A PRELIMINARY INVESTIGATION
OF THE CORRELATION BETWEEN
IQ SCORES AND MODALITY

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by
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CHAPTER 1
INTRODUCTION

One of the prime concerns of education today is a more efficient approach to matching the needs of students, in preparing for the world of the future, with the educational structure to meet these needs. As education attempts to apply a scientific approach to this problem, it becomes increasingly necessary to gather extensive information concerning students' individual characteristics in order to formulate the underlying generalities which will enable the system to improve.

In seeking the answer to why some students succeed in their educational experiences and some do not, multifactored assessment of students is now considered a desirable practice. In order to answer the question of what is the most appropriate and beneficial educational program for any student, information on the total child needs to be considered.

One component of such an approach remains the use of a mental abilities test. Although intelligence tests clearly do not measure all of what we consider to be intelligence, they do measure much of what is necessary for current academic success. Interpreted properly, intelligence tests can be useful in the educational program in helping expand the student's learning potential.

Another component of a multifactored assessment is determining a student's dominant modality. In order to help
a student reach his fullest potential it is only logical to
determine through which sensory channel a student processes
information most efficiently.

In looking at the data which multifactored assessment
has generated, several questions occur. What relationship
exists between the different instruments' results? Can any
predictions be made concerning a student's optimum learning
potential from the different sources? Can the educator pre-
dict, from the student's performance on an intelligence test,
his modality strength? Can a prediction regarding a student's
intelligence test performance be made from that student's
score on a modality test? What are the relationships between
the subtest scores?

While it is necessary to compile information on each
individual child in the regular educational setting, it is
also necessary to look for the relationships between the
various assessment findings. Data on the individual is nec-
essary for planning for that individual, but examination of
the relationships of the different components may help us
discover general findings which will assist us in the future
in better determining what are appropriate measures for
defining individual differences.

Recognizing that need, this study proposes to examine
the relationship between an intelligence test and performance
on a modality instrument. The content of the intelligence
test, Slosson Intelligence Test (SIT), stresses mathematical
reasoning, vocabulary, auditory memory, and general information. The modality instrument, Swassing-Barbe Modality Index (SBMI), assesses the child’s strength in each of three sensory modalities: visual, auditory, and kinesthetic. The question this investigation pursued was whether there was a significant correlation between the findings of the two instruments. Specifically:

1. Is there a relationship between the intelligence test scores and the total raw scores on the modality instrument?
2. Is there a relationship between the intelligence test scores and the visual subtest raw scores?
3. Is there a relationship between the intelligence test scores and the auditory subtest raw scores?
4. Is there a relationship between the intelligence test scores and the kinesthetic subtest raw scores?
5. Is there a relationship between the intelligence test scores, of the visual dominant subjects, and their total raw scores on the modality instrument?
6. Is there a relationship between the intelligence test scores, of the auditory dominant subjects, and their total raw scores on the modality instrument?
7. Is there a relationship between the intelligence test scores, of the kinesthetic dominant subjects, and their total raw scores on the modality instrument?
8. Is there a relationship between the intelligence test scores, of the mixed modality dominant subjects, and their total raw scores on the modality instrument?
CHAPTER 2
REVIEW OF RELATED RESEARCH

Intelligence
We cannot plan a child's later education without
more or less dependable means of predicting what abilities
he will possess. Anything that adds to our knowledge of
mental growth is bound to be of great practical signifi-
cance for education.

To arrive at a definition for a complex abstract such
as intelligence may be impossible. Anastasi (1976) cautions
that intelligence is not a single, unitary ability, but a
composite of several functions. The term is used to cover
that combination of abilities required for survival and
advancement within a particular culture. While a common
definition cannot be stated, some views on what intelligence
comprehends, involves, and distinguishes can be found in
the literature.

Binet (Binet and Simon, 1916) regarded intelligence as
a collection of faculties: judgment, practical sense, ini-
tiative and the ability to adapt oneself to circumstances.

Terman (1916) regarded intelligence as the ability to
carry on abstract thinking, and considered an individual
intelligent in relation to his ability to carry on abstract
thinking.

The distinction between what can be covered by tests and
what cannot be is made by Freeman (1921). Those capacities which are measured by tests involve chiefly: sensory capacity; perceptual recognition; quickness, range, or flexibility of association; facility in imagination; span or steadiness of attention; and quickness or alertness in response. But he included an even larger number of characteristics as being beyond our abilities to test: mental balance, co-ordination of the mental processes, the judicious management of the processes of learning or reflection; mental control; mental adjustment; the direction of the attention toward the significant aspects of experience; a degree of non-suggestibility; the adoption of intellectual purposes and the adaptation of means to their satisfaction; sensitiveness to significant combinations between experiences which illuminate one another or which are effective in building up systems of thought; and balanced and sane reaction to the entire world of things, ideas, and persons.

The importance of the individual's interaction with the environment was stressed by Colvin (1921). He felt that intelligence was mental adaptability to environment but that this conception was in one respect too broad, since it included instinctive adaptations as well as those that have been acquired by experience. He felt a more comprehensive view would be to consider intelligence as the equivalent to the capacity to learn, that an individual possessed intelligence in so far as he has learned, or can learn, to adjust
himself to his environment.

Thurstone (1921) identified three psychologically differentiable components: the capacity to inhibit an instinctive adjustment, the capacity to redefine the inhibited instinctive adjustment in the light of imaginally experienced trial and error, and the volitional capacity to realize the modified instinctive adjustment into overt behavior to the advantage of the individual as a social animal.

Wechsler (1958) felt that intelligence, operationally defined, is the aggregate or global capacity of the individual to act purposefully, to think rationally and to deal effectively with his environment. But intelligence is not identical with the mere sum of these abilities for three reasons: The ultimate products of intelligent behavior are a function not only of the number of abilities or their quality but also of the way in which they are combined - their configuration; factors such as drive and incentive are also involved in intelligent behavior; and an excess of any given ability may add relatively little to the effectiveness of the behavior as a whole.

