

DOCUMENT RESUME

ED 105 999

PS 007 889

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TITLE A Preschool Inventory of Cognitive Functioning.  
PUB DATE Mar 75  
NOTE 12p.; Paper presented at the Annual Meeting of the American Educational Research Association (Washington, D.C., March 30 - April 3, 1975)

EDRS PRICE MF-\$0.76 HC-\$1.58 PLUS POSTAGE  
DESCRIPTORS \*Cognitive Development; Comparative Testing; Pictorial Stimuli; \*Preschool Education; \*Preschool Tests; \*Test Construction; Test Reliability; Test Validity

IDENTIFIERS Pennsylvania Preschool Inventory (PPI)

ABSTRACT

This study was undertaken to determine reliability and validity estimates for a newly developed preschool inventory of cognitive functioning which provides many advantages over traditionally utilized measures. A predominantly pictorial stimulus-psycomotor response set was the format for the test. The test consisted of a series of 61 items divided into six sections: passive vocabulary, complementary relationships, noncomplementary relationships, number concepts, verbal analogies, and awareness of self. A KR-20 reliability coefficient of .93 was obtained on a sample of 85 nursery school children. In terms of validity, significant correlations with the Stanford-Binet, the Slosson Intelligence Test and the Peabody Picture Vocabulary Test were obtained on a sample of 20 children and later on a sample of 68 children. For the latter sample, these correlations were .90, .86 and .91, respectively. The advantages of the test are that the administrative time is brief and that it can be used by the average preschool teacher. (Author/CS)

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**A PRESCHOOL INVENTORY OF COGNITIVE FUNCTIONING**

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PS 007889

A paper presented at the 1975 Annual Meeting of the  
American Educational Research Association in Washing-  
ton, D.C.

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## A PRESCHOOL INVENTORY OF COGNITIVE FUNCTIONING

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A study was undertaken to determine reliability and validity estimates for a newly developed preschool inventory of cognitive functioning which provides considerable advantages over traditionally utilized measures. A KR-20 reliability coefficient of .93 was obtained on a sample of 85 nursery school children. In terms of validity, significant correlations with the Stanford-Binet, the Slosson Intelligence Test and the Peabody Picture Vocabulary Test were obtained on a sample of 20 children and later on a sample of 68 children. For the latter sample, these correlations were .90, .86 and .91, respectively.

## A PRESCHOOL INVENTORY OF COGNITIVE FUNCTIONING

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The objective of the present study was to develop a preschool inventory for the assessment of cognitive development and to determine reliability and validity estimates for this newly developed instrument. It was believed that the shortness of administration time together with the suitability of use by the average preschool teacher were characteristics of this inventory which would make it a potentially valuable measure for widespread adoption in a variety of early childhood programs.

The Pennsylvania Preschool Inventory (PPI) was originally developed to meet the need for a straightforward and efficient measurement, at the preschool level, for determining the relative cognitive development of the young child. Its function is to offer the preschool teacher a viable alternative to more complicated tests at the preschool level and, as such, to promote a more widely accepted standardized preschool evaluation program. The direct focus of the inventory is the three-to-six-year-old child involved in a preschool program, and its results have potential relevance to both current and future school success. The emphasis of the test format rests in its pictorial stimulus-response set, with primarily psychomotor responses required. Although it is acknowledged that social-behavioral, creative and motor abilities in the young child are strongly connected with academic achievement, it was felt that the cognitive area was of foremost concern in the assessment of early school experiences, and therefore, a measurement which directed its efforts to tapping that domain would serve as an efficient, although partial, measure of the child's developmental progress. This is especially true in the evaluation

of disadvantaged children, as in programs funded under Title I of the Elementary and Secondary Education Act, where the cognitive domain is a vital key to future success or failure in the educational process.

In its present form, the test inventory is a series of 61 items divided into six separate sections: Passive Vocabulary, Complementary Relationships, Noncomplementary Relationships, Number Concepts, Verbal Analogies and Awareness of Self. These sections contain 15, 11, 10, 7, 11 and 7 items, respectively. For each item, a response is marked as correct or incorrect and the total score for the inventory represents simply the number of correct responses.

