knowledge/comprehension and higher order) and Maine Studies, a subset of the social studies questions.

## Humanities

The MEA humanities test is based on the following objectives framework:

| Humanities Area | Forms, Elements, and Techniques | Meaning and Purpose | Social/Historical Perspectives |
|---|---|---|---|
| Literature | | | |
| Visual Arts | | | |
| Performing Arts | | | |
| Language | | | |
| Religion/Philos. | | | |

Each row and each column in the matrix above constitutes a reporting category for school level results. Individual student scores will not be reported for humanities, because humanities will be assessed with matrix sampled questions only.

As in other content areas, items in the humanities matrix cover a wide range of cognitive processes. Additionally, the columns of the figure above represent progressively more involved understandings of the different areas within the humanities. "Forms, Elements, and Techniques" includes items dealing with

the recognition of various forms of literature, types or styles of art, and characteristics of different languages, religions, or philosophies. Items that associate tools or materials with an art form, or identify features or methods used in creating a literary or artistic work, would also be placed in this category. Items under "Meaning and Purpose" deal with the interpretation of literature, specific works of art, and philosophical concepts. Also covered are items identifying the purpose of various forms of literature and art and various religious practices, and items requiring students to compare and contrast types of literature, different works of art, differing forms of communication, and varying philosophical viewpoints. "Social and Historical Perspectives" items associate various aspects of the humanities with place or time in history or cultural origin. For example, they require that students associate famous authors/artists with their works, and place a variety of languages, religions, and philosophies or philosophers within the appopriate social reference or historical time frame. Influences of the humanities on society and history, and the effects of society and history on the humanities, are also covered.

# APPENDIX

## Concepts, Topics, and Skills Characterizing the Domains of Science, Social Studies, and Humanities

This appendix provides a more complete description of test content in the matrix sampled areas for which test questions themselves are not released to the schools. It should assist schools in better identifying areas of weakness suggested by assessment results. The lists provided below include samples of concepts, topics, and skills that exemplify items in each reporting category. The test items in a particular year's assessment are intended to represent the content domains well, but not necessarily to cover all of the entries in the lists. Test questions will change over the years.

There are minor variations in reporting subcategories across grade levels. Also, the concepts listed are not associated with specific grade levels. Although some may not be appropriate for inclusion in the curriculum at a particular grade, most of them are appropriate at varying levels of complexity. For example, aspects of photosynthesis could be as simple as "plants need water" or as complex as "water, light, chlorophyll and carbon dioxide are used to produce sugar and oxygen." At item review/selection meetings, the MEA content advisory committees determine whether particular concepts or topics are likely to have been covered by the time the students at a grade level take the tests.

## SCIENCE

### *Scientific Inquiry*

**Nature of Science/Scientific Investigation**
- perceptions of science and scientists
- capabilities of technology
- replication of experiments
- responsibility regarding harmful side effects
- design of experiments
- relevant information
- empirical vs. nonempirical evidence
- sampling
- experimental vs. control groups

**Observing and Measuring**
- sorting, categorizing, classifying
- sequencing
- observation vs. conclusion
- observation vs. interpretation
- quantities measured by instruments
- reading instruments
- measurement units
- measurement error
- data reduction — appropriate summary statistic

**Analyzing and Interpreting Data**
- circle, bar, line graphs
- tables/charts
- interpolation/extrapolation
- appropriate generalizations
- conclusions from data in graphs and tables

### *Life Sciences*

**Characteristics of Life**
- stages of development
- levels of organism organization (e.g., cells, tissues, organs)
- natural selection
- genetics/heredity
- biological classification
- basic life functions

**Systems/Functions**
- nutrition/basic food groups

- structure/function (animals)
- respiratory, circulatory, reproductive, nervous systems
- microorganisms
- causes/nature of diseases
- disease prevention/treatment
- structure/function (plants)
- photosynthesis
- plant reproduction
- decay

Ecology/Environment
- predator/prey relationships
- food chains/webs
- ecological balance
- ecosystems
- cycles (energy, water, carbon, oxygen)
- kinds of pollution
- accumulation of substances in food chain
- populations

## *Earth and Space Sciences*

Astronomy
- relative motions of bodies in space
- rotation/revolution
- relative distances in space
- gravitation
- types of heavenly bodies

Climate and Weather
- weather characteristics (wind, humidity, pressure, temperature/climate)
- forms of clouds and precipitation
- weather prediction/change (air movement, maps, role of past weather history and probability)
- weather instruments
- water cycle

Geology/Oceanography
- earth's history (formation)
- make-up of the earth (rock types, layers)
- landforms (mountains, valleys)
- changes in earth's surface (erosion, earthquakes, volcanoes)
- natural resources/energy sources and conservation
- water cycle
- motions of water (tides, currents, waves)
- concentrations of marine life, marine habitats
- water conditions (salinity, pressure, etc.)