Gulford (1959) classified various facets of intelligence into a theory of human intellect. One classification is by process or operation performed. This kind of classification gives us five major groups of intellectual abilities: factors of cognition, memory, convergent thinking, divergent thinking, and evaluation. A second way of classifying the
intellectual factors is according to the kind of material or content involved. The factors thus far identified involve three kinds of material or content: figural, symbolic, and semantic. The third classification is products. Regardless of the combinations of operations and content, the same six kinds of products may be found: units, classes, relations, systems, transformations, and implications. Each human ability then represents an intersection of a unique combination of kinds of operation, content, and product.

Another view of intelligence is that it is composed of two factors - fluid intelligence and crystallized intelligence (Cattell, 1965). These factors are viewed as distinct but correlated. Fluid intelligence is considered a basic capacity for learning and problem solving, independent of education and experience. Fluid intelligence is general to many different fields, and is used in tasks requiring adaptation to new situations. Crystallized intelligence is the result of the interaction of the individual's fluid intelligence and his culture, it consists of learned knowledge and skills.

Gallagher (1975) gave four types of mental functions which he felt characterized intelligence: memory - long term and short term; association linkage; reasoning - convergent and divergent; and evaluation, the ability to use good judgment.

Herrnstein (1980) commented on the use of intelligence testing by stating that intelligence tests endure in the face
of unpopularity because they correlate with so many different things. We should start with school because success in school is what the tests were originally designed to predict. No fact about a six or seven year old child predicts later success in school as well as an intelligence test score.
Modality

The subject of learning modalities continues to attract attention in the field of education. Since modality refers to any of the sensory channels through which an individual receives and retains information, this issue has attracted an increasing number of studies. Educators and scientists continue to work in an attempt to discover how humans receive, process, and utilize sensory data. From this effort has come documentation that people differ far more than might be evident from casual observation.

As early as 1886, Charcot discussed preferred learning modalities: audile, visile, and tactile (Blanton, 1971).

Grace Fernald (1921) developed a multisensory approach to teaching reading and spelling that united visual, auditory, kinesthetic, and tactile elements.

Wepman (1968) proposed a hypothetical model of the structural base underlying the learning act. One feature emphasized the unique modality-based nature of all sensory input signals and all motor output patterns. In discussing this model (Wepman, 1974) he stated the concept of differential use of the separate input pathways is no longer purely theoretical but is assuming the proportions of an acceptable fact about children and their learning.

Rosner (1971) refers to perception as the dynamic act of extracting concrete information from the environment. Information is transmitted as intangible sensations. The
perceiver must apply structure to these sensations in order to use them meaningfully. Thus, perception is the act of applying structure to sensations so that they may be coded into symbols. In essence, it is the act of organization of visual and acoustical sensations used for written and spoken communications.

Dunn (1976) considers classroom instruction which fails to account for students’ different modalities as operating from “fallacious reasoning based on a lack of understanding of individual differences.” In discussing the modalities she stressed that students who can learn through their auditory sense can differentiate among sounds and can reproduce symbols, letters or words by hearing them. Students who learn through their visual sense can associate shapes and words and conjure up the image of a form by seeing it in their mind’s eye. Those students who learn through their tactual sense cannot begin to associate word formations and meanings without involving a sense of touch, while students who learn through their kinesthetic sense need whole-body involvement.

Barbe and Swassing (1979) consider the modalities the keys to learning and feel that the three modalities that have the greatest utility in the classroom are the visual, auditory, and kinesthetic. They concur with the usual meaning of visual, as referring to a student who learns by seeing; and auditory, as referring to learning by hearing; but consider the most useful definition of kinesthetic, for educational
purposes, as one which includes large muscle movements, small muscle movements, and the sense of touch. This broader definition reflects the behavior of children in classrooms better than considering each of the three separately.
Intelligence and Modality

Studies using modality instruments have dealt primarily with the impact of modality on teaching reading and its role in learning disabilities (Patridge, 1968). However, several of these studies have included information on the students' intelligence test scores.

Smith (1971), in discussing the inconsistencies of modality-based instruction studies, raises the question of the relationship of intelligence to modality and cites the differences in the mental ages of the subjects in these studies as a possible cause of the discrepancies.

The study of the relationship of modality strength to learning capabilities is not only of recent interest. Gates (1926) conducted a study of 310 children, grades one through six, to compare the correlations between scholastic proficiency and "special organic and functional excellence." Instruments were developed to assess visual perception; capacity in associative learning, both auditory-visual and visual-visual; reading abilities; and spelling abilities. Intelligence was measured by the Stanford Binet Intelligence Scale. Mental age was found to correlate most highly with the reading and spelling scores, with a range from .50 to .23; while correlations with the visual perception tests were low, ranging from .23 to .05. The correlations of association of auditory and visual symbols with Binet scores were .29 for the 90 third and fourth grade students, .35 for
the 144 fifth and sixth grade students, with an average of .32. The correlations for the association of visual and visual symbols with intelligence were: .30 for the 90 third and fourth grade students, .37 for the 144 fifth and sixth grade students, with an average of .34.

Birch and Belmont (1965) conducted a study on the developmental course of auditory-visual equivalence in children between five and twelve years of age and the relation of such equivalence to intellectual status and the emergence of reading skill. Using the Otis Quick-Scoring Tests of Mental Ability and an auditory-visual matching test developed at Albert Einstein College of Medicine, 220 children from a suburban elementary school, grades K through six, were tested. Results showed the level of auditory-visual integrative proficiency was positively related to intellectual level. Except for the youngest, kindergarten, and the oldest, sixth graders, there was a positive relationship between the intelligence test scores and auditory-visual integration. However, the degree of relationship tends to decrease as age-grade placement increases.

