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The Relationship Among Subtest Scores on the Structure of Intellect-Learning Abilities Test, Teacher Assigned Grades & Standardized Measures of Achievement for a Population of Gifted Students

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Randy A.
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THE STRUCTURE OF INTELLECT-LEARNING ABILITIES TEST,
TEACHER ASSIGNED GRADES, AND STANDARDIZED
MEASURES OF ACHIEVEMENT FOR A
POPULATION OF GIFTED STUDENTS

A Thesis Presented to
the Faculty of the
Department of Psychology
Western Kentucky University
Bowling Green, Kentucky

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts

by
Randy A. Rhoad
December 1986

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THE RELATIONSHIP AMONG SUBTEST SCORES ON
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The purpose of this study was to investigate the relationship, among gifted students, between scores obtained on the Structure of Intellect-Learning Abilities (SOI-LA) test and two measures of achievement: teacher assigned grades and scores obtained on the Comprehensive Test of Basic Skills (CTBS). This study was based on the assertion that academic abilities should be linked to specific cognitive abilities measured by the SOI-LA subtests. Significant, positive relationships between academic abilities and SOI-LA subtest scores would imply that curricula based on the Structure of Intellect theory, in areas identified as deficient by the SOI-LA tests, may increase achievement among the gifted population.

One hundred fifty-seven academically gifted students enrolled in grades 5 through 7 during the 1984-1985 school year were selected for this study. All of the participants qualified for admittance into the Gifted and Talented (GAT)

program in a south central Kentucky school district. The SOI-LA and CTBS were administered between November 1984 and April 1985 by one of two GAT teachers; classroom teachers additionally provided grades in reading, language arts, and mathematics.

Stepwise multiple regression analyses indicated that:

1. Convergent Production of Semantic Systems (NSS) alone was the best predictor model for teacher assigned math grades.
2. Cognition of Semantic Relations (CMR) and Divergent Production of Semantic Units (DMU) together provided the best predictor model for teacher assigned reading grades.
3. None of the SOI-LA test variables proved significant predictors of teacher assigned language arts grades.
4. The combination of Evaluation of Symbolic Classes (ESC), Cognition of Semantic Relations (CMR), Convergent Production of Figural Units (NFU), Memory of Symbolic Implications (MSI), Convergent Production of Symbolic Systems (NSS), and Cognition of Symbolic Relations (CSR) provided the best predictor model for CTBS math scores.
5. The combination of CMR and CMU was shown to be the best predictor model for CTBS reading scores.
6. The best predictor model for CTBS language scores was Convergent Production of Symbolic Transformations (NST), ESC, Memory of Symbolic Units-Visual (MSU-V), DMU, MSI, CMR, and NFU.

Pearson product-moment coefficients were additionally calculated to facilitate the interpretation of the multiple regression analyses.

An explanation for the SOI-LA test's relatively poor predictive power for teacher assigned grades, compared to standardized test scores, may be the subjective nature of the assigned grades rather than the validity of the SOI-LA test.

CHAPTER I

Introduction

Interest in the education of gifted children is not a new phenomenon. Plato was probably one of the first to recognize that the training of brilliant minds was advantageous for society (Whitmore, 1980). The American patriarch Thomas Jefferson also believed that the training of the best minds was crucial for the survival of a free world (Haring, 1982). The use of the term "gifted" to label intellectually capable persons predates many other educational terms (e.g., learning disabled and educably mentally retarded) by as much as 40 years. Although there are many forms of giftedness, in educational settings the term most often refers to academic giftedness. Academic giftedness is often defined as an exceptional potential for learning and a superior ability to assimilate conceptual and factual information (Whitmore). Much of what is known today about the gifted population is a result of Lewis Terman's well-known longitudinal study which began in 1921 and continues today by Terman's Stanford University colleagues. Terman's study of 1500 gifted children proved to be an impetus for continuing research and serves as a model for current research concerning the gifted.

The gifted child is most often thought of as a child who excels at school and one who produces significant intellectual accomplishments. There are, however, children with above average intellectual ability who perform academically below their potential--these are the gifted underachievers. Educators have commonly defined underachievement as performance, judged by either grades or achievement test scores, that is significantly below the student's measured or demonstrated potential for academic achievement (Pirozzo, 1982). Estimates of the prevalence for underachievement in the gifted population range from 10% to 40%, with only about 3% of the underachievers being identified as severe underachievers and served by the educational system (Hoffman, Wasson, & Christianson, 1985). Based upon a review of literature, Hoffman et al. generated a checklist of typical criteria that describes major weaknesses in the underachieving gifted student. These criteria include

- (1) high IQ with a discrepancy between expected and actual performance levels
- (2) weakness in basic skills (especially spelling)
- (3) a lack of persistence in goal accomplishments
- (4) a lack of self-confidence
- (5) antisocial tendencies
- (6) exhibition of feelings of inferiority
- (7) blames others for difficulties or
- (8) withdrawal behavior.

Research results have indicated that numerous environmental variables are associated with underachievement in gifted students, including the home environment. Strang (1951), in Whitmore (1980), suggested that parental pressure and stress contribute to underachievement in the gifted child. A more recent review of research by Colangelo and Dettmann (1983) on family interaction and the gifted underachiever showed that the underachiever frequently experiences considerable parental rejection and hostility, whereas achievers had more accepting parents. The researchers, however, do not discuss the possibility that the student's underachievement may have contributed to the parental rejection. The researchers seem to assume that the parental rejection and hostility is a direct cause of the underachievement in their gifted offspring. It seems difficult to show which occurred first, the parental rejection or the underachievement in the student. In another study, Dennis and Dennis (1976) found that gifted underachievers do tend to come from homes that are broken or emotionally inadequate and homes of low socio-economic status.

The effects of school environment on gifted underachievement have been investigated by many researchers. Fine (1967) discussed the effect of rigid conformist teachers and schools and the part they play in the underachievement of children from middle and upper-class families. Fine found that gifted underachievers believed a

teacher to be "bad" if the teacher did not recognize the individuality of students and was sarcastic and overly critical. Fine believed that students' perceptions of teachers' negative feelings may contribute to underachievement in the gifted student. Sears and Sherman (1964) suggested that motivation based on grades and external adult evaluation instead of inner desire and standards set by the student contributes to underachievement in some gifted students. Strang (1951) suggested that a curriculum that is "dull" and "meager" and not challenging can contribute to underachievement in the gifted child.

Other research has addressed personality/emotional differences between gifted achievers and underachievers. In a study involving underachieving high school males with intelligence scores of 115 or higher, Combs (1964) showed significant differences between underachievers and achievers in that those in the underachieving group saw themselves as less adequate and less acceptable to others than did individuals in the achieving group. On the basis of a compilation of research, Taylor (1964) asserted that the underachiever possessed a "free-floating" anxiety related to his or her underachievement. Taylor also concluded that the underachiever was self derogatory, had feelings of inadequacy, and was overly concerned about health as compared to achievers. In a study conducted with bright junior high boys, O'Shea (1970) administered

personality inventories to 284 academically bright students and found that junior high low achievers described themselves as having weaker achievement motivation, as being less aggressive, less persistent, and less conforming than did the high achievers. Results of the well known longitudinal study conducted by Terman and Oden (1959) indicate that gifted achievers are more successful than underachievers in developing good work habits, developing plans, and achieving success and happiness in marriage relationships. In a review of research concerning gifted underachievers, Pirozzo (1982) reported that research has shown gifted underachievement to be related to a combination of personal and adjustment problems in addition to limited programs in the schools. Personality/emotional variables have thus been considered to be significant contributors to underachievement among gifted students.