## *Physical Sciences*

Force and Motion
- applications of Newton's laws
- friction
- acceleration due to gravity/ falling objects
- simple machines
- basic concepts/quantities (inertia, velocity, acceleration, force, work, energy)
- conservation of momentum/energy
- vector quantities (resultant forces, equilibrium)
- relative motion

Energy
- wave characteristics (amplitude, frequency, wavelength)
- sound, light, laser, electromagnetic waves
- light intensity, reflection, refraction, absorption
- heat/heat transfer
- electrical safety
- energy use/conservation
- conductivity, resistance, current
- simple circuits
- magnetism
- energy conversion

Matter
- characteristics of materials (density, hardness, magnetic)
- displacement
- conservation of matter
- structure/types of matter (atomic/molecular structure, elements, compounds, etc.)
- physical and chemical changes/reactions
- states of matter
- gas laws
- chemical formulas, equations
- fission, fusion, radioactivity
- combustion/oxidation

# SOCIAL STUDIES

## *Physical Environment*

Physical Geography
- place geography (Maine, United States, world)
- surface features (land/terrain/bodies of water)
- climate (regional climates, climate zones)
- vegetation and natural resource distribution

Human Geography

- population density and clustering
- influence of geography on politics, economics, culture
- man's adaptation to, use of, and protection of the environment

## *History*

**World History — Pre-19th Century**
- prehistoric humans
- early forms of transportation/ communication
- characteristics/influences of ancient civilizations (Greek/Roman)
- Middle Ages
- Renaissance period
- early exploration

**World History — 19th and 20th Century**
- England's Industrial Revolution
- 20th century events/people/conditions (e.g., major world conflicts)
- growth of third world nations

**U.S. History — Pre-20th Century**
- early North American inhabitants
- reasons for migration to new world
- European influence on early American life
- American Revolution (causes and results)
- U.S. Constitution
- slavery/13th Amendment
- North-South differences
- manifest destiny

**U.S. History — 20th Century**
- rise of U.S. as a world power
- social reform
- wars and major conflicts of the 20th Century
- postwar prosperity
- Great Depression
- the Cold War
- the Vietnam Era

## *Political Science*

**Characteristics of Governmental Systems**
- systems of government
- governing agencies (e.g., purpose/function of UN, U.S. State Department)
- structure of U.S. government
- roles/responsibilities/interaction of branches and levels of U.S. government

**Citizenship and Political Processes**
- political processes (electoral processes, checks & balances, creation of bills/laws, changes in interpretation of laws over time)
- citizenship (legal rights, duties/ responsibilities)

## *Economics*

**Concepts and Principles**
- economic terms (e.g., export, tariff, capital, depression)
- production methods
- supply and demand
- consumer behavior
- effects of industrial growth, specialization
- personal economics (earning and managing money)

**Characteristics of Economic Systems**
- differences among economic systems
- purpose of labor unions and laws
- role of U.S. government in U.S. and international economy

## *Sociology and Anthropology*

**Social Issues**
- social institutions (family, religion, education, government)
- social organization (stratification, groups)
- effect of social change on family
- changing roles of men and women
- role of education in our culture
- role of community helpers
- social behavior/conflict
- specialization/interdependence
- current social issues

**Cultural Studies**
- similarities/differences among cultures
- cultural traits, cultural universals, and cultural values
- cultural transmission

## *Process Skills*

**Reading and Translating Information**
- read maps and globes
- identify types of maps
- read/interpret graphs, tables, & charts

**Analyzing and Evaluating Information**
- evaluate and use appropriate reference materials
- recognize appropriate problem-solving strategies in social science contexts
- draw inferences from evidence
- identify types of information (fact, opinion, assumption, generalization) in social studies contexts (e.g., political speeches)
- evaluate arguments/evidence

# HUMANITIES

## *Literature*

- literary genre (folktale, poetry, myth, etc.)
- elements of literature (plot, theme, setting, etc.)
- literary techniques (metaphor, personification)
- genre and specific works associated with particular authors
- interpretation of literary selections
- tone/mood of literary selections
- author's purpose
- time periods associated with particular authors and works

## *Visual Arts*

- outstanding technical feature of a piece
- different artistic styles (e.g., realistic vs. abstract)
- tool(s) associated with a particular art form
- visual perspective
- primary colors
- original purpose of various art forms
- mood of a piece
- theme (common theme) of a piece(s)
- culture/time period associated with a particular work
- culture/time period associated with a particular architectural style

## *Performing Arts*

- musical instrument and families of instruments
- musical form associated with particular instrument
- musical symbols
- relation of melody to printed music
- characteristics/elements of various forms of performing arts
- art form associated with particular artist
- setting/character type inferred from selection of a dramatic piece
- purpose of art form (e.g., anthem)
- origin of art form (e.g., jazz)

## *Language*

- forms of communication
- fields associated with particular jargon
- time period associated with form of script
- origins of words
- characteristics of regional dialects
- impact of voice inflections on phrases
- impact of language(s) on interrelationships among cultures
- relationship between language and social assimilation
- predominance of particular languages

## *Religion*

- places of worship
- religions associated with specific holidays
- basic functions of religious leaders
- similarities of major religions
- purpose of religious music
- basis of mythology
- origins of major religions
- religious conflicts throughout history (e.g., Reformation)

## *Philosophy*

- meaning of philosophical phrases
- tenets of major philosophies
- culture/time period associated with particular philosophical viewpoints
- comparison and contrasting of philosophical views
- famous philosophers