While exploring the efficacy of an auditory approach compared to that of a visual approach in first grade reading, Bateman (1968) tested the modalities of 182 kindergarten children with the Illinois Test of Psycholinguistic Abilities (ITPA) and their mental abilities with the Detroit Group Intelligence Scale. She found no significant difference
between the mean intelligence test scores of the auditory strength subjects and the visual strength subjects. The intelligence test results were most marked in the comparison of good and poor readers, as determined by administering the Gates Primary Word Recognition and Paragraph Reading tests to the subjects at the end of their first grade year. The visual subjects who were good readers were substantially above the average IQ for the total group, while the auditory subjects who were poor readers were appreciably below the group mean in intelligence.

Robinson (1972) studied the relationship of auditory and visual perception scores to reading achievement and intelligence in first and third grade children. Subjects were administered the Picture Squares Test, Pattern Copying Test, and Reversal Test, from the Goins Battery (Goins, 1958), for a visual perception score; the Weisman Auditory Discrimination Test for the auditory score; and the Science Research Associates (SRA) Primary Mental Abilities Test for ages 5-7 for an intelligence test score. Among the findings was that those subjects with deficits in either visual or auditory modalities also had lower intelligence test scores, and those low in both modalities appeared to be most limited in intelligence, as determined by the tests used.

Similar relationships between modality strength and intelligence test scores were found by Van derveer and Neville (1974). They examined the effectiveness of matching modality
aptitudes to classroom-based reading instruction. Intelligence was measured with the Stanford Binet Intelligence Scale. To assess modalities, the authors constructed a procedure which presented each child with three sample lessons of twelve words each; one lesson was presented visually, another auditorially, and the third kinesthetically. In order to select strength and weakness children for the intervention, three multiple regression equations were developed: 1.) visual and auditory scores were used to predict kinesthetic scores; 2.) auditory and kinesthetic scores were used to predict visual scores, and 3.) kinesthetic and visual scores were used to predict auditory scores. Those 72 students who obtained discrepancies between actual and predicted scores, which were significant at or beyond .15 level, were selected. One of the findings of the study was that the strength subjects had higher IQs than the weak strength modality subjects.

Other studies have found conflicting results. In an investigation of the relationship between perceptual tests and intelligence tests, Wepman and Morency (1967) examined 177 subjects with the Peabody Picture Vocabulary Test; Lorge-Thorndike Group I Test; Wepman's Auditory Discrimination Test; and the Visual Discrimination Test by Weiner, Wepman, and Morency. They found little, if any, significant relationship existing between the perceptual factors and intelligence, as assessed by the standard instruments used. Correlations between intelligence and auditory discrimination ranged from
-.29 for the first graders to -.17 for the third graders; correlations between intelligence and auditory memory ranged from .10 for first grade to .27 for third grade; intelligence scores and visual discrimination scores correlations ranged from -.44 to -.22, with grade not being a factor, and the correlations for intelligence and visual memory ranged from -.96, for the Peabody with third graders, to -.10, for the Peabody with first graders.

Similar results were found by Jones and Aaron (1971) in a study to determine if significant relationships exist among intersensory transfer ability, intersensory perceptual shifting ability, modal preference, and reading achievement. The subjects were 90 randomly selected third grade children. The subjects' modalities were assessed with an individually administered measure of differential performance in learning auditory and visual labels for pictures of concrete objects, constructed by the authors. The degree of preference for learning auditory or visual labels for the pictures was determined by subtracting the visual labeling score from the auditory labeling score. This procedure provided the degree of preference as well as the direction - auditory or visual.

Intelligence was measured with the Strong-Thorndike Intelligence Test, Level 2, Form A. Jones and Aaron found a correlation of .0603 between modal preference and the intelligence test scores, which was not significant.

A study by Singer and Brunk (1967) examined whether
or not groups of children rated high and low in intelligence would perform similarly on perceptual motor tasks. The 91 students were tested on a series of perceptual motor tasks designed by the authors. The tasks required the students to replicate geometrical patterns on geoboards. Intelligence was measured with the Pintner Elementary Test, consisting of picture and reading parts. Low, positive, and significant correlations were found between the perceptual motor tasks and both sections of the Pintner test, .27 for the picture section and .13 for the reading section.

Reck (1977) examined the relationship of visual and auditory perception and modality patterns to reading achievement and intelligence. The subjects in the study were 53 students between the ages of seven and nine who showed a one year deficit in reading, all of whom had IQs of 80 or above. Modality was tested with six subtests from the Perceptual Test Battery (PTB) covering visual discrimination, visual memory, spatial orientation, auditory discrimination, auditory memory, and auditory sequential memory. Intelligence was measured with the Wechsler Intelligence Scale for Children (WISC). She found the visual perceptual abilities of memory and spatial orientation were slightly related to verbal intelligence, while visual discrimination and the auditory perceptual abilities were not related to either verbal or performance intelligence. No relationship to intelligence was found when the perceptual abilities were combined to reflect modality, nor were modality patterns indicating visual or auditory
perceptual strengths and weaknesses related to intelligence.

Lilly and Kelleher's (1973) study developed visual and auditory memory tests with regard to the reading process. The tests consisted of presenting known words to the subjects, in sequences of increasing length, and having the subjects repeat the sequences in correct order. The Wechsler Intelligence Scale for Children was used to measure intelligence, except for a few cases where the Stanford-Binet was used. They found small, positive correlations, ranging from .19 to .32, between the IQ scores and modality measures.

