DOCUMENT RESUME

ED 334 233 TM 016 749

AUTHOR	Stricker, Lawrence J.; Alderton, David L.
TITLE	Response Latency Measures for Biographical Inventories. Technical Report.
INSTITUTION	Educational Testing Service, Princeton, N.J.
SPONS AGENCY	Office of Naval Research, Arlington, Va.
REPORT NO	ONR-RR-91-19
PUB DATE	Mar 91
CONTRACT	N00014-89-K-0072
NOTE	71p.
PUB TYPE	Reports - Research/Technical (143)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	Adults; *Biographical Inventories; *Computer Assisted Testing; Males; *Military Personnel; Predictive Validity; *Reaction Time; *Scoring; Test Items; *Test Validity; Weighted Scores
IDENTIFIERS	*Armed Services Applicant Profile; Navy

ABSTRACT

The usefulness of response latency data for biographical inventory items was assessed for improving the inventory's validity. Focus was on assessing whether weighting item scores on the basis of their latencies improves the predictive validity of the inventory's total score. A total of 120 items from the Armed Services Applicant Profile (ASAP) were administered via computers to 1,090 male Navy recruits at the Recruit Training Center in San Diego (California); the regular score, latency-weighted scores, and measures of deviant latencies were obtained. The latency-weighted scores did not improve the ASAP's validity in predicting 6-month retention beyond that obtained with the regular score; the deviant latency measures did not function as suppressor or moderator variables to increase the ASAP's validity. Subgroups of items with differing latencies varied systematically in their internal-consistency reliability (with increased reliability for subgroups with shorter latencies), and a small subgroup of items with moderate latencies was almost as valid as the regular score, suggesting that latency data may be useful in writing and selecting inventory items. Five tables and four graphs complement the study. A 34-item list of references is included. (Author/SLD)

RR-91-19-ONR

RESPONSE LATENCY MEASURES FOR BIOGRAPHICAL INVENTORIES

Lawrence J. Stricker
Educational Testing Service

David L. Alderton
Navy Personnel Research and Development Center

This report was prepared under the Navy Manpower, Personnel, and Training R & D Program of the Office of the Chief of Naval Research under Contract N00014-89-K-0072.

Educational Testing Service
Princeton, New Jersey

March 1991

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION
Unclassified

1b. RESTRICTIVE MARKINGS

2a. SECURITY CLASSIFICATION AUTHORITY

2b. DECLASSIFICATION / DOWNGRADING SCHEDULE

3. DISTRIBUTION / AVAILABILITY OF REPORT
Approved for public release; distribution unlimited.

4. PERFORMING ORGANIZATION REPORT NUMBER(S)

5. MONITORING ORGANIZATION REPORT NUMBER(S)

6a. NAME OF PERFORMING ORGANIZATION
Educational Testing Service

6b. OFFICE SYMBOL *(If applicable)*

7a. NAME OF MONITORING ORGANIZATION
Cognitive Science Program
Office of Naval Research (Code 1142CS)

6c. ADDRESS *(City, State, and ZIP Code)*
Princeton, NJ 08541

7b. ADDRESS *(City, State, and ZIP Code)*
800 North Quincy Street
Arlington, VA 22217-5000

8a. NAME OF FUNDING / SPONSORING ORGANIZATION

8b. OFFICE SYMBOL *(If applicable)*

9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
N0014-89-K-0072

8c. ADDRESS *(City, State, and ZIP Code)*

10. SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO	PROJECT NO	TASK NO	WORK UNIT ACCESSION NO
0602233N	RM33M20		

11. TITLE *(Include Security Classification)*
Response Latency Measures for Biographical Inventories (Unclassified)

12. PERSONAL AUTHOR(S)
Stricker, Lawrence J. Educational Testing Service
Alderton, David L. Navy Personnel Research and Development/ Center

13a. TYPE OF REPORT
Technical

13b. TIME COVERED
FROM 3/1/89 TO 12/31/90

14. DATE OF REPORT *(Year, Month, Day)*
1991, February 28

15. PAGE COUNT
55

16. SUPPLEMENTARY NOTATION
Supported by the Office of the Chief of Naval Research Manpower, Personnel, and Training R & D Program

17. COSATI CODES

FIELD	GROUP	SUB-GROUP
05	09	

18. SUBJECT TERMS *(Continue on reverse if necessary and identify by block number)*
Response latencies, inventories, attrition, screening recruits, Armed Services Adaptability Profile

19. ABSTRACT *(Continue on reverse if necessary and identify by block number)*

This study assessed the usefulness of response latency data for biographical inventory items in improving the inventory's validity. The Armed Services Applicant Profile (ASAP) was computer administered to Navy recruits, and the regular score, latency-weighted scores, and measures of deviant latencies were obtained. The latency-weighted scores did not improve the ASAP's validity in predicting six-month retention, when used instead of or in addition to the regular score, and the measures of deviant latencies did not function as suppressor or moderator variables to improve the ASAP's validity. But subgroups of items with differing latencies varied systematically in their internal-consistency reliability (with increased reliability for subgroups with shorter latencies) and a small subgroup of items with moderate latencies was almost as valid as the regular score, suggesting that latency data may be useful in writing and selecting inventory items.

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS

21. ABSTRACT SECURITY CLASSIFICATION
Unclassified

22a. NAME OF RESPONSIBLE INDIVIDUAL
Charles E. Davis

22b. TELEPHONE *(Include Area Code)*
703-696-4046

22c. OFFICE SYMBOL
ONR 1142CS

DD Form 1473, JUN 86 Previous editions are obsolete SECURITY CLASSIFICATION OF THIS PAGE

S/N 0102-LF-014-6603

Unclassified

Response Latency Measures for Biographical Inventories

Lawrence J. Stricker
Educational Testing Service

David L. Alderton
Navy Personnel Research and Development Center

Technical Report

February 1991

This report was prepared under the Navy Manpower, Personnel, and Training R & D Program of the Office of the Chief of Naval Research under Contract N00014-89-K-0072. Reproduction in whole or part is permitted for any purpose of the United States Government. Approved for public release; distribution unlimited.

Abstract

This study assessed the usefulness of response latency data for biographical inventory items in enhancing the inventory's validity. The Armed Services Applicant Profile (ASAP) was computer administered to Navy recruits, and the regular score, latency-weighted scores, and measures of deviant latencies were obtained. The latency-weighted scores did not improve the ASAP's validity in predicting six-month retention, when used instead of or in addition to the regular score, and the deviant latency measures did not function as suppressor or moderator variables to increase the ASAP's validity. But subgroups of items with differing latencies varied systematically in their internal-consistency reliability (with increased reliability for subgroups with shorter latencies), and a small subgroup of items with moderate latencies was almost as valid as the regular score, suggesting that latency data may be useful in writing and selecting inventory items.

Response Latency Measures for Biographical Inventories

Recent theoretical and empirical work in personality and social psychology, coupled with the advent of computerized testing, raises the real possibility of improving the validity of personality, interest, and biographical inventories by administering them via computer and using information about latency of responding to the items to modify conventional scoring techniques.

Response latencies on personality inventory items and personality-trait adjectives have been extensively studied since the 1970s. A key finding is that items with long latencies are unstable: the responses to these items tend to change on retest. In itemmetric studies, latencies and the proportion of changed responses (over a four-week interval) correlated .21 to .41 for MMPI (Hathaway & McKinley, 1951) items (Dunn, Lushene, & O'Neil, 1972), latencies and changed responses (over a one-week period) correlated .36 for Personality Research Form (PRF; Jackson, 1984) items (Holden, Fekken, & Jackson, 1985), and latencies and changed responses (over a one-month period) correlated .49 for Basic Personality Inventory (BPI; Jackson, 1989) items (Holden & Fekken, 1990).[1] (But in an itemmetric study that used changed responses on immediate retesting, latencies and the Ambdex index [Goldberg, 1963], a measure of instability, correlated -.05 [not significant] for PRF items [Rogers, 1973].) In experiments on individual differences, the PRF items that each subject changed on retest (immediately in one experiment; after a one-week period in the other) were predicted significantly better than chance on the basis of which items had the longest latencies for him or her during the initial administration (Fekken & Jackson, 1988).

Several otherwise divergent conceptualizations are alike in suggesting that long latencies for inventory items reflect difficulty in responding.

Some of the conceptualization are based on item characteristics, and others on the interaction between individual differences and item characteristics (Fekken & Jackson, 1988). The item characteristic conceptualizations argue that the difficulty comes about because the item is hard to understand--unreadable, ambiguous, etc. (e.g., Dunn et al., 1972; Hanley, 1962). The conceptualizations concerned with the interaction between individual differences and item characteristics contend that the difficulty arises because (a) the person has trouble in applying the item to himself or herself--the item may deal with matters that are unfamiliar or unknown to the person, or the different response alternatives to the item may appear equally descriptive of him or her (e.g., Kuncel, 1973; Markus, 1977; Rogers, 1974a, 1974b) or (b) the items may arouse emotions (e.g., Gilbert, 1967; Temple & Geisinger, 1990).

The observed link between the response latency of personality items and the items' instability implies that the items' latencies are also associated with the items' validity, especially their predictive validity--the items with the longest latencies not only being the least stable but also the least valid over time. The findings in the two investigations that bear on this issue are inconsistent. In one study (Holden et al., 1985), latencies for PRF items correlated -.22 with a concurrent validity criterion (a composite of self-ratings, self-reports on an adjective checklist, and preference ratings), but in a second investigation (Holden & Fekken, 1990), latencies for BPI items correlated -.11 (not significant) with another concurrent validity criterion (ratings by clinicians). However, the findings of these studies may be affected by the dichotomous format of the items: items with extreme endorsement proportions tend to be more stable and less valid (Goldberg,

1963). Furthermore, these results were based on concurrent criteria, and the consequences of the items' instability would be more pronounced if predictive criteria were used.

The purpose of the present study was to determine whether the findings about the connection between item latencies and item instability can be used to improve an inventory's validity. More specifically, the main goal was to assess whether weighting item scores on the basis of their latencies improves the predictive validity of the inventory's total score. A secondary aim was to assess whether measures that reflect the extent to which subjects' latencies are deviant function as suppressor or moderator variables to increase the validity of the inventory's total score. The notion is that deviant latencies reflect an unusual pattern of responding to the inventory, stemming from idiosyncratic difficulties with certain items, poor test-taking attitudes, and other variables that attenuate validity. Hence using measures of deviant latencies to suppress this invalid variance or to exploit their interaction with the inventory's score should increase validity.

Method

Overview

One hundred and twenty items from the Armed Services Applicant Profile (ASAP), a biographical inventory, were computer administered to Navy recruits (all men), and the subjects' response choices and response latencies were recorded. The regular score for the ASAP and three kinds of latency-weighted scores were obtained: (a) regular scores for subgroups of items with different latencies, for optimal weighting by standard multiple-regression methods; (b) item scores directionally weighted by their latencies (i.e., less weight for items with relatively long latencies); and (c) item scores

nondirectionally weighted by their latencies (i.e., less weight for items with either relatively long or relatively short latencies). Measures of deviant latencies and, for exploratory purposes other suppressor/moderator variables were also obtained. Data for the criterion, retention in the Navy for six months, was subsequently secured.

ASAP

Background. The ASAP (Trent, Quennette, & Pass, 1989) is designed to predict the adjustment of enlisted personnel to military service. The final version of the ASAP consists of two 50-item alternate forms drawn from an initial pool of 170 heterogeneous items chosen for their potential relevance to adjustment. The items have three to five alternatives, and the alternatives are separately scored with weights of 1 to 3 that have been empirically derived to predict retention at 21 months of service. The items encompass six factors (nondelinquency, work orientation, work ethic, academic achievement, social adaptation, and athletic involvement).

The inventory's predictive validity against retention criteria has been extensively studied, using a cohort of applicants for active duty in all the armed services. The present form of the ASAP or earlier forms (with 50 to 130 items) correlated .18 to .20 with retention at 6 months (T. Trent, personal communication, August 1986), .21 with retention at 21 months (Trent et al., 1989), and .27 with retention at 36 months (Trent, 1989). The internal-consistency reliability was .71 to .76 for 50-item forms (Trent et al., 1989, 1990) and .77 for 125 item forms (T. Trent, personal communication, December 1987).

Items. A set of 120 items was available for this study. Twenty-six of the other 50 items in the initial pool had been dropped previously because

they concerned circumstances beyond the respondent's control, they might involve ethnic or social class bias, they were intrusive, or they asked about the type of high school credential (T. Trent, personal communication, October 27, 1988). The additional 24 items were eliminated for this study because they duplicated remaining items.

Minor editorial changes were made in the 120 retained items to achieve a consistent format and to eliminate unnecessary instructions (e.g., "Pick the main one"), and the items were arranged in random order.

Because the current item weights for the ASAP are unavailable for some of the 120 items and are based on retention for 21 months rather than the six-month period used in this study, new item weights were obtained, using the same procedures and the same cohort data (N=13,172 to 26,857) employed in deriving the current weights (Trent et al., 1989; M. A. Quennette, personal communication, January 1989), but for a six-month period.

In brief, a modification of the "horizontal percent" method (Stead & Shartle, 1940) for deriving empirical weights for biographical items was employed. The percentage of applicants retained was computed for each alternative for the 90 items common to the two original 130 item forms of the ASAP. The distribution of these percentages was trichotomized, and alternatives with percentages in the top third were given a weight of 3, alternatives in the middle third a weight of 2, and those in the bottom third a weight of 1. These weights were also given to the alternatives for the items unique to each form. An exception was made for alternatives indicating that the respondent did not graduate from high school: these alternatives were assigned a weight of 1, regardless of their actual weight, to make the

ASAP independent of high school diploma status for policy reasons. (Only one of the 120 items had an alternative that was altered for this reason.)[2]

Computer administration. The paper-and-pencil version of the ASAP was adapted for computer administration via the same Hewlett Packard Integral Personal Computer used in the Accelerated Computerized Adaptive Testing--Armed Services Vocational Aptitude Battery system (Tiggle & Rafacz, 1985). The computer-adapted version of the ASAP was designed to be as close as possible to the original one in all important respects.

The computer keyboard was simplified, consisting of numerical keys for entering the subject's identification number; keys labeled A, B, C, D, and E for response choices; an Enter key; and a Help key. The subject chose a response and recorded it by pressing the Enter key. The response could be changed at will before the Enter key was pressed. After the Enter key was pressed, the next item was presented, and the subject could not return to the previous item or earlier ones. The subject could seek assistance from the proctor by pressing the Help key and raising his hand.

