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ABSTRACT

The Miller Assessment for Preschoolers (MAP) is a new developmental screening tool for children aged 2 years 9 months to 5 years 8 months. The instrument, which has been standardized on 1,200 subjects representing nine geographic regions, identifies children who are functioning below the developmental level of their peers. The sampling method was rigorous, and the results closely parallel United States Census Bureau statistics. The reliability is well within acceptable professional standards. Preliminary validity studies demonstrate strong content and construct validity. When predictive validity studies are completed, information concerning the ability of this test to identify children at risk for future school problems will be available. At present, the MAP is one of the few nationally stanardized instuments available that identifies the full spectrum of severe-to-mild delays in preschoolers. It is unique in that it allows both screening conclusions and supplemental observations, which are important for providing appropriate intervention strategies. As services for young handicapped children increase, the need for a discrete tool such as this instrument will also increase. (Author/RH)

# Development and Standardization of the Miller Assessment for Preschoolers



by

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ABSTRACT

The Miller Assessment for Preschoolers is a new developmental screening tool for children aged two years nine months to five years eight months, which identifies children who are functioning below the developmental level of their peers. The instrument has been standardized on 1200 children, representing nine geographic regions. The sampling method was rigorous and the results closely parallel U.S. Census Bureau statistics. The reliability is well within acceptable professional standards. Preliminary validity studies demonstrate strong content and construct validity. When predictive validity studies are completed, information concerning the ability of this test to identify children at risk for future school problems will be available. The MAP is at present one of the few nationally standardized instruments available which identifies the full spectrum of severe-to-mild delays in preschoolers. It is unique in that both screening conclusions and supplemental observations, which are important for providing appropriate intervention strategies, can be obtained. As services for young handicapped children increase, the need for such a discrete tool is emphasized.

In 1975 Public Law 94-142, The Education for All Handicapped Children Act, was passed to ensure the rights of handicapped children to a free, appropriate education. The passage of this law has underlined the national recognition of the many social implications of handicapping conditions, and has led educators to seek means for aiding handicapped individuals in achieving their maximum potential. A natural outgrowth of this movement, and a partial requirement of P.L. 94-142, is the identification of handicapped children of school age and younger. The assessment of preschoolers is important primarily for the following two purposes: 1) to identify children with developmental problems so that they might receive appropriate intervention during the formative years; and 2) to aid school districts in planning for future remedial programs. Practitioners have responded in a variety of ways, including the the use and development of preschool screening devices.

In this particular area of assessment, in addition to ascertaining when a child has a severe handicapping condition, it is also important to detect mild-to-moderate developmental delays that might otherwise escape the detection of teachers or other school staff. Severe handicapping conditions are more obvious to the school's preschool staff, and practice-founded interventions to meet that child's special educational needs can more easily be generated. Identification and remediation of mild to moderate developmental delays has proven to be more difficult.

The effect of <u>not</u> recognizing disorders at an early age is potentially significant. As the literature in child development amply establishes (Fuller & Friedrich, 1973; Novack, 1973), the

child with moderate developmental delays frequently becomes a learning disabled student or an underachiever. The literature also supports the notion that with such children school-related problems frequently translate into the behavioral areas and on-going social dysfunction patterns may tend to result, (Johnson, 1975; Stoksky, 1974). Bloom (1964) and Bruner (1972) have also noted that untreated developmental problems may result in the "cumulative deficit" effect. This refers to the tendency for deficits in one area, (e.g., language) to impact on another area (e.g., cognition) or for the deficit in one area to become increasingly debilitating if left untreated. Also, the current research indicates that early intervention is far more effective and less expensive than are later interventions when the child's academic/behavioral/social problems become acute (Bronfenbrenner, 1975; Gallagher, 1973; Hobbs, 1975).

This argument underlies the need for accurate, early detection of developmental delays and other conditions, so that efficacious intervention strategies can be attempted. Scholarly reviews of existing screening and assessment tools, inventories and checklists find most to have serious limitations (Goodwin & Driscol, 1980).

The preschool screening instruments in existence in the mid-to-late 1970's were inadequate for the task of identifying the child with mild-to-moderate dysfunctions. These inadequacies included poor standardization; inadequate technical data (i.e., --reliability and validity); content limitations (e.g.,--they only assessed one developmental domain, such as language, or focused on one aspect of curriculum); and age limitations, (e.g.