### Test Design

The PPI was developed in response to the paucity of short and easily administrable preschool evaluation instruments available to teachers and administrators of preschool programs, especially those programs enrolling disadvantaged children. Many of the tests currently offered at the preschool level demand a substantial amount of sophistication and test experience on the part of the examiner. Moreover, due to the size and nature of the typical preschool, the hiring or employing of a testing specialist is often quite unrealistic. Consequently, although the normal needs of the preschool make desirable a fairly straightforward method of evaluation, it is nonetheless uncommon. Very few instruments offer the combined qualities of short administration time and scoring techniques which make few technical demands on the average teacher. It is observed that this lack of easily administrable standardized preschool tests contributes to the hesitation of preschools to adopt a regular and continuous program of testing. In addition, the confusion involved in obtaining, administering, scoring and interpreting many of the existing tests contributes to the inhibition of the preschool teacher

in experimenting with their use. In fact, when several preschool directors and teachers were contacted during the early planning stages of this test development effort, many expressed a desire for a measurement which would simplify the process of testing children, while retaining the ability to convey information about the progress of the individual child.

Actual development of the PPI began with a consideration of the characteristics of a test which would fulfill the identified needs. Elements which were considered pivotal in the construction of such a test were then taken as a framework for the design. Those elements which were used as guidelines for construction were: individual administration; a maximum of 15 minutes for testing time; a minimum of required technical knowledge for administration and scoring; and resulting scores that are easily interpreted and which serve as relative indices of cognitive development.

The PPI was designed as an individual rather than a group test in order to strengthen its accuracy and reliability through the monitoring of child reaction by the examiner. In the finalized form, it was hoped that any deviation noted through the one-to-one experience would be recorded and later employed as a method of prescribing individual activities for the child to strengthen or expand various cognitive areas. As in every individually administered test, the probability of error due to misunderstood directions decreases and more confidence can therefore be placed in the final score. Although individual administration of any test is less efficient than group administration, the young age range to which the PPI is directed makes group testing a somewhat unreliable, if not impractical, method of administration.

The decision to design the PPI so as to make administration possible in a 15-minute time period alleviates problems incurred by the longer tests in taxing the child's attention span. The examiner using the PPI, expected to be an average preschool teacher, would have fewer demands placed on

proficiency as a testing expert and less trouble in maintaining rapport with the child through the testing period.

To further the production of an efficient and simple measurement for preschool children, the scoring procedure and test package of the PPI were designed to be as trouble-free as possible. No extra materials were permitted beyond the test booklet and score sheet, insuring the user the ability to commence testing without lengthy preparations or repeated manual reviews. Both scoring and packaging of the test were such as to be as nontechnical as possible. This stress on minimization of needless sophistication permits a larger choice of examiners, ranging from classroom teachers to school administrators.

As a format for the PPI, it was felt that a predominantly pictorial stimulus-psychomotor response set would be most appropriate for the prescribed purposes. In dealing with young children from varied backgrounds, it was expected that this type of presentation would be least verbally demanding. In this way, less pressure would be placed on the examiner interpreting a child's response which may be less clear than normal due to anxiety created by either the examiner or the test situation.

### Test Construction

Test construction for the PPI was organized into three stages. Stage I was concerned with the test survey and review of possible item formats in existing tests. Stage II then concentrated on the refinement of test item formats and the creation of the pilot item pool. Test administration and item analysis was conducted during Stage III.

There are two primary areas of effort which were investigated in the first stage of the test development schedule: surveying the existing test field and related literature; and selecting sample item formats consistent with PPI purposes, which would serve as models for the final test form.

The tests selected for inclusion in the basic test survey were those preschool tests which appeared to have some similarity in purpose with the prescribed goals of the PPI. The criterion developed for inclusion of these tests in the review process was that each contain the following characteristics:

- (a) Its measurement objective was to lie predominantly in the cognitive domain.
- (b) It was to be an appropriate measure for children ranging from three to six years.
- (c) It was to be able to be scored in an objective manner.
- (d) Its reviews were to indicate that it had a high reliability and validity and was to be held in high regard in the test field.
- (d) Its administration and scoring was to not involve personal reports from parents or prolonged observation of the child being tested.

