Guilford's Structure of Intellect Theory: An Evaluation of the Three Dimensional Model and the Implications for Its Use in the Education of the Gifted Child

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GUILFORD'S STRUCTURE OF INTELLECT THEORY:
AN EVALUATION OF THE THREE DIMENSIONAL MODEL AND THE
IMPLICATIONS FOR ITS USE IN THE EDUCATION OF THE GIFTED CHILD

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
Judith B. Parr
May, 1984
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GUILFORD'S STRUCTURE OF INTELLECT THEORY:
AN EVALUATION OF THE THREE DIMENSIONAL MODEL AND THE
IMPLICATIONS FOR ITS USE IN THE EDUCATION OF THE GIFTED CHILD

Recommended April 13, 1984

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APPROVED April 27, 1984

Emil Stang
Dean of the Graduate College
ACKNOWLEDGEMENTS

For the contributions of two members of my thesis committee, Dr. Richard Miller and Dr. Carl Martray, I am indeed grateful. In addition to many professional contributions their willingness to help and constant encouragement meant more to me than I can express.

As chairperson of my thesis committee, Dr. Doris Redfield is well deserving of extra special mention. Her unyielding persistence and constructive criticism throughout the study indeed made this thesis possible.

For the confidence they expressed by allowing me access to the confidential data, I extend my appreciation to Doris Mills and Neil Taylor. Also, for overlooking all the interruptions and maintaining pleasant working conditions, I am very thankful to all the principals, teachers and central office personnel in both school districts.

To my husband and children, I owe a special debt of gratitude. Without their constant support and encouragement I could not have pursued this endeavor to the finish.

Last, although not least, to Carolyn Chelette, the typist, I am grateful. It was through her generous and persistent efforts that the final draft of this paper achieved the standards acceptable to the University Library.
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There is much current interest in the field of education concerning the academically gifted student's needs. Guilford's Structure of Intellect model (Guilford, 1956) holds particular promise for positively influencing the development of cognitive skills among academically gifted students. The purpose of this study was to evaluate the effect of using a program of instruction based upon Guilford's Structure of Intellect (SI) model (Meeker, 1969) with children identified as academically gifted. Subjects consisted of 68 fourth-grade students who resided in two counties of northwestern Kentucky and who were identified as being academically gifted. The treatment group consisted of 34 academically gifted fourth-grade students attending various schools in one of the counties. Each student in the treatment group received three hours of instruction per week based on the SI model. This SI instruction was on a resource basis, outside their regular classroom instruction, and lasted for a total of 34 weeks. The control group consisted of 34 academically gifted fourth-grade students who attended school within a second county in northwestern Kentucky. The control group received no instruction based upon the SI model; rather, they received only traditional instruction in a regular classroom. The dependent variables were the abilities of evaluation, memory, cognition, divergent production, and convergent production as defined by Guilford and as
measured by the five subscales of the Structure of Intellect/Learning Abilities (SOI/LA) test (Meeker, 1969) which possess independent items across the subtests. A pretest-posttest control group design was used. Five analyses of covariance were computed, one for each of the five dependent variable measures. Results of the analyses indicated significant differences between the SOI/LA scores of the treatment group over the control group at the time of posttesting for all of the dependent variable measures except memory. Results of this study demonstrated that a program of instruction, based upon Guilford's SI model, positively influenced the development of cognitive skills, as measured by the SOI/LA test, among students in the treatment group.
CHAPTER I
Introduction

Intellectual giftedness and the education of intellectually gifted children has been of interest to philosophers and educators for many years (Hildreth, 1966; Terman, 1947). Continuing interest in the intellectually gifted prevails today. In fact, there seems to be a current aura of urgency surrounding the necessity for development of educational programs for academically gifted students (Gourley and Richert, 1978; Jackson, 1977). Some of this interest is reflected by increased allocation of tax dollars for gifted education as well as the development of special interest groups, e.g., the National Association for Gifted Education and its state level affiliates.

The types of educational programs currently in use with the gifted are varied (Maak and Swicord, 1979; Porter, 1968; Clifford, 1972; Gensley, 1972; Luca and Allen, 1974, Schwartzstein, 1978). In general, these programs fall into one of five categories: (a) acceleration (Abraham, 1958; Horne and Dupuy, 1981; Keating and Stanley, 1972; Robeck, 1968), (b) enrichment (DeHaan and Havighurst, 1962; Horne and Dupuy, 1981; Los Angeles City Schools, 1962), (c) special grouping (Cutts and Moseley, 1957; Lamping, 1981; Los Angeles City Schools, 1962), (d) special schools (Lewis, 1974; Vail, 1979) and (e) resource programs (Vail, 1979).

Despite the variety of education programs being used with academically gifted students, few were specifically designed for use with
gifted students. Some notable exceptions to this lack of special programs for the gifted are the California Project Talent (Robeck, 1968) and the Governor's School of North Carolina (Lewis, 1974).

In addition to the lack of special programs for the gifted, very little documentation exists regarding the effectiveness of special programming for the gifted (Renzulli, 1980). The effects of many programs currently in use with academically gifted students have not been empirically validated, relying instead upon subjective evaluation to determine their effectiveness.

One educational program which is being used on a fairly widespread basis with intellectually gifted children is a Structure of Intellect (SOI) program for gifted students (Bennett and Markle, 1978; Meeker, 1981). The SOI program of instruction has particular appeal for educators because it seems to be built upon a solidly defensible theory base, i.e., Guilford's Structure of Intellect (SI) model (Guilford, 1959).

Guilford's SI model is conceptualized in a three-dimensional form, i.e., a matrix in which the operational, content and product components of intellect are related. Many previous models of intellect were based upon hierarchies, implying that learning occurs in a fixed sequence (Guilford, 1956). In other words, hierarchical models do not allow for skills to be learned out of sequence or simultaneously.

Guilford's SI model states that intellectual functioning requires five separate abilities, which he refers to as operations. These operations, which interact with the content and product dimensions of intellect, have been classified as cognition, memory, evaluation, convergent production and divergent production. The SI model may
have particular implications for educating gifted students. Academically gifted students, by definition, master basic academic skills earlier than their non-gifted peers. Therefore, academically gifted students may profit from additional instruction in non basic skill areas, e.g., those described by the SI model. The purpose of this study was to evaluate the effects of using a program of instruction, based upon Guilford's SI model, with children identified as academically gifted.
CHAPTER II
Literature Review

Models of Intelligence

Early theories of intelligence proposed that intelligence consisted on one general ability factor. For example, Spearman (1904) stated that "All branches of intellectual activity have in common one fundamental function" or general ability factor. However by 1927, Spearman's research led him to believe that the "one fundamental function" might actually consist of a group of related functions, each being saturated by the general factor.