While much research has focused on environmental and personality/emotional variables, little research has been reported concerning cognitive differences between gifted achievers and underachievers. This lack of research is particularly a dilemma since gifted students are typically classified on the basis of cognitive functioning and ability. Nonetheless, past research has been mostly concerned with providing a description of the environmental and personological differences between achievers and underachievers, rather than differences in cognitive functioning. It would seem that cognitive functioning also

needs to be considered when attempting to explain underachievement among gifted students.

The Structure of Intellect-Learning Abilities (SOI-LA) test (Meeker & Meeker, 1975) has been used to identify cognitive abilities and deficiencies among various types of students, including the gifted. Results of the SOI-LA test have also been used to develop curricula for correcting the identified deficiencies (Jones, 1980; Kester, 1979; Owen, 1982). The SOI-LA test is based on Guilford's multifactor theory of intelligence rather than global or general intelligence theories (Clarizio & Mehrens, 1984). Guilford postulated that intelligence consists of 120 separate abilities, while the general intelligence theorists (i.e., Spearman, 1923; Wechsler, 1974) postulated that intelligence is unitary in nature. Maker (1982) reported that Guilford's theory of the Structure of Intellect (SOI) has probably had greater influence on the field of gifted education than any other cognitive model because it has allowed educators to consider "intelligence" as expandable and flexible rather than an unchangeable, fixed ability. This fluid conceptualization of intelligence is important to gifted education because it implies that cognitive abilities can be strengthened through the use of appropriate teaching strategies. The purpose of much of the research performed with the SOI-LA test has focused on curriculum intervention based on test results (Owen, 1982; Jones, 1980; Ring, 1981). There is, however, a lack of

research concerning the use of the SOI-LA test to ascertain how the cognitive strengths and weaknesses of underachieving gifted students may differ from those of achieving gifted students. Research is needed in this area in order to study the usefulness of the SOI-LA test for identifying patterns of deficient abilities among gifted students who perform less well than their peers in classroom achievement. If the SOI-LA subtests can be shown to predict classroom achievement, then already established SOI instructional materials can be used to increase deficient cognitive skills among students who perform less well than expected in the classroom.

The purpose of this study was to determine the relationship between performance on the SOI-LA subtests and classroom achievement. Classroom achievement, rather than achievement as measured by standardized tests, was the achievement variable of interest in this study because all gifted students, achieving or underachieving, were identified by standardized test scores. However, what makes the underachiever different from the achiever is his or her classroom achievement as measured by teacher assigned grades. The Comprehensive Test of Basic Skills (McGraw-Hill, pub., 1982), a standardized achievement measure, was included as a criterion variable in this study in order to study the relationship between performance on the SOI-LA subtests and teacher assigned grades compared to

the relationship between SOI-LA subtest scores and the scores from a standardized achievement test.

Because reading comprehension is an academic skill that affects classroom achievement in all academic disciplines, it was hypothesized that a significant positive relationship would exist between classroom achievement in reading and language arts and performance on those SOI-LA subtests which Meeker, Meeker, and Roid (1985) found to measure abilities affecting reading skills. These subtests are Cognition of Semantic Relations (CMR), Cognition of Semantic Systems (CMS), Cognition of Semantic Units (CMU), Memory of Figural Units (MFU), and Convergent Production of Symbolic Transformations (NST). It was also hypothesized that a significant positive relationship would exist between CMR, CMS, CMU, MFU, and NST and the Comprehensive Test of Basic Skills (CTBS) (McGraw-Hill, pub., 1982) reading achievement scores and CTBS language arts scores. According to Meeker et al. (1985), the cognition subtests related to reading are particularly important in academic achievement. They report that "students high in cognition ability are rapid learners but students low in cognition ability, no matter how high their IQ scores, will need repetitive explanation to catch on" (p. 70). Cognition involves the recognition of information in various forms and is the foundation for comprehension. A student may have a high IQ score but have difficulty in understanding information that is presented to him or her.

It was also hypothesized that a significant positive relationship would exist between students' mathematics grades and performance on those SOI-LA subtests which Meeker hypothesized to measure abilities affecting mathematics skills. These subtests are Memory of Symbolic Systems-Auditory (MSS-A), Cognition of Symbolic Systems (CSS), Evaluation of Symbolic Classes (ESC), Evaluation of Symbolic Systems (ESS), and Convergent Production of Symbolic Systems (NSS). The "symbolic" content area of all five of these subtests is believed to be related to the ability to solve mathematical problems. It was further hypothesized that a positive relationship would exist between those subtests reportedly relating to advanced mathematics performance and mathematics grade. Those subtests are Cognition of Figural Systems (CFS), Cognition of Figural Transformations (CFT), Cognition of Symbolic Relations (CSR), Memory of Symbolic Implications (MSI), and Convergent Production of Symbolic Implications (NSI). It was also hypothesized that a positive relationship would exist between the CTBS math scores and the above SOI-LA subtests reportedly related to arithmetic and mathematics.

Confirmation of the above hypotheses would imply that the teaching of curriculum based on the SOI model in the identified areas of deficiency may increase achievement in the deficient academic and cognitive areas.

CHAPTER II

Review of the Literature

This study focused upon the use of the SOI-LA test to determine deficiencies in cognitive abilities common to gifted students who perform less well in the classroom than their gifted peers. Since the SOI-LA test is based on Guilford's Structure of Intellect model, it is necessary to have a basic understanding of the Structure of Intellect model (Guilford, 1959), the SOI-LA test (Meeker & Meeker, 1975), and the uses of the SOI-LA test with gifted students. It is also important to look at some studies implementing the results of SOI-LA testing for the instruction of achieving gifted students because the teaching of SOI skills may also lead to an increased level of achievement in the underachieving gifted population.

The SOI Model

J. P. Guilford's Structure of Intellect (SOI) was introduced as a formal theory of intelligence in 1959 after years of research (Guilford, 1967). The basic assumption of the SOI theory is that intelligence is a multivariate concept instead of a single, general (g) factor expressed in a two or three digit number (Guilford, 1972). The SOI is an expansion and revision of earlier factor models of intelligence as presented by Thorndike (1927) and Thurstone

(1938), and is in direct contrast to Spearman's (1923) theory of a single, general (g) intelligence factor. Guilford's SOI model classifies 120 mental abilities on three dimensions: operation, content, and products (Guilford, 1967). Guilford postulated that the 120 different intellectual abilities result from the intersections of five types of thinking "operations" that are applied to four types of "contents," which result in a possibility of six different kinds of "products" (Karnes, Kemp, & Williams in Karnes, 1983).

The dimension "Operations" is defined as "major kinds of intellectual activities or processes; things that the organism does in the processing of information, information being defined as that which the organism discriminates" (Guilford & Hoepfner, 1971, p. 20). The five types of Operations are cognition, memory, convergent production, divergent production, and evaluation. "Cognition" is discovery, rediscovery, recognition, or awareness of information which may be presented in various forms (i.e., auditory, kinesthetic, or visual). Cognition may be considered to be synonymous with "comprehension." It is a skill necessary to possess in order to understand material that is presented. "Memory" is the ability to store and recall newly learned information. "Divergent production" is the ability to generate logical alternatives from given information. The emphasis is on variety and quantity. The divergent thinker is often seen as creative and original.

"Convergent production" is the process of finding logical answers from given information. The process of convergent production involves thinking that is ordered and systematic to enable convergence on a solution. "Evaluation" involves planning and practical thinking. It is the ability to make judgments about already understood material and the suitability, adequacy, or desirability of information (Meeker et al., 1985).

