CORRELATION OF THE TEST OF NONVERBAL INTELLIGENCE (TONI) WITH THE SHIPLEY INSTITUTE OF LIVING SCALE (SILS)

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CORRELATION OF THE TEST OF NONVERBAL INTELLIGENCE (TONI) WITH THE SHIPLEY INSTITUTE OF LIVING SCALE (SILS)

An Abstract

Presented to the

Graduate and Research Council of

Austin Peay State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

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by

Judy Carol Rowland Bledsoe

July 1989

ABSTRACT

This study was made to examine the concurrent validity and alternate form reliability of a relatively new test called the Test of Nonverbal Intelligence (TONI). Since scientists began developing intelligence tests, there has existed a need for a statistically sound test of nonverbal intelligence; thus, this study was formulated. The TONI was correlated with the Shipley Institute of Living Scale (SILS), a verbal measure of intelligence, in order to examine its concurrent validity. The TONI Forms A and B were correlated to determine its alternate form reliability.

The subjects were 60 undergraduate students attending Austin Peay State University, located in Clarksville, Tennessee. The TONI was administered individually, and the SILS was administered in small groups. Testing covered the summer, fall, and winter of 1988-89.

Results of the Pearson product-moment method indicated that Forms A and B of the TONI correlated at .57, $p<.001$. The TONI Forms A and B were not significantly correlated with the SILS Verbal scores. However, the TONI Forms A and B correlated positively and significantly with the SILS Abstraction and Total scores. Respectively, the results were .58, .50, .49, and .42, $p<.001$ for all the correlations.

CORRELATION OF THE TEST OF NONVERBAL INTELLIGENCE (TONI) WITH THE SHIPLEY INSTITUTE OF LIVING SCALE (SILS)

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July 1989

To the Graduate and Research Council:

I am submitting herewith a Thesis written by Judy Carol Rowland Bledsoe entitled "Correlation of the Test of Nonverbal Intelligence (TONI) with the Shipley Institute of Living Scale (SILS)." I have examined the final copy of this paper for form and content, and I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Counseling and Guidance.

John D Martin
Major Professor

We have read this thesis
and recommend its acceptance.

Patricia F. Chappell
Second Committee Member

Garland E. Blair
Third Committee Member

Accepted for the Graduate and
Research Council:

William H. Ellis
Dean of the Graduate School

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CHAPTER 1

Introduction

How to measure intelligence is a question that has plagued investigators in the field of psychological testing for more than a century. Since Esquirol's conclusion in 1838 that one's use of language is the most dependable criterion by which to determine one's intellectual level, and since the development of the Army Beta Test in 1917 that classified illiterate and non-English speaking recruits, there has existed a dichotomy in the classification of intelligence measures. That is to say, there are verbal and nonverbal tests of intelligence. This particular dichotomy exists because of the overwhelming evidence that language is the best predictor of one's intellectual level; whereas, there are special populations which cannot be properly tested using a traditional, verbal measure of intelligence (Anastasi, 1982).

For many years, investigators in the field of psychological testing have continued to indicate a need for a test of nonverbal intelligence that can be used with special populations as well as with traditional populations; therefore, the writer chose to examine the concurrent validity and alternate form reliability of a relatively new test called the Test of Nonverbal Intelligence (TONI). According to the authors of the TONI, Brown, Sherbenou, and Johnsen (1982), it can be described as a language-free

measure of cognitive ability to be used with individuals ranging in age from 5-0 to 85-11 years, and with traditional as well as with special populations. According to Zachary (1986), the Shipley Institute of Living Scale (SILS), the test with which the TONI was correlated, is essentially a group measure of verbal or language ability to be used with adolescents and adults, 14 years and older.

Measuring intelligence actually has its roots in the classification and training of mentally retarded people. As institutions in Europe and the United States began to provide care for their mentally retarded populations, administrators needed to classify the mental capacity of the retarded patients (Anastasi, 1982).