Thorndike (1927) disagreed with Spearman's theory of general intelligence. Thorndike proposed that intelligence consisted solely of independent, specific mental abilities (e.g., abstract, social, and mechanical).

Thurstone (1935) elaborated upon Thorndikes' notion of specific mental abilities and provided a multiple-factor theory of intelligence (Thurstone, 1938; Thurstone and Thurston, 1941). In this first major study, Thurstone (1935) thought that as many as nine common factors were sufficiently interpretable psychologically to justify calling them "primary mental abilities." The primary mental abilities included space, number, verbal comprehension, word fluency, memory, induction, deduction, flexibility, and speed of closure.
Guilford (1956) rejected Spearman's initial concept of intelligence as a general ability. He expanded upon the concepts of specific mental abilities as presented by Thorndike (1927) and Thurstone (1938) by presenting a multi-dimensional theory of intellect.

**Guilford's Structure of Intellect (SI) Model of Intelligence**

Guilford's work progressed through several stages. In the first stage, Guilford considered Thurstone's primary mental abilities to be a description of intellectual abilities. During this initial stage of his work, Guilford conducted research with aviation psychologists in the U. S. Army Air Force during the Second World War (Guilford and Lacy, 1947).

Guilford believed that Thurstone's primary mental abilities were one major source of intellectual abilities. Guilford's research with aviation psychologists expanded upon Thurstone's original concept of primary mental abilities. Guilford found that, in some cases, one of Thurstone's primary mental abilities constituted just one factor, a component, of intelligence and that some of the abilities identified by Thurstone could be further subdivided into three or four factors. In addition to the increase in the number of factors thought to be involved in intelligence, Guilford explored new ideas for the testing of reasoning, memory and conceptualization.

In the second stage of his work, Guilford (1949) identified a major source of intellectual abilities through a program of analysis conducted by the Aptitude Research Project at the University of Southern California. The Aptitude Research Project was supported by the Office of Naval Research (Guilford, 1959); attention was directed toward abilities contributing to reasoning, creative
thinking, planning evaluation and problem solving. At the termination of this project in 1969, Guilford and his associates had identified over 100 abilities which are purported to comprise intelligence and learning.

As these "abilities which comprise intelligence and learning" were being identified in the Aptitude Research Project, Guilford began an attempt to organize the abilities into a logical scheme of learning (Guilford, 1956). Guilford initially attempted to organize these abilities into a hierarchical model. He later discarded this hierarchical model because it implied a ladder type of learning which did not allow for skills to be learned out of sequence or simultaneously.

Guilford used the procedure known as multiple-factor analysis in order to identify the factorial abilities constituting intelligence. The procedure of multiple-factor analysis was developed in the United States (Thurstone, 1944) and is a mathematical procedure which enables the researcher to classify tests of different kinds. The classification is based upon the way in which the scores intercorrelate with one another. The basic theory includes the belief that where two or more tests are intercorrelated there is at least one underlying ability or trait involved, i.e., a common factor. If the analysis is properly planned and executed, each common factor appears to have a rational, psychological meaning. Factor analysis shows that the abilities to solve problems are essentially the unique abilities within the structure of intellect (Guilford, 1968).

When efforts were first made by Guilford (1955) to organize the known intellectual abilities that had been identified by factor analysis, 37 distinct abilities were recognized. By 1958, a total
of 43 abilities had been identified by Guilford and included in his model (Guilford, 1959). Currently, there are 120 demonstrated or hypothesized abilities in the SI model (Guilford, 1972).

Guilford's SI model classifies the 120 mental abilities on three dimensions. One of the three dimensions is the Operational dimension. Guilford defines operation as "major kinds of intellectual activities or processes; things the organism does with raw materials of information; information being defined as 'that which the organism discriminates'" (Guilford and Hoepfner, 1966). The Operational dimension consist of (a) evaluation, (b) convergent production, (c) divergent production, (d) memory, and (e) cognition.

A second dimension of the SI model is the Content dimension. Guilford defined this dimension as "the substantive kind of information involved in the ability." Thus, content is the input which is processed by one or more of the operations at any given point. The Content dimension consists of (a) figural, (b) symbolic, (c) semantic, and (d) behavioral contents.

A third dimension of the SI model is the Product dimension. Guilford defines the Product as "the form that this information takes." In other words, Products are the observable results of the Operations acting on Contents. The Product dimension consist of (a) units, (b) classes, (c) relations, (d) systems, (e) transformations, and (f) implications.

The SI model, then, is a cubical model of 120 cells. Each cell represents a unique ability because of a specific interaction of operation, content, and product. The SI model is depicted by a $5 \times 4 \times 6$ cubical matrix as shown in Figure 1.
Figure 1. The structure-of-intellect model, representing the intellectual abilities classified in three intersecting ways (Guilford, 1968).

Numerous studies have provided supporting evidence for the validity of the SI model (Brown, Guilford, Hoepfner, 1966; Cherry, 1976; Elshout, Van Hemert and Van Hemert, 1975; Gershon, Guilford, Merrifield, 1963; Hoepfner, Guilford, Merrifield, 1964; Landig and Naumann, 1978; Peterson, Guilford, Merrifield, 1963; Tenopyr, Guilford and Hoepfner, 1966). The studies cited have all been based on the SI model and deal specifically with different abilities within the SI model.

Guilford's SI model presents a model of intelligence which could be applied to the education of all children. The SI model offers special advantages in the use of educating academically gifted
children. Dr. Mae Seagoe, of the University of California, has stated that the characteristics of gifted children indicate that they possess strong abilities in the five operations Guilford has defined in the model. Characteristics occurring to some degree in all children, but to a stronger degree in children identified as academically gifted, include (a) interest in inductive learning and problem solving (convergent production); (b) retentiveness, power of concentration (memory); (c) creativeness and inventiveness; interest in creating, brainstorming, free-wheeling (divergent production); (d) power of critical thinking, evaluative testing (evaluation); and (e) keen power of observation; power of abstraction, conceptualization, synthesis (cognition) (Seagoe, 1967).