The pertinent instructions follow:

> Read each question and all of its possible answers carefully, then select the one answer that is best or most appropriate for you....You should work quickly but be as accurate as you can. Your answers to some of these questions may be verified for accuracy and honesty.

Subjects were not informed that their latencies were being recorded.

The following information was recorded for each item:

1. The response choice.
2. The number of times that the response was changed.

3. The latency (in hundredths of a second) between the time that the item was presented and the Enter key was pressed.

4. The number of times that the Help key was used.

ASAP measures. The regular ASAP score (the sum of the regular item scores) and three kinds of latency-based ASAP scores were secured. The latency-based scores employed standardized latencies, and two versions of each score were obtained. (Items for which the subject used the Help key were excluded in standardizing the latencies and in the latency-based scores; items for which the subject changed his responses were included in the standardization and in the scores because of the prevalence and relevance of changed items.)

One version of the scores, using double-standardized latencies to eliminate the main effects of individuals and items (e.g., Popham & Holden, 1990), reflected conceptualizations concerned with the interaction between individual differences and item characteristics.

First, items were standardized to eliminate item differences associated with readability, ambiguity, and other characteristics. For this purpose, "interquartile deviations" were computed: (Actual Latency-Sample Median)/ Sample Interquartile Range. This nonparametric procedure (Tukey, 1977) was employed, instead of the conventional procedure, to reduce the effects on the standardization of the extreme skewness in the latency data. Note that this linear transformation does not distort the real-time character of the latency data (Pachella, 1974).

Then, using these interquartile deviations, each subject's latencies were standardized to eliminate individual differences associated with reading speed, reaction time, and similar characteristics. For this purpose, "double-

standardized interquartile deviations" were computed: (Interquartile Deviation-Subject's Median)/Subject's Interquartile Range.

The other version of the scores, employing single-standardized latencies to eliminate the main effects for individuals, reflected conceptualizations linked with item characteristics. Using the actual latencies, each subject's latencies were standardized to eliminate individual differences. "Interquartile deviations" were computed: (Actual Latency-Subject's Median)/Subject's Interquartile Range.

The three latency-based ASAP measures follow:

1. Item subgroup scores: mean regular item score for each of 10 subgroups of 12 items, the subgroups varying in their latencies, and the items in the subgroups differing from subject to subject. For example, Subgroup 1 had the items with the largest interquartile deviations (the longest latencies) for each subject, and Subgroup 10 the items with the smallest interquartile deviations (the shortest latencies). When an item was excluded for a subject because the Help key was used, his Subgroup 10 had the 11 items with the smallest interquartile deviations.)

Ten groups of items were used to achieve adequate reliability while permitting an examination of subsets of items with extreme latencies. The scores were intended to be combined by multiple regression methods that weight the scores for maximum validity in predicting the retention criterion.

2. Directionally weighted item score: the mean of the item scores that are directionally weighted by their items' corresponding latencies. Each subject's items were classified into nine categories on the basis of the interquartile deviations, ranging from -.81 or more (the shortest latencies) to 2.00 or more (the longest latencies). His regular score for each item was

shrunk towards the mean for the sample, depending on the extremeness of the item's latency (items with very large interquartile deviations, indicative of long latencies, were shrunk the most) and the distance between his score and the sample mean. (See Table 1.) The subject's shrunken item score was calculated as follows: Subject's Item Score + Shrinkage Rate (Sample Mean - Subject's Item Score). For example, suppose a subject had an interquartile deviation of -.2 and a score of 1 for an item, and the mean item score was 3. His directionally shrunken score would be 1 + 25% (3 - 1) = 1.5.

Nine categories were chosen to provide a sufficient range of adjustments in the item scores. The nine represent equal intervals for the interquartile deviations (except for the intervals at each end--the interval of 2.00 or more at the high end corresponds to an "outside" outlier; Tukey, 1977).[3] The rates of shrinkage for the intervals were in equal steps, going from 100% for the lowest interval to 0% for the highest. The basic rationale for this weighting procedure is that the score is invalid for an item with a very long latency, and hence the best estimate of this score is the sample mean. Thus the longer the latency, the more the item's score is shrunk to the mean.

3. Nondirectionally weighted item score: the mean of the item scores that are nondirectionally weighted by their latencies. This score was computed in the same way as the directional score, except that items with latencies at either extreme (very large interquartile deviations, indicative of long latencies, and very small interquartile deviations, indicative of short latencies) were shrunk the most. (See Table 1.) For example, again suppose a subject had an interquartile deviation of -.2 and a score of 1 for an item, and the mean item score was 3. His nondirectionally shrunken item score would be 1 + 50% (3 - 1) = 2.0.

This measure used the same nine intervals as the directionally weighted item score, and its rates of shrinkage were in equal steps from 0% to 100% to 0%. The rationale is also similar: the score is invalid for an item with either a very long or a very short latency, and hence the more extreme the latency is in either direction, the more the item's score is shrunk to the mean.

This nondirectional measure is ad hoc, included on the basis of preliminary results with the double-standardized item subgroup scores, which exhibited trends towards lower reliability and validity for scores with either extremely short latencies or extremely long latencies.

Insert Table 1 about here

Deviant latency measures. Four measures of deviant latencies were also obtained (all excluded items for which the subject used the Help key):

1. The product-moment correlation (transformed to Fisher's Z) between a subject's actual latencies and the sample's median actual latencies. This is an index of the correspondence between the subject's and the sample's latencies.

2. The absolute difference between the subject's and the sample's median interquartile deviation for items. This is an index of the deviation between the subject's and the sample's average latencies.

3. The subject's interquartile range for item interquartile deviations. This is an index of the variability of the subject's latencies.

4. The number of subject's double-standardized interquartile deviations of ?.5 or more. This is an index of outlying latencies (an interquartile deviation of 3.5 defines a "far out" outlier; Tukey, 1977).[4]

Other Measures

Several measures were included, for exploratory purposes, as suppressor/moderator variables. Two were also used in screening the sample (Maximum Number of Changes Per Item and Effort on Test), attenuating their value as suppressor or moderator variables to some extent.

Two measures were secured from the computer administration of the ASAP (both excluded items for which the subject used the Help key):

1. Proportion of items changed. This is a control for individual differences in latencies associated with changes in response.

2. Maximum number of changes per item. This is an index of test-taking attitudes.

Several measures were obtained from a paper-and-pencil questionnaire completed at the end of the testing session:

1. Effort on test. This is the sum of the standard scores for three variables:

a. At the beginning of the test, how hard did you try? Tried Very Little (1)...Tried Very Hard (4).

b. At the end of the test, how hard did you try? Tried Very Little (1)...Tried Very Hard (4).

c. Overall, how hard did you try to do on the test? Tried Very Little (1)...Tried Very Hard (4).

2. Tiredness during test. This is the sum of the standard scores for two variables:

a. How tired did you feel at the beginning of the test? Extremely Tired (7)...Extremely Rested (1).

b. Overall how tired did you feel at the end of the test? Extremely Tired (7)...Extremely Rested (1).

3. Computer use. This was derived from the following question: Within the last year, how often have you used a computer? Never, or 1 to 10 times (1)...31 or More Times (4).

In addition, the Armed Services Vocational Aptitude Battery (ASVAB; U.S. Department of Defense, 1984) Paragraph Comprehension scale score was obtained from the subjects' records. (The ASVAB was completed when the subjects applied for enlistment.) This is a 15-item measure of reading comprehension.

Criterion

The criterion was completion of six months (i.e., 180 days) of active service (or separation for "nonpejorative" reasons during that period: officer commission, breach of contract by the service, death, or early release), calculated from service entry date. This operational definition of retention is adapted from the one used in previous ASAP research (Trent et al., 1989).

Procedures

The ASAP, followed by one or more experimental cognitive tests, was computer administered to groups of approximately 30 subjects from February to May 1989. The questionnaire about test-taking attitudes and related matters was completed at the end of the session. The ASAP administration took approximately a half hour, and the entire administration about two and a half hours. The testing room held a battery of 34 personal computers.

Sample

The sample consisted of 1,090 Navy recruits (all men) at the Recruit Training Center (San Diego).

All recruits in the available units were asked to volunteer to participate in the study, but recruits who were not in the SAM or TAR programs (reservists with limited active-duty obligations) were given preference. (SAM and TAR recruits were not part of the study population.) The recruits were instructed that the test results would not affect their subsequent assignments or become part of their official records.

The ASAP was administered to a total of 1,493 subjects. Forty-two subjects were eliminated because information was unavailable for most or all of their pertinent variables. An additional 136 subjects not part of the study population were excluded for one or more of these reasons:

1. They were in the SAM program (no subjects were in the TAR program).

2. They had prior military service (or information about this matter was missing).

3. They took the ASAP more than 15 days after service entry (or this information was missing).

4. They had a dominant language other than English.[5]

The remaining 225 subjects were eliminated because of their test-taking behavior or attitudes. This was done in two stages for the 1,315 subjects not already excluded. First, 122 subjects were dropped for either of two reasons:

1. They used the Help key for more than one item.

2. They reported on the paper-and-pencil questionnaire that they tried "Very Little" in the testing session (either at the beginning, at the end, or overall, or this information was missing).

Second, of the remaining subjects, 103 were eliminated for any of these reasons:

1. They made more than five changes in their responses to an item. This corresponded to an interquartile deviation of 3.5 in the distribution for this variable--a "far out" outlier;

2. They had a maximum double-standardized interquartile deviation of 10.98 or more. This corresponded to an interquartile deviation of 3.5 in the distribution of maximum interquartile deviations--a "far out" outlier.

3. They had a minimum actual latency of 2.21 seconds or less. This was the latency by the fastest .5% of the sample to the item with the shortest latencies, a criterion for improbably short latencies associated with premature responding (Jensen, 1985).

Analyses

Internal-consistency reliability was estimated by Coefficient Alpha for the regular ASAP score and the directionally and nondirectionally weighted item scores and by the intraclass correlation (Shrout & Fleiss, 1979, Case 1 for mean ratings) for the item subgroup scores..

The product-moment intercorrelations among the variables were computed. (Paragraph Comprehension scores were unavailable for 32 subjects, and the sample mean was substituted for the missing scores.)

A series of regression analyses of the four kinds of ASAP measures was carried out against the retention criterion. The comparative validity of the measures was appraised from the zero-order correlations of the regular ASAP score, nondirectionally weighted item score, directi›ıally weighted item score, and the multiple correlation of the item subgroup scores.

The incremental validity of the latency-based measures when combined with the regular ASAP score was assessed by hierarchical regression analyses (Cohen & Cohen, 1983): the zero-order correlation for the regular ASAP score was compared with the multiple correlation for the regular ASAP score plus the latency-based measure. This analysis was done separately for each latency-based measure. (In the analyses for the item subgroup scores, the scores were treated as a set, and Subgroup 10 was excluded to avoid collinearity between the regular ASAP score and the subgroup scores.)

The ability of the deviant latency measures and the other variables to suppress or moderate the validity of the regular ASAP score and the latency-based ASAP measures was also assessed by hierarchical regression analyses A suppressor effect was evaluated by (a) a comparison of the zero-order or multiple correlation for the ASAP measure with the multiple correlation for the ASAP measure plus the suppressor/moderator variable and (b) a comparison of the corresponding zero-order correlation and partial-regression weights for the suppressor/moderator variable, if the first comparison revealed a significant difference between the two correlations. (When suppression exists, the regression weight for a variable falls outside the boundaries set by its zero-order correlation and zero; Cohen & Cohen, 1983). These analyses were done separately for each ASAP measure. (In the analyses of item subgroup scores, the ten scores were treated as a set.)

A moderator effect was evaluated by a comparison of the multiple correlation of the ASAP measure and the suppressor/moderator variable with the multiple correlation for the two variables plus their product term (the latter representing the interaction between the ASAP measure and the suppressor/

moderator variable). In common with the suppressor analyses, these moderator analyses were done separately for each ASAP measure, and the item subgroup scores were treated as a set.

Results

Retention Criterion

The retention rate was 91.2%: 994 subjects of the 1,090 subjects completed six months of active service (or separated for nonpejorative reasons),[6] comparable to the 91.3% retention rate for the same time period in previous ASAP research (T. Trent, personal communication, August 1986).

The reasons for the 96 subjects' attrition, based on the Interservice Separation Codes, are reported in Table 2. The major reasons were fraudulent entry (28.1%), erroneous enlistment or induction (25.0%), and trainee discharge (21.9%).

Given the extreme split in the retention criterion, the maximum product-moment correlation with it is .57 (McNemar, 1962).

Insert Table 2 about here

Reliability of ASAP Measures

The internal-consistency reliability of the regular ASAP score and the latency-based ASAP measures is reported in Table 3. The reliability of the item subgroup scores is also shown in Figures 1 and 2. The regular ASAP score and the nondirectionally weighted item score were somewhat more reliable than the directionally weighted item score. The reliability was .80 for the regular ASAP score, comparable to the previously reported reliability of .77 for a 125-item form (T. Trent, personal communication, December 1987). The

reliability was also .80 for the directionally weighted item score (both the double-standardized and single-standardized versions), but the reliability was lower for the nondirectionally weighted item score: .74 for the double-standardized version and .72 for the single-standardized version.

The reliability was also lower for the item subgroup scores: .14 to .31 for the double-standardized versions, and .10 to .40 for the single-standardized versions. The trends for the two kinds of scores diverged markedly. For the double-standardized version, the reliability was noticeably lower for scores at both extremes (Subgroup 1, r_{tt}=.14; 10, r_{tt}=.23). For the single-standardized version, the reliability systematically increased from the score with the longest latencies (Subgroup 1, r_{tt}=.10) to the score with the shortest latencies (Subgroup 10, r_{tt}=.40).

Because the item subgroup scores were based on 12 items, a relevant comparison is the estimated reliability (using the Spearman-Brown formula) of .29 for the regular ASAP score with the same number of items. None of the double-standardized scores had appreciably highe- reliability whereas the two extreme scores had appreciably lower reliability (Subgroup 1, r_{tt}=.14; Subgroup 10, r_{tt}=.23). In contrast, the two single-standardized scores with the longest latencies had appreciably higher reliability than the .29 estimate (Subgroup 9, r_{tt}=.37; 10, r_{tt}=.40), and the two scores with the shortest latencies plus a score with moderate latencies had noticeably lower reliability than this estimate (Subgroup 1, r_{tt}=.10; 2, r_{tt}=.15; 5, r_{tt}=.21).

