

A Test of the Theoretical Model of the Revised Illinois Test of Psycholinguistic Abilities

Nerella V. Ramanaiah, James P. O'Donnell and Michael Adams
Southern Illinois University at Carbondale

This study tested the theoretical model underlying the Revised Illinois Test of Psycholinguistic Abilities (ITPA). The ITPA model is a hierarchical factor model which includes five first-order factors (Receptive Process, Organizing Process, Expressive Process, Closure, and Sequential Memory); two second-order factors (Representational Level and Automatic Level); and one third-order factor (Psycholinguistic Ability). Results from correlated multiple-group component analyses of the ITPA subtest intercorrelations for each age group in the standardization sample provided strong support for the theoretical model.

Since its publication, the Illinois Test of Psycholinguistic Abilities (ITPA) has become one of the most popular instruments for the assessment of psycholinguistic abilities and disabilities in children. Its popularity may be partly attributed to the intuitively appealing psycholinguistic model used for its development. This theoretical model is an adaptation of Osgood's (1957a, b) three-dimensional communication model (Paraskevopoulos & Kirk, 1969, p. 11). The Osgood model deals with an individual's psychological functions which operate in communication activities. The revised ITPA consists of 12 subtests which are divided into two levels—Representational and Automatic. There are six subtests at

the Representational Level, which are grouped under three interrelated processes—Receptive, Organizing, and Expressive. The remaining six subtests, organized at the Automatic Level, cover two related processes—Closure and Sequential Memory. This paper reports the results of an empirical study which tested the theoretical model underlying the revised ITPA.

Following the publication of the original version of the ITPA, a number of factor analytic studies were conducted seeking empirical support for the ITPA theoretical model. (Excellent reviews of these studies can be found in Meyers, 1969; Ryckman & Wiegerink, 1969.) In general, factors corresponding to the Representational Level and to the Auditory-Vocal and Visual-Motor channels were found consistently. The Automatic Level did not appear to be a strong ITPA dimension, while Process Orientation emerged as a separate factor at higher age levels in a few studies.

In describing the revised ITPA, Paraskevopoulos and Kirk (1969) reported that several of their own attempts to factor analyze the intercorrelations among the revised ITPA subtests by standard factor analytic methods produced nebulous results; and they concluded that the ITPA subtests are too complex to yield a simple factor structure (p. 183). Nevertheless, the theoretical model underlying the ITPA continues to fascinate researchers, and several studies bear-

APPLIED PSYCHOLOGICAL MEASUREMENT
Vol. 2, No. 4 Fall 1978 pp. 519-525
© Copyright 1978 West Publishing Co.

ing on the factor structure of the revised ITPA have been published. For example, Smith and Marx (1971), using normal children, obtained one factor corresponding to the Expressive Process and three other factors which are not specified by the ITPA model. Burns and Watson (1973), using underachieving children, reported results supporting the existence of factors corresponding to the Visual-Motor and Auditory-Vocal channels of communication and the Expressive Process. Finally, Doughtie, Wakefield, Sampson, and Alston (1974) tested the hypothesis that the relative placement of the first six ITPA subtests in factor space corresponds with their placement in the Representational Level of the ITPA model. Factor analysis of the published ITPA subtest intercorrelations (Paraskevopoulos & Kirk, 1969) at each age level supported the hypothesis for six older age groups (ages 5 to 10) but not for the two youngest age groups (ages 2 to 4).

A major problem with most of the previous studies is that empirical evidence was sought for Osgood's three-dimensional communication model rather than for the model which was actually used for developing the ITPA. Examination of the description of the organization of the 12 subtests of the revised ITPA (Paraskevopoulos & Kirk, 1969, pp. 16–23) indicates that these subtests have been organized according to the hierarchical factor model presented in Figure 1. This model specifies five first-order factors (Receptive Process, Organizing Process, Expressive Process, Closure, and Sequential Memory); two second-order factors (Representational Level and Automatic Level); and one third-order factor (Psycholinguistic Ability). The model also defines each first-order factor as a function of a specific set of ITPA subtests and each second-order factor in terms of a specific set of first-order factors. Another important problem is that many of the previous studies were based on exploratory factor analysis methods which are not appropriate for testing the presence of a hypothesized factor structure (Gorsuch, 1974). The present study sought em-

pirical evidence for the hierarchical factor model (Figure 1) which was used as the theoretical model for developing the ITPA.