,--not covering the entire 2 1/2 to 5 1/2 age range). "The main emphasis has been placed on assessing achievement of milestones, rather than the basis on which they are built" (Burns & Watter, 1974).

The Miller Assessment for Preschoolers (MAP) was developed in order to respond to the need for an effective, accurate, easily used screening device that would detect potential problems in all domains of development. First, it was constructed to assess a broad range of developmental variables which have been shown, through research, to be deficient in school age L.D. children. Second, rigorous test construction procedures for item selection, standardization, and reliability and validity research were used.

## Components of the Instrument

The MAP is designed to be used as a unit, with the total score yielding a screening result of red (refer), yellow (watch), or green (developmentally average). There are suggested guidelines for specific cut-off points for each category, however, each screening agency is encouraged to establish cut-offs appropriate for their situation. The child's MAP scores can also be analyzed for strengths and weaknesses by utilizing the five performance indices (subtests) that, in combination provide an overview of the child's developmental status (see Figure 1). The test incorporates several areas, not included in other screening tests, that reflect neurological and sensory integrity. These areas may prove to be important indicators of future school success.

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Insert Figure 1 About Here

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Sensory and motor abilities are addressed in the Foundations Index. The child is assessed on position and movement, sense of touch, basic movement patterns, and body scheme.

The assessment of the child's motor abilities is targeted in the Coordination Index. This index includes items relating to gross motor, fine motor, oral motor, and articulation.

Cognitive abilities are tested in two indices, the Verbal Index and the Non-Verbal Index. Tasks in the Verbal Index require the child to demonstrate verbal problem-solving, classification, auditory processing, following directions, quantification abilities, and comprehension of spatial relations/prepositions. The child's expressive language (e.g., vocabulary and syntax) and memory skills are also assessed.

The Non-Verbal Index looks at the child's ability to generalize from previous experience and relate abstract concepts in non-verbal forms, using visual and mental processing abilities. Tasks involve sequencing, memory, visualization, and visual closure.

The Complex Tasks Index reflects tasks that combine sensory, motor, and cognitive abilities. Although these tasks are individually assessed in other indices, the tasks in this index require an integration of basic skills into more complex behaviors, such as writing and building block designs.

In addition to the five indices, the Behavior During Testing sections allows consideration of attention, social interaction,

and reaction to sensory input. These areas have been noted in the research to relate to possible dysfunction and problems in school (Adelman, Feshback, Fuller & Williamson, 1973; Bellack and Charles, 1979; Keogh, 1970).

For more indepth information, therapists and teachers may find the Supplemental Observations useful. These provide guidelines for observing the more subtle difficulties a child may demonstrate, with an emphasis on the qualitative aspect of a child's behavior. Included are qualitative aspects of movement, touch, vision, speech and language, and draw-a-person. These observations do not influence the child's final score, but provide more comprehensive information on subjective, subtle aspects of the child's performance.

## Process of Test Development

Prior to the development of the test, an extensive review of the literature relating to both normal and abnormal development was completed. In addition to the review of the literature, an exhaustive review of hundreds of existing tests for preschool children was conducted (Miller, 1982). Relevant aspects of development were determined and items which would measure those factors were selected or developed and subjected to extensive field testing. Over 800 items were tested but only those items having the most solid statistical support were included in the final edition. Those items felt to be integral to normal development, but nonquantifiable were subsequently incorporated into the Behavior During Testing form and the Supplemental Observations Sheet.

The first edition of the MAP was compiled in 1974-1975, and was subsequently administered to approximately 400 children. Early childhood teachers in the Winthrop Massachusetts Public School preschool screening program were trained to administer and score the first edition on 206 children. In addition, approximately 20 clinicians located in the greater Boston area field tested the MAP on an additional 200 subjects, who demonstrated some dysfunction. The results from these administrations were compiled and statistically analyzed. The MAP was then revised in 1976.

The second edition of the MAP was piloted in the Tewksbury, Massachusetts Public School system on 486 children. With feedback from this study, the third edition was completed and copyrighted in 1978.