Insert Table 3 and Figures 1 and 2 about here

Intercorrelations of ASAP Measures and Retention Criterion

The intercorrelations of the ASAP measures and the retention criterion appear in Table 3. All the ASAP measures (double-standardized and single-standardized versions) were highly correlated. The regular ASAP score correlated .98 to .99 with the two versions of the directionally weighted item score and .96 to .97 with the two versions of the nondirectionally weighted item score. The double-standardized versions of the directionally and nondirectionally weighted item scores correlated .95 with each other and the single-standardized versions correlated .93. And the multiple correlations were .99 and .97, respectively, between the double-standardized versions of the item subgroup scores and the same versions of the directionally and nondirectionally weighted item scores; the corresponding correlations were 1.00 and .99 for the single-standardized versions.

Comparative Validity of ASAP Measures

Figures 3 and 4 show the correlations of the ASAP item subgroup scores with the criterion.

All the ASAP measures had the same level of validity. The regular ASAP score correlated .17 with the criterion, comparable to the .18 to .20 correlations with six-month retention reported previously (T. Trent, personal communication, August 1986). The correlations for directionally weighted and nondirectionally weighted item scores were similar: .16 for the two versions of the directionally weighted score, and .15 and .16 for the two versions of the nondirectionally weighted score. The multiple correlations of the item subgroup scores were also similar: .18 for both versions.

The correlations for the individual item subgroup scores were lower: .07 to .14 for the double-standardized version, and .07 to .12 for the single-

standardized version. Again, the trends for the two versions diverged. For the double-standardized version, the trend was curvilinear: the correlation was appreciably higher for a middle score (Subgroup 6, r=.14) and noticeably lower for the scores at the extremes (especially Subgroup 10, r=.07). No trend was apparent for the single-standardized version.

A relevant comparison for these findings about the item subgroup scores is the estimated validity of .10 (using the Spearman-Brown formula) of the regular ASAP score for 12 items. Only one double-standardized score had appreciably different validity (Subgroup 6, r=.14). None of the single-standardized scores had noticeably different validity than this estimate.

Insert Figures 3 and 4 about here

Incremental Validity of Latency-Based ASAP Measures

The multiple regression analyses of the incremental validity of the latency-based ASAP measures are summarized in Table 4. None of the measures significantly ($p>.05$) increased the multiple correlation with the criterion when combined with the regular ASAP score.

Insert Table 4 about here

Incremental Validity of Suppressor/Moderator Variables

The multiple regression analyses of the incremental validity of the suppressor/moderator variables are summarized in Table 5. None of these variables significantly ($p>.05$) increased the multiple correlation with the criterion when combined with the regular ASAP score or with the latency-based

ASAP measures, indicating that the suppressor/moderator variables were not functioning as suppressor variables.

With one exception, none of the variables significantly ($p > .05$) increased the multiple correlation when their product score was combined with the ASAP measure and the suppressor/moderator variable, indicating that the suppressor/moderator variables were not functioning as moderator variables. The exception involved the Interquartile Range and single-standardized item subgroup scores. The multiple correlation in this analysis increased to .24 from .19 when the product score was added ($p < .05$).

Insert Table 5 about here

Discussion

Theoretical and Methodological Implications

It is apparent from the results that the latency-based ASAP measures did not improve the biographical inventory's predictive validity when used instead of or in addition to the conventional ASAP score. And it is equally clear that the measures of deviant latencies, along with the exploratory variables, did not function as suppressor or moderator variables to enhance the ASAP's validity either. (The single instance in which a deviant latency measure, displayed a moderator effect--the Interquartile Range vis-a-vis the single-standardized item subgroup scores--is not readily interpretable and probably represents a chance outcome of the large number of significance tests performed.)

Nonetheless, some important positive findings did emerge. Consistent with the expectation based on previous results that items with long latencies

are unstable, systematic trends in reliability occurred in the analysis of item subgroups with single-standardized latencies, with lower internal-consistency reliability for subgroups of items with longer latencies. The findings were much less clear cut in the reliability analysis of item subgroups with double-standardized latencies but suggested lower reliability for subgroups with either very long or very short latencies. This unanticipated possibility that items with unusually short latencies may also be unstable needs to be followed up. An obvious conjecture is that very short latencies indicate subjects are paying minimal attention to the item content or, at worst, are responding more-or-less randomly. The sample was screened to eliminate subjects with poor test-taking attitudes, including individuals making impossibly fast responses, but this process excluded only those with extreme behavior.

The trends in reliability in this analysis of single-standardized latencies support and extend itemmetric studies that uncovered a substantial association between latencies and instability for personality items (Dunn et al., 1972; Holden et al., 1988; Holden & Fekken, 1990). Because the single-standardization procedure was used, considerable commonality probably exists in the items that make up the item subgroup scores. The present findings indicate that the earlier results about retest reliability also apply to internal-consistency reliability and suggest that the previous findings were not simply an artifact of the dichotomous character of the personality items (Goldberg, 1963). The failure of these clear-cut trends in reliability to be paralleled by similar trends in validity may occur because of the generally low level of validity involved.

These reliability trends have implications for writing and selecting inventory items. First, reliability (and, in turn, validity) may be maximized by writing items that elicit short latencies. Such items are primarily short in length and unambiguous (Dunn et al., 1972; Holden et al., 1988).

Second, latency data may be useful in selecting items for reliability (and, indirectly, for validity) (Fekken & ckson, 1988; Holden & Jackson, 1990). Standard item analytic methods that choose items with high correlations with the total score or the criterion can accomplish these purposes, too. But latency data may be particularly useful when (a) the measure is heterogeneous and hence item-total score correlations are of questionable value, (b) the criterion has limited validity, or (c) the criterion requires time to mature.

Another important finding concerns the expectation that items with long latencies are less valid. The findings in the analysis of double-standardized item subgroup scores suggested that items with very long latencies as well as those with very short latencies were less valid. Furthermore, this analysis identified a subset of items with moderate latencies (Subgroup 6) that were more valid than the other sets and almost as v d as the regular ASAP score. Indeed, the estimated validity of this subgroup score would be .24 (using the Spearman-Brown formula) if it had as many items as the regular ASAP score, appreciably larger than the latter's validity of .17. This result clearly needs to be replicated, but it offers the intriguing prospect of improving the ASAP's validity by using more of the same kind of items that are in this subgroup. Because the double-standardization procedure clustered items on the basis of their subject by item interactions, it is unlikely that appreciable commonality exists in the items in this subgroup. Consequently, it would

probably be necessary to identify the appropriate items individually for each subject, using computerized adaptive testing. How accurately such items can be identified remains to be seen.

One other outcome is noteworthy. The similar validity of the ASAP regular score and the latency-based measures indicates that the unorthodox methods used to devise the latter--the item subgroup scores that rely on comparable scores from different sets of heterogeneous items, and the weighting scheme used in the directionally and nondirectionally weighted item scores--did not degrade the ASAP's validity. This outcome implies that these unusual procedures were reasonable.

All in all, the findings for the item subgroup scores, as well as the results for the weighted item scores, offer mixed support for the two kinds of competing conceptualizations: (a) individual differences by item characteristics interaction, represented by the double-standardized measures; and (b) item characteristics, represented by the single-standardized measures. The most clear-cut confirmation was associated with the reliability findings for the single-standardized item subgroup scores.

It should be recognized in this connection that the empirical keying of the ASAP items hampered the ability of the single-standardization procedure to improve validity. Insofar as the subjects' item latencies are in the same order, and the present sample is comparable to the one used in deriving the item scores, latency data will not improve validity because the items already have optimal weights for predicting the criterion. For instance, suppose that the items with the longest latencies for everyone in the sample were also the least valid. The weights for the items reflect the level of validity for the sample, and adjusting the weights in the same way for each subject (because

all subjects have the same latencies) will have no effect. The ASAP's empirical keying does not affect the reliability results for the single-standardized procedure because the items' weights are not optimal for reliability. The keying also does not affect either the validity or reliability results for the double-standardized procedure because this standardization makes the latencies and the resulting adjustments different for each subject.

The findings also offer no basis for choosing between the directionally and nondirectionally weighted items for the two performed similarly: their validity was equivalent, though the directional version was somewhat more reliable.

Future Directions

Future efforts might benefit by partitioning response latency into its major components. Rogers (1974a; 1974b, p. 130) has distinguished three main stages in responding to an inventory item: stimulus encoding, stimulus comprehension, and binary "true/false" decision about the item. This last stage, in turn, is divided into two substages: self-referent decision ("relating of the internalized item content to the 'self-concept'") and response selection. Similarly, Kuncel (1973, p. 547) has delineated two stages: meaning ("attributing some 'reasonable' interpretation to the item") and apply ("employing information which is 'well-suited' as a basis for answering the item").

The present study, in common with most research in this field, measured and used the total time involved in all these stages of responding, but the time consumed in the various stages may have very different psychological implications. The conceptualizations linked with item characteristics (e.g.,

Dunn et al., 1972; Hanley, 1962) focus on the early stages (e.g., Rogers' stimulus encoding and stimulus comprehension; Kuncel's meaning). In contrast, conceptualizations concerned with the interaction between individual differences and item characteristics (e.g., Gilbert, 1967; Kuncel, 1973; Markus, 1977; Rogers, 1974a, 1974b; Temple & Geisinger, 1990) primarily deal with the later stages (Rogers' binary decision stage, Kuncel's apply stage)

As a first step in partitioning latencies, it would be prudent to control experimentally for item length, as had been done in a few studies (Hanley, 1962; Rogers, 1974a, 1974b; Temple & Geisinger, 1990), because of its generally high association with latencies (Dunn et al., 1972; Holden et al., 1985; Tetrick, 1989).

It would be worthwhile to employ a more predictable criterion, as suggested earlier. The ASAP's validity was modest against the six-month retention criterion in this study, with correlations accounting for less than 4% of the criterion variance. In these circumstances, substantial increases in validity with improvements in the ASAP are difficult to uncover, even when reliability is dramatically enhanced, as in the analysis of the single-standardized item subgroup scores. At the least, a 36-month retention criterion might be used, given the substantially higher validity of the ASAP with 36-month retention (r=.27; Trent, 1989) than with 6-month retention (r=.18 to .20; T. Trent, personal communication, August 1986). Other criteria for the ASAP might also be employed, such as disciplinary records, promotions, and recommendations for re-enlistment.

It might also be fruitful to investigate situational influences. Latencies may convey more significant information, and consequently latency-based measures may be more useful, in situations that are perceived as more

important than the typical research study. Investigations that use the measures in actual selection or in faking experiments that approximate such demand characteristics are especially relevant. It is noteworthy that a recent faking experiment (Hsu, Santelli, & Hsu, 1989) found that latency measures (the mean latencies for subtle and obvious MMPI items) were able to detect dissimulation.

More research is obviously needed on methods for weighting individual items and for grouping items into subsets by their latencies. The schemes used in this study were no more than first approximations, and a variety of improvements are possible.

Finally, a systematic appraisal of the efficacy of latency data in writing and selecting inventory items is called for. Studies that experimentally manipulate item latencies, via changes in the length and other characteristics of the items, and then compare the items' reliability and validity are pertinent. Equally relevant are investigations that assess the relative reliability and validity of items selected on the basis of latency data with items chosen by standard item analytic methods.

Conclusion

Although this initial effort at using response latency data to improve the validity of a biographical inventory directly was unsuccessful, there were strong indications that employing these data in developing an inventory may enhance validity indirectly, and thereby accomplish the same goal.

It should also be borne in mind that closely related work has directly improved the validity of personality inventories. Several recent studies have found that latency scores for a scale (i.e., the mean latency for endorsed items on the scale, and the mean latency for rejected items on the scale)

frequently had incremental validity in predicting external criteria, when combined with the regular scale score (Fekken, 1990; Holden, Fekken, & Cotton, in press; Mervielde, 1988; Popham & Holden, 1990). This particular approach requires items that are dichotomous and homogeneous, and hence is inapplicable to a heterogeneous biographical inventory, such as the ASAP. Nonetheless, these findings underscore the potential for latency data.

Given the ease of collecting response latency information, its ability to improve the validity and utility of self-report inventories merits serious investigation.

References

Cohen, J. & Cohen, P. (1983). Applied multiple regression/correlation analysis for the behavioral sciences (2nd. ed.). Hillsdale, NJ: Erlbaum.

Dunn, T. G., Lushene, R. E., & O'Neil, H. F., Jr. (1972). Complete automation of the MMPI and a study of its response latencies. Journal of Counseling and Clinical Psychology 39, 381-387.

Fekken, G. C. (1990, August). Using item response latencies to assess psychopathology. Paper presented at the meeting of the American Psychological Association, Boston, MA.

Fekken, G. C., & Jackson, D. N. (1988). Predicting consistent psychological test item responses: A comparison of models. Personality and Individual Differences, 19, 873-882.

Gilbert, A. R. (1967). Increased diagnostic value of the Taylor Manifest Anxiety Scale by use of response latency. Psychological Reports, 20, 63-67.

Goldberg, L. R. (1963). A model of item ambiguity in personality assessment. Educational and Psychological Measurement, 23, 467-492.

Hanley, C. (1962). The "difficulty" of a personality inventory item. Educational and Psychological Measurement, 22, 577-584.

Hathaway, S. R., & McKinley, J. C. (1951). Minnesota Multiphasic Personality Inventory Manual. New York: Psychological Corporation.

Holden, R. R., & Fekken, G. C. (1990). Structured psychopathological test item characteristics and validity. Psychological Assessment: A Journal of Consulting and Clinical Psychology, 2, 35-40.

Holden, R. R., Fekken, G. C., & Cotton, D. H. G. (in press). Assessing psychopathology using structured test item response latencies. Psychological Assessment: A Journal of Consulting and Clinical Psychology.

Holden, R. R., Fekken, G. C., & Jackson, D. N. (1985). Structured personality test item characteristics and validity. Journal of Research in Personality, 19, 386-394.

Hsu, L. M., Santelli, J., & Hsu, J. R. (1989). Faking detection validity and incremental validity of response latencies to MMPI subtle and obvious items. Journal of Personality Assessment, 53, 278-295.

Jackson, D. N. (1984). Personality Research Form manual. Port Huron, MI: Research Psychologists Press.

Jackson, D. N. (1989). Basic Personality Inventory manual. Port Huron, MI: Research Psychologists Press.

Jensen, A. R. (1985). Methodological and statistical techniques for the chronometric study of mental abilities. In C. R. Reynolds & V. L. Wilson (Eds.), Methodological and statistical advances in the study of individual differences (pp. 51-116). New York: Plenum.

Kuncel, R. B. (1973). Response processes and relative location of subject and item. Educational and Psychological Measurement, 33, 545-563.

Markus, H. (1977). Self-schemata and processing information about the self. Journal of Personality and Social Psychology, 35, 63-78.

McNemar, Q. (1962). Psychological statistics (3rd. ed.). New York: Wiley.