If gifted children show evidence of the abilities described by Seagoe (1967), then a model of intelligence which emphasizes these abilities would be a sound basis upon which to develop an instructional program. Development of an educational program for the academically gifted student requires particular attention to three specific areas: (a) identification, (b) program development, and (c) program evaluation.

Identification of the Academically Gifted

Identification of the academically gifted is a necessary step in developing any program designed to meet the academic needs of the gifted. Brodbelt (1979) states that educators must identify and analyze problems in dealing with gifted students and design programs which meet their individual needs.
Renzulli and Smith (1977) point to a necessity for using several criteria in the identification of the gifted child. Renzulli (1980) makes the point that what we call giftedness and talent is made up of a combination of three trait clusters: (a) above average general abilities, (b) task commitment, and (c) creativity.

Research validates the use of several criteria for the identification of gifted children. (Brodbelt, 1979; Freedman, 1978; Gallagher, 1980; Gourley and Richert, 1978; Hammill, 1979; Miller, 1980; Renzulli, 1980; York, 1961). Some of the criteria most commonly used for the identification of the academically gifted child are teacher recommendation, IQ scores, achievement test scores, grade point average, parent evaluation, and self evaluation. Using only one criterion to measure giftedness increases the probability of overlooking gifted children who are underachievers, do not test well, or are culturally disadvantaged.

**Instruction of the Academically Gifted**

Once the academically gifted have been identified, the next concern centers on defining the needs of gifted children and how to best satisfy these needs. Emphasis in meeting those needs must be placed upon curriculum construction as well as teaching procedures. Many types of programs and curriculums have been used with academically gifted children. The five major types of programs most often used in educating academically gifted children are (a) acceleration (Abraham, 1958), (b) enrichment (DeHaan and Havighurst, 1961), (c) special grouping (Cutts and Moseley, 1957), (d) special schools (Vail, 1979), and (e) resource (Vail, 1979).
Acceleration Programs

In an acceleration program, the academically gifted child is allowed to advance academically at an accelerated rate. Acceleration was used with academically gifted children as early as 1868 in the St. Louis Public School System (Abraham, 1958) and in the Cambridge Tracking Plan begun in 1898 (Hildreth, 1966). Drawbacks to acceleration programs may include the relative emotional, physical and/or social immaturity of the child who "skips grades."

Enrichment Programs

In an enrichment program, children identified as academically gifted remain in the normal classroom setting but receive special attention within that setting. The Portland and Evanston Programs (DeHaan and Havigurst, 1961) are examples of formally organized enrichment programs. However, enrichment programs are often used informally by many school districts having no mandated program for the academically gifted. Some teachers have always recognized intellectually superior children in their classrooms and made a special effort to encourage and stimulate those children. However, most teachers have children of vastly differing abilities in a classroom and find it difficult to give special instruction to gifted children.

Special Grouping Program

Another type of program for academically gifted children is special grouping or tracking, e.g., Cleveland's Major Work Classes (Cutts and Moseley, 1957). Advantages of special grouping for gifted students include (a) increased challenges, (b) the opportunity to progress academically at a more rapid pace than the mainstream,
and (c) the opportunity for interaction with peers of similar ability. One disadvantage of special grouping programs is that their use is limited primarily to large, urban school systems where there is a large enough student population to fill the classes.

**Special Schools**

A fourth type of program involves the establishment of special schools for the gifted. One example is the Hunter College Campus School (Vail, 1979). One problem with special schools which cater solely to the academically gifted student is that the student, totally segregated from the "average" student, has little association with the majority of his/her peers.

**Resource Programs**

The most common type of program for the academically gifted student in use today is the resource or "pull-out" type of program. In a resource program, the academically gifted child remains in the normal classroom setting for much of the day. At predesignated times of the school day, the child leaves the classroom to meet with a small group of other academically gifted children. Usually, a specially trained teacher conducts these classes for the "gifted." In a resource class, special emphasis is usually placed on innovativeness and creativity (Vail, 1979). Students are encouraged to generate new ideas and ways of dealing with situations. Most resource classes make use of "brainstorming" techniques. Teachers often use role playing, hypothetical problems, word games to increase vocabulary, etc. There is a strong emphasis on helping an academically gifted child to recognize many aspects of a given situation, evaluate that situation in many ways, and make diverse conclusions (Brodbelt, 1979).
Structure of Intellect (SOI) Program

Improving a student's ability to recognize, evaluate, reason and think creatively are appropriate goals of any educational program. These abilities are more often emphasized in programs for gifted students than in mainstream programs. A program of educational instruction which emphasizes these abilities exists and is based upon Guilford's SI model. This program was developed by Drs. Robert and Mary Meeker in the 1960s and is referred to as the Structure of Intellect (SOI) Program (Meeker, 1981). While the SOI program was not specifically developed for use with academically gifted children, a strong rationale can be presented for using the SOI program with gifted students (Bennett and Markle, 1978). The SOI program emphasizes instruction in the operations of the SI model and focuses upon many of the skills which teachers of gifted children seem to perceive as important. The SOI program of instruction includes workbooks and resource materials which deal with each of the five operations of the SI model. The SOI program can be implemented within the setting of a separate school, a separate class, or a resource program.

Evaluation of Programs

Programs for the academically gifted may be more diverse among themselves than educational programs designed for the traditional classroom. Some school districts which have gifted programs have tailored those programs to meet specific needs. The flexibility typical of many gifted programs does not readily lend itself to objective evaluation. Hence, many gifted programs are evaluated subjectively. However, objective evaluation of any program of instruction is desirable in order to justify the existence of the program.
The Structure of Intellect Learning Abilities (SOI/LA) test may provide an objective measure of program effectiveness. The SOI/LA test was developed by Drs. Robert and Mary Meeker to (a) be used as a diagnostic tool and (b) to evaluate the progress of gifted students participating in the SOI program. In the initial stages of development of the SOI/LA test, the Meekers examined existing intelligence tests, particularly the Binet (Meeker, 1969). The Binet offers high reliability and validity but yields an unitary score, thereby implying that intelligence is a single, general ability. However, the Meekers attempted to place the items of the Binet into appropriate cells of the SI model. It was the Meekers' belief that assignment of Binet items to SI cells would allow educators to define deficiencies and, therefore, teach to these deficiencies.