The third public school pilot research project was conducted in Walpole, Massachusetts. An interdisciplinary preschool team was trained and supervised on the administration of the test to 136 subjects. Analysis of data from the third edition led to further refinement and final item selection for the MAP Research Edition which was administered nationwide in 1979.

Prior to national standardization of the MAP, twelve pilot research projects (funded by a grant from the American Occupational Therapy Foundation) were conducted nationwide. Thirty occupational and physical therapists tested 1,014 children. These pilot projects provided indepth information about specific items which were included in the MAP Research Edition.

## Standardization of the MAP

The MAP was standardized during 1979-1980, using a stratified research design, representing all continental geographic regions of the United States. Funding for the project was awarded in the Fall of 1979, by the Health, Education, and Welfare Department (currently Health and Human Services, Maternal and Child Health Division Grant #MC-R-240441-01-0).

Two stages were involved in the standardization. Stage one involved the national administration of the MAP Research Edition for the purpose of item selection. Stage two was the standardization of the MAP screening and the study of test reliability and validity.

## MAP Research Edition

Nine field supervisors were hired; one for each of the nine U.S. census bureau regions. All supervisors were trained in test theory, item administration and scoring, and randomization methods for obtaining their regional sample. In order to establish reliability, each supervisor was videotaped administering the MAP. Tapes were reviewed for use of standardized procedures.

Each of the nine supervisors randomly selected a sample of approximately 70 children, stratified on the basis of age, sex, race, size of community, and socio-economic variables such as education of mother and father, professional category of mother and father, and total family income. The procedure that was followed included compiling lists of major sources of child care for children within four different population density areas

(i.e., central city, large town or suburb, small town, and rural areas). Nurseries, preschools, daycare centers, church nurseries, well-baby clinics, and babysitters were among those listed. An effort was made to obtain children not attending school, as well as pre-school/day care. Using a random numbers table, specific lists were selected. If approval for testing was granted, a random numbers table was again employed for child selection. Three to five children were tested from each list. Supervisors monitored the various quotas needed to meet standardization variables and "skipped" children when necessary. Although an infrequent occurrence, schools or children whose parents were reluctant to participate were eliminated from the project. Children included in the standardization sample had no noticable physical, mental, or emotional impairment, spoke English fluently, and lived at home.

In addition to the normal sample, a selected sample of approximately 60 children, who had previously been identified by parents, teachers, or physicians as having some functional delay, were administered the entire battery of items. These children demonstrated perceptual, behavioral, or language problems. Children with diagnosed cerebral palsy, mental retardation, or autism were not included in the "preacademic problem" sample.

Statistical analysis of the data from the MAP Research Edition led to the selection of the items for the MAP Final Edition. Selection of items was based on the following criteria:

1. the ability of an item to show a developmental degree of difficulty;

2. the ability of an item to clearly distinguish those within the "normal" population functioning in the low range;

3. the ability of an item to distinguish between normal and pre-academic problem populations;

4. the ease of administration in terms of material needed and time to administer;

5. the content of the items in relation to a broad range of developmental behavioral variables;

6. the reliability/objectivity of the item.

In addition to the above analysis, consultants who were experts in a specific field of child development (e.g., pediatric neurology, pediatric occupational therapy, etc.), were employed to give expert advice relevant to specific content areas. The final edition of the MAP was kept to 27 items and a series of structured observations in an attempt to keep administration time to 25-30 minutes.

Standardization of the Final MAP Screening

After determination of the final test items was made, phase two of standardization was begun. The regional field supervisors were retrained in the new test procedures. The plan for randomization of the sample was reviewed and a sample size of 1200 was targeted. This sample had the same sample characteristics as the Research Edition also based on the 1970 United States census reports and subsequent updates. Age, geographic region, race,

sex, size of residential community, and socio-economic variables were again considered. Sampling was random, except that a child who had been tested on the Research Edition would not be included in this sample. (See Table II for a description of the population tested by stratification variables).

An attempt was made to obtain approximately the same number of children from each region, even though population in the nine regions is unequal. A target of 11.1 % from each region was set. (See Table II for percentages of population tested from each region in comparison to Census Bureau Statistics). As can be seen in Table II the 11.1% goal from each region was closely approximated.