The intellectual activities Guilford termed "Operations" act upon areas which Guilford referred to as "Content." Guilford and Hoepfner (1971) defined "Content" as "broad, substantive, basic kinds or areas of information" (p. 20). Individuals may have different abilities in dealing with the kinds of Content found in mathematics, reading, the arts, or sports. The four types of Content are figural, symbolic, semantic, and behavioral. "Figural" content involves an individual's ability to perceive or recall information in the form of shapes, images, and concrete objects and ideas. "Symbolic" content is that which is presented in a symbolic or representative format such as numbers, letters, or notes of music. "Semantic" content refers to words and ideas to which abstract meanings are associated. For example, the word "dog" has an abstract element because one person's idea of a dog may differ from another person's, although each understands what the other is expressing through the use of the word (Meeker et al., 1985). The fourth Content area,

"Behavioral," deals with nonverbal information involved in human interactions. None of the Behavioral content area is measured by the SOI-LA test.

"Products" is the organization of content information in the individual's cognitive processing. Products act as organizing categories for figural, symbolic, and semantic stimulus materials. The six types of Products defined by Guilford are units, classes, relations, systems, transformations, and implications. A "Unit" is a single item; e.g., a single word, letter, or figure. The Product "Classes" involves the ability to group items or units by virtue of their common properties. For example, the Semantic Units "beagle," "poodle," and "collie" are part of a larger class of words representing dogs, which also belongs to the class "mammals." "Relations" is the connection between items of information such as numbers or figures. For example, the analogy "plane is to water as boat is to" is a task which requires an individual to realize the relationship between Semantic Contents. "Systems" deals with complex interrelationships between figures, numbers, or words which require an individual to comprehend a sequence of operations in order to find a solution. "Transformations" involves modifying original material into a new form or idea. For example, in the Semantic Content area, a Transformation exercise might involve asking students to respond with ideas about the various creative ways for which a brick can be used (i.e.,

doorstop, bookend, paper weight). "Implications" involves the prediction of consequences or the ability to perceive "what happens next in a problem presented visually, vocally, or by physical movement" (Meeker et al., 1985).

The intersection of the three dimensions results in the potential for 120 separate intellectual abilities (5 operations x 4 contents x 6 products = 120), as shown in Figure 1.

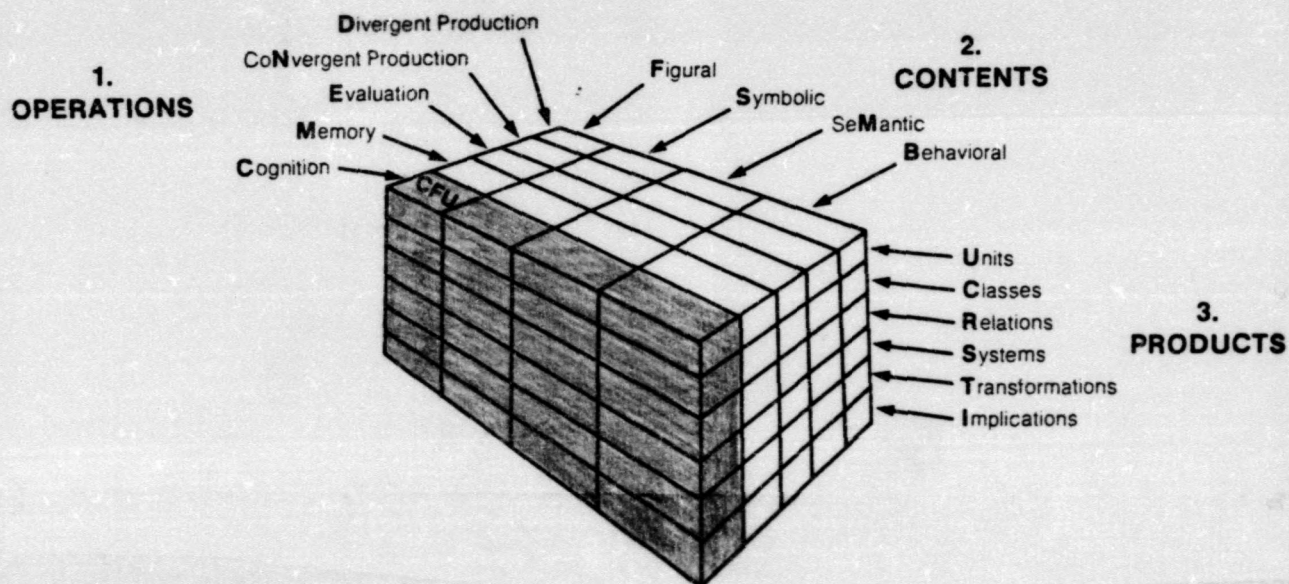


Figure 1. The Structure of Intellect Model
From Meeker et al. (1985)

Each of the 120 different intellectual abilities is a unique combination of one descriptor from each of the three dimensions. For example, CMU represents the Cognition of

Semantic Units and NST represents the Convergent Production of Symbolic Transformations.

The SOI-LA Test

Mary Meeker became interested in the practical applications of the SOI model beginning in the early 1960s. Her work has involved applying Guilford's model to the educational assessment of children and more recently adults (Meeker, Meeker, & Roid, 1985). As a result of the Meekers' research, the Structure of Intellect-Learning Abilities (SOI-LA) test was published in 1975.

Instead of providing a single IQ score as do most instruments designed to measure cognitive ability, the SOI-LA test consists of 26 subtests and yields a detailed profile of learning abilities based on Guilford's model. Each subtest measures one of 26 separate abilities extracted from Guilford's model and is labeled with a three letter trigram (i.e., CMU, NST, or DMR). The research that led to the development of the 26 subtests was performed over several years (i.e., 1962-1974). The 26 subtests resulted from research on those abilities of the SOI model contributing to success in reading and math/arithmetic achievement. Much of Meeker's research involved the Stanford-Binet Intelligence Scale and Wechsler Intelligence Scale for Children in which Meeker (1969) placed items from the Binet and Wechsler Scale into comparable ability cells of the SOI model. Meeker believed the resultant profiles

could aid educators in better defining cognitive strengths and weaknesses in their students (Meeker, 1969).

Meeker et al. (1985) report research that aided in the development of the SOI-LA subtests. Subtests were reportedly selected for their relationship to school learning, particularly in areas of reading, arithmetic, writing, and creativity. For example, Guilford, Hoepfner, and Petersen (1965) used a battery of SOI tests composed of the interaction of the areas of the three dimensions to predict academic achievement of students in ninth-grade algebra classes (cited in Meeker et al., 1985). They found that the combination of Divergent Production of Symbolic Relations (DSR), Memory of Symbolic Implications (MSI), Convergent Production of Symbolic Systems (NSS), Evaluation of Semantic Relations (EMR), Convergent Production of Symbolic Implications (NSI), and Evaluation of Symbolic Implications (ESI) were important predictors of achievement in algebra. Schmadel (1960) in Meeker et al. (1985) showed that the Divergent Production factor measures of Figural and Semantic Units could add significantly to the prediction of reading achievement beyond the contribution of standardized intelligence tests. Feldman (1970) used multiple regression analyses to study the relationship between SOI-LA subtest scores on Cognition of Semantic Units (CMU), Cognition of Figural Units (CFU), Memory of Figural Units (MFU), and Evaluation of Figural Units (EFU), and reading achievement as measured by the Stanford

Achievement Test (SAT) (cited in Meeker et al., 1985). MFU-auditory, MFU-visual, and EFU-visual together contributed most to the prediction of the Word Reading subtest scores on the SAT. Much of Guilford's early work involving multiplefactor analysis also aided in the identification of specific abilities which are related to achievement in academic areas (Guilford & Hoepfner, 1971). Meeker et al. (1985) reported that Meeker mapped the origin of numerous tests for each of the Structure of Intellect factors from sources such as reasoning tests, visual-memory studies, cognitive factor tests, aptitude measures, studies of auditory functions, and studies of perceptual factors. The tests used in the majority of these studies and the Guilford studies were intended for adults. Meeker then converted the format, content, and response mode to a format that could be used with elementary school students.