Summary

While a commonly agreed upon definition of intelligence cannot be found, there is general agreement that it involves those abilities necessary for survival and advancement within the culture. The ability to carry on abstract thinking (Terman, 1916); adapting to one's environment (Binet and Simon, 1916; Colvin, 1921; Thurstone, 1921); abilities of association, imagination, attention, mental control (Freeman, 1921); the ability to act purposefully (Wechsler, 1958); interaction of operation, content and product (Guilford, 1959); and the basic capacity for learning in interaction with the culture (Cattell, 1963) are a few of the qualities which comprise intelligence.

Modality is considered to refer to any of the sensory channels through which information is received and retained.
That students do exhibit varying dominant modalities has been shown in the work of Wepman (1968,1974), Prestig (1963), Kirk (1969), Dunn and Dunn (1978), and Barbe and Swassing (1979). The relationship of intelligence to modality may be a factor in the inconsistencies which studies on modality have shown (Smith, 1971).

Low positive correlations between intelligence test scores and visual and auditory perception were found by Gates (1926); moderate correlations between IQ and auditory-visual integration were found by Birch and Belmont (1964), moderate, positive correlations were found by Lilly and Kelleher (1973) between visual and auditory modality strength and IQ; and low, positive, and significant relationships between perceptual motor tasks and intelligence test scores were found by Singer and Brunk (1967). Students who exhibited deficits in modality tended to also be those with lower intelligence test results in studies by Robinson (1972) and Vandover and Neville (1974). Other studies have found little, if any, significant relationship between perceptual factors and intelligence (Wepman & Morency, 1967; Jones & Aaron. 1971). Feck (1977) found a slight relationship between visual memory and spatial orientation with verbal intelligence, no relationship between auditory perceptual abilities and intelligence, and no relationship between modality patterns and intelligence test performance.
CHAPTER 3

METHOD

The purpose of this investigation was to compare the results of intelligences tests and performance on a modality instrument.

Subjects
The subjects for the study were 31 boys and girls whose grade placement was 3.2. They attend school in a district which draws its students from a mixture of rural and small-town homes. However, the socio-economic-status of the population is above the national average due to the location of several major corporate research divisions in the area. Those minority students who were part of the experiment were members of families who have participated in the main stream culture for at least two generations. The age range for the subjects was from 7-11 to 8-11, with a mean of 8-7. The sample consisted of 18 boys and 13 girls.

Procedure
The testing was conducted as part of the district's regular screening process to assist in long range educational planning for academic enrichment activities. Subjects were selected for this screening by the classroom teachers on the basis of classroom performance and prior years' achievement test results.

The tests for the study were administered, on an indiv-
individual basis, over a two week period, by one examiner. The examiner had received prior training in the administration of both instruments and was experienced in using them. One half of the subjects were given the intelligence test first, followed by the modality test; while the other half were given the modality test first. Testing sessions were of approximately 45 minute duration, with a five minute break between the two tests. The tests were administered following the directions in the tests' manuals. An equal number of students were tested in the morning and afternoon. The test site was the conference-test room in the subject's home schools.

Instruments

The two instruments, whose scores are used in the study, are the Slosson Intelligence Test (SIT) and the Swassing-Barbe Modality Index (SBMI).

SIT

The Slosson Intelligence Test is a brief, individual test of intelligence designed to be used in working with both children and adults. The SIT is an adaptation of items from the Stanford-Binet and correlations between the two instruments have been reported ranging from .60 to .94, with a median correlation of .90 (Sattler, 1974). The author reports a test-retest reliability coefficient of .97. All questions are presented verbally and require spoken responses. Item content stresses mathematical reasoning, vocabulary
auditory memory, and information. The SIT yields a ratio IQ. The high ceiling makes the test sufficiently challenging for bright students (Hunt, 1972).

**SITN**

This instrument is designed to identify the modalities through which a child learns best. It is a matching-to-sample task in which a stimulus item is presented and the respondent is asked to duplicate the sample. The stimulus items are shapes: circle, square, triangle, and heart; arranged in sequences of increasing length. There are potentially nine stimulus items in each modality subtest. The instrument yields three modality raw scores: one for visual, one for auditory, and one for kinesthetic; which added together equal the total raw score. To identify the relative strength of each modality, it is necessary to compute the percentage of the total score each modality represents. A five point difference between modality percentages is considered to be educationally relevant, if the percentage score in one modality is at least five points greater than that of another modality, the first is the stronger of the two. If one modality is five points greater than each of the remaining modalities, it is considered the dominant modality.

The visual test is administered first by placing the stimulus items in front of the student, giving directions, removing the stimulus, and having the student reproduce the sequence with his own set of shapes. The auditory section
is administered by reading aloud the names of the shapes in sequence and having the student reproduce them. The kinesthetic subtest is administered by blocking the student's vision, having him feel the sequence of shapes, and reproduce the pattern.

Factor analysis conducted on modality raw scores from the instrument indicated three factors corresponding to the visual, kinesthetic, and auditory modalities. Test-retest reliability of the subtests ranged from .58 to .67, when the SEWI was administered to a group of students twice over a span of approximately four months (Barbe & Swassing, 1979).
Data Analysis

In order to examine the relationship between two variables, in this study the Slosson Intelligence Test (SIT) scores and raw scores from the Swassing-Barbe Modality Index (SBMI), the researcher used a coefficient of correlation. The correlations for the scores of the whole sample group were determined using Pearson's Product Moment Correlation Coefficients. Where data were from fewer than 25 pairs of scores, the Spearman Rank-Difference Correlation Coefficient was calculated.

The significance of the difference between the means of two groups of scores is commonly determined by comparing this difference to the standard error of difference between means in order to determine the probability that the particular difference came from that given distribution. Traditionally, these probabilities that are considered to be "small" that the difference was due to chance are the levels of significance of .05 and .01. To determine the critical values in order to establish the significance of the difference between the means for the Pearson's Product Moment Correlation Coefficients, the 5% and 1% Value for $t$ Table was used. To determine the critical values for the Spearman Rank-Difference Correlation Coefficients, Fisher's Critical Values of $t$ Table was used (Dillehay, et al., 19??).
CHAPTER 4
RESULTS

Although many studies have been conducted on the effect modality plays in the educational process, the thrust of the research has primarily been in trying to determine the impact of modality based instruction. The role of intelligence testing, in connection with these studies, has primarily been in selecting the control group and the intervention group.