Esquirol, a French physician, published a two-volume set in 1838 in which more than one hundred pages were devoted to the subject of mental retardation. Esquirol's main point was that the mental capacity of retarded people existed on a continuum from slightly below normal to very low, thus requiring different classifications for training and care purposes. Esquirol tried diverse methods of classifying mentally retarded people and finally concluded, as mentioned earlier, "the individual's use of language provides the most dependable criterion of his or her intellectual level" (cited in Anastasi, 1982, p. 6). The point is that as early as 1838 measuring intelligence had begun to be associated with verbal or language ability. Even today, intelligence tests

are highly loaded with verbal or language measures.

From the time of Esquirol, many scientists have experimented with diverse types of intelligence tests. Such tests have included ones that utilize sensory and perceptual discrimination as well as memory, association, and motor functions (Anastasi, 1982).

Finally, Alfred Binet in 1905 developed what might be referred to as the first true test of intelligence--the Binet-Simon Scale. Binet developed this scale to help identify French children who could benefit from a public education (Brown et al., 1982). Binet's test was actually designed to include such aspects of intelligence as sensory and perceptual discrimination; however, the major proportion of the test included verbal or language measures (Anastasi, 1982).

When the U.S. entered WWI in 1917, a need arose for the rapid classification of more than a million recruits according to general intellectual functioning. During the classification of these recruits, Army psychologists discovered a need for a nonverbal measure to classify illiterates and foreign-born recruits who were unable to speak English. Army psychologists began working with an unpublished group intelligence test designed by Arthur S. Otis. The final aspects of that work resulted in the development of the Army Alpha and Army Beta intelligence tests. The Alpha was designed for routine testing; whereas,

the Beta was a nonlanguage scale designed to test the illiterates and foreign-born recruits who were unable to speak English. Even in 1917, the Army recognized a need for a test of nonverbal intelligence to be used with special populations (Anastasi, 1982).

From the time of the first Binet-Simon Scale in 1905 to the first group test in 1917, many institutions have used intelligence tests for classification purposes. Schools have used intelligence tests to classify samples of retarded, learning disabled, and gifted and talented. College and vocational schools have used intelligence tests to estimate the potential of their applicants. Psychiatric institutions, hospitals, clinics, and rehabilitation centers have used these tests to determine the degree of patients's mental impairment. All of these institutions have some individuals who can be tested with verbal measures, but they also have some individuals who require testing through nonverbal measures (Brown et al., 1982).

Even though there has been a plethora of intelligence tests developed, individual and group, scientists still desire a more adequate test of nonverbal intelligence. Their desire is simply the result of the fact that the common thread running through most traditional tests, to date, is the high loading on verbal or language measures.

The two major purposes for developing the TONI according to Brown, Sherbenou, and Johnsen (1982) were: (1) to devise

an instrument to evaluate the potential of individuals who are difficult or impossible to test with many of the more traditional intelligence tests currently available. Such an instrument should be entirely free of listening, speaking, reading, and writing for people who are unable to read or write and people who have poor or impaired linguistic skills; (2) to devise a culturally reduced test that is less dependent on exposure to specific language symbols and thereby less biased against subjects from racial and socioeconomic as well as linguistic minorities.

Culturally reduced tests seem to be a viable alternative for what have been called culture free and culture fair tests. It appears there is no such thing as a completely culture free and fair test, but a culturally reduced test.

The authors of the TONI then took the guidelines, developed by Jensen for a culturally reduced test, and tried to determine if such a test existed. The Jensen guidelines included the following (Brown et al., 1982, p. 2):

1. A culturally reduced test should be well-constructed with a representative sample and empirical evidence of reliability and validity.
2. Performance measures should be used rather than paper-and-pencil tasks.
3. Instructions should be pantomimed to the subject and not conveyed orally or in writing.

4. Preliminary practice items should be incorporated into the test.
5. The test should be untimed.
6. Test items should have abstract content instead of pictures or passages to read.
7. Items should require reasoning or problem solving and not specific factual information.
8. Novel problems should be presented to avoid the recall of previously learned information.