Method

Subjects

The data for this study consisted of the correlations among the 12 subtests for each age group in the standardization sample of the revised ITPA (Paraskevopoulos & Kirk, 1969, pp. 202–209). The standardization sample consisted of 962 normal children drawn from age groups ranging from 2 years 7 months to 10 years 1 month of age. The number of subjects in various age groups ranged from 107 to 128. There was an equal number of males and females in each age group. A detailed description of the standardization group can be found in Paraskevopoulos and Kirk (1969, pp. 50–72).

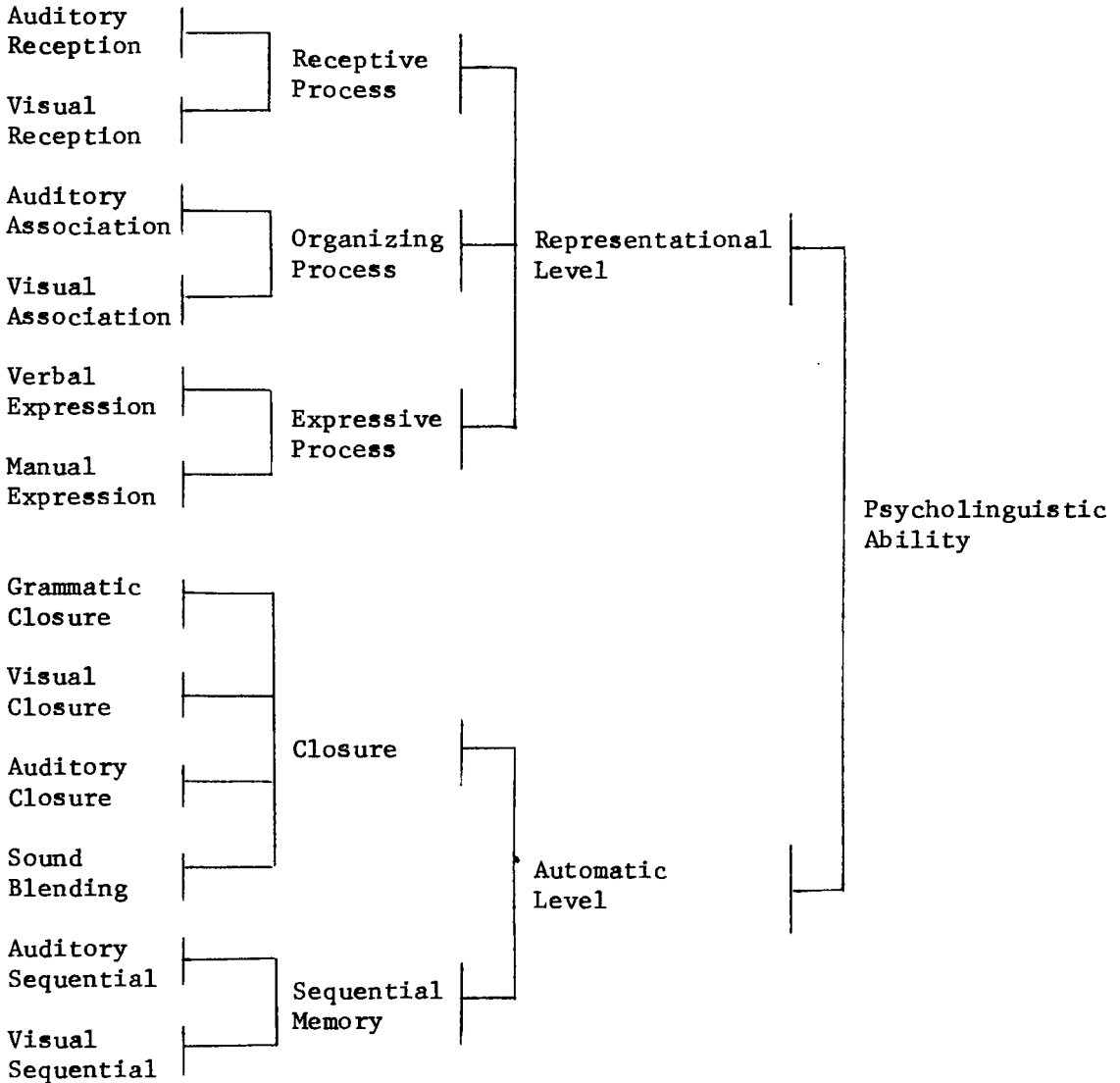
Data Analyses

The construct validity of the revised ITPA in terms of its theoretical model was assessed by separately testing the hypotheses concerning the five first-order factors, the two second-order factors, and the third-order factor as specified by the hierarchical factor model in Figure 1. The hypothesis that Receptive Process, Organizing Process, Expressive Process, Closure, and Sequential Memory are the five first-order factors was tested separately for each age group by performing correlated multiple-group components analysis (Gorsuch, 1974, pp. 74–78) for the matrix of intercorrelations among the 12 ITPA subtests. This multiple-group components analysis involves the use of the hypothesized factor-loading matrix for the first-order factors.