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Insert Table II About Here

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Scoring System

A scoring system, which is quick and simple, was developed from the standardization data. It provides clear information about a child's performance compared to other children as well as information on a child's strengths and weaknesses. A final classification system was devised which categorizes the performance into three groups:

-RED or STOP; Lowest 5% - Child likely to be in need of further evaluation and possible remediation;

-YELLOW or CAUTION; 6-25% - Child demonstrates borderline

scores; these scores should be subjected to close scrutiny and further in depth interpretation; child should be "watched";

-GREEN or GO; Above 20% - Child's performance is in the average range or above.

The cut-off points (division between) red and yellow, and between yellow and green were established based on logic and statistics. The divisions are basically arbitrary and should not be thought of as rigid divisions, but rather as general guidelines. This final score system was designed so that a child receives a specific numerical percentile score, ranging from 1% (low) to 99% (high). Thus, each examiner is given the responsibility for determining actual cut-off points.

For example, although a final score of 5% falls in the "red" category and a final score of 6% falls in the "yellow" category, it is clear these two scores are quite similar. The final decision about which children should receive further services may be based on a combination of pragmatic programming realities, as well as educational and clinical judgement. Rather than indicating the child "passed" or "failed", the child's performance, relative to his/her peers is obtained and the final classification of pass, questionable, or fail is determined by the screening team.

A variety of additional analyses are described to assist the examiner in making final decisions. For example, each item score can be classified by percentile ranking (1-99%), as well as by Red, Yellow, Green. In addition to individual item scores,

scores can be derived for each of the performance indices (i.e., foundations, coordination, verbal, non-verbal, and complex tasks). These results provide data for determining whether further evaluation of the child is needed and in what areas. For a child who needs to be "watched", the information regarding strengths and weaknesses can provide useful data for the child's teacher. Although beyond the scope of this article, an examiner can obtain a wealth of additional information which aids in the interpretation of the child's performance. The reader is referred to the MAP Manual (Miller, 1982) for further guidelines on analysis of the MAP.

It should be emphasized that the MAP has been developed to identify those children functioning in the low to low-normal range. This test is not appropriate for use in identifying exceptionally bright children. Any score above 50% must be interpreted as "average or above" although how much above average cannot be determined.

Reliability

Although future articles will deal in detail with the reliability and validity of the MAP, the issue is also relevant to the discussion of the standardization of the test, and thus, will be briefly summarized here.

Reliability, or the consistency of scores, was established through both an inter-rater reliability study and a test-retest reliability study. In the former, two Field Supervisors, trained in administration and scoring of the MAP, administered the test to 40 children. One-half of the children (N=20) were tested by

one examiner while the other examiner observed and scored the same child. The examiners' roles were then reversed for the other 20 children. Analysis indicated excellent inter-rater reliability. (See Table III) Inter-rater reliability was .97 and above on the total test, as well as on four of the five indices. The fifth index, Coordination, had acceptable inter-rater reliability (.84). Further analysis (Miller, 1982) revealed the deflated correlations to be due to one item, articulation.

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Insert Table III About Here

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Test-retest reliability was also investigated. Three Field Supervisors administered the MAP twice to 90 children. The testing sessions were completed no less than one nor more than four weeks apart. The correlation between the two tests was computed by using the child's total scores and the category (i.e., Red, Yellow, or Green) into which the score fell. The percentage of children who remained in the same category after second testing can be seen in Table IV. On the total test, as well as on four of the five indices, 80% or higher remained stable in the final scoring category. Of the children who changed category (i.e., from RED to YELLOW) all but two did better on the second test. Since the tests were given at a relatively close interval, the change in scores could be attributed to practice effect. The MAP appears to be comfortably stable over time.

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Insert Table IV About Here

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## Validity

A variety of validity studies have been done to date and are discussed in detail in the MAP examiner's manual (pp. 47-58). A brief summary of these studies in four areas: Content Validity, Criterion-Related Validity, Construct Validity, and Predictive Validity follows.

## Content Validity

A thorough specification table was constructed to explain the developmental domains assessed as well as the contribution of each item to each domain. In addition, the relationship of item performance to chronological age was studied.