The seven tests examined by the authors were as follows: the Culture Fair Intelligence Test (Cattell, 1950); the Leiter International Performance Scales (Leiter, 1948); the Otis-Lennon Mental Ability Test (Otis and Lennon, 1970); the Progressive Matrices (Raven, 1938); the Slosson Intelligence Test for Children and Adults-Revised (Slosson, 1981); the Stanford-Binet Intelligence Scale (Terman and Merrill, 1962); and Wechsler Intelligence Scale for Children-Revised (Wechsler, 1974). None of the above tests met all eight Jensen guidelines. Therefore, the TONI was developed to meet all of them.

Once the TONI had been developed, its authors established its concurrent validity by correlating it with seven different measures of intelligence and achievement. Those measures included Raven's (1938) Progressive Matrices; Leiter International Performance Scale (Leiter, 1948); Wechsler Intelligence Scale for Children-Revised (Wechsler, 1974);

Otis-Lennon Mental Ability Test (Otis and Lennon, 1970); Iowa Tests of Basic Skills (ITBS) (Lindguist and Hieronymus, 1956); SRA Achievement Series (Naslund, Thorpe, Lefever, 1978); and the Stanford Achievement Test (Madden and Gardner, 1972). These studies included three with normal subjects, two with deaf subjects, two with learning disabled subjects, and one with mentally retarded subjects (Brown et al., 1982).

Brown et al. (1982) reported that all correlations were extremely high--all exceeded the .35 criterion and 41% exceeded the .80 criterion. Brown et al. (1982) suggested, "this is strong evidence for the TONI's concurrent validity which is further reinforced by similarity of findings across populations of normal and handicapped subjects" (p. 13). The authors contended that the reliability and validity data of the TONI are very encouraging; however, they called for further research to confirm their findings.

Three studies examining the reliability and validity of the TONI have provided some support for the test's ability to assess nonverbal intelligence. Bond and Kennon (1982) conducted a concurrent validity study comparing the scores from the TONI with those from the Slosson Intelligence Test (SIT) and those from the Wechsler Intelligence Scale for Children-Revised (WISC-R). They tested 71 subjects ranging in age from 7 to 18 years. The correlation of the scores between the TONI and the SIT was .71; between the TONI and the WISC-R was .72. Both coefficients were significant at

the .001 level. Bond and Kennon concluded that the TONI is an appropriate substitute intelligence measure when a language-free measure is needed.

Bond and Kennon (1982) found that the scores derived from the TONI and the WISC-R verbal scale correlated .61, ($p>.01$) in an average population. The TONI and WISC-R performance scale scores correlated .77, ($p>.01$). Bond and Kennon concluded that the TONI appears to be more strongly related to a language-free or composite measure of intelligence than a verbal one. They also stated that further research was indicated relative to the TONI's concurrent validity.

Haddad (1986) also conducted a concurrent validity study correlating the TONI with the WISC-R as well as with an achievement measure, the Wide Range Achievement Test (WRAT). Sampled were 66 learning disabled children with a mean age of 9-5. Haddad's (1986) results contrasted sharply with Bond and Kennon's results. Controlling for the effect of the performance IQ, the partial-correlation coefficient between the TONI and the verbal IQ was extremely low ($r = .13$). Controlling for the effect of the verbal IQ, the partial-correlation coefficient between the TONI and the performance IQ was low ($r = .30$; $p<.05$). Haddad (1986) concluded that the results of the partial correlation lend little support to the position of Brown et al. (1982) that the TONI is basically a measure of nonverbal intelligence.

Haddad (1986) was also concerned that the Block Design on the WISC-R, the only good measure of g on the performance scale according to Haddad, yielded the lowest correlation coefficient with the TONI. Haddad, too, found the correlation between the TONI and the WRAT to be low. He concluded that more research is needed to establish the TONI as a measure of nonverbal intelligence.