Mervielde, I. (1988). Cognitive processes and computerized personality assessment. European Journal of Personality, 2, 97-111.

Pachella, R. G. (1974). The interpretation of reaction time in information-processing research. In B. H. Kantowitz (Ed.), Human information processing: Tutorials in performance and cognition, (pp. 41-82). Hillsdale, NJ: Erlbaum.

Popham, S. M., & Holden R. R. (1990). Assessing MMPI constructs through the measurement of response latencies. Journal of Personality Assessment, 54, 469-478.

Rogers, T. B. (1973). Toward a definition of the difficulty of a personality item. Psychological Reports. 33, 159-166.

Rogers, T. B. (1974a). An analysis of the stages underlying the process of responding to personality items. Acta Psychologica, 38, 205-214.

Rogers, T. B. (1974b). An analysis of two central stages underlying responding to personality items: The self-referent decision and response selection. Journal of Research in Personality, 8, 128-138.

Shrout, P. E., & Fleiss, J. L. (1979). Intraclass correlations: Uses in assessing rater reliability. Psychological Bulletin, 86, 420-428.

Stead, W. H., & Shartle, C. L. (1940). Occupational counseling techniques. New York: American Book.

Temple, D. E., & Geisinger, K. F. (1990). Response latency to computer-administered inventory items as an indicator of emotional arousal. Journal of Personality Assessment, 54, 288-297.

Tetrick, L. E. (1989). An exploratory investigation of response latency in computerized administrations of the Marlowe-Crowne Social Desirability scale. Personality and Individual Differences, 10, 1281-1287.

Tiggle, R. B., & Rafacz, B. A. (1985). Evaluation of three local CAT-ASVAB network designs. Proceedings of the 27th Annual Conference of the Military Testing Association, 23-28.

Trent, T. (1989). The Adaptability Screening Profile: Technical issues. Proceedings of the 31st Annual Conference of the Military Testing Association, 428-433.

Trent, T., Quennette, M. A., & Laabs, G. J. (1990, November). Implementation of the Adaptability Screening Profile (ASP). Paper presented at the meeting of the Military Testing Association, Orange Beach, AL.

Trent, T., Quennette, M. A., & Pass, J. J. (1989, August). An old-fashioned biographical inventory. Paper presented at the meeting of the American Psychological Association, New Orleans, LA.

Tukey, J. W. (1977). Exploratory data analysis. Reading, MA: Addison-Wesley.

U. S. Department of Defense (1984). Test manual for the Armed Services Vocational Aptitude Battery. North Chicago, IL: U S. Military Entrance Processing Command.

Author Notes

This report was prepared under the Navy Manpower, Personnel, and Training R & D Program of the Office of Chief of Naval Research under Contract N00014-89-K-0072.

Thanks are due to John J. Pass for encouraging this research; Thomas Trent for assisting in all stages of the study; John H. Wolfe for facilitating data collection; Mary A. Quennette for providing information about the screening and scoring of ASAP items; Gerald E. Larson for supplying the questionnaire on test-taking attitudes; Rebecca Redard and Thomas Sheridan for programming the computer-administered version of the ASAP; Michael Alvarez and Mark Knapp for administering the ASAP; Mike Dove for furnishing retention data; Robert F. Boldt and Donald A. Rock for advising on psychometric and statistical issues; Lucient C. Chan and Annette Turner for doing the computer programming for the data analysis; John J. Ferris and Judith Pollack for supervising this programming; and Robert F. Boldt and Philip K. Oltman for reviewing a draft of this report.

Footnotes

[1]The signs of the correlations in the Dunn et al. and the Holden and Fekken studies have been reflected to be consistent with the reversal of the dependent variable in these investigations from the proportion of unchanged responses to the proportion of changed responses.

[2]Several of the current weights were assigned on rational grounds to improve content validity; it was not feasible to replicate that process for this study.

[3]An interquartile deviation of 2.00 defines the "inner fence" of a frequency distribution (Tukey, 1977).

[4]An interquartile deviation of 3.50 defines the "outer fence" of a frequency distribution (Tukey, 1977).

[5]Dominant language was assessed by the following question that was computer administered, immediately preceding the ASAP: What language do you read and write best? (A) English, (B) Spanish, (C) Chinese, (D) Tagalog, (E) Some other language.

[6]Two subjects were separated for nonpejorative reasons: Non-Battle Death--Other, and Death--Cause Not Specified.

Table 1

Shrinkage Rates for Directionally and Nondirectionally Weighted Item Scores

	Shrinkage Rate	
Interquartile Deviation	Directional	Nondirectional
-.81 or more	0.0%	100.0%
-.80 to -.41	12.5	75.0
-.40 to -.01	25.0	50.0
.00 to .39	37.5	25.0
.40 to .79	50.0	0.0
.80 to 1.19	62.5	25.0
1.20 to 1.59	75.0	50.0
1.60 to 1.99	87.5	75.0
2.00 or More	100.0%	100.0%

Table 2

Reasons for Attrition, N = 96

Reason[a]	Percent
Medical conditions existing prior to service	3.1%
Medically unqualified for active duty--other	4.2
Character or behavior disorder	8.3
Drugs	1.0
Fraudulent entry	28.1
Good of the service	2.1
Basic training attrition	2.1
Trainee discharge	21.9
Erroneous enlistment or induction	25.0
Other	4.2%

[a]Interservice Separation Code

Table 3

Intercorrelations and Reliability of Regular and Latency-Based ASAP Measures and the Retention Criterion, N = 1090

Measure	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1. Regular ASAP	274.63	16.32	(80)	99	97	51	58	61	55	58	59	60	61	58	55	98	96	43	50	53	56	58	59	58	62	66	67	17
2. Directionally Weighted Item Score--D.S.	2.30	.09		[illegible]	[illegible]	51	57	60	54	58	58	59	60	57	53	99	94	36	44	50	55	60	60	58	64	68	69	16
3. Nondirectionally Weighted Item Score--D.S.	2.29	.07			(74)	50	56	60	54	55	[illegible]	59	59	55	53	95	95	40	50	53	56	58	59	55	58	61	61	15
4. Item Subgroup Score 1--D.S.	2.32	.22				(14)	19	28	20	23	23	22	23	24	17	50	49	23	23	28	28	31	29	29	32	36	35	08
5. Item Subgroup Score 2--D.S.	2.26	.24					(27)	26	21	26	26	32	27	25	27	57	55	22	28	26	34	[illegible]	35	36	36	38	43	07
6. Item Subgroup Score 3--D.S.	2.25	.23						(26)	28	28	27	31	30	28	27	61	58	23	30	30	37	35	37	33	38	40	43	09
7. Item Subgroup Score 4--D.S.	2.28	.24							(27)	30	25	24	23	24	19	54	51	25	23	25	30	[illegible]	35	33	33	36	38	08
8. Item Subgroup Score 5--D.S.	2.33	.23								(25)	23	24	30	25	26	57	57	22	28	30	33	37	33	37	35	38	38	10
9. Item Subgroup Score 6--D.S.	2.3[illegible]	.24									(28)	27	31	25	25	58	57	24	29	29	32	35	36	31	39	41	37	14
10. Item Subgroup Score 7--D.S.	2.27	.23										(26)	32	28	25	58	59	28	30	34	33	35	35	35	39	38	35	10
11. Item Subgroup Score 8--D.S.	2.25	.24											(31)	28	26	60	59	25	30	35	32	35	39	33	38	39	44	09
12. Item Subgroup Score 9--D.S.	2.27	.24												(26)	23	56	55	29	25	33	31	32	31	33	32	42	39	11
13. Item Subgroup Score 10--D.S.	2.33	.24													(23)	53	54	28	30	32	32	29	30	32	34	34	33	07
14. Directionally Weighted Item Score--S.S.	2.29	.09														(80)	93	31	42	48	54	57	60	59	65	70	71	16
15. Nondirectionally Weighted Item Score--S.S.	2.28	.07															(72)	37	52	61	61	61	57	56	56	57	55	16
16. Item Subgroup Score 1--S.S.	2.27	.21																(10)	13	21	20	20	17	13	14	21	20	07
17. Item Subgroup Score 2--S.S.	2.25	.22																	(15)	15	22	19	20	20	27	19	25	11
18. Item Subgroup Score 3--S.S.	2.31	.23																		(24)	18	21	25	25	24	27	26	09
19. Item Subgroup Score 4--S.S.	2.25	.23																			(25)	28	23	28	23	30	31	07
20. Item Subgroup Score 5--S.S.	2.26	.23																				(2[illegible])	30	25	28	31	35	10
21. Item Subgroup Score 6--S.S.	2.26	.24																					(25)	27	31	33	31	07
22. Item Subgroup Score 7--S.S.	2.28	.24																						(26)	29	30	32	13
23. Item Subgroup Score 8--S.S.	2.30	.25																							(32)	38	36	08
24. Item Subgroup Score 9--S.S.	2.34	.26																								(37)	43	10
25. Item Subgroup Score 10--S.S.	2.45	.26																									(40)	12
26. Retention Criterion	.9[illegible]	.28																										(--)

Note. Decimal points have been omitted for correlations and reliability coefficients. Correlations of .06 and .08 are significant at the .05 and .01 levels (two-tail), respectively. Reliability coefficients appear in parentheses. Reliability was estimated by Coefficient Alpha for the Regular ASAP, Directionally Weighted Item Score, and Nondirectionally Weighted Item Score, and by the intraclass correlation for the Item Subgroup Scores.

Table 4

Incremental Validity of Latency-Based ASAP Measures when Combined with Regular ASAP Measures, N = 1,090

Measures	n	R	R Increase
Regular ASAP	1	.1653**	
Regular ASAP and Directionally Weighted Item Score--Double Standardized	2	.1681**	.0028
Regular ASAP	1	.1653**	
Regular ASAP and Nondirectionally Weighted Item Score--Double Standardized	2	.1667**	.0014
Regular ASAP	1	.1653**	
Regular ASAP and Item Subgroup Scores--Double Standardized	10	.1809**	.0156
Regular ASAP	1	.1653**	
Regular ASAP and Directionally Weighted Item Score--Single Standardized	2	.1656**	.0003
Regular ASAP	1	.1653**	
Regular ASAP and Nondirectionally Weighted Item Score--Single Standardized	2	.1660**	.0007
Regular ASAP	1	.1653**	
Regular ASAP and Item Subgroup Scores--Single Standardized	10	.1826**	.0173

**p <.01

Table 5

Incremental Validity of Suppressor/Moderator Variables when Combined with Regular and Latency-Based ASAP Measures, N = 1,090

Measures	n	R	R Increase
Regular ASAP	1	.1653**	
Regular ASAP and Correlation Between Subject's and Sample's Latencies	2	.1709**	.0056
Regular ASAP, Correlation Between Subject's and Sample's Latencies, and Product	3	.1709**	.0000
Regular ASAP	1	.1653**	
Regular ASAP and Interquartile Range	2	.1728**	.0075
Regular ASAP, Interquartile Range, and Product	3	.1728**	.0000
Regular ASAP	1	.1653**	
Regular ASAP and Interquartile Deviations of 3.5 or More	2	.1667**	.0014
Regular ASAP, Interquartile Deviations of 3.5 or More, and Product	3	.1713**	.0046
Regular ASAP	1	.1653**	
Regular ASAP and Difference Between Median Interquartile Deviation for Subject and Sample	2	.1656**	.0003
Regular ASAP, Difference Between Median Interquartile Deviation for Subject and Sample, and Product	3	.1662**	.0006

Table 5 (Continued)

Measures	n	R	R Increase
Regular ASAP	1	.1653**	
Regular ASAP and Items Changed	2	.1669**	.0016
Regular ASAP, Items Changed, and Product	3	.1731**	.0062
Regular ASAP	1	.1653**	
Regular ASAP and Maximum Changes Per Item	2	.1728**	.0075
Regular ASAP, Maximum Changes Per Item, and Product	3	.1728**	.0000
Regular ASAP	1	.1653**	
Regular ASAP and Effort on Test	2	.1690**	.0037
Regular ASAP, Effort on Test, and Product	3	.1730**	.0040
Regular ASAP	1	.1653**	
Regular ASAP and Tiredness During Test	2	.1727**	.0074
Regular ASAP, Tiredness During Test, and Product	3	.1773**	.0046
Regular ASAP	1	.1653**	
Regular ASAP and Computer Use	2	.1654**	.0001
Regular ASAP, Computer Use, and Product	3	.1674**	.0020

Table 5 (Continued)

Measures	n	R	R Increase
Regular ASAP	1	.1653**	
Regular ASAP and Paragraph Comprehension	2	.1688**	.0035
Regular ASAP, Paragraph Comprehension and Product	3	.1707**	.0019
Directionally Weighted Item Score--Double Standardized	1	.1581**	
Directionally Weighted Item Score and Correlation Between Subject's and Sample's Latencies	2	.1641**	.0060
Directionally Weighted Item Score, Correlation Between Subject's and Sample's Latencies, and Product	3	.1642**	.0001
Directionally Weighted Item Score--Double Standardized	1	.1581**	
Directionally Weighted Item Score and Interquartile Range	2	.1662**	.0081
Directionally Weighted Item Score, Interquartile Range, and Product	3	.1662**	.0000
Directionally Weighted Item Score--Double Standardized	1	.1581**	
Directionally Weighted Item Score and Interquartile Deviations of 3.5 or More	2	.1595**	.0014
Directionally Weighted Item Score, Interquartile Deviations of 3.5 or More, and Product	3	.1619**	.0024

Table 5 (Continued)

Measures	n	R	R Increase
Directionally Weighted Item Score--Double Standardized	1	.1581**	
Directionally Weighted Item Score and Difference Between Median Interquartile Deviation for Subject and Sample	2	.1583**	.0002
Directionally Weighted Item Score, Difference Between Median Interquartile Deviation for Subject and Sample, and Product	3	.1602**	.0019
Directionally Weighted Item Score--Double Standardized	1	.1581**	
Directionally Weighted Item Score and Items Changed	2	.1596**	.0015
Directionally Weighted Item Score, Items Changed, and Product	3	.1647**	.0051
Directionally Weighted Item Score--Double Standardized	1	.1581**	
Directionally Weighted Item Score and Maximum Changes Per Item	2	.1658**	.0077
Directionally Weighted Item Score, Maximum Changes Per Item, and Product	3	.1659**	.0001
Directionally Weighted Item Score--Double Standardized	1	.1581**	
Directionally Weighted Item Score and Effort on Test	2	.1623**	.0042
Directionally Weighted Item Score, Effort on Test, and Product	3	.1659**	.0036

Table 5 (Continued)