The SOI/LA test is designed to allow for group administration and consists of 24 subtests. Each subtest measures several cells contained within each of the five operations of Guilford's SI model. While there are 120 cells in Guilford's SI model, the SOI/LA test purports to measure only 24 of these cells. Some cells of the SI model have only been hypothesized at this point; their existence has yet to be demonstrated or validated. Research into the SOI/LA test and the SI model has continued since the initial development of both (Bennett and Markle, 1978; East Whittier City School District, California, 1974; Elsout, Van Hermert, and Van Hermet, 1975; Fowler, 1966; Guilford, 1972; Horn and Knapp, 1973; Horn and Undheim, 1977; Landig and Naumann, 1978; Meeker, 1981).
Rationale

The purpose of this study was to determine the effect of a specific type of instruction upon children identified as academically gifted. The specific instruction was based on Guilford's SI model of intelligence and Drs. Robert and Mary Meeker's SOI program of learning.

One school system in northwestern Kentucky has adopted Guilford's model of intelligence and based its curriculum for gifted students on the SOI program. The study reported in this thesis examined the effects of using the SOI program of instruction with academically gifted fourth graders during the 1981-82 school year in this school system. An adjacent county which had no program for the academically gifted functioned as a control group.

Hypothesis

The hypothesis of this study was that the specified and described training in the SI program would be positively related to improvement on the cognition, evaluation, convergent production and divergent production subscales of the SOI/LA test. Significant improvements in scores for the memory subscale were not expected because the treatment program does not emphasize the operation of memory.
CHAPTER III

Methods

Subjects

Students, identified as being academically gifted, were selected from two adjacent county school districts in Kentucky. Identified students in one school district comprised the treatment group; identified students in the other school district comprised the control group. There were 34 subjects in each group. All subjects were enrolled in the fourth grade during the 1981-82 school year. All 68 subjects qualified for admittance into the gifted/talented program according to the guidelines then in use in the treatment group school district. The four criteria used to identify gifted students in both counties were (a) teacher recommendation, (b) a grade point average (GPA) of 3.0 or higher, (c) California Test of Basic Skills, Form S (CTBS/S) scores above the 91st percentile, and (d) Short Form Test of Academic Aptitude (SFTAA) scores above the 91st percentile.

None of the subjects in either the treatment group or control group had previously participated in any type of special program for the gifted/talented. The treatment group consisted of 17 boys and 17 girls, aged eight to ten. The control group consisted of 13 boys and 21 girls, aged eight to ten.

Subjects were selected as follows. Computer printouts which contained both CTBS/S scores and SFTAA scores for all fourth grade students were examined. Based upon these two criteria, a potential
pool of subjects was selected. Each potential subject was then examined individually using the other two criteria, i.e., 3.0 GPA and teacher nomination. Any student who was outside the given age limits, i.e., eight to ten years of age, or had been previously exposed to gifted training or specialized instruction was excluded from the potential sample pool. Consideration was given to the fact that the male/female ratio in the two samples was not balanced; but, the only control for this potential between-group inequity would have been to use fewer subjects in each group. Such reduction in sample size was rejected because a smaller sample size would reduce the power of the statistical analyses.

Subjects in the control group were drawn from a northwestern Kentucky county in which the main source of revenue is the coal industry. The population of the control county in the 1980 census was 21,765 (Urban Studies Center, 1982). There were nine elementary schools in the control county which contained either Kindergarten through sixth grade or Kindergarten through eighth grade. The control county had one middle school, grades seven and eight, and one high school, grades nine through twelve. At the time of this study, the control county had no educational program for academically gifted students.

The treatment county is adjacent to the control county. The population of the treatment county in the 1980 census was 83,949 (Urban Studies Center, 1982). The treatment county contained both a city and a county school district. The population of the treatment county, excluding the city, was approximately 31,555 (Urban Studies center, 1982). The treatment county school district had 13 elementary
schools which were either Kindergarten through fifth grade or Kindergarten through sixth grade; two middle schools which included grades six, seven and eight; and two high schools containing grades nine through twelve. The treatment county had been receiving state funds to operate a gifted program since 1978. Income among county residents comes from industries located outside the city limits, e.g., mining, farming.

Both the control and treatment counties are predominantly rural in structure. The students enrolled in both school systems at the time of this study were predominantly white, middle class children.

Instrumentation

Four criteria have been recommended for use in the state of Kentucky to identify academically gifted children. These criteria include (a) teacher recommendation, (b) a grade point average (GPA) of 3.0 or higher, (c) California Test of Basic Skills, Form S (CTBS/S) scores above the 91st percentile, and (d) Short Form Test of Academic Aptitude (SFTAA) scores above the 91st percentile.

Teacher Recommendation or Nomination

Classroom teachers were given an evaluation sheet by their principal for use with each student. Although evaluation forms may vary slightly from district to district, basic guidelines for the forms are established by the Kentucky Association of Gifted Education and include questions concerning attitudes, motivation, etc. All subjects in this study were evaluated using the same form.
To qualify for recommendation, a subject has to receive positive ratings on 10 or more of the 21 items included on the form. A copy of the form appears in Appendix A.

**Grade Point Average**

Students must have at least a 3.0 average on a 4.0 scale to be identified as academically gifted. This guideline has been recommended by the Kentucky Association for Gifted Education. All students participating in this study did satisfy this criterion.

**Comprehensive Test of Basic Skills, Form S (CTBS/S) Score**

The CTBS/S is an achievement test, administration of which is mandatory in the state of Kentucky at grades 3, 5, 7, and 10. The CTBS/S includes math, reading, and language subtests. The reliability coefficients for CTBS/S (KR 20) at grade 4.7 are .97 for total reading; .95 for total language; .97 for total mathematics; and .99 to total battery. (Del Monte Research Park, 1974).

Guidelines for gifted education in Kentucky suggest that students score at the eighth or ninth Stanine to be admitted to a gifted program. The gifted/talented program requirements in the treatment county states that students must score above the 91st percentile on the CTBS/S in order to satisfy this admission criterion. The 91st percentile is a Stanine score between eight and nine. This 91st percentile figure was used to determine eligibility for a gifted program for both treatment and control group subjects.
Short Form Test of Academic Aptitude (SFTAA) Scores

Administration of the SFTAA was not mandated by the State of Kentucky; but, it was usually given by the classroom teacher in conjunction with the CTBS/S. The SFTAA is purported to measure academic aptitude. The KR 20 correlation coefficient for the internal consistency of the SFTAA at the fourth grade level is .95. The SFTAA reliability coefficients of stability for test-retest over a 14 month interval are .82 for language; .74 for non-language; and .85 for total. (Del Monte Research Park, 1974). The minimum requirement for acceptance into the gifted program in the treatment county was a score above the 91st percentile on the SFTAA. This figure was arrived at because it is half-way between the eighth and ninth Stanine. The same criterion was used to select control subjects.