A varimax rotated factor matrix was computed to determine if the items clustered together revealing common traits. The results indicated relative agreement with division of items into subtests. Correlation studies of items and indices revealed that all items are contributing significantly (<.01) to the final score, and that the subtests do not overlap significantly in behaviors measured.

## Criterion-Related Validity

The MAP was compared with four other assessment instruments to obtain a direct and independent measure of validity. The expectation did not exist that any one test would have a direct correlation to the MAP, since the MAP was developed because no similar test existed. It was anticipated, however, that certain sections of the MAP would correlate with certain parts of other

tests. The four other assessments used are noted below, with summary results presented in Table V.

--The Southern California Sensory Integration (SCSIT)

--The Weschler PreSchool and Primary Scale of Intelligence (WPPSI)

--The Illinois Test of Psycholiguistic Abilities (ITPA)

--The Denver Developmental Screening Test (DDST)

As expected, the correlations were not high for total test scores (See Table V). Analysis of individual subtests, however, revealed higher correlations. These are detailed in the MAP Manual.

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Insert Table V About Here

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Construct Validity

There were ninety children with "preacademic problems" tested during the MAP standardization project. These were children identified by parents, teachers, or physicians as functioning less well than their peers but without diagnosed problem such as autism or mental retardation. Following the development of the final scoring system for the MAP, these ninety children were scored. It was established that 75% of these problem children would have been identified in the Red or Yellow category; if only children aged three years eight months and older are considered, 84% of the problem sample would have been identified as at risk.

These results,while encouraging, do not replace the need for predictive validity studies.

Predictive Validity

The MAP is designed to be used as a developmental assessment

to determine a child's current status as compared to his/her peers. It's predictive power has not yet been established. Until predictive validity studies are completed, it is not possible to know definitively how accurate the MAP is in identifying children at risk for future problems.

Predictive studies are currently planned which will investigate the current status of the standardization sample (now aged five, six, and seven).Comparative predictive validity testing of the MAP and four commonly used preschool tests will be done.

--Denver Developmental Screening Test (DDST)

--Comprehensive Identification Process (CIP)

--Developmental Indicators in Assessment of Learning (DIAL)

--Learning Accomplishment Profile-Screen (LAP)

Full reports of these findings will be generated in future publications.

Conclusion

The Miller Assessment for Preschoolers is a new developmental screening tool for children, age two years nine months to five years eight months, which identifies children who are functioning below the developmental level of their peers. The instrument has been standardized on 1200 children, representing nine geographic regions. The sampling method was rigorous and the results closely parallel U.S. Census Bureau statistics. The reliability is well within acceptable professional standards. Preliminary validity studies demonstrate strong content and construct validity. When predictive validity studies are completed, information concerning the ability of this test to identify

children at risk for future school problems will be available. The MAP is at present one of the few standardized instruments, available nationally which identifies the full spectrum of severe-to-mild delays in preschoolers. It is unique in that both screening conclusions and supplemental observations, which are important for providing appropriate intervention strategies, can be obtained. As services for young handicapped children increase, the need for such a discrete tool is emphasized.