Measures	n	R	R Increase
Directionally Weighted Item Score--Double Standardized	1	.1581**	
Directionally Weighted Item Score and Tiredness During Test	2	.1660**	.0079
Directionally Weighted Item Score and Tiredness During Test, and Product	3	.1700**	.0040
Directionally Weighted Item Score--Double Standardized	1	.1581**	
Directionally Weighted Item Score and Computer Use	2	.1581**	.0000
Directionally Weighted Item Score, Computer Use, and Product	3	.1621**	.0040
Nondirectionally Weighted Item Score--Double Standardized	1	.1547**	
Nondirectionally Weighted Item Score and Correlation Between Subject's and Sample's Latencies	2	.1619**	.0072
Nondirectionally Weighted Item Score, Correlation Between Subject's and Sample's Latencies, and Product	3	.1620**	.0001
Nondirectionally Weighted Item Score--Double Standardized	1	.1547**	
Nondirectionally Weighted Item Score and Interquartile Range	2	.1638**	.0091
Nondirectionally Weighted Item Score, Interquartile Range, and Product	3	.1640**	.0002

Table 5 (Continued)

Measures	n	R	R Increase
Nondirectionally Weighted Item Score--Double Standardized	1	.1547**	
Nondirectionally Weighted Item Score and Interquartile Deviations of 3.5 or More	2	.1564**	.0017
Nondirectionally Weighted Item Score, Interquartile Deviations of 3.5 or More, and Product	3	.1636**	.0072
Nondirectionally Weighted Item Score--Double Standardized	1	.1547**	
Nondirectionally Weighted Item Score and Difference Between Median Interquartile Deviation for Subject and Sample	2	.1550**	.0003
Nondirectionally Weighted Item Score, Difference Between Median Interquartile Deviation for Subject and Sample, and Product	3	.1551**	.0001
Nondirectionally Weighted Item Score--Double Standardized	1	.1547**	
Nondirectionally Weighted Item Score and Items Changed	2	.1564**	.0017
Nondirectionally Weighted Item Score, Items Changed, and Product	3	.1607**	.0043
Nondirectionally Weighted Item Score--Double Standardized	1	.1547**	
Nondirectionally Weighted Item Score and Maximum Changes Per Item	2	.1627**	.0080
Nondirectionally Weighted Item Score, Maximum Changes Per Item, and Product	3	.1629**	.0002

Table 5 (Continued)

Measures	n	R	R Increase
Nondirectionally Weighted Item Score--Double Standardized	1	.1547**	
Nondirectionally Weighted Item Score and Effort on Test	2	.1585**	.0038
Nondirectionally Weighted Item Score, Effort on Test, and Product	3	.1603**	.0018
Nondirectionally Weighted Item Score--Double Standardized	1	.1547**	
Nondirectionally Weighted Item Score and Tiredness During Test	2	.1629**	.0082
Nondirectiona'ly Weighted Item Score, Tiredness During Test, and Product	3	.1698**	.0069
Nondirectionally Weighted Item Score--Double Standardized	1	.1547**	
Nondirectionally Weighted Item Score and Computer Use	2	.1547**	.0000
Nondirectionally Weighted Item Score, Computer Use, and Product	3	.1572**	.0025
Nondirectionally Weighted Item Score--Double Standardized	1	.1547**	
Nondirectonally Weighted Item Score and Paragraph Comprehension	2	.1582**	.0035
Nondirectionally Weighted Item Score, Paragraph Comprehension, and Product	3	.1596**	.0014

Table 5 (Continued)

Measures	n	R	R Increase
Item Subgroup Scores--Double Standardized	10	.1810**	
Item Subgroup Scores and Correlation Between Subject's and ample's Latencies	11	.1870**	.0060
Item Subgroup Scores, Correlation Between Subject's and Sample's Latencies, and Product	21	.2037**	.0167
Item Subgroup Scores--Double Standardized	10	.1810**	
Item Subgroup Scores and Interquartile Range	11	.1887**	.0077
Item Subgroup Scores, Interquartile Range, and Product	21	.2079**	.0192
Item Subgroup Scores--Double Standardized	10	.1810**	
Item Subgroup Scores and Interquartile Deviations of 3.5 or More	11	.1820**	.0010
Item Subgroup Scores, Interquartile Deviations of 3.5 or More, and Product	21	.2079**	.0259
Item Subgroup Scores--Double Standardized	10	.1810**	
Item Subgroup Scores and Difference Between Median Interquartile Deviation for Subject and Sample	11	.1812**	.0002
Item Subgroup Scores, Difference Between Median Interquartile Deviation for Subject and Sample, and Product	21	.1992**	.0180

Table 5 (Continued)

Measures	n	R	R Increase
Item Subgroup Scores--Double Standardized	10	.1810**	
Item Subgroup Scores and Items Changed	11	.1826**	.0016
Item Subgroup Scores, Items Changed, and Product	21	.2087**	.0261
Item Subgroup Scores--Double Standardized	10	.1810**	
Item Subgroup Scores and Maximum Changes Per Item	11	.1877**	.0067
Item Subgroup Scores, Maximum Changes Per Item, and Product	21	.1971**	.0094
Item Subgroup Scores--Double Standardized	10	.1810**	
Item Subgroup Scores and Effort on Test	11	.1850**	.0040
Item Subgroup Scores, Effort on Test, and Product	21	.2051**	.0201
Item Subgroup Scores--Double Standardized	10	.1810**	
Item Subgroup Scores and Tiredness During Test	11	.1870**	.0060
Item Subgroup Scores, Tiredness During Test, and Product	21	.2111**	.0241
Item Subgroup Scores--Double Standardized	10	.1810**	
Item Subgroup Scores and Computer Use	11	.1810**	.0000
Item Subgroup Scores, Computer Use, and Product	21	.1937**	.0127

Table 5 (Continued)

Measures	n	R	R Increase
Item Subgroup Scores--Double Standardized	10	.1810**	
Item Subgroup Scores and Paragraph Comprehension	11	.1842**	.0032
Item Subgroup Scores, Paragraph Comprehension, and Product	21	.1892**	.0050
Directionally Weighted Item Score--Single Standardized	1	.1609**	
Directionally Weighted Item Score and Correlation Between Subject's and Sample's Latencies	2	.1670**	.0061
Directionally Weighted Item Score, Correlation Between Subject's and Sample's Latencies, and Product	3	.1671**	.0001
Directionally Weighted Item Score--Single Standardized	1	.1609**	
Directionally Weighted Item Score and Interquartile Range	2	.1691**	.0082
Directionally Weighted Item Score, Interquartile Range, and Product	3	.1691**	.0000
Directionally Weighted Item Score--Single Standardized	1	.1609**	
Directionally Weighted Item Score and Interquartile Deviations of 3.5 or More	2	.1624**	.0015
Directionally Weighted Item Score, Interquartile Deviations of 3.5 or More, and Product	3	.1651**	.0027

Table 5 (Continued)

Measures	n	R	R Increase
Directionally Weighted Item Score--Single Standaradized	1	.1609**	
Directionally Weighted Item Score and Difference Between Median Interquartile Deviation for Subject and Sample	2	.1612**	.0003
Directionally Weighted Item Score, Difference Between Median Interquartile Deviation for Subject and Sample, and Product	3	.1629**	.0017
Directionally Weighted Item Score--Single Standardized	1	.1609**	
Directionally Weighted Item Score and Items Changed	2	.1624**	.0015
Directionally Weighted Item Score, Items Changed, and Product	3	.1697**	.0073
Directionally Weighted Item Scores--Single Standardized	1	.1609**	
Directionally Weighted Item Score and Maximum Changes Per Item	2	.1685**	.0076
Directionally Weighted Item Score, Maximum Changes Per Item, and Product	3	.1685**	.0000
Directionally Weighted Item Score--Single Standardized	1	.1609**	
Directionally Weighted Item Score and Effort on Test	2	.1650**	.0041
Directionally Weighted Item Score, Effort on Test, and Product	3	.1682**	.0032

Table 5 (Continued)

Measures	n	R	R Increase
Directionally Weighted Item Score--Single Standardized	1	.1609**	
Directionally Weighted Item Score and Tiredness During Test	2	.1686**	.0077
Directionally Weighted Item Score, Tiredness During Test, and Product	3	.1732**	.0046
Directionally Weighted Item Score--Single Standardized	1	.1609**	
Directionally Weighted Item Score and Computer Use	2	.1610**	.0001
Directionally Weighted Item Score, Computer Use, and Product	3	.1659**	.0049
Nondirectionally Weighted Item Score--Single Standardized	1	.1630**	
Nondirectionally Weighted Item Score and Correlation Between Subject's and Sample's Latencies	2	.1699**	.0069
Nondirectionally Weighted Item Score, Correlation Between Subject's and Sample's Latencies, and Product	3	.1707**	.0008
Nondirectionally Weighted Item Score--Single Standardized	1	.1630**	
Nondirectionally Weighted Item Score and Interquartile Range	2	.1711**	.0081
Nondirectionally Weighted Item Score, Interquartile Range, and Product	3	.1711**	.0000

Table 5 (Continued)

Measures	n	R	R Increase
Nondirectionally Weighted Item Score--Single Standardized	1	.1630**	
Nondirectionally Weighted Item Score and Interquartile Deviations of 3.5 or More	2	.1646**	.0016
Nondirectionally Weighted Item Score, Interquartile Deviations of 3.5 or More, and Product	3	.1708**	.0062
Nondirectionally Weighted Item Score--Single Standardized	1	.1630**	
Nondirectionally Weighted Item Score and Difference Between Median Interquartile Deviation for Subject and Sample	2	.1633**	.0003
Nondirectionally Weighted Item Score, Difference Between Median Interquartile Deviation for Subject and Sample, and Product	3	.1643**	.0010
Nondirectionally Weighted Item Score--Single Standardized	1	.1630**	
Nondirectionally Weighted Item Score and Items Changed	2	.1647**	.0017
Nondirectionally Weighted Item Score, Items Changed, and Product	3	.1717**	.0070
Nondirectionally Weighted Item Score--Single Standardized	1	.1630**	
Nondirectionally Weighted Item Score and Maximum Changes Per Item	2	.1704**	.0074
Nondirectionally Weighted Item Score, Maximum Changes Per Item, and Product	3	.1706**	.0002

Table 5 (Continued)

Measures	n	R	R Increase
Nondirectionally Weighted Item Score--Single Standardized	1	.1630**	
Nondirectionally Weighted Item Score and Effort on Test	2	.1667**	.0037
Nondirectionally Weighted Item Score, Effort on Test, and Product	3	.1704**	.0037
Nondirectionally Weighted Item Score--Single Standardized	1	.1630**	
Nondirectionally Weighted Item Score and Tiredness During Test	2	.1703**	.0073
Nondirectionally Weighted Item Score, Tiredness During Test, and Product	3	.1747**	.0044
Nondirectionally Weighted Item Score--Single Standardized	1	.1630**	
Nondirectionally Weighted Item Score and Computer Use	2	.1630**	.0000
Nondirectionally Weighted Item Score, Computer Use, and Product	3	.1635**	.0005
Nondirectionally Weighted Item Score--Single Standardized	1	.1630**	
Nondirectionally Weighted Item Score and Paragraph Comprehension	2	.1669**	.0039
Nondirectionally Weighted Item Score, Paragraph Comprehension, and Product	3	.1680**	.0011

Table 5 (Continued)

Measures	n	R	R Increase
Item Subgroup Scores--Single Standardized	10	.1813**	
Item Subgroup Scores and Correlation Between Subject's and Sample's Latencies	11	.1867**	.0054
Item Subgroup Scores, Correlation Between Subject's and Sample's Latencies, and Product	21	.2094**	.0227
Item Subgroup Scores--Single Standardization	10	.1813**	
Item Subgroup Scores and Interquartile Range	11	.1891**	.0078
Item Subgroup Scores, Interquartile Range, and Product	21	.2357**	.0466*
Item Subgroup Scores--Single Standardization	10	.1813**	
Item Subgroup Scores and Interquartile Deviations of 3.5 or More	11	.1824**	.0011
Item Subgorup Scores, Interquartile Deviations of 3.5 or More, and Product	21	.2063**	.0239
Item Subgroup Scores--Single Standardized	10	.1813**	
Item Subgroup and Difference Between Median Interquartile Deviation for Subject and Sample	11	.1815**	.0002
Item Subgroup, Difference Between Median Interquartile Deviation for Subject and Sample, and Product	21	.2096**	.0281

Table 5 (Continued)

Measures	n	R	R Increase
Item Subgroup Scores--Single Standardized	10	.1813**	
Item Subgroup Scores and Items Changed	11	.1826**	.0013
Item Subgroup Scores, Items Changed, and Product	21	.1937**	.0111
Item Subgroup Scores--Single Standardized	10	.1813**	
Item Subgroup Scores and Maximum Changes Per item	11	.1883**	.0070
Item Subgroup Scores, Maximum Changes Per Item, and Product	21	.2012	.0129
Item Subgroup Scores--Single Standardized	10	.1813**	
Item Subgroup Scores and Effort on Test	11	.1843**	.0030
Item Subgroup Scores, Effort on Test, and Product	21	.2078**	.0235
Item Subgroup Scores--Single Standardized	10	.1813**	
Item Subgroup Scores and Tiredness During Test	11	.1877**	.0064
Item Subgroup Scores, Tiredness During Test, and Product	21	.2128**	.0251
Item Subgroup Scores--Single Standardized	10	.1813**	
Item Subgroup Scores and Computer Use	11	.1813**	.0000
Item Subgroup Scores, Computer Use, and Product	21	.2218**	.0405

Table 5 (Continued)

Measures	n	R	R Increase
Item Subgroup Scores--Single Standardized	10	.1813**	
Item Subgroup Scores and Paragraph Comprehension	11	.1844**	.0031
Item Subgroup Scores, Paragraph Comprehension, and Product	21	.1981**	.0137

