Order Number 1345617

The usefulness of the HOTS program as a nontraditional tool for identification of giftedness in educationally disadvantaged students

Keown, Sharon Marie, M.A.

The University of Arizona, 1991

U·M·I
300 N. Zeeb Rd.
Ann Arbor, MI 48106

THE USEFULNESS OF THE HOTS PROGRAM AS A NONTRADITIONAL TOOL FOR IDENTIFICATION OF GIFTEDNESS IN EDUCATIONALLY DISADVANTAGED STUDENTS

by

Sharon Marie Keown

A Thesis Submitted to the Faculty of the

DEPARTMENT OF SPECIAL EDUCATION AND REHABILITATION

In Partial Fulfillment of the Requirements
For the Degree of

Master of Arts

In the Graduate College

THE UNIVERSITY OF ARIZONA

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STATEMENT BY AUTHOR

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SIGNED Sharon M. Kerown

APPROVAL BY THESIS DIRECTOR

This thesis has been approved on the date shown below:

C. June Maker — 7/11/91

C. June Maker
Professor of Gifted Education

Date

ACKNOWLEDGEMENTS

I would like to express my heartfelt thanks to the many people who have influenced me during my graduate academic career and the writing of my thesis. I am most grateful to Dr. C. June Maker. Her enthusiasm and knowledge in the field of giftedness sparked my interest in Education for the Gifted and brought me to Arizona to study. Dr. Maker's assistance and guidance throughout this thesis as well as her invaluable encouragement, support, and friendship will always remain prominent in my memories of this educational process. I would also like to thank my committee members, Dr. Todd Fletcher and Dr. Stanley Pogrow, for their interest in, and expert contributions to this project. I am grateful to Dr. Steve Powers for giving me his time, statistical lessons, and advice. His statistical expertise proved invaluable in completing the data analysis of this thesis.

The principal at the school, Frank Howe, deserves a special thanks for promoting and encouraging this study. The children and teachers also deserve an extra special thanks, for without their participation, this study would not have been possible.

The G.A.T.E office, especially Jerry Barkan (in his willingness for me to use his personnel and tests) and Diana Grossman (in her friendliness, advice, and help with my scoring the tests) deserve special thanks just as Kevin Chuc does for her assistance in testing.

Very special thanks and love goes to Larry for all the unique and heartfelt support, encouragement, and love he has shown me throughout my academic studies. A final thank you is extended to my family who offered love and encouragement via long distance and my close friends who did their best to keep me sane through the many stages involved in writing a thesis.

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ABSTRACT

This study was designed to investigate the usefulness of the Higher Order Thinking Skills (HOTS) program as a nontraditional tool for identification of giftedness in educationally disadvantaged students. Twenty-three HOTS students were studied. The comparison group consisted of eight students. This study used the quasi-experimental pre-posttest design. Pre and post tests of the Cognitive Abilities Test (CogAT) were administered to both groups. The HOTS group was given the Woodcock Johnson Psycho-educational Battery: Part One (W-J) and rated on a teacher's checklist before and after treatment. Treatment consisted of sixty hours of HOTS instruction. The t Test for dependent samples was used to analyze all the data to determine any significant gains. Significant growth was noted with the HOTS group in the Quantitative and Nonverbal areas as well as in the W-J subtests.

The HOTS program is useful in advancing students' thinking skills in a short period of time. Further research is warranted to determine if greater gains would be achieved through a larger sampling and longer study.

CHAPTER ONE

INTRODUCTION

Research all over the country has shown that disproportionately low numbers of "Disadvantaged" students have been placed in programs for the gifted (Mercer, 1977, Maker & Schiever, 1989). A few questions are brought to mind by these results: 1) What differences exist between the disadvantaged population and the identified gifted population? 2) In what ways can we bridge those differences? and 3) How can educators in schools with a high population of disadvantaged students help their students attain the standards set by states and local school districts to be identified as gifted?