Description of SOI-LA Subtests

The subtests included in the SOI-LA test in order of administration and a description of each are included in Appendix A. According to Meeker et al. (1985), specific learning deficiencies and needs may be diagnosed by grouping the SOI-LA subtests according to the specific academic areas which they predict. When a student scores consistently low on all subtests in a particular academic area, achievement in that area may be hindered and remediation of the deficient learning ability may be in order. Students' performance may also vary on those

subtests within a specific academic area indicating that there may be deficits limiting achievement. Table 1 shows the Meeker categorization of the SOI-LA subtests according to the specific academic areas (Meeker et al., 1985).

Criticisms of SOI Model

While use of the SOI-LA test has proven beneficial for the identification and remediation of academic deficiencies, there are those who find fault with Guilford's SOI model upon which the SOI-LA test is based. Clarizio and Mehrens (1984) critically analyzed research and literature concerning Guilford's SOI model as it pertains to the cognitive functioning for gifted students. They reported that much of the criticism is directed toward the complexity of Guilford's model (e.g., Eysenck, 1967; Cattell, 1971) and that the 120 abilities are broken down into factors of little importance (McNemar, 1964). Clarizio and Mehrens also reported that other researchers (e.g., Vernon, 1979; Jensen, 1980) believed Guilford's 120 abilities could not be observed in daily life or that evidence did not exist for 120 separate intellectual abilities. Clarizio and Mehrens (1985) also reported that the SOI model has not delivered the anticipated results of its promotional literature.

Roid (1985) argued against Clarizio and Mehrens (1984) by saying that they looked only at the negative aspects of the SOI model and neglected the strengths and positive attributes. Roid emphasized such SOI-LA test values as

Table 1

Academic Ability Categories for SOI-LA Subtests

Academic Ability	SOI-LA Subtest
Reading Abilities	
Basic Reading	
Visual closure	CFU
Visual conceptualization	CFC
Visual discrimination	EFU
Judging similarities and matching concepts	EFC
Visual attending	MSU-V
Visual concentration for sequencing	MSS-V
Advanced Reading	
Vocabulary	CMU
Comprehension of verbal relations	CMR
Comprehension of extended verbal information	CMS
Visual memory for details	MFU
Speed of word recognition	NST
Math Abilities	
Arithmetic Ability	
Comprehension of numerical progressions	CSS
Auditory attending	MSU-A
Auditory sequencing	MSS-A
Judgment of arithmetic similarities	ESC
Judgment of correctness of numerical facts	ESS
Application of math facts	NSS
Mathematics Performance	
Constancy of objects in space	CFS
Spatial conservation	CFT
Comprehension of abstract relations	CSR
Inferential memory	MSI
Form reasoning and logic	NSI
Writing Ability	
Psychomotor readiness	NFU
Creativity	
Creativity with objects and figures	DFU
Creativity with math facts	DSR
Creativity with words and ideas	DMU

using the SOI-LA test profiles for remediating individual weaknesses and using the SOI-LA test to gain valuable intellectual processing information that is missed on other cognitive batteries, e.g., Wechsler Scales (Wechsler, 1974) and Stanford-Binet (Terman, Merrill, & Thorndike, 1973).

Many of the reviews criticizing Guilford's model occurred prior to the development of the SOI-LA test or prior to its demonstrated usefulness in remediation of academic deficiencies. It may be valid to assert that the SOI model is complicated and elaborate. However, if use of the SOI-LA test continues to assist students in learning academic skills, the criticisms targeted at the model upon which it is based would appear to be unjustified and relatively unimportant.

SOI-LA Research

The research discussed in this section addresses the inadequacy of the SOI-LA test for the identification of gifted students and its usefulness in curriculum development. Using multiple regression, Pearce (1983) found that Cognition of Semantic Systems was the only one of ten subtests from the SOI-SFG (Screening for Gifted Form of the SOI-LA test) to be significantly related with Verbal, Performance, and Full Scale IQ scores of the Wechsler Intelligence Scale for Children-Revised (WISC-R) (Wechsler, 1974). Because of the small number of significantly related subtests, Pearce recommended that using the SOI-SFG for either screening or identification

purposes should be performed with caution. She did not consider the possibility that perhaps the SOI-SFG and WISC-R are not measuring the same construct and are not designed to do so. However, because Pearce believed the SOI-SFG to have potential for instructional purposes, she did assert that "perhaps its value lies in the advancement of curriculum through the improvement of skills" (p. 18). O'Tuel, Ward, and Rawl (1983) also found that performance on the SOI-SFG does not show a strong relationship to success in the gifted program, as measured by a teacher checklist and classroom grades, and did not recommend its use as an identification tool. The difficulty Pearce and O'Tuel et al. have experienced in attempting to find a relationship between the SOI-SFG subtests and success in a gifted program may have been because program activities were not related to factors measured by the SOI-SFG.

While the SOI-SFG has not been shown to be an adequate identifier of gifted students, research does indicate the usefulness of the SOI-LA test in areas of curriculum development and for the identification of intellectual strengths and weaknesses in individual students. Roid (1984) found strong evidence for the construct validity of the Content dimension of the Guilford model as implemented in the general ability scores of Figural, Symbolic and Semantic on the SOI-LA tests in a study involving a sample of second-grade students. He further reported that these findings are useful to educators who use the Figural,

Symbolic, and Semantic ability scores to assign second-grade students to teaching methods in academic instruction. Kanter (1981) compared the reading and mathematics scores on the Comprehensive Test of Basic Skills (CTBS) to those subtests of the SOI-LA which Meeker identified to be related to reading and mathematics. He reported positive correlation coefficients between the CTBS and SOI-LA subtests ranging from moderate to good (.55 to .73), indicating that results of SOI-LA testing may lead to curriculum development to improve achievement in reading and mathematics. Parr (1984) found that academically gifted students significantly increased their scores on the SOI-LA test after being exposed to curriculum based upon the SOI model. Jones (1982) conducted a study with 36 gifted children in second through sixth grades to show that training in specific learning abilities leads to improvement in reading and arithmetic achievement. Those students who received training in either arithmetic-related or reading-related abilities improved their scores on standardized achievement tests in areas in which they had been trained. Similar studies involving gifted, general education, and retarded children have shown the usefulness of the SOI-LA test for providing assistance in curriculum planning (Blazey & Mead, 1972; Manning, 1974; Ring, 1981; Patton, Goodloe-Kaplan, & Shore, 1982; Owen, 1982; Jones, 1980). Therefore, the utility of the SOI-LA has been shown

for measuring cognitive abilities that are considered prerequisites for learning.

Thompson and Anderson (1983) researched the construct validity of the three Divergent production subtests of the SOI-LA test (Divergent Production of Figural Units, Divergent Production of Semantic Units, and Divergent Production of Symbolic Relations) by "rotating obtained factors to a position of best fit with a theoretically expected target matrix" (p. 653). The resultant "factor adequacy" coefficients were .91 for DFU, .91 for DMU, and .98 for DSR, which they believed indicated general support of the construct validity for the Divergent subtests. They also investigated the reliability of the scoring procedures for these three subtests between three raters. The mean correlation coefficient between Raters I and II was .91, between I and III, .95, and between Raters II and III, .94.