*$p < .05$; **$p < .01$

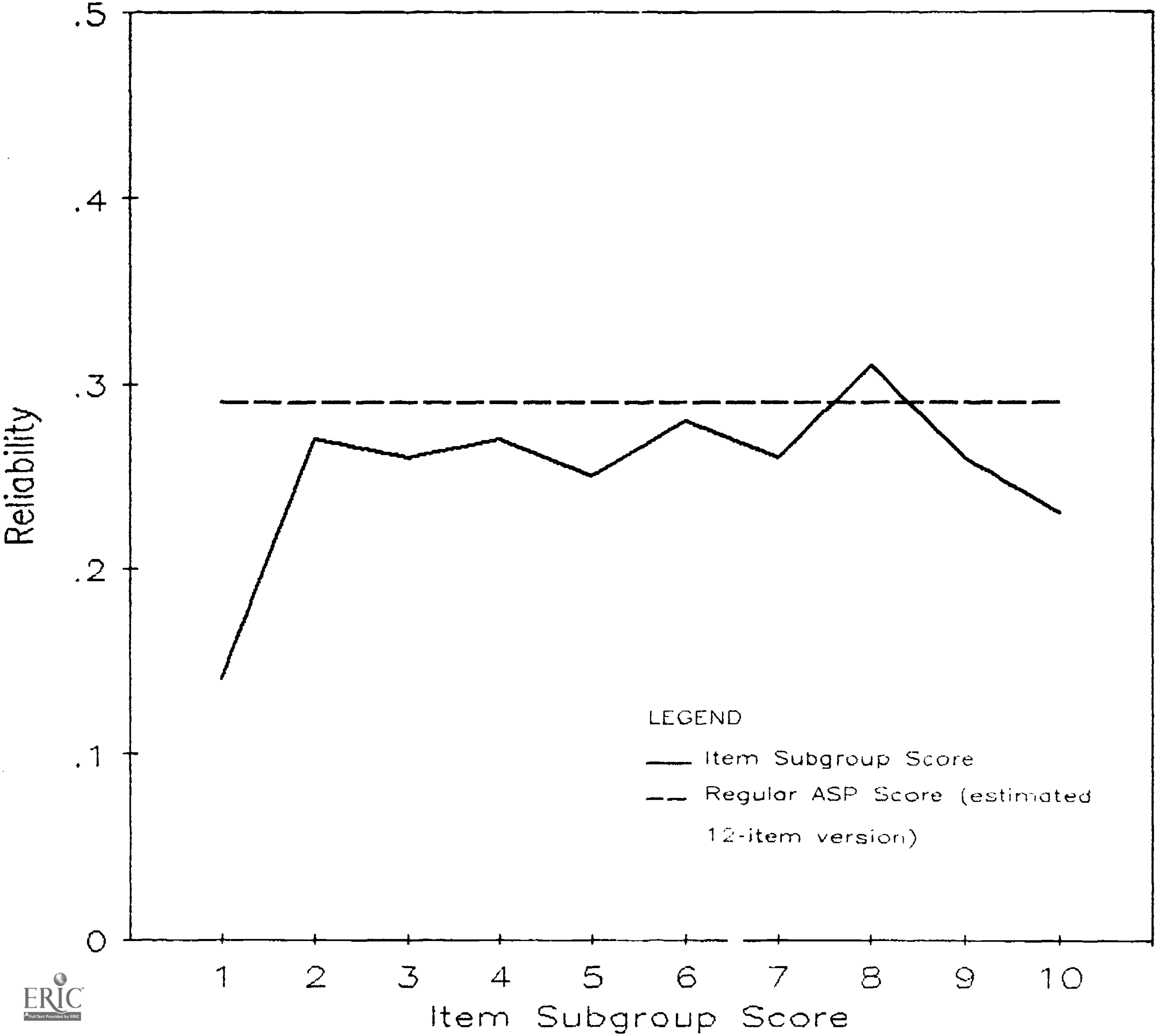
Figure Captions

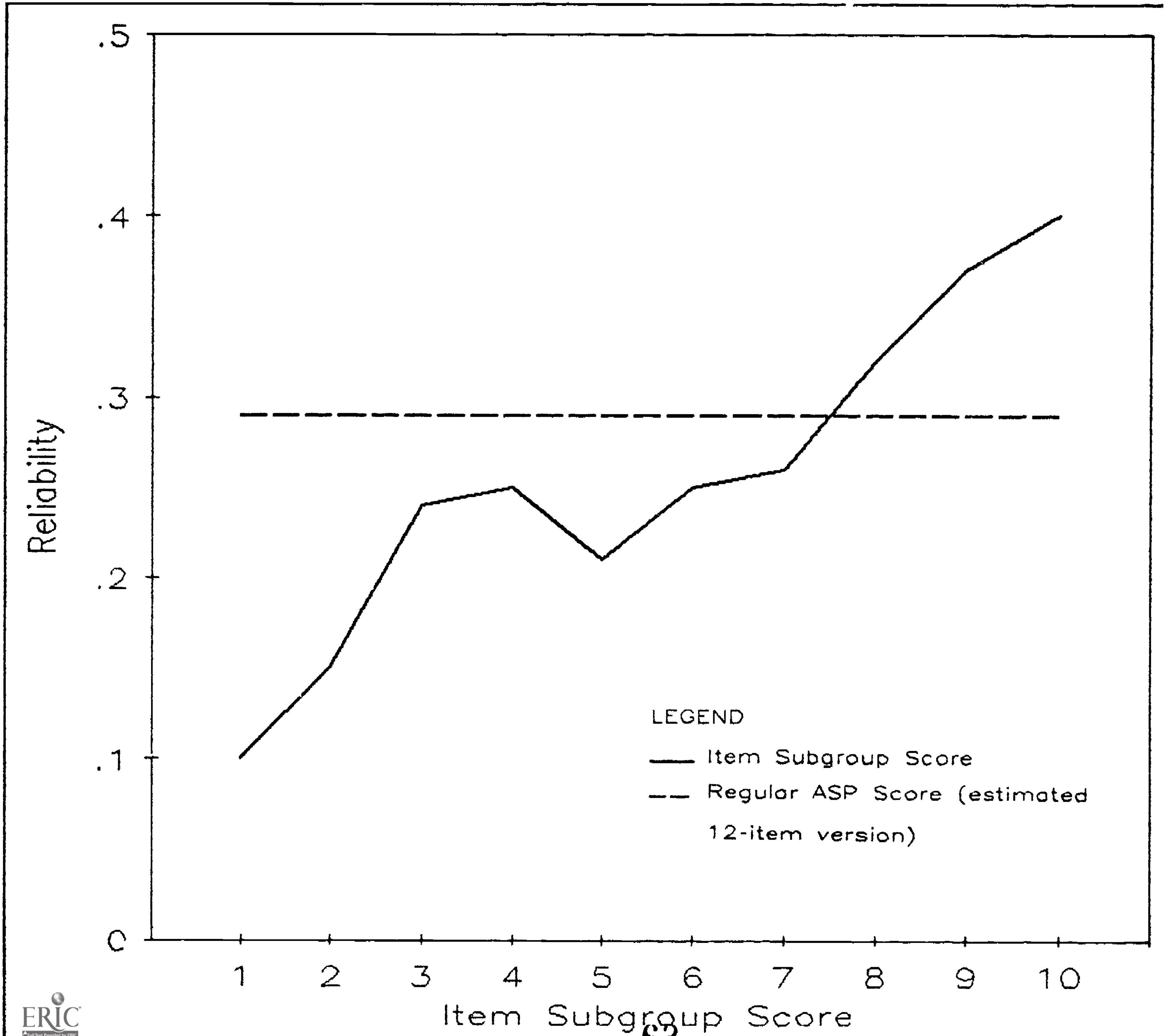
Figure 1. Internal-consistency reliability of double-standardized item subgroup scores.

Figure 2. Internal-consistency reliability of single-standardized item subgroup scores.

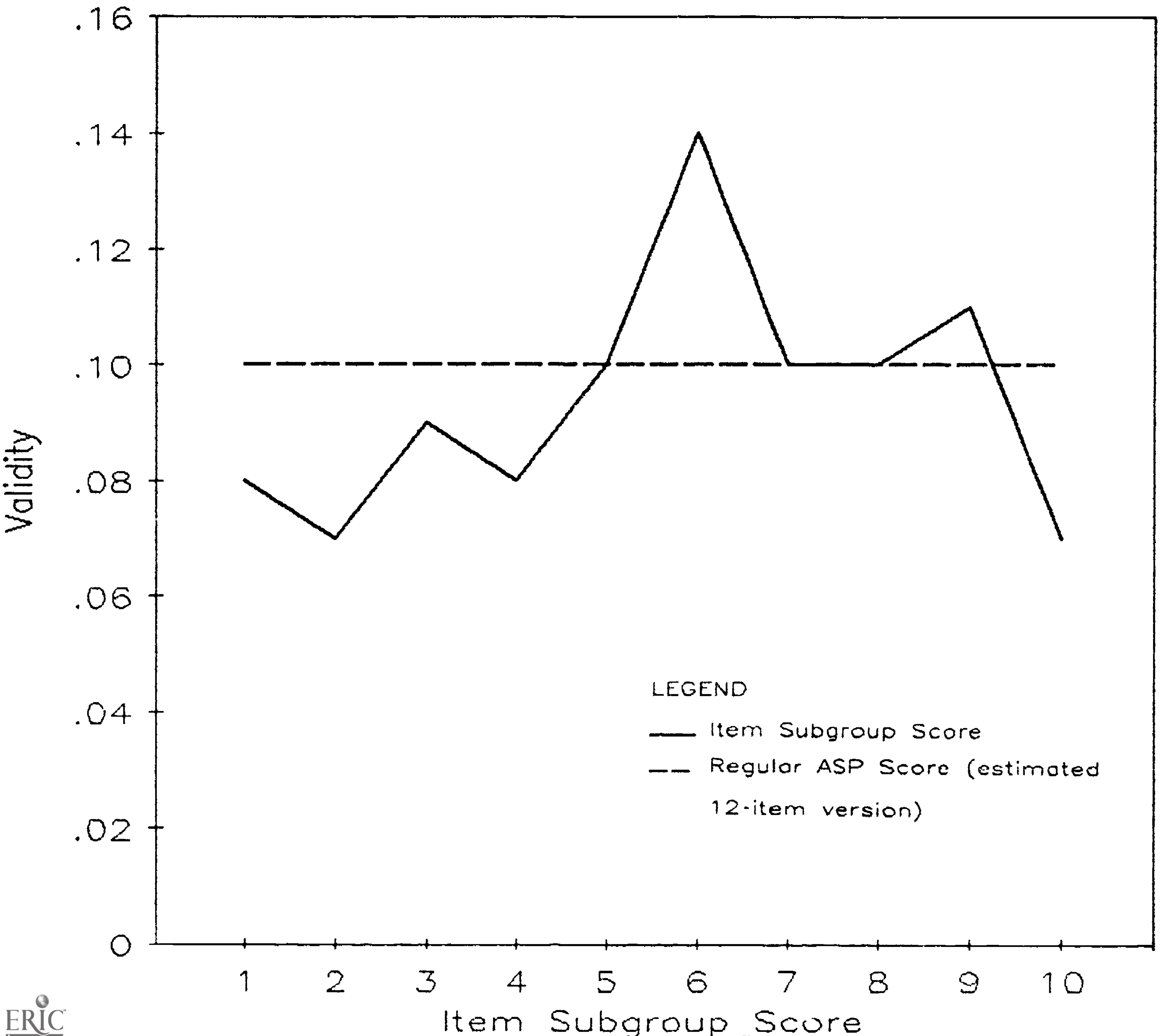
Figure 3. Predictive validity of double-standardized item subgroup scores.

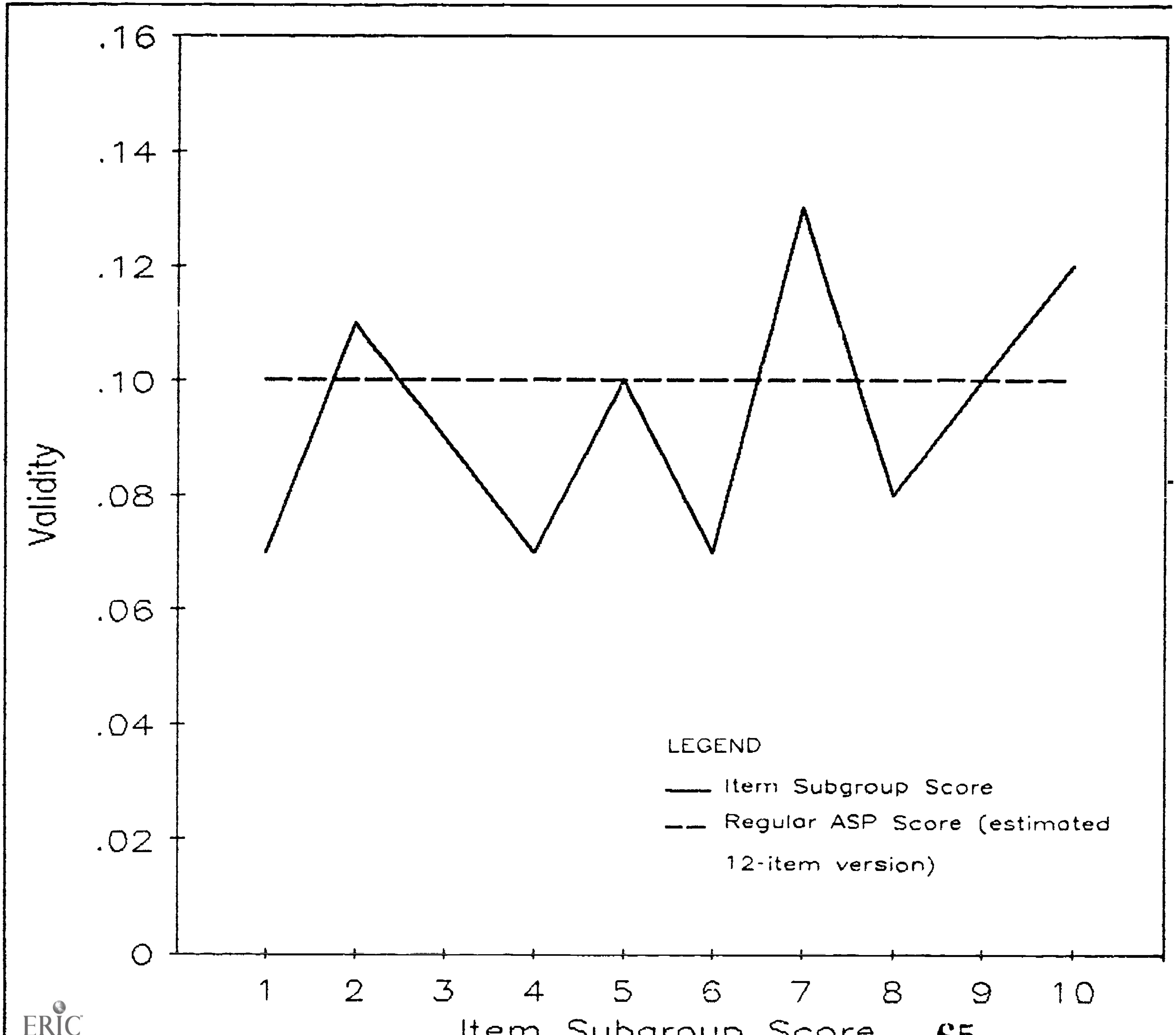
Figure 4. Predictive validity of single-standardized item subgroup scores.