The question this study pursued was how the intelligence test (SIT) scores would correlate with the modality test (SB&I) scores. The number of variables involved in any study of modality makes the subject extremely difficult to examine. Intelligence is one of those variables, therefore the following were examined:

1. The relationship between the intelligence test scores and the total raw scores on the modality instrument.
2. The relationship between the intelligence test scores and the visual raw scores.
3. The relationship between the intelligence test scores and the auditory raw scores.
4. The relationship between the intelligence test scores and the kinesthetic raw scores.
5. The relationship between the intelligence test
scores, of the visual dominant subjects, and their total raw scores on the modality instrument.

6. The relationship between the intelligence test scores, of the auditory dominant subjects, and their total raw scores on the modality instrument.

7. The relationship between the intelligence test scores, of the kinesthetic dominant subjects, and their total raw scores on the modality instrument, and

8. The relationship between the intelligence test scores, of the mixed modality dominant subjects, and their total raw scores on the modality instrument.

The first category of questions involved the relationship of the entire group of subjects' SBMI total raw, visual subtest raw, auditory subtest raw, and kinesthetic subtest raw scores to their SIT scores.

As may be seen in Table 1 (page 27), the sample consisted of 31 students. The central tendency, range of scores, and standard deviations are given for the data. As was anticipated, due to the selection of subjects, the mean IQ on the SIT was significantly above the general population average, with a range from 104 to 150, a mean

26
of 123.42, and a standard deviation of 12.82. The total raw scores on the SBMI ranged from 40 to 101, with a mean of 61.32 and a standard deviation of 15.47. The visual raw scores on the SBMI ranged from 15 to 40, with a mean of 23.23, and standard deviation of 6.40. The auditory subtest raw scores ranged from 12 to 43, with a mean of 17.71, and standard deviation of 7.44. The kinesthetic subtest raw scores ranged from 7 to 38, with a mean of 20.39, and a standard deviation of 7.52.

<table>
<thead>
<tr>
<th>N: 71</th>
<th>X</th>
<th>Range</th>
<th>σ'</th>
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<tr>
<td>C.A.</td>
<td>8-6.9</td>
<td>1 yr.</td>
<td>m.a.</td>
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<td>SIT IQ</td>
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<td>46</td>
<td>12.82</td>
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<td>61</td>
<td>15.47</td>
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<td>26</td>
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<td>SBMI Auditory raw score</td>
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<td>7.44</td>
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<tr>
<td>SBMI Kinesthetic raw score</td>
<td>20.39</td>
<td>21</td>
<td>7.52</td>
</tr>
</tbody>
</table>

σ' - Standard Deviation

Table 1. Population Characteristics, Mean, Range, and Standard Deviation of the SBMI and SIT Scores.
The distribution of the pairing between the SBMI total raw modality scores and the SIT IQ scores is shown in Figure 1. As can be seen, a low positive relationship was indicated. The Pearson Product Moment Correlation Coefficient for the IQ scores and the modality total raw scores was .39. When tested for statistical significance, the correlation was shown to be significant at the .05 level.

Figure 1. Scatter Diagram of the Pairs of Scores, SIT IQ and SBMI Total Raw Scores.
The distribution of the pairing between the SBMI visual subtest raw scores and the SIT IQ scores is shown in Figure 2. A low positive relationship was indicated. The Pearson Product Moment Correlation Coefficient for the IQ scores and the modality visual subtest raw scores was .32. When tested for statistical significance, the correlation was not significant at or beyond .05.

Figure 2. Scatter Diagram of the Pairs of Scores, SIT IQ and SBMI Visual Subtest Raw Scores.
The distribution of the pairing between the SBMI auditory subtest raw scores and the SIT IQ scores is shown in Figure 3. A low positive relationship was indicated. The Pearson Product Moment Correlation Coefficient for the IQ scores and the modality auditory subtest scores was .34. When tested for statistical significance, the correlation was not significant at or beyond .05.

Figure 3. Scatter Diagram of the Pairs of Scores, SIT IQ and SBMI Auditory Subtest Raw Scores.
Figure 4 shows the distribution of the pairing between the SEMI kinesthetic subtest raw scores and the SIT IQ scores. A negligible relationship was indicated. The Pearson Product Moment Correlation Coefficient for the IQ scores and the modality kinesthetic subtest scores was .18. When tested for statistical significance, the correlation was not significant at or beyond .05.

Figure 4. Scatter Diagram of the Pairs of Scores, SIT IQ and SEMI Kinesthetic Subtest Raw Scores.
The correlations for the four variables are shown in Table 2. The level of significance, at .05 for 29 d.f., for the correlations was .36.

<table>
<thead>
<tr>
<th></th>
<th>V₁</th>
<th>V₂</th>
<th>V₃</th>
<th>V₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQ</td>
<td>.39*</td>
<td>.32</td>
<td>.34</td>
<td>.18</td>
</tr>
</tbody>
</table>

*significant at .05

V₁: Total Raw Scores
V₂: Visual Subtest Raw Scores
V₃: Auditory Subtest Raw Scores
V₄: Kinesthetic Subtest Raw Scores

Table 2. Pearson Product Moment Correlation Coefficients for SIT IQ Scores and SMI Total Raw and Subtest Raw Scores.

