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⑨ RESEARCH MEMORANDUM 55-3

⑥ CONSTRUCTION OF ARITHMETIC REASONING ITEMS FOR THE ARMED FORCES QUALIFICATION TEST, AFQT-5 AND -6.

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CONSTRUCTION OF ARITHMETIC REASONING ITEMS FOR THE
ARMED FORCES QUALIFICATION TEST, AFQT-5 AND -6

I. AUTHORITY FOR PROJECT

Construction and implementation of Forms 5 and 6 of the Armed Forces Qualification Test were authorized by the Assistant Secretary of Defense, in a memorandum to the Assistant Secretaries of the Army, Navy, and Air Forces, dated 3 March 1954. The memorandum directed that action be taken to insure the development of AFQT-5 and -6 with a target date for introduction of these forms by 1 January 1956. It was further directed that such development be undertaken through research participation by all Services, with the Department of the Army designated as Executive Agent for this project.

To coordinate the interservice research participation, there was established the Armed Forces Committee for Monitoring Development of AFQT-5 and -6. At a meeting of that committee (21 April 1954) it was agreed that there would be prepared 150 experimental items for each of four item pools (vocabulary, arithmetic reasoning, tool functions, and spatial relations). Responsibility for construction of the vocabulary and arithmetic items was accepted by the Army, with assistance to be furnished by the U. S. Marine Corps.

II. PURPOSE OF REPORT

The present report is concerned with construction of the arithmetic reasoning items.

III. SPECIFICATIONS FOR THE TESTS

The Assistant Secretary of Defense, in addition to setting the target date of 1 January 1956 for introduction of the new forms and specifying research participation by all Services, imposed other conditions on the development of AFQT-5 and -6. These other conditions were that:

1. greater emphasis be placed on the selection function of the test by increasing discrimination below the 31st percentile
2. the new forms be standardized on a group representative of the World War II full mobilization population
3. the new forms be parallel to AFQT-1, -2, -3, and -4

IV. SPECIFICATIONS FOR ARITHMETIC ITEMS

The monitoring committee approved the following set of specifications for arithmetic reasoning items:

1. Arithmetic reasoning, rather than computational ability, was to be reflected in the correct alternatives and in as many distractors as possible. All computations were to be simple, involving manipulation of numbers in multiples of 5 or 10 when possible.
2. Leads were to be as short, direct, and low in verbal level as possible.
3. Item content was to avoid use of terminology or problem situations peculiar to military life.
4. All situations were to be plausible.
5. Items were to be made as free as possible of cultural and geographical bias.
6. Item content was to be in good taste.
7. The position of the correct alternatives was to be randomized throughout each item pool.

In addition, the committee approved the distribution of item difficulties desired. For the arithmetic items, this distribution was broken down in PRB, by the arithmetic process assumed to be involved. This target distribution is presented in Table 1.

Table 1

DISTRIBUTION OF ITEMS BY ESTIMATED DIFFICULTY

Raw p-value (% men scoring R)	No. of experi- mental items
.90-.96	12
.82-.89	24
.75-.81	40
.67-.74	24
.60-.66	24
.52-.59	10
.45-.51	10
.25-.44	6
	150

V. CONSTRUCTION OF ITEMS

The items were written in pairs, with pair members judged to be comparable in estimated difficulty level and arithmetic process involved. The original quota was a 150-item pool. During the course of the conferences between Army and Marine Corps technicians, however, it became apparent that it was possible to subject these items to a preliminary tryout, thereby obtaining much better estimates of item difficulties. Accordingly, 200 items were constructed for this preliminary tryout, to allow for selection of the best 150. One hundred were written and received by Army technicians, and one hundred by the Marine Corps technicians.

The preliminary tryout consisted of administration of the items to a sample of 200 Marine recruits. The items were scored in FRB. Scores for these recruits on AGCT-3a or -3b were also obtained. The recruits were divided into high and low groups on the basis of their AGCT scores, and item difficulties computed for each level and the total group.

Those items which matched the desired distributions of difficulty and which showed p-values consistent with reference test groupings were selected for inclusion in the 150-item pool.

On the basis of the tryout, 75 pairs of items were selected which showed highest discrimination on the AGCT reference test, with the required distributions of difficulty and arithmetic process, and which provided a spread in context of problem situations.

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