.5
.4
.3
.2
.1
0
Reliability
1
2
3
4
5
6
7
8
9
10
Item Subgroup Score
LEGEND
Item Subgroup Score
Regular ASP Score (estimated
12-item version)



.5
.4
.3
.2
.1
0
Reliability
LEGEND
Item Subgroup Score
Regular ASP Score (estimated 12-item version)
1
2
3
4
5
6
7
8
9
10
Item Subgroup Score


.16
.14
.12
.10
.08
.06
.04
.02
0
Validity
1
2
3
4
5
6
7
8
9
10
Item Subgroup Score
LEGEND
Item Subgroup Score
Regular ASP Score (estimated 12-item version)


.16
.14
.12
.10
.08
.06
.04
.02
0
Validity
LEGEND
Item Subgroup Score
Regular ASP Score (estimated 12-item version)
1
2
3
4
5
6
7
8
9
10
Item Subgroup Score

Dr. Terry Ackerman
Educational Psychology
210 Education Bldg.
University of Illinois
Champaign, IL 61801

Technical Director,
Air Force Human Resources Lab.
Brooks AFB, TX 78236-5601

Personnel Analysis Division,
AF/MPXA
5C360, The Pentagon
Washington, DC 20330

Dr. James Algina
1403 Norman Hall
University of Florida
Gainesville, FL 32605

Dr. Erling B. Andersen
Department of Statistics
Studiestraede 6
1455 Copenhagen
DENMARK

Technical Director, ARI
5001 Eisenhower Avenue
Alexandria, VA 22333

Dr. Ronald Armstrong
Rutgers University
Graduate School of Management
Newark, NJ 07102

OASD(Manpower & Reserve Affairs)
5D800, The Pentagon
Washington, DC 20350-1000

Dr. Eva L. Baker
UCLA Center for the Study
of Evaluation
145 Moore Hall
University of California
Los Angeles, CA 90024

Dr. Laura L. Barnes
College of Education
University of Toledo
2801 W. Bancroft Street
Toledo, OH 43606

Dr. William M. Bart
University of Minnesota
Dept. of Educ. Psychology
330 Burton Hall
178 Pillsbury Dr., S.E.
Minneapolis, MN 55455

Dr. Isaac Bejar
Law School Admissions
Services
P.O. Box 40
Newtown, PA 18940-0040

Dr. Ira Bernstein
Department of Psychology
University of Texas
P.O. Box 19528
Arlington, TX 76019-0528

Dr. Thomas G. Bever
Department of Psychology
University of Rochester
River Station
Rochester, NY 14627

Dr. Menucha Birenbaum
School of Education
Tel Aviv University
Ramat Aviv 69978
ISRAEL

Dr. Bruce Bloxom
Defense Manpower Data Center
99 Pacific St.
Suite 155A
Monterey, CA 93943-3231

Cdt. Arnold Bohrer
Sectie Psychologisch Onderzoek
Rekruterings-En Selectiecentrum
Kwartier Koningen Astrid
Bruijnstraat
1120 Brussels, BELGIUM

Naval Supply Systems Command
NAVSUP 5512
ATTN: Sandra Borden
Washington, D.C. 20376-5000

Dr. Robert Breaux
Code 252
Naval Training Systems Center
Orlando, FL 32826-3224

Dr. Robert Brennan
American College Testing
Programs
P. O. Box 168
Iowa City, IA 52243

Dr. Gregory Candell
CTB/McGraw-Hill
2500 Garden Road
Monterey, CA 93940

Dr. Pat Carpenter
Carnegie-Mellon University
Department of Psychology
Pittsburgh, PA 15213

Dr. John B. Carroll
409 Elliott Rd., North
Chapel Hill, NC 27514

Dr. John M. Carroll
IBM Watson Research Center
User Interface Institute
P.O. Box 704
Yorktown Heights, NY 10598

Dr. Robert M. Carroll
Chief of Naval Operations
OP-01B2
Washington, DC 20350

Dr. Raymond E. Christal
UES LAMP Science Advisor
AFHRL/MOEL
Brooks AFB, TX 78235

Mr. Hua Hua Chung
University of Illinois
Department of Statistics
101 Illini Hall
725 South Wright St.
Champaign, IL 61820

Dr. Norman Cliff
Department of Psychology
Univ. of So. California
Los Angeles, CA 90089-1061

Director, Manpower Program
Center for Naval Analyses
4401 Ford Avenue
P.O. Box 16268
Alexandria, VA 22302-0268

Director,
Manpower Support and
Readiness Program
Center for Naval Analysis
4401 Ford Avenue
Alexandria, VA 22302-0268

Dr. Stanley Collyer
Office of Naval Technology
Code 222
800 N. Quincy Street
Arlington, VA 22217-5000

Dr. Hans F. Crombag
Faculty of Law
University of Limburg
P.O. Box 616
Maastricht
The NETHERLANDS 6200 MD

Ms. Carolyn R. Crone
Johns Hopkins University
Department of Psychology
Charles & 34th Street
Baltimore, MD 21218

Dr. Timothy Davey
American College Testing Program
P.O. Box 168
Iowa City, IA 52243

Dr. C. M. Dayton
Department of Measurement
Statistics & Evaluation
College of Education
University of Maryland
College Park, MD 20742

Dr. Ralph J. DeAyala
Measurement, Statistics,
and Evaluation
Benjamin Bldg., Rm. 4112
University of Maryland
College Park, MD 20742

Dr. Lou DiBello
CERL
University of Illinois
103 South Mathews Avenue
Urbana, IL 61801

Dr. Dattprasad Divgi
Center for Naval Analysis
4401 Ford Avenue
P.O. Box 16268
Alexandria, VA 22302-0268

Chief, Survey and Market
Analysis Division
Defense Manpower Data Center
1600 Wilson Blvd., #400
Arlington, VA 22209

Dr. Stephanie Doane
Institute of Cognitive Science
Campus Box 345
Boulder, CO 80309-0345

Mr. Hei-Ki Dong
Bell Communications Research
Room PYA-1K207
P.O. Box 1320
Piscataway, NJ 08855-1320

Dr. Fritz Drasgow
University of Illinois
Department of Psychology
603 E. Daniel St.
Champaign, IL 61820

Defense Technical
Information Center
Cameron Station, Bldg 5
Alexandria, VA 22314
(2 Copies)

Dr. Stephen Dunbar
224B Lindquist Center
for Measurement
University of Iowa
Iowa City, IA 52242

Dr. James A. Earles
Air Force Human Resources Lab
Brooks AFB, TX 78235

Dr. Susan Embretson
University of Kansas
Psychology Department
426 Fraser
Lawrence, KS 66045

Dr. George Englehard, Jr.
Division of Educational Studies
Emory University
210 Fishburne Bldg.
Atlanta, GA 30322

ERIC Facility-Acquisitions
2440 Research Blvd, Suite 550
Rockville, MD 20850-3238

Dr. Benjamin A. Fairbank
Operational Technologies Corp.
5825 Callaghan, Suite 225
San Antonio, TX 78228

Dr. Marshall J. Farr, Consultant
Cognitive & Instructional Sciences
2520 North Vernon Street
Arlington, VA 22207

Dr. P-A. Federico
Code 51
NPRDC
San Diego, CA 92152-6800

Dr. Leonard Feldt
Lindquist Center
for Measurement
University of Iowa
Iowa City, IA 52242

Dr. Paul Feltovich
Southern Illinois University
School of Medicine
Medical Education Department
P.O. Box 3926
Springfield, IL 62708

Dr. Richard L. Ferguson
American College Testing
P.O. Box 168
Iowa City, IA 52243

Dr. Gerhard Fischer
Liebiggasse 5/3
A 1010 Vienna
AUSTRIA

Dr. Myron Fischl
U.S. Army Headquarters
DAPE-MRR
The Pentagon
Washington, DC 20310-0300

Prof. Donald Fitzgerald
University of New England
Department of Psychology
Armidale, New South Wales 2351
AUSTRALIA

Mr. Paul Foley
Navy Personnel R&D Center
San Diego, CA 92152-6800

Dr. Alfred R. Fregly
AFOSR/NL, Bldg. 410
Bolling AFB, DC 20332-6448

Dr. Meg Gerrard
Psychology Department
Iowa State University
Ames, IA 50010

Dr. Robert D. Gibbons
Illinois State Psychiatric Inst.
Rm 529W
1601 W. Taylor Street
Chicago, IL 60612

Dr. Janice Gifford
University of Massachusetts
School of Education
Amherst, MA 01003

Dr. Drew Gitomer
Educational Testing Service
Princeton, NJ 08541

Dr. Robert Glaser
Learning Research
& Development Center
University of Pittsburgh
3939 O'Hara Street
Pittsburgh, PA 15260

Dr. Clark Glymour
Department of Philosophy
Carnegie-Mellon University
Pittsburgh, PA 15213

Dr. Timothy Goldsmith
Department of Psychology
University of New Mexico
Albuquerque, NM 87131

Dr. Sherrie Gott
AFHRL/MOMJ
Brooks AFB, TX 78235-5601

Dr. T. Govindaraj
Georgia Institute of
Technology
School of Industrial
and Systems Engineering
Atlanta, GA 30332-0205

Dr. Bert Green
Johns Hopkins University
Department of Psychology
Charles & 34th Street
Baltimore, MD 21218

Michael Habon
DORNIER GMBH
P.O. Box 1420
D-7990 Friedrichshafen 1
WEST GERMANY

Prof. Edward Haertel
School of Education
Stanford University
Stanford, CA 94305

Dr. Ronald K. Hambleton
University of Massachusetts
Laboratory of Psychometric
and Evaluative Research
Hills South, Room 152
Amherst, MA 01003

Dr. Delwyn Harnisch
University of Illinois
51 Gerty Drive
Champaign, IL 61820

Dr. Grant Henning
Senior Research Scientist
Division of Measurement
Research and Services
Educational Testing Service
Princeton, NJ 08541

Ms. Rebecca Hetter
Navy Personnel R&D Center
Code 63
San Diego, CA 92152-6800

Dr. Thomas M. Hirsch
ACT
P. O. Box 168
Iowa City, IA 52243

Dr. Paul W. Holland
Educational Testing Service, 21-T
Rosedale Road
Princeton, NJ 08541

Dr. Paul Horst
677 G Street, #184
Chula Vista, CA 92010

Ms. Julia S. Hough
Cambridge University Press
40 West 20th Street
New York, NY 10011

Dr. William Howell
Chief Scientist
AFHRL/CA
Brooks AFB, TX 78235-5601

Headquarters U.S. Marine Corps
Code MA
Washington, DC 20380-0001

Dr. Lloyd Humphreys
University of Illinois
Department of Psychology
603 East Daniel Street
Champaign, IL 61820

Dr. Steven Hunka
3-104 Educ. N.
University of Alberta
Edmonton, Alberta
CANADA T6G 2G5

Dr. Huynh Huynh
College of Education
Univ. of South Carolina
Columbia, SC 29208

Director
Instructional Development &
Educational Program Support Dept.
NETPMSA
Pensacola, FL 32509

Dr. Robert Jannarone
Elec. and Computer Eng. Dept.
University of South Carolina
Columbia, SC 29208

Dr. Kumar Joag-dev
University of Illinois
Department of Statistics
101 Illini Hall
725 South Wright Street
Champaign, IL 61820

Prof. David W. Johnson
Cooperative Learning Center
University of Minnesota
150 Pillsbury Drive, S.E.
Minneapolis, MN 55455

Dr. Peder Johnson
Department of Psychology
University of New Mexico
Albuquerque, NM 87131

Dr. William B. Johnson
Search Technology, Inc.
4725 Peachtree Corners Circle
Norcross, GA 30092

Dr. Douglas H. Jones
1280 Woodfern Court
Toms River, NJ 08753

Dr. Brian Junker
Carnegie-Mellon University
Department of Statistics
Schenley Park
Pittsburgh, PA 15213

Dr. Michael Kaplan
Office of Basic Research
U.S. Army Research Institute
5001 Eisenhower Avenue
Alexandria, VA 22333-5600

Dr. Milton S. Katz
European Science Coordination Office
U.S. Army Research Institute
Box 65
FPO New York 09510-1500

Prof. John A. Keats
Department of Psychology
University of Newcastle
N.S.W. 2308
AUSTRALIA

Dr. Jeffery L. Kennington
School of Engr. & Applied Sciences
Southern Methodist University
Dallas, TX 75275

Dr. Jwa-keun Kim
Department of Psychology
Middle Tennessee State University
P.O. Box 522
Murfreesboro, TN 37132

Dr. Soon-Hoon Kim
Kedi
92-6 Umyeon-Dong
Seocho-Gu
Seoul
SOUTH KOREA

Dr. G. Gage Kingsbury
Portland Public Schools
Research and Evaluation Department
501 North Dixon Street
P. O. Box 3107
Portland, OR 97209-3107

Dr. William Koch
Box 7246, Meas. and Eval. Ctr.
University of Texas-Austin
Austin, TX 78703

Dr. Richard J. Koubek
Department of Biomedical & Human Factors
139 Engineering & Math Bldg.
Wright State University
Dayton, OH 45435

Dr. Leonard Kroeker
Navy Personnel R&D Center
Code 62
San Diego, CA 92152-6800

Dr. Jerry Lehnus
Defense Manpower Data Center
Suite 400
1600 Wilson Blvd
Rosslyn, VA 22209

Dr. Thomas Leonard
University of Wisconsin
Department of Statistics
1210 West Dayton Street
Madison, WI 53705

Dr. Michael Levine
Educational Psychology
210 Education Bldg.
University of Illinois
Champaign, IL 61801

Dr. Charles Lewis
Educational Testing Service
Princeton, NJ 08541-0001

Library
Naval Training Systems Center
Orlando, FL 32813

Library
Naval War College
Newport, RI 02940

Science and Technology Division
Library of Congress
Washington, DC 20540

Mr. Rodney Lim
University of Illinois
Department of Psychology
603 E. Daniel St.
Champaign, IL 61820

Dr. Robert L. Linn
Campus Box 249
University of Colorado
Boulder, CO 80309-0249

Dr. Robert Lockman
Center for Naval Analysis
4401 Ford Avenue
P.O. Box 16268
Alexandria, VA 22302-0268

Dr. Frederic M. Lord
Educational Testing Service
Princeton, NJ 08541

Dr. Richard Luecht
ACT
P. O. Box 168
Iowa City, IA 52243

Dr. George B. Macready
Department of Measurement Statistics & Evaluation
College of Education
University of Maryland
College Park, MD 20742