Throughout my teaching career I have taught both populations and the answer to my first question comes easily. Many differences can be found between the two groups but the biggest differences seem to be 1) environmental factors (social, family and education), 2) expectations (of self, family and teacher), and 3) motivation. The second and third questions are not answered so easily.

I have been involved in the Chapter I HOTS (Higher Order Thinking Skills Program) (Pogrow, 1986) for the past two years. This program was designed specifically for At-Risk students. The HOTS Program (Pogrow, 1988) consists solely of systematically designed higher order of thinking activities. These activities are based upon Socratic questioning techniques and popular computer software programs. After seeing significant gains in test scores, motivation and self confidence by the students who have been in the program only six months, I began to

wonder if the HOTS Program was one of the bridges that I was looking for in my second question.

This research was begun with that idea in mind. Through this study I believe I will discover what attributes of giftedness are enhanced by the HOTS Program (Pogrow, 1988) and how educators can use that information to identify possible giftedness in disadvantaged students. These data will be of interest to other educators with similar high risk, disadvantaged populations who have deep concerns about the equity of the programs being offered to them.

Definition of Terms

In reports, discussions, and conferences the terms Disadvantaged, Culturally Diverse, Culturally Different, Culturally Deprived, Culturally Disadvantaged and Children from poverty Cultures are used interchangeably. This practice is misleading. While some disadvantaged children are culturally diverse, many are not. Also, while some culturally diverse students are disadvantaged, many are not (Clark, 1979).

Sato (1974) claims:

> "The "Culturally Different" comprise one segment of the larger population called the "Educationally Disadvantaged." This latter, broader group includes not only the culturally different but also the economically deprived, female, handicapped, rural and underachieving. Thus the definition of the "Culturally Different" is membership in a culture other than the dominant culture in society." (p. 573)

Sisk (1973) agrees with these ideas. She views "disadvantaged" or "culturally disadvantaged" as similar to "problem children, retarded children, slow learners, and underachievers." Gowan (1973) defined "Disadvantaged" as "Being reared by the poor lower class native parents out of the cultural mainstream."

Maker (1982) clarifies the definition of disadvantaged or culturally different by describing "Disadvantaged" as "children from low-income areas or whose parents are very poor and who lack many of the early experiences, opportunities, or materials at home that can enhance their intellectual development" (p. 184). Passow (1987) states that educationally disadvantaged students are not a homogeneous group although they usually have poverty, minority status, and low achievement in common.

For the purpose of this research the term "Educationally Disadvantaged" will be broadened and defined as any person who comes from an environment without a base or encouragement for intellectual development, motivation, and the self-confidence that is needed for success in life as a learner.

"At Risk" also appears to be the latest semantic label American educators have attached to several groups of students who have experienced difficulty or, in fact, failure in their careers as learners (Presseisen, 1988). Therefore, in this paper, the terms "Educationally Disadvantaged" and "At Risk" will be used interchangeably.

In a proposal to study a particular issue related to a population of gifted children, giftedness must be defined. Definitions of

giftedness have changed over the years. First, a very simple and narrow definition was based on a superior IQ. Gradually, more broadly-based or inclusive conceptions emerged (Maker, 1986). J.P. Guilford's (1959, 1967) theory of human intelligence has had a greater influence on the field of education of the gifted than any other theory or model. After his ideas spread into the educational community, the multifaceted or multidimensional conception of giftedness began to form the basis for programs (Maker, 1982).

In 1981 Congress passed the Education Consolidation and Improvement Act with these guidelines:

> "Gifted and talented children are now referred to as, children who give evidence of high performance capabilities in areas such as intellectual, creative, artistic, leadership capacity, or specific academic fields, and who require services or activities not ordinarily provided by the school in order to fully develop such capabilities." (Sec. 582)

Giftedness also has been defined as general intellectual ability, creative and productive thinking, specific academic aptitude, leadership ability, visual/performing arts ability, and psychomotor ability (Marland, 1972). Psychomotor ability was deleted in 1981 in PL 97-35, but it still is an important area to be assessed (Khatena, 1982). For the purpose of this paper the term giftedness will reflect the definition as accepted by Congress in 1981.