The SOI/LA Test

Since it's original publication in 1975, the SOI/LA test has been used in studies and education programs throughout the United States, Canada, Australia, and Israel. Original norming was done in 1975; the SOI/LA test was renormed in the fourth quarter of 1980. In the 1980 norming there were six sites: New Albany, Indiana; Guthrie, Oklahoma; Imperial Beach, California; Solana Beach, California; Romona, California; and Laredo, Texas.

Reliability studies concerning the SOI/LA involved both test/retest and alternate form components. At each of the norm group testing sites, half of the students were initially tested on Form A and half on Form B. Within a two to four week interval all students were retested. Half of those initially tested on Form B were
retested on Form A and the other half with Form B; similarly, those initially tested on Form A, were retested with Form B and the other half with Form A. At each site, four groups were created. Additionally, each of these groups included equal numbers of males and females as was possible. The norming was done at grade levels two through six. The basic conditions of testing represent a 4 X 2 split plot design with the four groups representing the sequence of test administration. Reliability coefficients yielded by the 1980 norming study of the SOI/LA test for Guilford's five operations are presented in Table 1.

Table 1
General Abilities (Operations)
Grade Level 4

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<tr>
<th>Reliability Coefficient</th>
<th>Cognition</th>
<th>Memory</th>
<th>Evaluation</th>
<th>Convergent Production</th>
<th>Divergent Production</th>
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<td>.64</td>
<td>.69</td>
<td>.47</td>
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<td>.57</td>
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</tbody>
</table>
The SOI/LA test consist of 24 sections categorized into five subtests. Each subtest provides a measure for one of the five operations of the SI model. Hence, the subtests are labeled (a) Cognition; (b) Memory; (c) Evaluation; (d) Convergent Production and (e) Divergent Production.

Cognition. There are nine subtests which together measure the operation of cognition; these nine subtests each represent a unique learning ability as conceptualized in the SI model. Each subtest actually represents the three unique abilities present in one particular cell of the SI model. The nine subtests measure: (a) Cognition of Figural Units (CFU) which is the ability to recognize familiar figures that have been partially obscured and a prerequisite for learning to read; (b) Cognition of Figural Classes (CFC) which is the ability to identify the class or classes to which a presented figure belongs; (c) Cognition of Figural Systems (CFS) which is the ability to perceive a system from any viewpoint; (d) Cognition of Figural Transformations (CFT) which is the ability to transform figures and to recognize a figure when it has been rotated into a new orientation; (e) Cognition of Symbolic Relation (CSR) which is the ability to find the relationship between letters embedded in pairs of words and select the correct word to complete the third pair; (f) Cognition of Symbolic Systems (CSS) which is the ability to find the rule that is generating a number series; (g) Cognition of Semantic Units (CMU) which is the ability to comprehend the meaning of ideas or words; (h) Cognition of Semantic Relations (CMR) which is the ability to see relationships between meanings of words or ideas; and (i) Cognition of Semantic Systems (CMS) which is the ability to understand relatively complex and difficult ideas.
Memory. There are four subtests in the SOI/LA which purport to measure the operation defined as memory. These four subtests measure (a) Memory of Figural Units (MFU) which is the ability to remember given figural objects; (b) Memory of Symbolic Units (MSU) which is the ability to remember isolated items of symbolic information, such as syllables and words; (c) Memory of Symbolic Systems (MSS) which is the ability to remember the order of symbolic information; and (d) Memory of Symbolic Implications (MSI) which is the ability to remember arbitrary connections between symbols.

Evaluation. The SOI/LA contains four tests which seek to measure the operation of evaluation. These four tests measure (a) Evaluation of Figural Units (EFU) which is the ability to judge units of figural information as being similar or different; (b) Evaluation of Figural Classes (EFC) which is the ability to classify units specified in some way; (c) Evaluation of Symbolic Classes (ESC) which is the ability to judge applicability of class properties of symbolic information; and (d) Evaluation of Symbolic Systems (ESS) which is the ability to estimate appropriateness of aspects of a symbolic system.

Convergent Production. For the operation of Convergent Production, there are four subtests contained within the SOI/LA. The four subtests measure (a) Convergent Production of Figural Units (NFU) which is the ability to coordinate eye to hand; (b) Convergent Production of Symbolic Systems (NSS) which is the ability to produce a fully determined or sequence of symbols; (c) Convergent Production of Symbolic Transformations (NST) which is the ability to produce new symbolic items of information by revising given items; and
(d) **Convergent Production of Symbolic Implications (NSI)** which is the ability to produce a completely determined symbolic deduction from given symbolic information, where the implication has not been practiced as such.

**Divergent Production.** There are three subtests which measure the operation of Divergent Production in the SOI/LA. These three measure (a) **Divergent Production of Figural Units (DFU)** which is the ability to produce many figures conforming to simple specifications; (b) **Divergent Production of Semantic Units (DMU)** which is the ability to produce many elementary ideas appropriate to given requirements; and (c) **Divergent Production of Symbolic Relations (DSR)** which is the ability to relate letters or numbers in many different ways. These twenty-four subtests were selected (from the complete model of ninety identified abilities) for their established relationship to school learning—particularly reading, arithmetic, writing and creativity.

**Procedures**

This study assumed a pretest posttest control group design. Subjects in both the treatment and control groups were selected using the same four criteria, i.e., teacher recommendation, GPA, CTBS/S test scores and SFTAA test scores.

Using the four criteria, two groups of subjects were selected by the experimenter during the first two weeks of September 1981. Each group consisted of 34 students. Following group placement, both treatment and control subjects were administered Meeker's
The SOI/LA test was administered in groups of not more than fifteen students and in from two to four sittings. Each subject had at least one morning and one afternoon testing period. Tests were administered by the experimenter and teachers in the gifted program, all of whom had been instructed in the administration of the SOI/LA test by representatives of the SOI Institute. All subjects were given the opportunity to complete all portions of the SOI/LA test.

Following administration of the SOI/LA test, the tests of both treatment group subjects and control group subjects were scored by the experimenter. To control for experimenter bias all test protocols were placed in random sequencing; the experimenter/scorer remained blind regarding the group identity of each protocol. All scoring on all sections of the pretest administration of the SOI/LA test was done by the experimenter to control for interrater consistency. Intrarater stability was established by having the experimenter rescore six randomly selected tests from each group. Rescoring was done after an interval of three weeks. There were no changes in scores upon rescoring; hence intrarater stability for six cases across three weeks was 1.00.