In an article concerning educational uses for SOI skills with gifted students, Navarre (1983) suggested using the SOI-LA test to aid the teacher in the understanding of cognitive abilities and to individualize instruction for the "average" and gifted student.

The Use of the SOI With Minorities

Meeker et al. (1985) reported the usefulness of the SOI in differentiating patterns of abilities unique to various ethnic groups (Meeker & Meeker, 1973; Hermanson, 1974; Cunningham, Thompson, Alston, & Wakefield, 1978;

Kanter, 1980; Vida, 1982, all cited in Meeker et al., 1985).

In a study reported in Meeker et al. (1985), Shaddock and Mestyanek (1984) studied black children who were failing in the third through sixth grades who had Binet or WISC-R IQs ranging from 90 to 148. SOI curriculum was shown to remediate their weaknesses as was demonstrated by improved scores on an SOI-LA retest. Hengen, Keith, and Bessai (1982) conducted a study involving Canadian Indians in grades 4 through 6. Achievement scores of those exposed to SOI instruction 20 minutes a day for a period of five months were significantly increased in a test-retest design. Vice and Gonzales (1979) in Meeker et al. (1985) conducted a four-year longitudinal study involving educationally disadvantaged Mexican-American students. A control group and treatment group were pre and posttested using the SOI-LA test and a standardized test for arithmetic and reading achievement. Students in the treatment group received SOI-LA ability training related to arithmetic achievement, while the control group received no SOI instruction. At the end of the four-year period, the experimental group showed gains of an average of 22 normal curve equivalence points in arithmetic on the standardized achievement test, while the control group's scores decreased.

SOI-LA Test and Measure of Achievement

Thompson, Alston, Cunningham, and Wakefield (1978) studied the relationship between the SOI-LA test and academic achievement as measured by the Iowa Test of Basic Skills (Hieronymus, Lindquist, & Hoover, 1982) by using regression analyses. The composite of the 11 SOI ability scores that were hypothesized by Meeker to be related to reading achievement was statistically significant ($R=.59$). The multiple correlation between the 11 subtests hypothesized to be related to mathematics achievement was also significant ($R=.83$). The highest correlations for reading were .52 for Cognition of Semantic Relations (CMR), .49 for Convergent Production of Symbolic Systems (NSS), .45 for Evaluation of Symbolic Classes (ESC), and .45 for Cognition of Semantic Systems (CMS). Higher correlations were found between the SOI-LA subtests and arithmetic achievement than those found for reading. Cognition of Semantic Relations was also found to correlate the highest with arithmetic (.68), followed by Convergent Production of Symbolic Implications (.62), Evaluation of Symbolic Classes (.56), and Evaluation of Symbolic Systems (.54).

In a study sample consisting of learning disabled and emotionally disturbed students, Johnson (1979) found 22 significant correlations when comparing scores on the Peabody Individual Achievement Test (PIAT; Dunn & Markwardt, 1970) to SOI-LA test scores. Correlations with the PIAT math subtests ranged from .33 to .50 for Cognition

of Figural Systems (CFS), Cognition of Semantic Relations (CMR), Memory of Figural Units (MFU), Evaluation of Figural Classes (EFC), Convergent Production of Symbolic Systems (NSS), and Convergent Production of Symbolic Implications (NSI). Correlations with the PIAT Reading Comprehension subtest ranged from .32 to .45 for Cognition of Semantic Units (CMU), Memory of Symbolic Implications (MSI), Evaluation of Figural Classes (EFC), Convergent Production of Symbolic Implications (NSI), and Divergent Production of Figural Units (DFU). Correlations between the PIAT Reading Recognition subtest and SOI-LA test scores ranged from .38 to .40 for Cognition of Figural Units (CFU), Cognition of Semantic Units (CMU), Memory of Symbolic Systems-Visual (MSS-V), and Divergent Production of Figural Units (DFU). Johnson reported that these correlations indicate adequate concurrent validity with a well standardized measure of achievement. However, Johnson did not mention the possibility of probability pyramiding which can occur due to the number of variables involved in his study.

The research discussed in this section has been focused on the effects of SOI training on specific abilities and/or the transfer of SOI training to general school performance. Research has already shown the usefulness of the SOI-LA test for identifying deficiencies which may be remediated through instruction based on the SOI model. The SOI-LA test is thus shown to be a useful tool in planning curriculum for the gifted student.

However, there is a lack of research concerning how those gifted students who do not perform as well in the classroom as their gifted achieving peers differ in performance on the SOI-LA subtests.

The relationship between performance on the SOI-LA subtests and classroom achievement among gifted students may indicate that specific cognitive abilities play a role in achievement. The results of SOI-LA testing could then lead to the use of already developed curriculum and remediation programs to assist the underachieving gifted student to develop his or her deficient skills to achieve in the classroom at an expected level. Therefore, the relationship between performance on the SOI-LA test and classroom achievement in a gifted population was investigated. The relationship between performance on the SOI-LA test and a standardized achievement test (Comprehensive Test of Basic Skills, 1982) was also investigated in order to compare the relationship between two measures of achievement (Standardized test scores and teacher assigned grades) and SOI-LA subtest scores.

CHAPTER III

Methods

Participants

One hundred fifty-seven academically gifted students enrolled in grades 5 through 7 during the 1984-1985 school year were selected for this study. All of the participants qualified for admittance into the Gifted and Talented (GAT) program in a south central Kentucky school district. Criteria used for placement in the GAT program required a Cognitive Skills Index (CSI) of 125 or higher on the Test of Cognitive Skills (McGraw-Hill, pub., 1982) or a score of 125 or higher on a standardized test of intelligence. Three of the following criteria also had to be met in order for placement in the GAT program.

1. A total score at the 95th percentile or above on the Comprehensive Test of Basic Skills (CTBS) (McGraw-Hill, pub., 1982)
2. A score at the 8th stanine or above on the Reading, Language Arts, and/or Mathematics subscales of the CTBS
3. Teacher nomination or recommendation
4. Self-nomination
5. Parent nomination

6. Nomination by a psychologist or other qualified professional

Instrumentation

The instruments used in this study included (a) the SOI-LA test (form A); (b) a teacher rating scale (TRS) designed by Kieta, Redfield, Martray, and Beck (1984); and (c) the CTBS. A copy of the TRS appears in Appendix B.

The SOI-LA test is a series of tests "designed to assess a wide variety of cognitive abilities or factors of intelligence in children and adults" (Meeker et al., 1985). Test-retest reliability coefficients reported in the test manual (1985) for the 26 subtests ranged from .35 to .91 for grades 2 through 6 with a test-retest interval of from two to four weeks.

The TRS form required the teachers of each of the students to list end of the semester grades in reading, mathematics, and language arts. Each letter grade was assigned a number value ranging from 1 to 14 (A+=14 to F=1). An Overall Grade was then computed by adding the grades in each reported academic area.

The CTBS is an achievement measure of basic academic skills which provides standardized scale scores in reading, math, and language arts. CTBS scores were used in the study in order to determine the relationship between performance on the SOI-LA subtests and a standardized achievement measure. Support for the content validity of the test is reported in The Mental Measurements Yearbook

(Buros, 1972) which reports that teachers and other educators were consulted in the construction of the original test. Internal consistency reliability coefficients range from .85 to .95.

Procedures

The TRS, SOI-LA, and CTBS were administered between November 1984 and April 1985 by one of two GAT teachers in the school district used in this study. Interrater reliability for the Divergent subtests of the SOI-LA was calculated using Pearson correlations since these subtests are scored subjectively. Two raters scored 50 protocols each. Interrater reliability coefficients for the DFU, DMU, and DSR subtests were .92, .91, and .98, respectively. The subtests on the remaining 102 protocols, which were able to be scored objectively, were scored by a trained assistant, while the remaining DFU, DMU, and DSR subtests were scored by the researcher.