Literature Review

This literature review will be written in three sections. First, the history and literature related to identifying giftedness in the disadvantaged will be reviewed and supportive studies will be cited. The second section will consist of literature and studies concerning evolution and need of change in Chapter I programs. The third, and final, section will contain literature and studies upon which the HOTS Program (Pogrow,1990) was designed and built.

Identification of disadvantaged gifted

Beginning in the 1900s, when people needed a "comfortable" assessment of giftedness, they relied on a high score on an intelligence test. Maker (1986) cites the leading researchers who defined giftedness in terms of IQ scores as Binet (1916), Terman (1925), Hollingworth (1926), Hildreth (1952), and Martinson (1961). This limited the definition of giftedness to potential success in an academic setting. This concept continued into the early 1960s.

However, as early as the 1930s and 1940s, Otto Klineberg (1935, 1944) and Allison Davis and his associates (Davis, Gardner, & Gardner) (1941) presented considerable data concerning the inappropriateness of traditional intelligence tests and the loss of talent among Blacks. Measurement establishments seemed unimpressed by these and other arguments and defended traditional assessment procedures.

Maker (1986) states:

> "The civil rights movement with its emphasis on the diversity of cultures and values, and on the considerable loss of potential in disadvantaged or culturally different groups, caused the change of focus. IQ tests were attacked by many as being biased against minorities and those from disadvantaged homes, and their use was discontinued by many school systems. Now the major criterion in definitions was no longer acceptable, so new definitions had to be developed" (p. 196).

Noted scholars in the field of education of the gifted have summarized the problem of definition and the identification procedures for Gifted children: We should all be concerned with the assessment of minorities because they seem to be underrepresented in programs for the gifted (Mercer, 1973), and minorities may be this country's largest untapped source of talent (Passow, 1972). A great deal of giftedness exists among the culturally different and the waste or underuse of these resources is tragic (Torrance, 1977).

Riessman (1962), Gowan (1964), Torrance (1964, 1977), Renzulli (1970), and Bruch (1975), have attempted to identify the major issues in discovering and nurturing giftedness in the culturally different. They indicate the unfairness of trying to identify disadvantaged groups using instruments designed for middle class populations; the early environment, language in the home, neglect of physical and psychological needs, lack of motivation, and low self-confidence. All these factors play a part in the identification of disadvantaged children.

Numerous studies have shown differences in characteristics of gifted children who come from different economic and cultural

backgrounds. In Table 1 findings on the different characteristics of disadvantaged gifted children are summarized. Frierson (1965) found significant differences between upper and lower socioeconomic status students in the Cleveland Major Work Program. Riessman (1962) summarized major differences in learning styles of the disadvantaged child. Torrance (1962) enumerated a list of strengths for the creative disadvantaged child. Gowan (1973) credits Bruch as seeing disadvantaged students as having differential strengths in certain areas of the Guilford Structure of Intellect, particularly in areas of figural strength (visual, auditory, and kinesthetic), in behavioral content areas (social intelligence), in divergent operations (creativity), and in product transformation. These considerations must be kept in mind when designing a suitable identification procedure and program to nurture the potential of giftedness in children from disadvantaged populations.

As a result of research such as that cited above, many researchers have been developing (or are refining) alternate, nontraditional procedures, or a combination of traditional and nontraditional measures, for identification of this special segment of the gifted population. A variety of research reports has been published on the identification of gifted minority students (Stallings, 1973; Bruch, 1971; Fitz-Gibbon, 1974; Bernal, 1974; Bernal and Reyna, 1974; Torrance, 1977; Chen & Good, 1976; Mercer & Lewis, 1978; Meeker, 1978; Chambers, Barron, & Sprecher, 1980). See Table 2 for a summary of research on procedures for identifying giftedness.