Vance, Hankins, and Brown (1988), investigated ethnic and sex differences using the TONI, Quick Test(QT), and WISC-R. Sampled were 89 students taken from a mixed urban and rural population. The students had been referred for psychological services. The subjects ranged in age from 6-4 to 16-10 years. Since Vance et al. (1988) found no significant interactions between sex and race on the TONI, WISC-R, and QT, they concluded that the three tests are valid assessors of abilities in similar populations.

A review of the literature for alternate form reliability studies relative to the TONI revealed nothing. However, some studies were cited in the TONI manual. Brown et al. (1982) reported a correlation coefficient of .78 for ages 8-6 to 10-11, and correlation coefficients all in the .80s and .90s with the remainder of the age intervals. These correlation coefficients were calculated using a sample of 1,888 subjects. Brown et al. concluded that Forms A and B of the TONI are equivalent.

Bond and Kennon (1982) and Haddad (1986) indicated a

need for research relative to the validity of the TONI. The authors of the TONI, too, suggested further research concerning the validity and reliability of their instrument.

In the present study, the Shipley Institute of Living Scale (SILS) was used as a criterion measure for establishing the TONI's validity. The SILS is a paper-and-pencil intelligence test that is appropriate for individual or group testing. The SILS, as described by Zachary (1986), "was designed to assess general intellectual functioning and to aid in detecting cognitive impairment in individuals with normal original intelligence" (p. 1).

The SILS consists of two scales--a 40-item vocabulary scale and a 20-item abstract thinking scale. From the scores on the two scales, one can obtain a total score. The scores obtained on the SILS are considered basically verbal measures of intelligence according to Zachary.

The SILS has been so often correlated with the Wechsler intelligence scales that the SILS manual now contains tables listing estimated WAIS-R scores form SILS total scores stratified by age. The SILS can be utilized in various settings where it is desirable to obtain a fast, reliable, and valid estimate of intellectual functioning. Uses of the SILS now include intellectual screening of psychiatric patients, personnel selection, vocational guidance, and research (Zachary, 1986).

According to Zachary (1986), "the fact that the SILS is

very brief, can be administered to groups and correlates very highly with more time-consuming individual intelligence tests makes the Shipley a very useful instrument for obtaining a quick measure of verbal intellectual ability" (p. 1). He states, moreover, that the SILS can be used with adolescents and adults, ages 14 and older. The SILS should basically be used as a screening device for those of near-average intelligence and for those who have suffered only mild-to-moderate cognitive impairment.

A substantial amount of data was available on the concurrent validity of the SILS. Correlations with such intelligence measures as the Wechsler tests, Army General Classification Test (AGCT), Slosson, Raven, Quick Word Test, Wide Range Vocabulary Test, California Short-Form Mental Maturity, and Revised Beta Exam as well as its use with various populations, such as with mixed psychiatric patients, alcoholics, the elderly, brain-injured, and prisoners, has made the SILS a well-accepted instrument in the field of psychological testing.

Zachary (1986), in the SILS manual, reported that many scientists have examined the validity of the SILS by using it to estimate scores for the Wechsler-Bellview (W-B) (Wechsler, 1939), the Wechsler Adult Intelligence Scale (WAIS) (Wechsler, 1955), and the Wechsler Intelligence Scale-Revised (WAIS-R) (Wechsler, 1981). Correlations between all three Wechsler tests and the SILS have frequently been high.

For the W-B, the median correlation was .77; for the WAIS, the median correltion was .79; for the WAIS-R, the range was from .74 to .85. These results covered 17 studies and basically a population of psychiatric patients.

Paulson and Lin (1970) found a correlation coefficient of .78 between the SILS and WAIS in a study of 290 psychiatric patients. Their study confirmed the high correlations found between the SILS and WAIS as reported by other scientists. For example, Sines and Simmons (1959) found a correlation coefficient of .90 in a group of 30 state hospital inpatients; Wahler and Watson (1962) found a correlation coefficient of .88 in agroup of 105 rehabilitation center patients. Also a study conducted by Mack (1970) concluded that in a comparison of the Beta and SILS in predicting WAIS full scale scores the SILS was preferable.