Dr. Gary Marco
Stop 31-E
Educational Testing Service
Princeton, NJ 08451

Dr. Clessen J. Martin
Office of Chief of Naval Operations (OP 13 F)
Navy Annex, Room 2832
Washington, DC 20350

Dr. James R. McBride
HumRRO
6430 Elmhurst Drive
San Diego, CA 92120

Dr. Clarence C. McCormick
HQ, USMEPCOM/MEPCT
2500 Green Bay Road
North Chicago, IL 60064

Mr. Christopher McCusker
University of Illinois
Department of Psychology
603 E. Daniel St.
Champaign, IL 61820

Dr. Robert McKinley
Educational Testing Service
Princeton, NJ 08541

Mr. Alan Mead
c/o Dr. Michael Levine
Educational Psychology
210 Education Bldg.
University of Illinois
Champaign, IL 61801

Dr. George A. Miller
Dept. of Psychology
Green Hall
Princeton University
Princeton, NJ 08540

Dr. Timothy Miller
ACT
P. O. Box 168
Iowa City, IA 52243

Dr. Robert Mislevy
Educational Testing Service
Princeton, NJ 08541

Dr. William Montague
NPRDC Code 13
San Diego, CA 92152-6800

Ms. Kathleen Moreno
Navy Personnel R&D Center
Code 62
San Diego, CA 92152-6800

Headquarters Marine Corps
Code MPI-20
Washington, DC 20380

Dr. Ratna Nandakumar
Educational Studies
Willard Hall, Room 213E
University of Delaware
Newark, DE 19716

Director, Research & Analysis Div.
Navy Recruiting Command (Code 223)
4015 Wilson Blvd., Room 215
Arlington, VA 22203-1991

Deputy Director Manpower, Personnel and Training Div.
Naval Sea Systems Command
ATTN: Code CEL-MP63
Washington, DC 20362

Technical Director, Navy Health Research Ctr.
P.O. Box 85122
San Diego, CA 92138

Head, Leadership Branch
Naval Military Personnel Command
ATTN: LCDR E. Marits, NMPC-621
Department of the Navy
Washington, DC 20370-2000

Director, Rec. Services Dept.
Naval Military Personnel Command
N-651C
1300 Wilson Blvd., Room 932
Arlington, VA 22209

Naval Ocean Systems Center
Command Support Technology Division
Attn: Mr. J. Grossman, Code 4402
Bldg. 334
San Diego, CA 92152-5000

Head, Fleet Liaison Department
NPRDC (Code 03)
San Diego, CA 92152-6800

Head, Manpower Systems Department
NPRDC (Code 11)
San Diego, CA 92152-6800

Head, Personnel Systems Department
NPRDC (Code 12)
San Diego, CA 92152-6800

Head, Testing Systems Department
NPRDC (Code 13)
San Diego, CA 92152-6800

Head, Training Systems Department
NPRDC (Code 14)
San Diego, CA 92152-6800

Head, Training Technology Department
NPRDC (Code 15)
San Diego, CA 92152-6800

Commanding Officer,
Navy Personnel R&D Center
San Diego, CA 92152-6800

Library, NPRDC
Code P201L
San Diego, CA 92152-6800

Technical Director,
Navy Personnel R&D Center
San Diego, CA 92152-6800

Librarian
Naval Center for Applied Research
in Artificial Intelligence
Naval Research Laboratory
Code 5510
Washington, DC 20375-5000

Commanding Officer,
Naval Research Laboratory
Code 2627
Washington, DC 20390

Naval School of Health Sciences
National Naval Medical Center
Bldg. 141
ATTN: CDR J.M. LaRocco
Washington, DC 20814-5033

Head, Human Factors Laboratory
Naval Training Systems Center
Code 71
Orlando, FL 32813-7100

Attn: Dr. David E. Daniel
Deputy Director, R&D Department
NTSC (Code 7A)
12350 Research Parkway
Orlando, FL 32826-3224

Academic Progs. & Research Branch
Naval Technical Training Command
Code N-625
NAS Memphis (75)
Millington, TN 38054

Dr. Harold F. O'Neil, Jr.
School of Education - WPH 801
Department of Educational
Psychology & Technology
University of Southern California
Los Angeles, CA 90089-0031

Director, Applied Research Division

Arlington, Va 22217-5000

Chairman, MPT R&D Committee
Office of the Chief
of Naval Research (Code 222)
800 N. Quincy Street
Arlington, VA 22217-5000

Dr. James B. Olsen
WICAT Systems
1875 South State Street
Orem, UT 84058

Director of Research Programs
Office of Naval Research (Code 11)
800 North Quincy Street
Arlington, VA 22217-5000

Program Manager, Statistics and
Probability (Code 1111SP)
Office of Naval Research
800 North Quincy Street
Arlington, VA 22217-5000

Office of Naval Research,
Code 1142
800 N. Quincy St.
Arlington, VA 22217-5000

Office of Naval Research,
Code 1142BI
800 N. Quincy Street
Arlington, VA 22217-5000

Office of Naval Research,
Code 1142CS
800 N. Quincy Street
Arlington, VA 22217-5000
(6 Copies)

Office of Naval Research,
Code 1142PS
800 N. Quincy Street
Arlington, VA 22217-5000

Asst. for Long Range Reqts.
CNO Executive Panel (OP-00K)
4401 Ford Avenue
Alexandria, VA 22302-0268

Assistant for Planning and
Technology Development
Office of the DCNO(MPT) (OP-01B2)
Department of the Navy
Washington, DC 20350-2000

Deputy Director Total Force
Training and Education Div.
Office of the DCNO(MPT) (OP-11B)
Department of the Navy
Washington, DC 20370-2000

Assistant for Training Technology
and Human Factors
Office of the DCNO(MPT) (Op-11B1)
Department of the Navy
Washington, DC 20350-2000

Head, Military Compensation
Policy Branch
Office of the DCNO(MPT) (OP-134)
Department of the Navy
Washington, DC 20370-2000

Deputy Director Military
Personnel Policy Division
Office of the DCNO(MPT) (OP-13B)
Department of the Navy
Washington, DC 20370-2000

Head,
Family Support Program Branch,
OP 156
1300 Wilson Blvd., Room 823
Arlington, VA 22209

Head, Manpower, Personnel,
and Training Branch
Office of the CNO (OP-813)
4A478, The Pentagon
Washington, DC 20350-1000

Assistant for Manpower
and Training
Office of the CNO (OP-987H)
5E683, The Pentagon
Washington, DC 20350

Dr. Judith Orasanu
Basic Research Office
Army Research Institute
5001 Eisenhower Avenue
Alexandria, VA 22333

Dr. Jesse Orlansky
Institute for Defense Analyses
1801 N. Beauregard St.
Alexandria, VA 22311

Assistant for Training and
Personnel Technology
Office of the Under Secretary of
Defense for Research & Engrg.
3D129, The Pentagon
Washington, DC 20301-3080

Dr. Peter J. Pashley
Educational Testing Service
Rosedale Road
Princeton, NJ 08541

Wayne M. Patience
American Council on Education
GED Testing Service, Suite 20
One Dupont Circle, NW
Washington, DC 20036

Dr. James Paulson
Department of Psychology
Portland State University
P.O. Box 751
Portland, OR 97207

Director, Center for Personnel
Security Research
Suite E, Building 455
99 Pacific Street
Monterey, CA 93940-2481

Dept. of Administrative Sciences
Code 54
Naval Postgraduate School
Monterey, CA 93943-5026

Department of Operations Research,
Naval Postgraduate School
Monterey, CA 93940

Dr. Mark D. Reckase
ACT
P. O. Box 168
Iowa City, IA 52243

Dr. Malcolm Ree
AFHRL/MOA
Brooks AFB, TX 78235

Mr. Steve Reiss
N660 Elliott Hall
University of Minnesota
75 E. River Road
Minneapolis, MN 55455-0344

Dr. Carl Ross
CNET-PDCD
Building 90
Great Lakes NTC, IL 60088

Dr. J. Ryan
Department of Education
University of South Carolina
Columbia, SC 29208

Dr. Eduardo Salas
Human Factors Division (Code 712)
Naval Training Systems Center
Orlando, FL 32813-7100

Dr. Fumiko Samejima
Department of Psychology
University of Tennessee
310B Austin Peay Bldg.
Knoxville, TN 37916-0900

Mr. Drew Sands
NPRDC Code 62
San Diego, CA 92152-6800

Dr. Walter Schneider
Learning R&D Center
University of Pittsburgh
3939 O'Hara Street
Pittsburgh, PA 15260

Lowell Schoer
Psychological & Quantitative
Foundations
College of Education
University of Iowa
Iowa City, IA 52242

Dr. Mary Schratz
4100 Parkside
Carlsbad, CA 92008

Dr. Dan Segall
Navy Personnel R&D Center
San Diego, CA 92152

Mr. Robert Semmes
N218 Elliott Hall
Department of Psychology
University of Minnesota
Minneapolis, MN 55455

Dr. Robin Shealy
Illinois State Water Survey
Room 149
2204 Griffith Dr.
Champaign, IL 61820

Dr. Kazuo Shigemasu
7-9-24 Kugenuma-Kaigan
Fujisawa 251
JAPAN

Dr. Randall Shumaker
Naval Research Laboratory
Code 5510
4555 Overlook Avenue, S.W.
Washington, DC 20375-5000

Dr. H. Wallace Sinaiko
Manpower Research
and Advisory Services
Smithsonian Institution
801 North Pitt Street, Suite 120
Alexandria, VA 22314-1713

Dr. Richard E. Snow
School of Education
Stanford University
Stanford, CA 94305

Dr. Richard C. Sorensen
Navy Personnel R&D Center
San Diego, CA 92152-6800

Dr. Judy Spray
ACT
P.O. Box 168
Iowa City, IA 52243

Dr. Martha Stocking
Educational Testing Service
Princeton, NJ 08541

Dr. Peter Stoloff
Center for Naval Analysis
4401 Ford Avenue
P.O. Box 16268
Alexandria, VA 22302-0268

Dr. William Stout
University of Illinois
Department of Statistics
101 Illini Hall
725 South Wright St.
Champaign, IL 61820

Dr. Lawrence J. Stricker
Educational Testing Service
Princeton, NJ 08541

Dr. Hariharan Swaminathan
Laboratory of Psychometric and
Evaluation Research
School of Education
University of Massachusetts
Amherst, MA 01003

Mr. Brad Sympson
Navy Personnel R&D Center
Code-62
San Diego, CA 92152-6800

Dr. John Tangney
AFOSR/NL, Bldg. 410
Bolling AFB, DC 20332-6448

Dr. Kikumi Tatsuoka
Educational Testing Service
Mail Stop 03-T
Princeton, NJ 08541

Dr. Maurice Tatsuoka
Educational Testing Service
Mail Stop 03-T
Princeton, NJ 08541

Dr. David Thissen
Department of Psychology
University of Kansas
Lawrence, KS 66044

Mr. Thomas J. Thomas
Johns Hopkins University
Department of Psychology
Charles & 34th Street
Baltimore, MD 21218

Mr. Gary Thomasson
University of Illinois
Educational Psychology
Champaign, IL 61820

Dr. Perry W. Thorndyke
FMC Corporation
Central Engineering Labs
1205 Coleman Avenue, Box 580
Santa Clara, CA 95052

Dr. Robert Tsutakawa
University of Missouri
Department of Statistics
222 Math. Sciences Bldg.
Columbia, MO 65211

Dr. Ledyard Tucker
University of Illinois
Department of Psychology
603 E. Daniel Street
Champaign, IL 61820

Dr. David Vale
Assessment Systems Corp.
2233 University Avenue
Suite 440
St. Paul, MN 55114

Dr. Frank L. Vicino
Navy Personnel R&D Center
San Diego, CA 92152-6800

Dr. Howard Wainer
Educational Testing Service
Princeton, NJ 08541

Dr. Michael T. Waller
University of Wisconsin-Milwaukee
Educational Psychology Department
Box 413
Milwaukee, WI 53201

Dr. Ming-Mei Wang
Educational Testing Service
Mail Stop 03-T
Princeton, NJ 08541

Dr. Thomas A. Warm
FAA Academy AAC934D
P.O. Box 25082
Oklahoma City, OK 73125

Dr. Brian Waters
HumRRO
1100 S. Washington
Alexandria, VA 22314

Dr. David J. Weiss
N660 Elliott Hall
University of Minnesota
75 E. River Road
Minneapolis, MN 55455-0344

Dr. Ronald A. Weitzman
Box 146
Carmel, CA 93921

Major John Welsh
AFHRL/MOAN
Brooks AFB, TX 78223

Dr. Douglas Wetzel
Code 51
Navy Personnel R&D Center
San Diego, CA 92152-6800

Dr. Rand R. Wilcox
University of Southern
California
Department of Psychology
Los Angeles, CA 90089-1061

German Military Representative
ATTN: Wolfgang Wildgrube
Streitkraefteamt
D-5300 Bonn 2
4000 Brandywine Street, NW
Washington, DC 20016

Dr. David Wiley
School of Education
Northwestern University
Evanston, IL 60201

Dr. Charles Wilkins
Navy Personnel R&D Center
Code 13
San Diego, CA 92152

Dr. Bruce Williams
Department of Educational
Psychology
University of Illinois
Urbana, IL 61801

Dr. Kent E. Williams
Inst. for Simulation and Training
University of Central Florida
P.O. Box 25000
Orlando, FL 32816-0544

Dr. Mark Wilson
School of Education
University of California
Berkeley, CA 94720

Dr. Hilda Wing
Federal Aviation Administration
800 Independence Ave, SW
Washington, DC 20591

Mr. John H. Wolfe
Navy Personnel R&D Center
San Diego, CA 92152-6800

Dr. George Wong
Biostatistics Laboratory
Memorial Sloan-Kettering
Cancer Center
1275 York Avenue
New York, NY 10021

Dr. Wallace Wulfeck, III
Navy Personnel R&D Center
Code 51
San Diego, CA 92152-6800

Dr. Kentaro Yamamoto
02-T
Educational Testing Service
Rosedale Road
Princeton, NJ 08541

Dr. Wendy Yen
CTB/McGraw Hill
Del Monte Research Park
Monterey, CA 93940

Dr. Joseph L. Young
National Science Foundation
Room 320
1800 G Street, N.W.
Washington, DC 20550

Mr. Anthony R. Zara
National Council of State
Boards of Nursing, Inc.
625 North Michigan Avenue
Suite 1544
Chicago, IL 60611

Dr. Steven Zornetzer
Office of Naval Research
Code 114
800 N. Quincy St.
Arlington, VA 22217-5000