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Figure 1

# INDIVIDUAL PROFILE

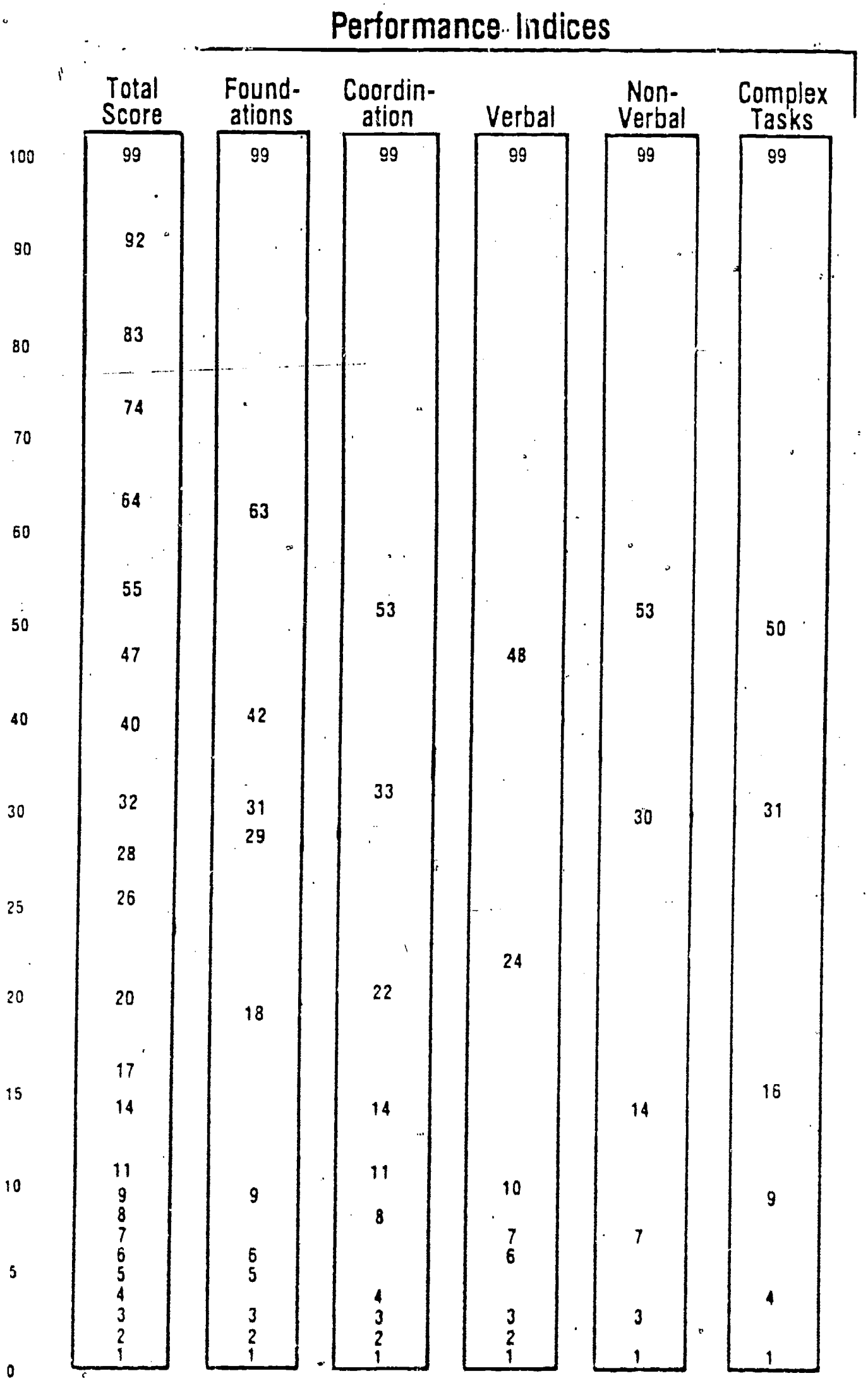

TABLE I

DESCRIPTION OF POPULATIONS TESTED BY STRATIFICATION VARIABLES

Projected Compared to Actual Percentages in Demongraphic Categories

| | Goal of Project (U.S. Census) | MAP Final Standardization Sample |
|---|---|---|
| I. Proportion of Samples by Ages | | |
| 1. 2'9° - 3'2° | 16.7% | 16.2% |
| 2. 3'3° - 3' 8° | 16.7 | 18.7 |
| 3. 3'9° - 4'2° | 16.7 | 19.0 |
| 4. 4'3° - 4'8° | 16.7 | 17.3 |
| 5. 4'9° - 5'2° | 16.7 | 14.9 |
| 6. 5'2° - 5'8° | 16.7 | 13.9 |
| II. Proportion of Samples by Community Sizes | | |
| 1. Central City | 30.5 | 33 |
| 2. Urban/Suburban | 41.3 | 44 |
| 3. Small Town | 3.5 | 7 |
| 4. Rural | 24.6 | 16 |
| III. Proportion of Samples By Sex | | |
| 1. Male | 49 | 51 |
| 2. Felmale | 51 | 49 |
| IV. Proportion of Samples by Race | | |
| 1. White | 88.2 | 86 |
| 2. Black | 10.2 | 12 |
| 3. Other | 1.5 | 2 |

| V. Proportion of Samples by Parents' Educational Level | (For Heads Of Households) | (Fath) | (Moth) |
|---|---|---|---|
| 1. 8 years | 14.7 | 1 | 1 |
| 2. 8 years | 12.2 | 1 | 1 |
| 3. 4 years High School | 18.9 | 6 | 5 |
| 4. H.S. diploma | 29.7 | 25 | 31 |
| 5. 4 years College | 11.6 | 23 | 29 |
| 6. Bachelor degree | 13.0 | 16 | 15 |
| 7. Graduate work | | 6 | 7 |
| 8. M.S. | | 11 | 9 |
| 9. Ph.D. | | 11 | 2 |
| 10. Unknown | | | |