Turning to the WAIS-R, Heinemann, Harper, Friedman, and Whitney (1985) found significant correlations between the SILS and WAIS-R. For Group I, the SILS as a power test (untimed) correlated .723 ($p<.001$); for Group II, the SILS as a speed test (timed) correlated .741 ($p<.001$). Those investigators did caution that they found an overestimation of below average IQs and an underestimation of above average IQs using the SILS to predict WAIS-R scores.

In a correlational study of the SILS and the WAIS-R, Zachary, Crumpton, and Speiger (1985) reported a correlation coefficient of .85 ($p<.0001$) in a group of mixed psychiatric

patients. Weiss and Shell's study (cited in Zachary, 1986) reported a correlation coefficient of .85 between the SILS and the WAIS-R in a group of 55 mixed psychiatric patients.

The SILS has been correlated with a variety of other intelligence tests, and the investigators also have reported significant and high correlations. For example, Watson and Klett (1968) reported a correlation coefficient of .75 ($p<.001$) when the SILS was correlated with the AGCT in a group of 96 psychiatric patients. Eisenthal and Hartford (1971), also using a group of 100 psychiatric patients, reported a correlation coefficient of .72 ($p<.01$) when the SILS was correlated with the Raven. Martin, Blair, and Vickers (1979a), using a group of 50 college undergraduates, reported correlation coefficients of .69 and .73 ($p<.001$), respectively, between the SILS and the Slosson and between the SILS and the Wide Range Vocabulary Test. Martin, Blair, and Vickers (1979b), also using 50 college undergraduates, reported correlation coefficients of .68 and .68 ($p<.01$), respectively, between the SILS and the Quick Word Test and the SILS and the California Short-Form Test of Mental Maturity.

One other relevant finding was that the Revised Beta Exam, a more or less nonverbal measure of intelligence, had lower correlation coefficients with the SILS than did the previously mentioned tests. Watson and Klett (1968) reported a correlation coefficient of .55 in a group of 96 psychiatric

patients; Bartz (1968) reported a correlation coefficient of .42 between the SILS and and the Beta in a group of 74 state hospital inpatients. Bartz concluded tht the SILS and the Beta probably tap different areas of intellectual functioning.

A review of the research literature disclosed no prior attempts to relate the TONI to the SILS. Neither did the review disclose any prior attempts to establish the alternate form reliability for Forms A and B of the TONI, other than those cited in the TONI manual.

The twofold purpose of this study was to assess the degree of relationship between the TONI and the SILS and the degree of the relationship between Forms A and B of the TONI.

CHAPTER 2

Method

The Sample

The sample consisted of 60 undergraduate students at Austin Peay State University, Clarksville, Tennessee, who were tested during the summer, fall, and winter of 1988-89. The 34 females and 26 males ranged in age from 18 to 57 years, with a mean age of 28.

Description of the Instruments

The Test of Nonverbal Intelligence (TONI) was described by its authors, Brown et al. (1982), as a language-free measure of cognitive ability. The TONI can be used with subjects who range in age from 5-0 through 85-11 years. The test consists of two equivalent forms, A and B, each containing 50 items arranged in order of difficulty. The TONI is made up of six testing formats and contains six training items to present the six formats.

The TONI is an untimed test which requires approximately 15 minutes to administer. To administer the TONI, one simply pantomimes the instructions; no reading, writing, listening, or speaking is involved on the part of the administrator or subject. The subject simply points to the appropriate response.

Problem solving is the basis of all TONI items. The authors chose problem solving because it appears to be a general component of intelligence and it lends itself to

abstract content and a nonverbal format--a goal of the TONI authors.

The subject is presented with a set of figures in which one or more of the figures is missing. The subject then answers by identifying a relationship among the figures. The figures include such characteristics as shape, position, direction or rotation, contiguity, shading, size or length, movement, and pattern within the figure.