The independent variable in this study was the type of educational program (instruction in SOI skills vs no specialized instruction in SOI skills). Children who qualified for the gifted program in the treatment county were given the SOI/LA test as a diagnostic and evaluative test upon their entrance to the program. Once the SOI/LA test had been scored and evaluated, a "profile" was generated
for each student based on the SOI/LA test, and individual strengths and weaknesses were pinpointed. The specialized areas of instruction in Guilford's five operations were used to set up the course of study to be followed within the gifted program.

Educators and teachers working within the gifted program received training from representatives of the SOI Institute in the summer of 1980. Each teacher in the gifted program received five manuals, each manual contained instructions for teaching one specific SI operation. Each manual was subdivided by products and contents within each operation. The four teachers met once a week routinely as a group to establish curriculum and select activities. In those meetings, the program director evaluated the direction and progress of the program, made suggestions, and solicited feedback from the teachers.

The gifted program used a pull-out technique to segregate academically gifted children into special classes for a period of time each week. Subjects in the treatment group met with the gifted teacher in special sessions which lasted from one to three hours a week. These meetings occurred during normal school hours. Each student in the gifted program was required to complete regular school work missed while that student participated in the gifted program.

In this resource program, the teacher selected activities from the SOI workbook to correspond with skills that needed improvement (as indicated by results on the SOI/LA test). If all the students in a particular group needed work in a certain operation, then instruction was given in a group sitting. If individualized instruction
was called for, then the instruction was tailored for a specific child. Groups normally ranged in size from four to seven; usually all children in a group were in the same grade. At any given time during the instruction, the ratio of gifted students to teacher was about five to one.

This SOI program is used as a resource program in the treatment county for educating children identified as gifted. The 1981-82 school year was the second year in which a program based specifically on the SI model and the SOI/LA test and corresponding workbooks was used. Subjects in the control group received no special instruction, since no gifted program was available to them. A placebo pull-out program was not feasible for the control group subjects because the treatment group school system had neither the money, personnel, nor inclination to provide such a program.

About four weeks prior to the end of the school year, the SOI/LA test was again administered to all subjects in both the treatment and control groups. The procedures used during the pretesting were repeated. All subjects in both groups were tested using the same form of the SOI/LA test which had been used in the pretest. Personnel administering the tests remained the same. All tests were again scored by the experimenter, using procedures identical to those used at the time of pretesting to establish interrater and intrarater reliability. Posttesting was completed for all 68 subjects by May 7, 1982.
CHAPTER IV

Results

Using an analysis of variance (ANOVA), significant differences between the two groups were found to exist at the onset of the study. There was a significant effect for the groups x subscales interaction ($F_{4,320} = 3.571, p = .05$). Because the interaction was significant, the main effects could not be directly interpreted. The significant interaction indicated significant ($p = .05$) between group differences on the Convergent Production and Divergent Production subscales.

To increase precision and maintain consistency, analyses of covariance (ANCOVAs), using the general linear model procedure of the Statistical Analysis Systems (Helwig, 1978), were computed for each of the five subscales using pretest scores as the covariates. The results of the initial $2 \times 5$ (group x subscale score) repeated measures ANOVA is presented in Table 2.

Table 2

Source Table for ANOVA on Pretest Findings

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
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<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
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<td>.136a</td>
<td>.136</td>
<td>19.429</td>
<td>.05</td>
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<tr>
<td>Subscales</td>
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<td>1.814</td>
<td>.454</td>
<td>64.857</td>
<td>.05</td>
</tr>
<tr>
<td>Groups x Subscales</td>
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<td>.098</td>
<td>.025</td>
<td>3.571</td>
<td>.05</td>
</tr>
<tr>
<td>Error</td>
<td>320</td>
<td>2.130</td>
<td>.007</td>
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<td>-----</td>
</tr>
<tr>
<td>Total</td>
<td>329</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
</tbody>
</table>

Note: Analysis was based upon percent correct rather than raw scores.
Cognition

ANCOVA of the scores obtained on the cognition subscale of the SOI/LA test shows that the treatment effect for groups, after adjusting for initial between group differences, was significant, $F(1, 64) = 12.86, p = .0006$. The covariate effect is also significant, $F(1, 64) = 45.79, p = .0001$, substantiating the need to remove its effect using ANCOVA. The nonsignificant interaction, $F(1, 64) = 1.86, p = .1769$, allows for direct interpretation of the adjusted treatment effect for groups. The results of the ANCOVA for the cognition variable are shown on Table 3. Obtained means and means adjusted for initial between group differences are shown in Appendix B.

Table 3
Cognition: Summary of Analysis of Covariance

<table>
<thead>
<tr>
<th>Source</th>
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<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
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<td>4357.5941</td>
<td>20.17</td>
<td>.0001</td>
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<tr>
<td>Covariate</td>
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<td>3297.0332</td>
<td>45.79</td>
<td>.0001</td>
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<tr>
<td>Adjusted Treatment</td>
<td>1</td>
<td>926.3079</td>
<td>12.86</td>
<td>.0006</td>
</tr>
<tr>
<td>Interaction</td>
<td>1</td>
<td>134.2530</td>
<td>1.86</td>
<td>.1769</td>
</tr>
<tr>
<td>Residual within</td>
<td>64</td>
<td>4608.5235</td>
<td>------</td>
<td>-----</td>
</tr>
<tr>
<td>Total Residuals</td>
<td>67</td>
<td>8966.1176</td>
<td>------</td>
<td>-----</td>
</tr>
</tbody>
</table>
**Memory**

ANCOVA of the scores obtained on the memory subscale of the SOI/LA shows that the effect for groups, after adjusting for initial between group differences, was nonsignificant, $F(1, 64) = 2.50, p = .1190$. The covariate effect was significant, $F(1, 64) = 19.07, p = .0001$, substantiating the need to remove its effect using ANCOVA. The nonsignificant interaction, $F(1, 64) = 0.36, p = .5520$, allows for direct interpretation of the adjusted treatment effect for groups. The results of the ANCOVA for the memory variable are shown in Table 4. Obtained means and means adjusted for initial between group differences are shown in Appendix B.