Analyses

Stepwise multiple regression using the Statistical Package for the Social Sciences (SPSS; Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975) was used to identify the best predictor model for achievement as measured by teacher assigned grades and standardized test scores. Scores obtained on the 26 subtests were the predictor variables. The criterion variables were the student's math grade, reading grade, language arts grade, CTBS math score, CTBS reading score, and CTBS language arts score. Pearson

product-moment correlations were also calculated using SPSS (Nie et al., 1975) to determine the relationship between individual SOI-LA subtests and each of the criterion variables (i.e., teacher assigned reading, math, and language arts grades; CTBS reading, math, and language arts scores).

CHAPTER IV

Results

Stepwise multiple regression analysis was used to determine the best combination of predictors for each of six criterion variables: teacher assigned mathematics grade (MGR), teacher assigned reading grade (RGR), teacher assigned language arts grade (LGR), CTBS math score, CTBS reading score, and CTBS language arts score. For each analysis, SOI-LA subtest scores functioned as the predictor variables. All analyses were accomplished using the New Regression program of the Statistical Package for the Social Sciences (SPSS; Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975).

Convergent Production of Semantic Systems (NSS) alone was the best predictor model for MGR ($F = 6.52$, $p < .01$, $R = .24$, $R^2 = .06$). Cognition of Semantic Relations (CMR) and Divergent Production of Semantic Units (DMU), together, provided the best predictor model for RGR ($F = 5.52$, $p < .01$, $R = .30$, $R^2 = .09$). A breakdown of the variance accounted for by CMR and DMU in RGR is summarized in Table 2.

None of the SOI-LA test variables proved significant predictors of LGR. The combination of Evaluation of Symbolic

Table 2

Stepwise Multiple Regression Summary Table with Reading Grades (RGR) as the Criterion Variable and SOI-LA Subtest Scores as the Predictor Variables

Source	df	SS	MS	F	<u>p</u>
Total	111	400.28			
Regression	2	36.81	18.41	5.52	<.01
CMR	1	21.09	21.09	6.33	<.01
DMU	1	15.72	15.72	4.72	<.05
Residual	109	363.47	3.33		

Classes (ESC), Cognition of Semantic Relations (CMR), Convergent Production of Figural Units (NFU), Memory of Symbolic Implications (NSI), Convergent Production of Symbolic Systems (NSS), and Cognition of Symbolic Relations (CSR) scores provided the best predictor model for CTBS math scores ($F = 11.64$, $p < .001$, $R = .60$, $R^2 = .36$). A summary of the variance in CTBS math scores accounted for by ESC, CMR, NFU, MSI, NSS, and CSR scores is shown in Table 3.

The combination of Cognition of Semantic Relations (CMR) and Cognition of Semantic Units (CMU) was shown to be the best predictor model for CTBS reading scores ($F = 15.28$, $p < .001$, $R = .44$, $R^2 = .19$). Results of this analysis are summarized in Table 4. When CTBS language scores were used

Table 3

Stepwise Multiple Regression Summary Table with CTBS Math Scores as the Criterion Variable and SOI-LA Subtest Scores as the Predictor Variables

Source	df	SS	MS	F	p
Total	130	53111.12			
Regression	6	19131.10	3188.52	11.64	<.001
ESC	1	8531.43	8531.43	31.13	<.001
CMR	1	2923.87	2923.87	10.67	<.001
NFU	1	3140.80	3140.80	11.46	<.001
MSI	1	1947.80	1947.80	7.11	<.01
NSS	1	1251.76	1251.76	4.57	<.01
CSR	1	1335.44	1335.44	4.87	<.01
Residual	124	33980.02	274.03		

Table 4

Stepwise Multiple Regression Summary Table with CTBS Reading Scores as the Criterion Variable and SOI-LA Subtest Scores as the Predictor Variables

Source	df	SS	MS	F	p
Total	130	167045.79			
Regression	2	32198.49	16099.24	15.28	<.001
CMR	1	26656.22	26656.22	30.56	<.001
CMU	1	5542.27	5542.27	5.26	<.05
Residual	128	134847.30	1053.49		

as the criterion, the best predictor model consisted of Convergent Production of Symbolic Transformations (NST), Evaluation of Symbolic Classes (ESC), Memory of Symbolic Units-Visual (MSU-V), Divergent Production of Semantic Units (DMU), Memory of Symbolic Implications (MSI), Cognition of Semantic Relations (CMR), and Convergent Production of Figural Units (NFU) scores ($F = 7.71$, $p < .001$, $R = .55$, $R^2 = .28$). A summary of the variance accounted for in CTBS language scores by NST, ESC, MSU-V, DMU, MSI, CMR, and NFU appears in Table 5.

Table 5

Stepwise Multiple Regression Summary Table with CTBS Language Scores as the Criterion Variable and SOI-LA Subtest Scores as the Predictor Variables

Source	df	SS	MS	F	<u>p</u>
Total	130	149184.52			
Regression	7	45531.65	6504.52	7.72	<.001
NST	1	13010.98	13010.98	15.44	<.001
ESC	1	7887.39	7887.39	9.36	<.001
MSU-V	1	6001.63	6001.63	7.12	<.01
DMU	1	7007.28	7007.28	8.32	<.01
MSI	1	4220.66	4220.66	5.01	<.05
CMR	1	3548.20	3548.20	4.21	<.05
NFU	1	3855.51	3855.51	4.58	<.05
Residual	123	103652.87	842.71		

Pearson product-moment correlation coefficients (Pearson r 's) were calculated between each of the criterion variables and the 26 SOI-LA subtest scores in order to show any significant relationships between the criterion and predictor variables. The Pearson r 's are tabulated in Table 6.

Table 6
Pearson Product-Moment Correlation Coefficients Between
SOI-LA Subtest Scores and Criterion Variables

SOI-LA Subtest	MGR	RGR	LGR	CTBS M	CTBS R	CTBS L
DFU	.04	.04	.01	-.07	.00	.00
DMU	.10	.19*	.12	.11	.14*	.19*
CFU	.14	-.02	-.10	.06	-.18*	-.15*
CMU ^b	-.03	.08	-.02	.26*	.31*	.21*
CFS ^a	.15*	.07	-.04	.22*	.09	.12
CFT ^a	.01	.15*	.13	.19*	.02	.09
CMR ^b	.06	.21*	.05	.28*	.30*	.15*
CMS ^b	.17*	.03	.02	.17*	.21*	.17*
DSR	.01	-.04	.04	.07	-.04	.00
CSR ^a	.13	.07	.02	.27*	-.05	.07
MSU-V	.14	.00	.03	.09	.05	-.11*
MSS-V	.19*	.04	.10	.08	-.03	.03
MSU-A	.02	-.01	-.10	.00	.01	-.05
MSS-A ^a	.05	-.03	-.01	.14*	.17*	.13
MSI ^a	.18*	.04	.07	.22*	.05	.21*
EFU	.18	-.05	-.04	.19*	.16*	.19*
CFC	.01	-.05	-.06	.17*	-.04	-.02
EFC	.02	-.01	.04	.00	-.17*	-.11
ESC ^a	.23*	.18*	.05	.41*	.10	.25*
CSS ^a	.17*	.18*	.02	.29*	.12	.03
ESS ^a	.14	.03	-.07	.23*	.02	.04
NSS ^a	.26*	.17*	.13	.32*	.09	.17*
NST ^b	.11	.08	-.01	.16*	.16*	.22*
NSI ^a	.11	.02	.04	.19*	-.01	.08
MFU ^b	-.01	-.03	-.01	.16*	.07	.16*
NFU	.09	.09	.00	-.23*	-.06	-.18*

^aHypothesized related to teacher assigned math grades and CTBS math scores

^bHypothesized related to teacher assigned reading and language arts grades and CTBS reading and language arts scores

*Considered significant ($p < .05$)

CHAPTER V

Discussion

It was hypothesized that (a) the SOI-LA subtests best predicting teacher assigned math grades and CTBS math scores would be MSSA, CSS, ESC, ESS, NSS, CFS, CFT, CSR, MSI, and NSI; and (b) the SOI-LA subtests best predicting teacher assigned reading and language arts grades and CTBS reading and language scores would be CMR, CMS, CMU, MFU, and NST.