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TABLE I (Cont.)

| | Goal of Project (U.S. Census) | MAP Final Standardization Sample | |
|---|---|---|---|
| | | (Fath) | (Moth) |
| **VI. Proportion of Samples by Parents' Professional Level** | | | |
| 1. Prof. | 15% | 34% | 24% |
| 2. Admin. | 8 | 19 | 9 |
| 3. Sales | 7 | 8 | 4 |
| 4. Clerical | 18 | 2 | 25 |
| 5. Craft | 14 | 17 | 4 |
| 6. Operator | 18 | 8 | 1 |
| 7. Laborer | 4 | 6 | 1 |
| 8. Farm | 3 | 1 | 1 |
| 9. Service | 11 | 4 | 9 |
| 10. Unemployed or homemaker | * | 1 | 22 |

*Numbers 1-9 from the U.S. Census Bureau are based only on the occupation of employed person and do not take into account those persons who are unemployed or homemakers. According to 1970 Census statistics, there were 68.8% of mothers unemployed or homemakers.

| | | |
|---|---|---|
| **VII. Proportion of Samples by Total Family Income** | | |
| 1. $0 - 5k | 21.4 | 11 |
| 2. 6 - 9 | 19.2 | 12 |
| 3. 10 - 14 | 13.9 | 12 |
| 4. 15 - 19 | 41.1 | 11 |
| 5. 20 - 24 | 3.6 | 14 |
| 6. 25 - 29 | .7 | 11 |
| 7. 30 - 34 | | 10 |
| 8. 35 - 39 | | 5 |
| 9. 40+ | | 14 |

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TABLE II
DESCRIPTION OF POPULATIONS TESTED
BY REGIONS

| Regions | Census Bureau | Goal of Project | Final Standardization Sample |
|---|---|---|---|
| New England | 6% | 11.1% | 11% |
| Mid-Atlantic | 18 | 11.1 | 11 |
| East North Central | 20 | 11.1 | 12 |
| West North Central | 8 | 11.1 | 8 |
| South Atlantic | 15 | 11.1 | 11 |
| East South Cnetral | 6 | 11.1 | 11 |
| West South Central | 10 | 11.1 | 11 |
| Mountain | 4 | 11.1 | 11 |
| Pacific | 13 | 11.1 | 14 |

Although the population in each U.S. Census Bureau Region was not equal, it was decided that an equal number of children in each region would be tested as a goal of this project.

TABLE III
INTER-RATER RELIABILITY

| TEST/INDEX | CORRELATION |
|---|---|
| Total MAP | .978 |
| Foundations | .97 |
| Coordination | .84 |
| Verbal | .98 |
| Non-Verbal | .99 |
| Complex Tasks | .98 |

TABLE V
ANALYSIS OF TEST-RETEST:
STABILITY OVER TIME

| Test/Index | % of group who remained stable (did not switch final scoring (category, upon retest) |
|---|---|
| Total MAP | 81% |
| Foundations Index | 80 |
| Coordination Index | 72 |
| Verbal Index | 80 |
| Non-Verbal Index | 94 |
| Complex Tasks Index | 91 |

TABLE V
CORRELATION OF MAP TOTAL SCORE
WITH FOUR OTHER ASSESSMENTS

| TEST | NUMBER CHILDREN TESTED | TOTAL MAP | SIGNIFICANCE |
|---|---|---|---|
| SCSIT | 30 | not possible to obtain | only Performance Index with "other" was significant at $\leq .04$ |
| WPPSI | 30 | .270 | not significant at $< .10$ |
| ITPA | 30 | .312 | $< .05$ |
| DDST | 90 | Map identifies 24% more children | $< .03$ |