The TONI yields scores as percentile ranks and as TONI Quotients with a mean of 100 and a standard deviation of 15. Scores are identified by referring to the raw scores and age intervals in the TONI manual (Brown et al., 1982).

The TONI was standardized using a sample of 1,926 subjects from 28 states. No subjects were intellectually impaired. Most subjects took Forms A and B in random order, and all test examiners were trained by the TONI authors (Brown et al., 1982).

The authors of the TONI consider it a very reliable and valid instrument. Since the TONI is a relatively new instrument, only a small amount of research information is available to confirm the data reported by the authors. The authors established acceptable levels of internal consistency reliability, alternate form reliability, and reliability with deviant populations. Also, the authors established acceptable levels of concurrent and construct validity (Brown et al., 1982).

The Shipley Institute of Living Scale (SILS) was described by Zachary (1986) as an instrument "designed to assess general intellectual functioning in adults and adolescents (14 years and older) and to aid in detecting cognitive impairments in individuals with normal original intelligence" (p. 1). The SILS consists of two scales--a 40-item Vocabulary test and a 20-item Abstraction test.

Both scales can be administered to individuals or groups. The total administration time is 20 minutes, 10 minutes for each scale. The Vocabulary scale uses a format of multiple-choice questions. The subject is asked to choose one of four possible words that means the same or nearly the same as a stimulus word. The Abstraction scale uses a format of completion questions. The subject is given a logical sequence and then asked to fill in the letters or numbers that best complete the sequence. When Shipley originally developed the SILS, he maintained that vocabulary was the best measure of premorbid intellectual functioning and that abstract reasoning ability rather than memory was a more accurate measure of post-impairment functioning (Zachary, 1986).

The SILS can be hand- or computer-scored. The test actually yields six scores; however, this study will use only three: a vocabulary score, an abstraction score, and a total score. SILS raw scores can be converted into age-correlated T-scores and percentile ranks for normalized T-scores (Zachary, 1986).

The SILS was originally standardized on 542 grammar school children (grades 4 to 8), 257 high school students, and 217 college students. The SILS has been recently restandardized using the stratified age norms on a mixed sample of 290 psychiatric patients (Paulson and Lin, 1970).

The fact that the SILS is considered to be a very reliable and valid instrument by Zachary (1986) is supported by a substantial amount of research. Zachary, in the revised manual, reported acceptable levels of split-half reliability and test-retest reliability. He also reported acceptable levels of concurrent and content validity.

Administration and Scoring

The administrator advised the subjects that they would be participating in a study to determine how the Test of Nonverbal Intelligence (TONI) correlated with the Shipley Institute of Living Scale (SILS). All subjects signed consent forms. The administrator then informed them that their responses would be kept confidential and they would receive feedback on their test results upon completion of the study. This was an attempt to insure maximum accuracy and objectivity.

All subjects were administered Forms A and B of the TONI during the same testing session. Half of the subjects took Form A first; the other half took Form B first. The alternating of the forms was to counterbalance for practice effects. The TONI was administered individually in a quiet, well lighted, and comfortable environment. Directions and

preliminary instructions followed the TONI manual. The scoring of the TONI was also implemented according to the instructions in the manual.

The SILS was administered to the subjects in small groups in a quiet, well lighted, and comfortable environment. Directions and preliminary instructions followed the SILS manual except that the 10 minute time limit for each part was extended to 15 minutes. A study by Heinemann et. al. (1985) found no significant differences between the scores of the subjects untimed and those timed (10 minutes each subtest), (cited in the SILS manual, 1986). The SILS was scored according to the directions in the manual.

CHAPTER 3

Results

Using the Pearson product-moment method, correlation coefficients were obtained that assessed the degree of relationship between the TONI and the SILS and the degree of relationship between Forms A and B of the TONI. Table 1 summarizes the correlations. Table 2 summarizes the means and standard deviations.