As indicated in Table 3, NSS alone was the best predictor of teacher assigned math grades. Successful performance on the NSS subtest requires mastery of basic arithmetic facts and the ability to solve advanced nonverbal arithmetic problems (Meeker et al., 1985). Table 6 shows significant zero-order correlations between five of the hypothesized SOI-LA subtest predictors (CSS, ESC, NSS, CFS, and MSI) and teacher assigned math grades. The fact that NSS alone was the only variable included in the regression equation to explain variance in teacher assigned math grades may indicate a substantial amount of intercorrelation among SOI-LA subtests. Thus, the joint prediction of the intercorrelated subtests may be little better than the prediction given by NSS alone.

NSS was also included in the regression equation for CTBS math scores, indicating that similar skills related to the successful completion of NSS are involved in classroom achievement and performance on the CTBS math subtest. In addition to NSS, Evaluation of Symbolic Classes (ESC), Cognition of Semantic Relations (CMR), Convergent Production of Figural Units (NFU), Memory of Symbolic Implications (MSI), and Cognition of Symbolic Relations (CSR) were included in the equation when CTBS math scores were used as the criterion. The fact that ESC, CMR, NFU, NSI, and CSR were included in the regression equation to predict CTBS math scores but not to predict teacher assigned math grades may indicate that different SOI abilities are involved between classroom performance as judged by teachers and performance as a standardized achievement measure. Examination of the zero-order correlation coefficients also revealed that all of the SOI-LA subtests hypothesized to be related to the CTBS math scores (MSS-A, CSS, ESC, ESS, NSS, CFS, CFT, CSR, MSI, and NSI) were significant, indicating possible usefulness for the teaching of SOI math skills for improving performance on standardized achievement measures. The fact that all of the hypothesized subtests were significantly correlated with CTBS math scores but several not included in the regression equation for CTBS math scores (i.e., MSS-A, CSS, ESS, NSS, CFS, CFT, and NSI) may indicate a substantial amount of intercorrelation among the hypothesized subtests.

Cognition of Semantic Relations (CMR) was the only hypothesized predictor variable to be included in the regression equation for teacher assigned reading grades. A divergent production subtest, Divergent Production of Semantic Units (DMU), was the only additional SOI-LA subtest included in the equation. Successful performance on the DMU subtest requires the creative use of words and ideas to write a story in a limited amount of time. It may be that teachers view students who have a creative vocabulary and possess creative ideas as good readers and those who do not have these abilities as poor readers. CMR was also included in the regression equation to predict CTBS reading scores, implying that abilities related to the CMR subtest may improve reading achievement. CMU was the only additional reading achievement SOI-LA subtest included in the regression analysis to predict CTBS reading scores. However, the combination of CMR and CMU accounted for 19% of the variance in CTBS reading scores, implying a usefulness for the teaching of CMR and CMU skills in promoting reading achievement as measured by a standardized achievement test. An examination of the zero-order correlations showed that CMR was the only hypothesized predictor to be significantly related to teacher assigned reading grades, while CMR, CMS, CMU, and NST were all significantly related to CTBS reading scores. This may imply that different factors are involved in performance as a standardized reading measure than those involved in

reading achievement in the classroom as measured by teacher assigned grades.

None of the SOI-LA subtests were shown to be useful in predicting teacher assigned language arts grades. However, seven SOI-LA subtests (NST, ESC, MSUV, CMU, MSI, CMR, and NFU) were shown to be useful in predicting the language arts scores on the CTBS. Only two (NST and CMR) of these seven were hypothesized to be related to CTBS language scores. An examination of the zero-order correlations revealed that all five of the SOI-LA subtests hypothesized to be related to the CTBS language score were significant. The fact that the SOI-LA subtests included in the regression equation for language arts scores on the CTBS were hypothesized to be related to academic areas other than language arts should not be surprising since language arts is an academic discipline that requires various skills and abilities (i.e., evaluation skills, word recognition skills, and creativity with words). This finding implies that the skills related to the SOI-LA subtests found to be useful in predicting CTBS language arts scores may aid in the remediation of language arts weaknesses in the gifted population.

Several additional implications appear to be noteworthy. First, since CMR was included in the regression equations for the prediction of teacher assigned reading grades, CTBS math scores, CTBS reading scores, and CTBS language scores, it may be a valuable SOI skill which

can be taught to improve performance in many academic areas. CMR deals with the comprehension of verbal relations which quite logically affects most academic areas. A second implication stems from the finding that SOI-LA subtests hypothesized to be related to math achievement were generally more highly correlated with teacher assigned math grades and CTBS math scores than were the SOI-LA subtests hypothesized to be related to reading achievement. These results imply that the SOI-LA test might be better used to predict mathematic achievement than reading achievement and that SOI curriculum might be more useful in improving mathematics skills than reading skills.

A third implication stems from the finding that a discrepancy existed between the number of useful predictors for teacher assigned grades and the number of useful predictors for scores on the CTBS. This finding indicates that the SOI-LA test is not as useful in predicting teacher assigned grades as it is in predicting scores on a standardized achievement measure. An implication of this finding may be that standardized achievement tests and teacher assigned grades are not measuring the same construct. Coty, Redfield, Martray, and Beck (1984) found a significant positive correlation between teacher assigned grades and teacher assigned conduct grades with a population of gifted students. It may be that teachers' perceptions of achievement are more dependent upon classroom behavior than actual academic performance. The

finding that SOI-LA subtests did not predict classroom grades as well as they did standardized achievement test scores is likely due to the subjective nature of teacher assigned grades rather than a fault of the SOI-LA test.

The SOI-LA test generally performed as expected in its predictive power of a standardized achievement measure, particularly in the area of mathematics. However, its usefulness for predicting teacher assigned classroom grades was not shown in this study. Further research is needed to explore the relationship between classroom grades and standardized achievement scores within the gifted population, since these factors are important in the identification of gifted students and the remediation of academic deficiencies. Since the results of this study also show significant relationships between achievement and specific SOI-LA subtests, follow-up research is warranted to study the effects of SOI curriculum training among the underachieving gifted population.

APPENDIX A
DESCRIPTION OF SOI-LA SUBTESTS

APPENDIX A

Description of SOI-LA Subtests

Divergent Production of Figural Units (DFU)

"This is a test of the student's ability to use ambiguous stimuli in creative ways" (Meeker et al., p.12). The student is instructed to create drawings on a page consisting of 16 squares in four rows with four squares in each row. Meeker suggests that high scores on this subtest may indicate talent in such areas as cartooning, designing, drafting, and fine arts.

Divergent Production of Semantic Units (DMU)

This is a creativity test which "assesses willingness to express one's ideas freely" (Meeker, et al., p.12). The student is instructed to create a story about a picture drawn in the previous DFU subtest. It tests verbal fluency and creativity and involves the ability to write and develop unique ideas in a limited amount of time (Meeker et al., 1985).