In general, a hypothesized factor-loading matrix specifies in matrix notation how the theoretical model defines each factor in terms of the relevant variables. The hypothesized factor-loading matrix for first-order factors consisted of 12 rows representing the 12 ITPA subtests and 5 columns corresponding to the 5 hypothe-

Figure 1

The hierarchical structure underlying the 12 ITPA subtests
See Paraskevopoulos & Kirk (1969) for a full description.



sized first-order factors. Each factor column in this matrix consisted of unities for subtests defining that factor and zeroes for the other subtests. Next, the hypothesis that Representational Level and Automatic Level were the two second-order factors was tested by performing correlated multiple-group components analysis for the matrix of intercorrelations among the five first-order factors obtained for each age group in the previous step. The hypothesized second-order factor-loading matrix consisted of five rows representing the five first-order factors and two columns assigned for the two second-order factors. Each second-order factor column consisted of unities for the first-order factors defining that factor and zeroes for the other first-order factors. A significant and high correlation between the two second-order factors would provide evidence for the existence of general Psycholinguistic Ability as the third-order factor in the hierarchical model. A tested hypothesis concerning the existence of a specified set of factors is said to be confirmed to the extent that the factor-loading matrix obtained from correlated multiple-group component analysis matched the hypothesized factor-loading matrix.

Results

Since the results were essentially the same for all age groups, this paper presents the results for three selected age groups: 3–7 to 4–1 (pre-school level); 5–7 to 6–1 (kindergarten level); and 7–7 to 8–1 (primary level). Table 1 presents the factor loadings of the 12 ITPA subtests on five hypothesized factors separately for the three age groups.¹ The communalities for most of the subtests were as high as the internal consistency reliability values published by Paraskevopoulos and Kirk (1969, p. 102) using the same data. The results in Table 1 clearly indicate that within each age group, the subtests hypothesized by the theoretical model to define a given first-order

factor had statistically significant and high loadings on that factor, while most other subtests had very low and nonsignificant loadings on that factor. As hypothesized, Receptive Process, Organizing Process, Expressive Process, Closure, and Sequential Memory clearly emerged as the first-order factors underlying the 12 ITPA subtests. At each age level, these five factors accounted for more than 50% of the total variance. The pattern of factor loadings was nearly the same in all age groups. Thus, the hypothesis about the five first-order factors received strong empirical support.

Table 2 gives the factor loadings of the five first-order factors on the two hypothesized second-order factors. As hypothesized, three first-order factors—Receptive Process, Organizing Process, and Expressive Process—clustered to form one second-order factor—Representational Level; the remaining two first-order factors—Closure and Sequential Memory—joined together to form the other second-order factor—Automatic Level. At each age level, the two second-order factors accounted for more than 50% of the total variance, and the factor structure was quite similar across the three age-groups. Thus, these results strongly support the hypothesis that Representational Level and Automatic Level are the two second-order factors.

The correlation between the two second-order factors was .61 in the pre-school group, .38 in the kindergarten group, and .39 in the primary school group. All of these correlations were significant at .01 level. These results support the hypothesis that general Psycholinguistic Ability is the third-order factor.

Conclusions

The factor structure of the data was very similar across a wide range of age groups. In addition, the factor structures were very similar to the theoretical model postulated. Thus, the present study provides strong empirical support for the hierarchical factor structure underlying the ITPA.

¹Factor loadings for the remaining five age-groups for all analyses may be obtained from the first author.

Table 1
Correlated Multiple-Group Factor Loadings of the Twelve
ITPA Tests for Three Selected Age-Groups