The tests selected for review were inspected as to their item content and format. These standardized tests were classified by numbers of different item types they presented. Tests such as the Peabody Picture Vocabulary Test and the Columbia Mental Maturity Scale contained only one specific type of item in their presentation and were classed as single-format tests. Tests such as the Stanford-Binet and Slosson Intelligence Test, on the other hand, were composed of several item presentation formats and were termed multi-format tests. The item content from both of these types of tests was then divided into categories based on the generalized purpose of the items. A convenient item classification system was devised consisting arbitrarily of the categories of psycho-social, factual, memory and logical-analytic. The above categories were defined as follows: psycho-social items were those concerned with behavior patterns of the child; factual items required the child to have previous knowledge of a specific area or piece of information he could state on demand; memory items gave the child visual or verbal sequences or sets, not known previously, that were to be committed to, and retrieved from,



short-term memory; logical-analytic items presented the child with a visual or verbal problem or group of facts and demanded a conclusion be reached from the evidence given. Items of the above types were selected out, using this categorization system, and considered as potential models for types of items to be constructed for the PPI.

Single-ability tests were analyzed with regard to: the single ability being measured; the generalizability of the single-ability trait; and the format in which the test was presented.

From the information gained from the test review process, efforts were made to design item formats for the PPI. Several steps were taken to arrive at the most efficient and valuable collection of item types. Prospective item types were assayed with regard to the abilities which they measured and from the standpoint of testing efficiency.

Stage II of the test construction process was concerned with the refinement of the item types assembled during Stage I. First, it was planned to eliminate those item types which were less efficient or which were redundant in terms of the measurement of various cognitive abilities. Second, new item types were to be constructed which would serve the specific purposes of the PPI. Finally, these general item types were to be converted into a pool of actual items, created for use in the pilot testing. The reduction at this point in time was minimal so as to allow a larger pool of item types from which to choose on the basis of preliminary test administrations. Consequently, the first pilot version of the PPI contained 14 separate item types. These 14 categories were examined with respect to their cognitive emphasis and found to possess a valuable diversity in the abilities being measured as well as the methods in which they were presented.

The items constructed within the predetermined categories were converted into appropriate item formats for their administration. Those items

which were based in pictorial stimuli were planned to be presented one item to a page, with four pictures given as response possibilities (one correct picture, three distractors). All pictures to be used were designed for clarity and simplicity of presentation.

After construction of the item pool, the initial pilot version of the PPI was compiled and reviewed for format difficulties before actual administration began.

The third stage of test development was primarily concerned with the administration of the pilot forms of the PPI. Scheduling of the test administrations was done in such a manner that the item pool was reduced by a step-down method, enabling each successive administration period to require less time. This procedure was performed several times during the period which was allotted for field testing; the final reduction of items leaving an item pool which would then constitute the PPI Research Form. The final version of the test was a product of successive item analyses on test data accumulated from over 150 children enrolled in 10 area nursery schools.

### Reliability and Validity

The full test was administered to a total of 85 children in the last stage of the process of development of the test itself and it is from this sample that the reliability estimate was obtained.

Two separate validity studies were undertaken. The first involved a sample of 20 children enrolled in the Pennsylvania Research in Infant Development and Education Project who were administered the inventory as a part of a large battery of test measures. The second study involved a larger sample of 68 children enrolled in the above program. For both of the above validity studies, data were obtained for the same subjects on the Stanford-Binet Intelligence Test (SBIT), the Slosson Intelligence Test (SIT) and the Peabody

Picture Vocabulary Test (PPVT). These data were analyzed via Pearson product-moment correlations among inventory raw scores, SBIT mental ages, SIT mental ages and PPVT language mental ages.

A KR-20 estimate of reliability of .93 was obtained on the inventory for the sample of 85 children tested from area nursery schools.

The first validity study on the sample of 20 children yielded the following results:

TABLE 1

	PPI	SBIT	SIT	PPVT
PPI	1.00	.85	.78	.68
SBIT		1.00	.89	.80
SIT			1.00	.84
PPVT				1.00

The second validity study on the sample of 68 children yielded the following comparable results:

TABLE 2

	PPI	SBIT	SIT	PPVT
PPI	1.00	.90	.86	.91
SBIT		1.00	.91	.87
SIT			1.00	.85
PPVT				1.00

All correlations listed in Tables 1 and 2 were found to be statistically significant beyond the .01 level. The results presented indicate considerable promise for the inventory studied. Not only does the reliability of the instrument appear to be exceptional, but the validity coefficients found for the two samples studied are exceedingly high and suggest that the inventory may well serve as a potential substitute for the Stanford-Binet during the three-to-six-year-age range, with obvious advantages over the latter. Current plans call for the accumulation of normative data on a sample of approximately 3,000 children in the latter part of 1975 and for detailed analyses of the individual sections of the test.

While it is evident that further research on this instrument should be undertaken, it is also evident that the results of research to date on the inventory are both impressive and significant.