Cognition of Figural Units (CFU)

This subtest consists of 16 partially obscured figures which the student is asked to identify. It is a test of visual closure and involves abilities necessary for learning to read. Meeker et al. (1985) say that low scores may indicate visual problems and problems in seeing complete words and shapes.

Cognition of Semantic Units (CMU)

The CMU subtest is a vocabulary test consisting of 15 mathematics and 15 language concepts which requires recognition of word meanings. Students with low scores on this subtest may have difficulty in solving word problems in math, and in reading comprehension. Meeker et al. (1985) report that this subtest is highly related to academic achievement.

Cognition of Figural Systems (CFS)

This tests the ability of the test-taker to perceive a figure in space no matter where he or she is in relation to the figure itself. The subtest consists of 26 items, each including a figure on the left, plus four different rotations of that figure to its right. Low scores may indicate learning difficulty in the higher math areas of calculus, trigonometry, and geometry (Meeker et al., 1985).

Cognition of Figural Transformations (CFT)

The CFT subtest tests the ability to recognize a figure when it has been rotated into a new orientation. This test also measures abilities involved in the achievement of higher mathematics skills. Meeker et al. (1985) report that when both CFS and CFT are high or low, greater significance is indicated by the two scores.

Cognition of Semantic Relations (CMR)

This is a test of the ability to see relations between ideas or the meanings of words. Each item includes two pictures or words with a question mark between them, and three or four answers from which to choose. CMR is important in the decoding of written language and is crucial to advanced reading comprehension skills. Students who do poorly on this subtest may also do poorly in mathematics as it relates to problem solving (Meeker et al., 1985).

Cognition of Semantic Systems (CMS).

CMS involves the ability to hold a complete system of ideas in cognition and of verbal comprehension. CMS is critical for the ability to understand lengthy directions and long sentences. This ability is crucial for success in all academic areas of the school environment (Meeker et al., 1985).

Divergent Production of Symbolic Relations (DSR)

On this subtest the student's are given 3 x 3 matrices with symbols in each and asked to complete the matrices creating a relationship between the symbols. Meeker et al. (1985) say that mathematics concepts are necessary to successfully complete this subtest.

Cognition of Symbolic Relations (CSR)

In this subtest the student is required to find the relationship between letters embedded in pairs of words. Meeker et al. (1985) report that low scores for older students may be indicative of difficulty in manipulating symbols in academic areas such as algebra, trigonometry, physics, and chemistry.

Memory of Symbolic Units-Visual (MSU-V)

This subtest requires the student to recall numbers presented visually. This ability is a prerequisite for reading and spelling readiness (Meeker et al., 1985).

Memory of Symbolic Systems-Visual (MSS-V)

MSS-V is the ability to remember connections between units of symbolic information. The student is required to hold a set of numbers in mind, sequence them, and process them in reverse from the order administered. Meeker et al. (1985) say it is a sequencing skill which is important for achievement in arithmetic and reading.

Memory of Symbolic Units-Auditory (MSU-A)

MSU-A is a test of auditory memory for symbols. It requires the student to recall numbers presented orally. Low scores on this test may indicate a memory weakness that may limit rote learning (Meeker et al., 1985).

Memory of Symbolic Systems-Auditory (MSS-A)

The MSS-A subtest is a test of the ability to remember the order of symbolic information that is presented orally. The task requires the student to hold a sequence of numbers in mind and then to reverse them. MSS-A is a basic skill for rote learning in arithmetic (Meeker et al., 1985).

Memory of Symbolic Implications-Visual (MSI-V)

This subtest tests the student's ability to associate unrelated symbolic information. Pairs of symbols are shown to the student and he or she is asked to recall them in correct association. Meeker et al. (1985) say that this skill is valuable in the learning of new material before full comprehension of the material has been reached (i.e. the study of foreign language).

Evaluation of Figural Units (EFU)

This is a test of the ability to evaluate and discriminate among complex figures. The student is shown a stimulus figure and asked to find the one exactly the same out of four figures just to the right of the stimulus. The test is a measure of the student's attention to detail and may effect reading ability (Meeker et al., 1985).

Cognition of Figural Classes (CFC)

CFC is a test of visual conceptualization which requires the student to identify the class or classes to

which a figure belongs. Students low in CFC may have difficulty in beginning comprehension ability and concept formation (Meeker et al., 1985).

Evaluation of Figural Classes (EFC)

This is a test of the ability to judge similarities and match concepts related to spatial stimuli. The student is required to find the figure that is most in common with the stimulus figure. EFC is related to concept formation and basic reading comprehension (Meeker et al., 1985).

Evaluation of Symbolic Classes (ESC)

This is a test of symbolic discrimination and is related to logic. Students are required to classify numbers by various criteria. Students with low ESC may have difficulty determining which mathematical operation is required in solving math problems (Meeker et al., 1985).

Cognition of Symbolic Systems (CSS)

CSS tests the comprehension of numerical progressions. The student is required to find the rule that is generating a number series. This ability is related to facility with arithmetic notation and to the ability to recognize patterns such as sequential ordering of numbers (Meeker et al., 1985).

Evaluation of Symbolic Systems (ESS)

The ESS subtest requires the student to examine four series of numbers and apply a rule in identifying the correct series. Low scores on ESS are associated with difficulties in solving math problems even when the math facts are known (Meeker et al., 1985).

Convergent Production of Symbolic Systems (NSS)

The NSS subtest tests the ability of the student to solve complicated arithmetic problems which do not depend on verbal skills. The student is presented with a given number and must obtain a specific number by the use of numerical operations. Students low in NSS have difficulty applying mathematical rules to solve math problems (Meeker et al., 1985).

Convergent Production of Symbolic Transformations (NST)

The NST subtest is a measure of the speed of word recognition. The student is required to draw a line through or circle words from groups of connecting letters. Scores on the NST subtest indicate a student's ability to keep up with his or her reading assignments (Meeker et al., 1985).

Convergent Production of Symbolic Implications (NSI)

This is a test of logic and form reasoning which requires the student to perform substitution of symbols to

find the correct answer. NSI ability is related to academic performance in algebra and critical thinking in the social sciences (Meeker et al., 1985).

Memory of Figural Units (MFU)

This tests the student's ability to remember the figural objects presented previously throughout the test booklet. Students low in MFU may be forgetful or have difficulty paying attention to details (Meeker et al., 1985).

Convergent Production of Figural Units (NFU)

This is a test of visual-motor ability that requires the student to copy geometric figures in a given amount of time. Low scores on the NFU subtest may indicate perceptual-motor problems or an indication that the student uses a methodical approach to school work (Meeker et al., 1985).

APPENDIX B
TEACHER RATING SCALE

APPENDIX B
TEACHER RATING SCALE

GENERAL DIRECTIONS

Using the form at the bottom of the page, fill out the sections that apply to the student whose name is listed.

Grades-List the final letter grades you assigned the student in applicable conduct and subject matter areas (e.g. Math, conduct during Math, Reading, conduct during Reading, Language Arts, conduct during Language Arts).

Rank-Use the seven point scale listed below to compare your perception of this student's ability (not other students' performances) to his/her actual level of classroom achievement:

- 1 = Nonproductive
- 2 = Very low level of achievement
- 3 = Low level of achievement
- 4 = Moderate level of achievement
- 5 = High level of achievement
- 6 = Very high level of achievement
- 7 = Superior level of achievement

<u>STUDENT'S NAME</u>		<u>GRADES</u>		<u>RANK</u>
		subject	conduct	
	Math			
	Reading			
	Language Arts			

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