TEST	3 years 7 months through 4 years 1 month			5 years 7 months through 6 years 1 month			7 years 7 months through 8 years 1 month			
	I	II	III IV V	I	II	III IV V	I	II	III IV V	
A. Receptive process tests										
1. Auditory Reception	<u>69</u>	18	-08 06 02	76	04	-04 -08 08	<u>75</u>	-07	-03 11	-04
2. Visual Reception	<u>89</u>	-18	08 -06 -02	<u>74</u>	-04	04 08 -08	<u>76</u>	07	03 -11	04
B. Organizing process tests										
3. Auditory Association	10	<u>79</u>	-03 -03 10	00	73	03 01 17	07	78	-02 02	-07
4. Visual Association	-10	<u>90</u>	03 03 -10	00	<u>82</u>	-03 -01 -17	-07	<u>82</u>	02 -02	07
C. Expressive process tests										
5. Verbal Expression	-06	05	72 10 -16	01	05	81 -04 03	03	-06	78 02	-15
6. Manual Expression	06	-05	<u>76</u> -10 16	-01	-05	<u>81</u> 04 -03	-03	06	<u>77</u> -02	15
D. Closure tests										
7. Grammatic Closure	08	24	05 53 06	09	05	-05 58 04	01	15	10 64	00
8. Visual Closure	-07	-08	-07 <u>78</u> 04	-12	00	03 <u>65</u> -10	02	05	07 <u>54</u>	01
9. Auditory Closure	02	02	-04 <u>77</u> -05	24	-12	18 <u>57</u> 14	-05	-20	-08 <u>76</u>	03
10. Sound Blending	-03	-18	07 <u>80</u> -05	-20	07	-17 <u>56</u> -08	02	00	-09 <u>72</u>	-04
E. Sequential Memory tests										
11. Auditory Sequential	-04	00	04 -10 <u>79</u>	-01	07	01 -18 <u>80</u>	-01	-07	-03 03	<u>73</u>
12. Visual Sequential	04	00	-04 10 <u>71</u>	01	-07	-01 18 <u>71</u>	01	07	03 -03	<u>72</u>
Percent of Total Variance	11	13	9 18 10	10	10	12 12 10	10	11	10 15	9

Note: Decimals are omitted for factor loadings. Italicized factor loadings correspond to unities in the hypothesized factor matrix, while the others correspond to zeros. Percent of total variance was rounded to nearest integral value.

Table 2
Correlated Multiple-Group Factor Loadings of the Five ITPA
First-Order Factors for Three Selected Age Groups

First-order Factor	Age:					
	3 years 7 months through 4 years 1 month		5 years 7 months through 6 years 1 month		7 years 7 months through 8 years 1 month	
	I	II	I	II	I	II
A. Representational level						
I. Receptive process	<u>75</u>	06	80	-08	67	04
II. Organizing process	<u>76</u>	05	<u>63</u>	26	<u>76</u>	13
III. Expressive process	<u>77</u>	-11	<u>66</u>	-18	<u>73</u>	-18
B. Automatic level						
IV. Closure	24	67	21	73	25	64
V. Sequential memory	-24	<u>96</u>	-21	<u>89</u>	-25	<u>83</u>
Percent of Total Variance	38	28	31	29	34	23

Note: Decimals are omitted for factor loadings. Italicized factor loadings correspond to unities in the hypothesized factor matrix while the others correspond to zeros. Percent of total variance was rounded to nearest integral value.

References

- Burns, G. W., & Watson, B. L. Factor analysis of the revised ITPA with under-achieving children. *Journal of Learning Disabilities*, 1973, 6, 371-376.
- Doughtie, E. B., Wakefield, J. A., Jr., Sampson, R. N., & Alston, H. L. A statistical test of the theoretical model for the representational level of the ITPA. *Journal of Educational Psychology*, 1974, 66, 410-415.
- Gorsuch, R. L. *Factor analysis*. Philadelphia, PA: W. B. Saunders Co., 1974.
- Meyers, C. E. What the ITPA measures: A synthesis of factor studies of the 1961 edition. *Educational and Psychological Measurement*, 1969, 29, 867-876.
- Osgood, C. E. A behavioristic analysis of perception and language as cognitive phenomena. In the University of Colorado, Psychology Department, *Contemporary approaches to cognition*. Cambridge, MA: Harvard University Press, 1957. (a)
- Osgood, C. E. Motivational dynamics of language behavior. In M. R. Jones (Ed.), *Nebraska symposium on motivation*. Lincoln, NB: University of Nebraska Press, 1957. (b)

- Paraskevopoulos, J. N., & Kirk, S. A. *The development and psychometric characteristics of the revised Illinois Test of Psycholinguistic Abilities*. Urbana, IL: University of Illinois Press, 1969.
- Ryckman, D. B., & Wiegerink, R. The factors of the Illinois Test of Psycholinguistic Abilities: A comparison of 18 factor analyses. *Exceptional Children*, 1969, 36, 107-113.
- Smith, P. A., & Marx, R. W. The factor structure of the revised edition of the Illinois Test of Psycholinguistic Abilities. *Psychology in the Schools*, 1971, 8, 349-356.

Acknowledgements

The authors thank Fred Ribich, who wrote the computer program for correlated multiple-group components analysis.

Author's Address

Nerella V. Ramanaiah, Department of Psychology,
Southern Illinois University, Carbondale, IL 62901.