

Essential Mathematics for Minimum Army Needs

Why?

Tests given to people drafted into the military in the early 1940s revealed low performance in many fundamental mathematics skills. These low performances (together with testimonials from respected military leaders, such as the letter from Admiral Nimitz in the 1942 Mathematics Teacher) provided momentum for establishing this Committee. Two premises for Committee action were that “the enlisted man has certain minimum mathematical needs and that the typical inductee does not have the training in mathematics which he needs.”

What?

Produced recommendations that dealt with “the improvement of instruction in mathematics” and “suggestions for setting up a program in the public schools and elsewhere.” The Committee also took on the task, not addressed by the Pre-Induction Committee, of outlining objectives of instruction for all men entering the Army whether or not they were currently in school. The goal was to then “determine those items in mathematics which should make up the minimum equipment of the inductee.”

Who?

Members of the committee:

Virgil S. Mallory, Montclair (N.J.) State Teachers College (**chair**)
Rolland R. Smith, Springfield, MA public schools
C. Louis Thiele, Detroit, MI public schools
F. Lynwood Wren, George Peabody College for Teachers
William A. Brownell, Duke University, consultant for the Civilian Pre-Induction
Training Branch, A .S. F.
John Lund, U. S. Office of Education
Giles M. Ruch, U. S. Office of Education

What was produced?

A report was completed and published in the Mathematics Teacher (October 1943). It had five general sections, beginning with a discussion of the nature of essential mathematics.

Nature of the Essential Mathematics

The committee first stated what the list of essential mathematics was and what it was not:

1. “This list does not constitute a course in mathematics.”
2. The topics listed reflect a minimum basis for inductees.
3. “This report is an extension of the report of the earlier U. S. Office of Education Mathematics Committee (The Pre-Induction Committee).” (This report was said to supplement the first one by focusing on the suggestions offered in the lower levels of the Special One-Year Course).

4. "The topics are appropriate objectives of instruction for all young men about to enter the Army."
5. "It is a fallacy to assume that enrollment in advanced high school courses in mathematics assures proficiency in the minimum essentials listed in this report."
6. This report has significance for instruction and therefore elementary teachers are urged to focus on certain recommendations in the report.
7. "This report does not sacrifice general education to the particular needs of the Army."
8. This report is not to be oversimplified; the reader should realize that more is called for than just computational competence. Two aspects of mathematical learning were recognized as being neglected: understanding and experience in application.
9. Men about to enter the Army must be educated in "the ability to meet quantitative problems effectively, confidently, and sensibly."

Outline for Essential Mathematics for Minimum Army Needs

The committee outlined the following topics as crucial components for minimum army needs (as taken directly from the report):

- A. Reading and Writing Arithmetical Symbols
- B. Counting (by 1's, 2's, 5's, and 10's to 500)
- C. Operations with Whole Numbers
- D. Operations with Common Fractions
- E. Operations with Decimal Fractions
- F. Part-Whole Relationships, with common fractions, decimal fractions, and percents
- G. Ratio and Proportion
- H. Powers and Roots
- I. Graphs and Maps
- J. Tables
- K. Formulas and equations
- L. Positive and Negative Numbers
- M. Measurement, including understanding of basic units
- N. Geometric Concepts
- O. Drawing and Construction
- P. Miscellaneous

Within each of these headings the committee outlined general topics of what should be taught in each section with many explicit military applications. Some examples are provided below (as taken directly from the report):

Part-Whole Relationships:

- Finding what part one number is of another. Used in the portion of a company that qualify in marksmanship.

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- Finding a number, given a part and its relative size. Used in calculating amount of product in Army baking operations.

Ratio and Proportion:

- Solving problems. Used in finding scales in aerial photographs.

Graphs and Maps:

- Interpreting maps and graphs. Used in discovering the location of artillery, the command post, hostile forces; determining the height of points on a terrain (from a map showing contour lines); scouting and reconnaissance; radio and signal communication.

Positive and Negative numbers:

- Used for indicating direction of flow of both alternating and direct current; machine gun firing tables; angle of sight instruments; calculating data for range cards on machine guns; determining direction' designating storage battery terminals.

General Suggestions with Respect to Instruction

1. Remedial instruction
Teachers need to realize their responsibilities to supplement their students' arithmetical competence. The teachers need to remedy this not by just assigning more practice but by observing students carefully and discovering what exactly are their deficiencies.
2. New concept
Some suggestions on how to teach new concepts were offered, along with one example, development of concepts of units of number. They recommended that instruction should be from "concrete to abstract and back again to concrete".
3. Applications
This section focused on the aspect of instruction that was "back again to concrete" with ample experiences in application; through this students could develop their mathematical sense, which is needed not only for army but also for civilian life.
4. Importance of meaning
This section posed several commonly asked questions from teachers and provided answers to each of the questions. A summary of the answers is provided below.
 - Although students can perform certain tasks without understanding the meaning of the concept, they can't transfer the concept into other situations.
 - Meaning should certainly be taught in the lower grades, but if it is not acquired in such grades, teachers need to teach for understanding by their students at all levels.
 - Members of the committee were not certain about whether all the students can acquire the meaning of concept or not. In such cases, they suggested a focus more on skills.

Specific Suggestions with Respect to Instruction

In each of the previous sections, the committee provided teachers with specific examples of problems students should be given and how the topics should be approached. In the detailed suggestions there is a great emphasis on number sense in approximation and estimation as well as problem solving. Many of the applied problems provided by the committee emphasize a connection to Army applications. Some examples are provided below (as taken directly from the report):

Operations with Whole Numbers:

- Approximation and estimation:
 - The ability to detect absurdities and to know what are reasonable answers for given number relationships is important in the Army.
- Problem-solving:
 - If only 37 men of a detail of 72 report on time, how many are late?
 - If you can pack 8 shells in a box, how many boxes will be needed for 256 shells?

Ratio and Proportion:

- The soldier is confronted with many situations like the following: “25% of the gasoline must be held in reserve,” “10% of all parachutes on hand must be kept packed,” and “The recipe will provide for 25 men and must be increased in proportion to the number in the mess.”

Setting Up the Instructional Program

The committee divided up the instructional program into two parts: student and evaluation. Within the student section the committee had three concerns: making sure mathematics majors had the necessary ideas and skills; taking appropriate steps to group students into those about to be inducted and those leaving school for work and setting up appropriate course work for the designated groupings; and finally inductees out of school should be given ample opportunity to make up their mathematical deficiencies.

Within the evaluation section the committee was concerned with having appropriate assessment methods to determine the mathematical knowledge of prospective inductees. The committee recognized that “evidence of his learning is of course secured through observation, and naturally the quality of observation will vary with the competence of the observer.” Consequently the committee provided the suggestion that “competence in observation is possible when the observer knows what he is looking for and what constitutes sound evidence.”

Significance of the Report

Echoed a frequent call for greater understanding of mathematics and the need for students to be able to apply that knowledge in different problem solving situation.

Provided a basis of mathematical instruction to ensure that Army needs were met.

Recommended a course of action for inductees who were already out of school, namely, courses in public schools in late afternoon or evening.

Recommended that agencies promoting pre-induction training should be “encouraged and multiplied.”

Emphasized the need for real world/military connections to theoretical mathematics in secondary education.

Emphasized the need for an assessment tool to ensure that a minimum level of mathematics was learned.

References

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Reeve, W. D. (1942). The importance of mathematics in the war effort. *Mathematics Teacher*, 35(2), 88-89.