The second general question which the study examined was the difference in relationships between the intelligence test scores of the students, according to their dominant modality, and their total raw scores. That is, what would the relationship be between the total raw modality scores and the intelligence scores for the visual strength subjects, the auditory strength subjects, and the kinesthetic strength subjects. If one modality score is five percentage points greater than each of the remaining modalities, it is considered the dominant modality, as determined by the SMI. Where a five percent difference does not occur, the student is considered to exhibit a mixed modality.
Table 3 shows the frequency of subjects according to their dominant modality. The number of students in each modality category is given, with chronological age, mean, and range for the IQ scores and the SBMI total raw scores.

<table>
<thead>
<tr>
<th>Dominant Modality</th>
<th>N</th>
<th>X</th>
<th>R*</th>
<th>C.A.</th>
<th>X</th>
<th>R*</th>
<th>IQ</th>
<th>X</th>
<th>R*</th>
<th>SBMI</th>
<th>X</th>
<th>R*</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>9</td>
<td>8-7</td>
<td>10 mo.</td>
<td>124</td>
<td>40</td>
<td>62</td>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>7</td>
<td>8-7</td>
<td>6 mo.</td>
<td>125</td>
<td>40</td>
<td>63</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>3</td>
<td>8-8</td>
<td>3 mo.</td>
<td>125</td>
<td>28</td>
<td>69</td>
<td>43</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V/A</td>
<td>10</td>
<td>8-6</td>
<td>11 mo.</td>
<td>122</td>
<td>45</td>
<td>56</td>
<td>61</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K/A</td>
<td>1</td>
<td>8-10</td>
<td>na</td>
<td>132</td>
<td>na</td>
<td>83</td>
<td>na</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V/A/Y</td>
<td>1</td>
<td>8-10</td>
<td>na</td>
<td>107</td>
<td>na</td>
<td>59</td>
<td>na</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Range

Table 3. Population Characteristics, Mean, and Range of SBMI and SIT Scores Grouped by Dominant Modality of Subjects.

Due to the limited number of subjects in each category, Spearman Rank-Difference Correlation Coefficients were determined only for the visual dominant, auditory dominant, and combination visual/auditory dominant subjects.

Comparison of their IQ scores and total raw SBMI scores yielded a .23 correlation for the nine visual dominant subjects, indicating a low positive relationship.

For the auditory dominance subjects, the correlation
between their SIT IQ scores and their SBMW total raw scores was -.11, indicating a negligible correlation.

A low positive relationship was found for the combined visual/auditory dominant subjects, with a correlation of .36 between their SIT IQ scores and their SBMW total raw scores. None of the correlations were significant at or beyond the .05 level. Levels of significance and Spearman Rank-Difference Correlation Coefficients for the three treatments are shown in Table 4.

<table>
<thead>
<tr>
<th></th>
<th>V</th>
<th>4</th>
<th>V/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>9</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Critical Value</td>
<td>.683</td>
<td>.786</td>
<td>.648</td>
</tr>
<tr>
<td>Rho</td>
<td>.23</td>
<td>-.11</td>
<td>.36</td>
</tr>
</tbody>
</table>

Table 4: Spearman Rank-Difference Correlation Coefficients; Critical Values of rho, .05 level of significance for two-tailed test.

Summary

In examining the data from the Swassing-Barbe Modality Index and the Slosson Intelligence Test the following results were found:

1. The relationship between the intelligence test scores and the total raw scores on the modality...
instrument was low, positive, and significant at the .05 level.

2. The relationship between the intelligence test scores and the visual raw scores was low and positive.

3. The relationship between the intelligence test scores and the auditory raw scores was low and positive.

4. The relationship between the intelligence test scores and the kinesthetic raw scores was negligible.

5. The relationship between the intelligence test scores, of the visual strength subjects, and their total raw scores on the modality instrument was low and positive.

6. The relationship between the intelligence test scores, of the auditory strength subjects, and their total raw scores on the modality instrument was negligible.

7. An insufficient number of kinesthetic strength subjects was found to examine the relationship between their intelligence test scores and the total raw scores, and

8. The relationship between the intelligence test scores, of the mixed modality strength subjects,
and their total raw scores on the modality instrument was negligible.

As indicated, only the relationship between the total group's SIT IQ scores and the SBMI total raw scores was statistically significant at the .05 level.
CHAPTER 5
DISCUSSION

Education today is concerned with finding the most efficient and effective way to deliver its services to each student. In order to maximize its results, multifactored assessment procedures are recommended practice in the schools in an attempt to answer the questions of what are the most appropriate and beneficial educational programs for students. Two components of a multifactored assessment procedure are mental abilities tests and modality instruments.

This study was concerned with the relationship between these two assessment instruments. Specifically, can any predictions be made concerning a student's intellectual abilities from his performance on a modality instrument, and, can any predictions be made concerning a student's dominant modality if one has information on that student's mental abilities performance.

While a commonly agreed upon definition of intelligence cannot be found, there is general agreement that it involves those abilities necessary for survival and advancement within the culture: abstract thinking, adapting to one's environment, and a basic capacity for learning.

Modality is generally considered to refer to any of the sensory channels through which information is received.
and retained. That students do exhibit varying strengths in the different modalities has been shown in the work of Wepman (1968, 1974), Frostig (1969), Kirk (1969), Dunn and Dunn (1978), and Barbe and Swassing (1979).

The relationship of intelligence to modality may be a factor in the inconsistencies shown by studies on the efficacy of matching instructional strategies to student modalities. Low to moderate correlations between IQ scores and modality tests were found by Gates (1926), Birch and Belmont (1965), Singer and Brunk (1967), and Lilly and Kelleher (1973); while Wepman and Morency (1967), Jones and Aaron (1971), and Peck (1977) found little relationship.