**Table 4**

Memory: Summary of Analysis of Covariance

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
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</thead>
<tbody>
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<td>931.5622</td>
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<td>Covariate</td>
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<td>Adjusted Treatment</td>
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<td>2.50</td>
<td>.1190</td>
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<tr>
<td>Interaction</td>
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<td>15.1907</td>
<td>0.36</td>
<td>.5520</td>
</tr>
<tr>
<td>Residual within</td>
<td>64</td>
<td>2719.2025</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Total Residuals</td>
<td>67</td>
<td>3650.7647</td>
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</tr>
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</table>
Evaluation

ANCOVA of the scores obtained on the evaluation subscale of the SOI/LA test shows that the treatment effect for groups, after adjusting for initial between group differences, was significant, $F(1, 64) = 8.32, p = .0053$. The covariate effect is also significant $F(1, 64) = 20.74, p = .0001$, substantiating the need to remove its effect using ANCOVA. The nonsignificant interaction, $F(1, 64) = 0.14, p = .7091$, allows for direct interpretation of the adjusted treatment effect for groups. The results of the ANCOVA for the evaluation variable are shown on Table 5. Obtained means and means adjusted for initial between group differences are shown in Appendix B.

Table 5
Evaluation: Summary of Analysis of Covariance

<table>
<thead>
<tr>
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<th>F</th>
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</thead>
<tbody>
<tr>
<td>Explained Variance</td>
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<td>Covariate</td>
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<td>663.3030</td>
<td>20.74</td>
<td>.0001</td>
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<tr>
<td>Adjusted Treatment</td>
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<td>266.2660</td>
<td>8.32</td>
<td>.0053</td>
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<tr>
<td>Interaction</td>
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<td>4.4930</td>
<td>0.14</td>
<td>.7091</td>
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<tr>
<td>Residual within</td>
<td>64</td>
<td>2047.1586</td>
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<tr>
<td>Total Residuals</td>
<td>67</td>
<td>2981.2206</td>
<td>-----</td>
<td>-----</td>
</tr>
</tbody>
</table>
**Convergent Production**

ANCOVA of the scores obtained on the convergent production sub-scale of the SOI/LA test shows that the treatment effect for groups, after adjusting for initial between group difference, was significant $F(1, 64) = 17.36, p = .0001$. The covariate effect accounted for significant amount of explained $F(1, 64) = 43.61, p = .0001$, substantiating the need to remove its effect using ANCOVA. The nonsignificant interaction, $F(1, 64) = 0.03, p = .8592$, allows for direct interpretation of the adjusted treatment effect for groups. The results of the ANCOVA for the convergent production variable are shown on Table 6. Obtained means and means adjusted for initial between group differences are shown in Appendix B.

**Table 6**

Convergent Production: Summary of Analysis of Covariance

<table>
<thead>
<tr>
<th>Source</th>
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</tr>
</thead>
<tbody>
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<td>.0001</td>
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<tr>
<td>Covariate</td>
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<td>10635.7952</td>
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<td>.0001</td>
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<tr>
<td>Adjusted treatment</td>
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<td>4234.4272</td>
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<td>.0001</td>
</tr>
<tr>
<td>Interaction</td>
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<td>7.7350</td>
<td>0.03</td>
<td>.8592</td>
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<tr>
<td>Residual within</td>
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<td>15607.5721</td>
<td>-----</td>
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<td>Total Residuals</td>
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<td>30485.5294</td>
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</table>
**Divergent Production**

ANCOVA of the scores obtained on the divergent production subscale of the S0I/LA test shows that the treatment effect for groups, after adjusting for initial between group differences, was significant $F(1, 64) = 16.89, p = .0001$. The covariate effect is also significant $F(1, 64) = 11.23, p = .0014$, substantiating the need to remove its effect using ANCOVA. The nonsignificant interaction, $F(1, 64) = 1.66, p = .2017$, allows for direct interpretation of the adjusted treatment effect for groups. The results of the ANCOVA for the divergent production variable are shown on Table 7. Obtained means and means adjusted for initial between group differences are shown in Appendix B.

**Table 7**

Divergent Production: Summary of Analysis of Covariance

<table>
<thead>
<tr>
<th>Source</th>
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<th>F</th>
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</thead>
<tbody>
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<td>Covariate</td>
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<td>11.23</td>
<td>.0014</td>
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<tr>
<td>Adjusted treatment</td>
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</tr>
<tr>
<td>Interaction</td>
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<td>.2017</td>
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<td>Residual within</td>
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<td>63742.7721</td>
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<tr>
<td>Total Residuals</td>
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<td>93406.2794</td>
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</table>
CHAPTER V
Discussion

Analysis of initial pretest scores of the SOI/LA indicated significant differences on some variables between the treatment group and the control group at the onset of the study. This difference can perhaps be explained. Although all subjects in both groups satisfied the same four criteria, an investigation of the Socio-Economic Status (SES) of the two counties from which the two groups were drawn may provide some useful insights (Urban Studies Center, Louisville, Kentucky, 1982). SES data is presented in Table 8.

Table 8
Socio-Economic Status

<table>
<thead>
<tr>
<th>Group</th>
<th>Median Household Income</th>
<th>% Families Below Poverty Level</th>
<th>Median Years of School (25 and over)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Males</td>
</tr>
<tr>
<td>Treatment County</td>
<td>$7867</td>
<td>9.2</td>
<td>11.8</td>
</tr>
<tr>
<td>Control County</td>
<td>$5003</td>
<td>24.5</td>
<td>8.7</td>
</tr>
</tbody>
</table>

34
Average SES differs between the two counties. Median education level of adults over age 25 is more than three years lower in the treatment county than in the control county. Also, 24.5% of the families in the control county live below the poverty level compared to only 9.2% in the treatment county.

The home environment in which a child is raised is not a factor which can be totally disregarded. Parents serve as role models for their offspring. The social and cultural factors of the home often influence children's goals and motivations. It may be that the significant difference found between the two groups on the basis of the pretest scores is a difference due mainly to the differences in SES levels of the two groups.

In order to obtain both precision and consistency, posttest data were submitted to ANCOVA. The significant treatment effect for the cognition variable support the hypothesis that the specified and described training in the SI program was positively related to improvement on the SOI/LA test in the area of cognition. There are nine subtests within the SOI/LA which are specifically designed to measure the components of the operation of cognition. The treatment program does place emphasis on improving cognitive skills as defined by the SI program and, hence, the SOI/LA test. The control group also improved their scores on the SOI/LA test area of cognition, but the improvement was not significant when compared to the improvement made by the treatment group.