The correlation of the TONI Form A with the TONI Form B was .57 and was significant beyond the .001 level. Neither the TONI Form A nor Form B was significantly correlated with the SILS Vocabulary scores. However, the TONI Form A and the SILS Abstraction scores correlated .58 which was significant beyond the .001 level. Also, the TONI Form B and the SILS Abstraction scores correlated .50 which was significant beyond the .001 level. Too, the TONI Forms A and B correlated with the SILS Total scores .49 and .42, respectively, and were significant beyond the .001 level.

TABLE 1

Correlation of TONI A with TONI B,
TONI A with SILS scores,
and TONI B with SILS scores

Variable	r	p-values
TONI A with TONI B	.57	.001
TONI A with SILS V	.09	.48
TONI A with SILS A	.58	.001
TONI A with SILS Total	.49	.001
TONI B with SILS V	.08	.53
TONI B with SILS A	.50	.001
TONI B with SILS Total	.42	.001

TABLE 2

Means and Standard Deviations

Variable	Mean	SD
TONI A	33.317	8.631
TONI B	34.500	9.109
SILS V	30.350	3.835
SILS A	32.900	5.650
SILS Total	63.250	7.348

CHAPTER 4

Discussion

Throughout the present study as well as throughout the literature on intelligence testing, it has been stated that a need has existed for a test of nonverbal intelligence to be used with nontraditional populations, as reported above. As a result of that need, the twofold purpose of the present study was to assess the degree of relationship between the TONI Form A and the TONI Form B and the degree of relationship between the TONI and the SILS. The results of the present study may add another piece to the puzzle of how to assess populations who require a test of nonverbal intelligence. However, the results did not complete the puzzle, and more research is indicated.

The correlation found between the TONI Form A and the TONI Form B ($r = .57$; $p<.001$) was positive and significant; however, this correlation did not reach the levels found by the TONI authors in their research. The authors' correlations ranged from .78 to .90 for all age groups, and they concluded that Forms A and B are equivalent. Even though the relationship found in the present study was positive and significant, further research is indicated to establish the alternate form reliability of Forms A and B of the TONI.

Some puzzling results from the present study were the correlations found between Forms A and B of the TONI and the SILS Vocabulary scores. The TONI Forms A and B

correlated .09 and .08, respectively, with the SILS Vocabulary scores. It follows that the TONI cannot be substituted for the Vocabulary portion of the SILS. These results seem to send research back to the first piece of the puzzle--what instrument can the professional use to test the nontraditional populations? More research is definitely indicated here.

Some encouraging results from the present study were the correlations found between Forms A and B of the TONI and the SILS Abstraction scores. Forms A and B correlated .58 and .50, respectively, with the SILS Abstraction scores. The SILS Abstraction and the TONI were both constructed using problem solving as a foundation. Considering this fact, one would not find it unusual that the two correlated positively and significantly. The developers of the TONI reported correlation coefficients ranging from .35 to .80. Thus, the present research seemed to support their findings. As two previous studies (Bond and Kennon, 1982; Haddad, 1986) have indicated, further research is needed to establish the TONI's concurrent validity. Also, the results of the present study indicate a need to continue efforts to establish the TONI's concurrent validity.

Other encouraging results were the correlations between Forms A and B of the TONI and the SILS Total. Forms A and B correlated .49 and .42, respectively, with the SILS Total. Both were positive and significant. Since the SILS is

essentially a verbal measure of intelligence and the TONI a nonverbal measure, the results were encouraging. However, more research is indicated to help understand the reasons that the tests were not more highly correlated. It appears that the professional might cautiously substitute the TONI for the SILS Total, but many other measures of the subject's behaviors should be considered.

In order to be fair to the subject being tested, whether in the school or agency setting, the professional has an obligation to remember that he/she needs as many pieces of the puzzle as possible. And the only way to gather those pieces and put them into place is to conduct further research into the area of human intelligence, verbal and nonverbal.

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