Research Design

The question this investigation pursued was how intelligence test, Slosson Intelligence Test (SIT), scores would correlate with the modality test, Swassing-Barbe Modality Index (SBMI), raw scores. Although the SBMI was designed to identify a student's modality strength, for purposes of this study the raw scores were the relevant data. Pearson Product Moment Correlation Coefficients were calculated for the SIT IQ scores and:

1. the total raw scores on the SBMI,
2. the visual subtest raw scores,
3. the auditory subtest raw scores, and
4. the kinesthetic subtest raw scores.
In addition, Spearman Rank-Difference Correlation Coefficients were calculated for the SIT IQ scores and:

1. the total raw scores of the visual dominant subjects,
2. the total raw scores of the auditory dominant subjects, and
3. the total raw scores of the visual-auditory dominant subjects.

The scores of the kinesthetic dominant subjects were also examined, but an insufficient number of subjects with dominant kinesthetic modalities were found.

The subjects for the study were 31 boys and girls whose grade placement was 3.2. They were selected for testing on the basis of previous achievement test scores and teacher recommendation as a part of the district's regular long-range planning for academic enrichment programs.

The instruments chosen were the Slosson Intelligence Test (SIT), an individually administered mental abilities test which yields a ratio IQ score; and the Swassing-Barbe Modality Index (SBMI), an individually administered matching-to-sample instrument which yields three modality raw scores for visual, auditory, and kinesthetic, from which the strength of the modalities and their dominance can be calculated.

Testing was conducted in the students' home schools over a two week period by one examiner.
Findings

Examination of the data revealed the mean IQ on the SIT was 123.42, with a standard deviation of 12.82. The total raw scores on the SBMI yielded a mean of 61.32 and a standard deviation of 15.47. The visual subtest raw scores showed a mean of 23.23, with a standard deviation of 6.40; auditory subtest scores showed a mean of 17.71 and a standard deviation of 7.44; and kinesthetic subtest scores yielded a mean of 20.39, with standard deviation of 7.52. The correlation for the SIT IQ/total raw scores of the SBMI was .39; for the SIT IQ/SBMI visual subtest raw scores was .32; for the SIT IQ/SBMI auditory subtest raw scores was .34; and for the SIT IQ/SBMI kinesthetic subtest raw scores was .18. Of these, only the correlation of the SIT IQ scores and the SBMI total raw scores was statistically significant at the .05 level.

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>S.D.</th>
<th>r*</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIT IQ</td>
<td>123.42</td>
<td>12.82</td>
<td>-</td>
</tr>
<tr>
<td>SBMI Total raw scores</td>
<td>61.32</td>
<td>15.47</td>
<td>.39</td>
</tr>
<tr>
<td>SBMI Visual subtest raw scores</td>
<td>23.23</td>
<td>6.40</td>
<td>.32</td>
</tr>
<tr>
<td>SBMI Auditory subtest raw scores</td>
<td>17.71</td>
<td>7.44</td>
<td>.34</td>
</tr>
<tr>
<td>SBMI Kinesthetic subtest raw scores</td>
<td>20.39</td>
<td>7.52</td>
<td>.18</td>
</tr>
</tbody>
</table>

*critical level at .05 ≥ .36

Table 5. Mean, Standard Deviation, Correlation Coefficients for the SBMI and SIT.
When the subjects were divided into subgroups by dominant modality the visual dominant group showed a mean IQ of 124; the auditory dominant group a mean IQ of 125; the visual/auditory dominant group a mean IQ of 122; and the kinesthetic dominant subjects a mean IQ of 125. Comparison of the SIT IQ scores and the total raw scores of the nine visual dominant subjects yielded a .23 correlation; of the seven auditory dominant subjects a -.11 correlation; and of the ten visual-auditory mixed dominance subjects a .36 correlation. Insufficient kinesthetic subjects were found to calculate the coefficient. None of these findings were significant at or beyond the .05 level.

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>n</th>
<th>X IQ</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Dominant Subgroup</td>
<td>9</td>
<td>124</td>
<td>.23</td>
</tr>
<tr>
<td>Auditory Dominant Subgroup</td>
<td>7</td>
<td>125</td>
<td>-.11</td>
</tr>
<tr>
<td>Visual/Auditory Dominant Subgroup</td>
<td>10</td>
<td>122</td>
<td>.36</td>
</tr>
<tr>
<td>Kinesthetic Dominant Subgroup</td>
<td>3</td>
<td>125</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 6. Number, Mean IQ, and Correlation Coefficients Between SIT IQ and SMMI Total Raw Scores.

Limitations

Due to the method used for selection of the subjects for the study, several factors are known to be atypical of
the general population of students. First, as shown by the mean IQ of 123, the students were all above average in mental ability. Secondly, the socio-economic-status of the community is above the national average. Finally, the students were not representative of the general population according to ethnic origins.

The use of the Slosson Intelligence Test requires that the results be viewed with some caution. Although correlations for the SIT and the Stanford-Binet are generally high, and for the SIT and WISC Verbal Scale range from .49 to .93, published research suggests it not be used uncritically as a substitute for either of them (Sattler, 1974). In addition, details concerning the characteristics of the standardization sample and the construction of the test are not available.

Criterion validity data is not available for the SEMI as there is no criterion that is a widely accepted measure of modality strengths. As it is a relatively new instrument, research literature is not available on it at this time.

The above average abilities of the students would have had the greatest impact on the study's findings. The students' intelligence test scores fell in approximately the upper 45% of the population, which would have restricted the range of scores on the SEMI correspondingly. Typically, a restricted range will result in a smaller correlation.

While the number of subjects was adequate for the
data comparisons with the whole group's scores, the comparisons performed with the subjects grouped by dominant modality were severely restricted by the number of students in those subgroups. The low correlations for the whole group comparisons also would have impacted the subgroup correlations. For these reasons, the correlations for the subgroup samples cannot be generalized beyond this particular sample.

Discussion

The findings that the correlation between the SIT scores and the SBMI total raw modality scores was low, positive, and significant; while the correlations between the SIT scores and the SBMI subtest scores, although low and positive, were not statistically significant, present several areas for discussion and further study.