No significant treatment effect was demonstrated for the memory subscale of the SOI/LA test. This finding might be explained in two ways. In the pretest findings, it was noted that
most subjects in both testing groups received high scores on the questions in the memory sections. In the pretest, numerous subjects in both groups received perfect scores on one or more of the four memory subtests. In effect, most students' scores on the memory subtests had little room for improvement.

A second explanation for a lack of improvement in "memory" scores by the treatment group may be that the treatment program did not emphasize memory skills per se. Rather, the treatment program attempted to broaden cognitive, evaluative and creative skills. The findings of this study appeared to justify the direction that the treatment program had taken with regard to not specifically teaching memory skills. Apparently students identified as academically gifted, regardless of group, already had well developed memory skills.

The significant treatment effect for the evaluation variable indicated that use of the SI program was positively related to improvement on the SOI/LA test in the area of evaluation. There are four subtests in the SOI/LA which are used to measure evaluation. The treatment program emphasized improving evaluative skills as defined by the SI program and, hence, the SOI/LA test. The control group also improved their scores on the SOI/LA test in the area of evaluation, but the improvement was not significant when compared to the improvement in the scores of the treatment group.

The significant effect for the convergent production variable suggests that use of the SI program was positively related to improvement on the SOI/LA test in the area of convergent production.
There are four subtests in the SOI/LA which deal specifically with the operation of convergent production; the treatment program did place emphasis on improving convergent production skills. While the control group made some improvement in scores in the area of convergent production, their improvement in scores was not significant when compared to improvements made in scores by the treatment group in the area of convergent production.

The significant effect for the divergent production variable suggests that use of the SI program was positively related to improvement on the SOI/LA test in the area of divergent production. There are three subtests in the SOI/LA which deal specifically with the operation of divergent production; the treatment program did place emphasis on improving divergent production skills. While the control group made some improvement in scores in the area of divergent production, their improvement in scores was not significant when compared to improvements made in scores by the treatment group in the area of divergent production.

In summary, the treatment, which was composed of specified instruction in the SI program, was positively related to a significant increase in scores on the SOI/LA test in four of the five areas, i.e., cognition, evaluation, convergent production and divergent production. Improvements made by the control group in these four areas were not significant when compared to improvements made by the treatment group. At the time of the posttest, all students were taking the SOI/LA for the second time. Also, all students had completed an additional year of schooling (the fourth grade). This
familiarity with the test and additional education was expected to increase all subjects scores to some degree. However, the obtained means for the treatment and control groups support the hypothesis that improvements by the control group were not significant when compared to improvements in scores made by the treatment group on the SOI/LA.

Based on this study, it may be concluded that academically gifted students in the treatment group did significantly increase their scores on the SOI/LA test after being exposed to specific treatment in the SI model. These increases were noted in the areas of cognition, evaluation, convergent production and divergent production. The SI model appears to have particular implications for educating academically gifted students. Based upon the results of this study, it can be concluded that a program of instruction, based on the SI model, positively influenced the development of particular cognitive skills among academically gifted students in the treatment group as measured by the SOI/LA test. Results of this study objectively supported use of the SI program of instruction as a resource program with gifted children in the treatment population.
APPENDIX A
PROGRAM FOR GIFTED AND TALENTED

Student Characteristics

The following list of characteristics, while by no means all inclusive, represents traits found in gifted/talented children. Consider carefully these characteristics that might be exhibited by children, then note these of each child in your classroom by checking the appropriate boxes on the accompanying sheet.

GENERAL PERSONALITY

1. Exhibits pleasure in learning for learning’s sake; is enthusiastic about discoveries.
2. Needs less outside control, is more self-disciplined, is a conscientious worker.
3. Has a wide range of interest.
4. Is venturesome, eager to do new things—a risk taker.
5. Is easily bored with routine tasks.
6. Demonstrates perseverance in accomplishing a goal (is persistent, has long attention span).
8. Has high energy level (possibly to the point of getting into trouble).
9. Loses awareness of time when involved in a task of great personal interest.
10. Has a questioning attitude (wants the reasons for things in general).

GENERAL INTELLECTUAL

1. Is alert, responds readily in a question-answer situation.
2. Learns easily and with little repetition.
3. Shows skill in abstract thinking (recognizes relationships, or senses cause and effect, or has a keen sense of humor).
4. Recognizes main ideas, giving structure to otherwise disorganized information.
5. Communicates effectively and fluently; has an outstanding vocabulary.
6. Is an avid reader who consistently reads on an advanced level.

SPECIFIC ACADEMIC

1. Has consuming interest in one of the four academic subject areas (indicate by marking one of the following: L = for Language Arts, M for Math, S for Science, SS for Social Studies).
2. Has received special recognition in the area.
3. Has acquired knowledge beyond that which is expected at this grade level.
4. Is eager to share knowledge, ideas, and insights with others.
5. Has task commitment; wants to finish a project once it is begun.
Worksheet for Nominating Students
Gifted/Talented Program

**TEACHER**  **SCHOOL**  **GRADE**

Place a check in the column which corresponds to the characteristics demonstrated by each child.

<table>
<thead>
<tr>
<th>CLASS ROLL</th>
<th>General Personality 1 2 3 4 5 6 7 8 9 10</th>
<th>General Intellectual 1 2 3 4 5 6</th>
<th>Specific Academic R Subj. 1 2 3 4 5</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
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*THIS FORM IS CONFIDENTIAL. Please return it personally to the office.*
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References


Clark, B. Growing up gifted. Columbus: Charles E. Merrill, 1979.

Clifford, T. Teaching gifted children literature in grades four through six. California State Department of Education. Sacramento Division of Special Education, 1972, pp. 22.


Gensley, J. T. Teaching gifted children literature in grades one through three. California State Department of Education, Sacramento Division of Special Education, 1972, pp. 20.


Hammill, J. Nothing is more unequal than the equal treatment of unequals. Science and Children, March 1979, 16(6), 18-21.


Keating, D. P. & Stanley, J. C. From eighth grade to selective college in one jump: Case studies in radical acceleration. Johns Hopkins University, Baltimore, Maryland, 1972, pp. 23.


Los Angeles City Schools, California, Committee of Intellectually Gifted Pupils. *Education of intellectually gifted pupils in Los Angeles City Schools,* May, 1962, pp. 25.


Urban Studies Center, Louisville, Kentucky, 1982.