When the SBMI subtests are viewed as measures of specific modality strength, the present study's findings are consistent with Gates (1926), Lilly and Kelleher (1977), and Singer and Brunk (1967), all of whom found low, positive correlations between specific modality strengths and intelligence. Wepman's (1967) findings differ markedly, as he found slight negative correlations between most individual perceptual measures and intelligence.

Of the research cited, only Peck (1977) was examining a combination of perceptual measures representing overall
modality strength, and her studies did not include a kine-
esthatic measure. Her findings generally disagree with this
present study, particularly where she found no correlation
between intelligence and total modality strength.

However, a comparison of these findings with any of
the literature must be made with caution. Of the studies
cited, no more than two used the same mental abilities test
while none of the studies used the same instrument to measure
modalities. Six of the studies used instruments to measure
modality designed specifically for that investigation (Gates,
1926; Birch & Belmont, 1965; Vandeveer & Neville, 1974; Jones
& Aaron, 1971; Singer & Brunk, 1967; and Lilly & Kelleher,
1973) while the others used various standardized instrum-
ents (Bateman, 1968, I.T.P.A.; Robinson, 1972, the Goins Battery;
Weisman, 1967. The Weisman Auditory Discrimination Test and the
Visual Discrimination Test by Weiner, Weisman, & Morency; and
Peck, 1977, the Perceptual Test Battery). Mental abilities
tests included the Stanford-Binet (Gates, 1926; Vandeveer &
Neville, 1974), Otis Quick-Scoring Tests of Mental Abilities
(Birch & Belmont, 1965), Detroit Group Intelligence Scale
(Bateman, 1968), SRA Primary Mental Abilities Test (Robinson,
1972), Peabody Picture Vocabulary Test (Weisman, 1967), Lorge-
Thorndike Intelligence Test (Singer & Brunk, 1967), and the
Wechsler Intelligence Scale for Children (Peck, 1977; Lilly

Similar difficulties were encountered in finding ap-
appropriate research for comparison, as few studies on the effectiveness of modality based instruction have included the correlational information on intelligence with the modality instrument used. Other difficulties were that a large proportion of the research has been concerned with reading students whose achievement was below average or with students whose intelligence test scores fall below the average of the general population.

Although the study dealt with comparisons of group means, an examination of the individual student's scores revealed several observations which support the case of individual differences. While the rankings of students on the two instruments were, in general, similar (See Figure 1, page 28) several notable exceptions occurred. The second ranked student on the SIT was the first ranked student on the SEMI; however, the top ranked student on the SIT, ranked 18th on the SEMI. Similarly, the third ranked student on the SIT ranked 16th on the SEMI.

The findings show no statements regarding a student's dominant modality can be made from that student's intelligence test performance, as no one modality was predominant in a particular SIT IQ range. For example, of the eleven students whose intelligence test results were two standard deviations above the mean on a normal distribution curve, 130 or above, two were auditory dominant, three were visual dominant, three were auditory/visual dominance mixed.
one was kinesthetic/visual mixed dominance, and two were kinesthetic dominant. This can also be seen in a comparison of the mean IQ scores for the subjects grouped by dominant modality. The mean IQ for the visual dominant subgroup was 124; for the auditory dominant subgroup, 125; for the visual/auditory mixed dominance subgroup, 122; and for the kinesthetic dominant group, 125 (see Table 3, p. 33).

Implications

The question of the relationship between students' modality strength and intelligence presents several areas where further research is needed to clarify the issues. The results of this study indicate a need for research to address the following concerns:

1. Studies using the same or similar instruments to identify both intelligence and modality, the lack of consistency among measures of modality limits the development of research comparisons while intelligence needs to be measured through the use of traditional, individual measures;

2. Studies with sample groups which are more representative of the general population, including both the socio-economic-status and intelligence;

3. Studies with sufficient numbers of subjects to examine the relationship of specific dominant modalities to intelligence;
4. Studies which examine the relationship between intelligence test scores and the strongest and weakest subtest scores of subjects grouped according to specific dominant modalities;

5. Controlled experiments to determine the effectiveness of instruction matched to the students' dominant modalities;

6. Studies at earlier grade levels for comparisons on dominant modality shifts and modality strength changes with maturity; and

7. Follow up studies of sample groups to further examine maturity effects.

The findings further imply that, for students who score high on mental abilities tests, one single instructional strategy is not appropriate since no one modality was predominant in the upper intelligence range. Where instruction is geared to students' modalities, it is as necessary to consider the individual student's dominant modality in higher level groupings as it is for students who are grouped according to deficits.

Conclusion

The lack of statistical significance between the SIT IQ scores and the SBMI subtest scores suggests that the total raw score is required in anticipating a student's intellectual level, while subtest scores provide little
information about intellectual functioning.

In addition, examination of the data suggests that a prediction concerning a student's dominant modality cannot be made from his intelligence test scores, nor can a prediction concerning a student's intelligence be made when his dominant modality is known.

While the data tends to support the generalization that a low, positive, significant relationship exists between intelligence test scores and modality strength scores; the study would seem to indicate that to provide the optimal program for each student, the student must be viewed as an individual - with unique characteristics, abilities, and needs.
References


Blanton, B. Modalities and reading. The Reading Teacher, 1971, 25 (2), 210-211.


Colvin, S.S. Intelligence and its measurement: A symposium. Journal of Educational Psychology, 1921, XII (3), 129-147.


Freeman, F.N. Intelligence and its measurement: A symposium. Journal of Educational Psychology. 1921. XII (3), 123-147.


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Weisman, J.M. The modality concept: Including a statement of the perceptual and conceptual levels of learning. In N.K. Smith (Ed.), *Perception and
Reading. Newark, Del.: International Reading Association, 1968. ERIC ED 012678.