Table 1

Characteristics of Disadvantaged & Non Disadvantaged Gifted

Study	Disadvantaged	Non Disadvantaged
Riessman, 1962	Physical	Aural
	Content Centered	Form centered
	Externally motivated	Introspective
	Problem Centered	Abstract
	Inductive	Deductive
	Spatial	Temporal
	Slow & Patient	Quick & Facile
Torrance, 1964,1967	High verbal fluency & originality	None given
	High creative productivity in small groups	
	Adeptness in visual art expression	
	High creativity in movement	
	Highly motivated by games, music, sports, humor, &	

Table 1 (Cont.)

Characteristics of Disadvantaged & Non Disadvantaged Gifted

Study	Disadvantaged	Non Disadvantaged
Torrance (Cont.)	concrete objects language rich in imagery	
Frierson, 1965	Excitable Demanding Attention getting Overactive Self-assertive Shrewd Realistic in Thinking Expressive Frank Do things on their own Strong private views Tense Frustrated	Self-controlled Considerate of others Constantly ordered Attentive to rules and people Interest in dramatics, travel and literature Controlled emotions Dependent Imaginative inner life Serious Persevering
Bruch, 1970	Displays strengths in: Memory operations Convergent productions	None given

Table 1 (Cont.)

Characteristics of Disadvantaged & Non Disadvantaged Gifted

Study	Disadvantaged	Non Disadvantaged
Bruch (Cont.)	Units products	
	Systems products	
	Art & music	
	Spontaneous recall	
	Complex (3 & 4 step)	
	Problem solving in daily activities	
	Awareness of detail in descriptions	
	Fluency of ideas	
	Spontaneous categorizations	
	Visual synthesis in complex drawings	
	Multiple musical or kinaesthetic perceptions of the whole organized system	

The common elements in this body of research include identification of gifted minority students through (a) Intelligence tests that do not penalize minorities such as the System of Multicultural Pluralistic Assessment (SOMPA), The Structure of Intellect (SOI), the Raven Standard Progressive Matrices and local design Environmental Testing; (b) tests of creativity that have been shown to have little racial or socio-economic differences, such as the Torrance Tests of Creative Thinking; (c) adjective checklists; (d) standardized achievement tests like the California Achievement Tests; and (e) teacher rating scales.

This "case study" method of identification commonly is agreed upon as a step in the right direction. However, three basic concerns in the identification process are the following: (a) the requirement of taking a standardized test of some sort for a child to be admitted into the gifted program; (b) adjective checklists; and (c) teacher ratings. These are major concerns because disadvantaged students have a very hard time achieving a satisfactory percentile (96%+) on a standardized test due to lack of education, motivation, self confidence, and environmental support (Riessman, 1962; Bloom, Davis, and Hess, 1965; Taba, 1966). Second, average checklists seldom include characteristics of the disadvantaged gifted or are not validated on these populations (Maker & Shiever, 1989). Finally, the average teacher's perception of disadvantaged students is not usually a very favorable one (Riessman, 1962; Bloom, Davis, Hess, 1965; Taba, 1966; Rosenthal, 1968; Priesseiman, 1988; Jones,1988), therefore, teacher ratings often

TABLE 2

Research on Identifying Gifted Disadvantaged Students

Researchers	Techniques Used	Areas of Giftedness
Bruch, 1971	Abbreviated Binet for Disadvantaged	Intellectual
Stallings, 1973	Environmental testing, Teacher observation, & Peer evaluation	Intellectual
Bernal & Reyna, 1974	Cartoon Conservation Scales, Torrance Test of Creative Thinking, Rating Scales, & WISC	Creative & Intellectual
Fitz-Gibbon, 1974	Ca Test of Mental Maturity, Raven, CAT, & WISC	Academic & Intellectual
Torrance, 1977	Torrance Tests of Creative Thinking	Creativity

TABLE 2 (Cont.)

Research on Identifying Gifted Disadvantaged Students

Researchers	Techniques Used	Areas of Giftedness
Chen & Good, 1976	Metro Achievement Test & Interviews	Academic
Meeker, 1978	Structure of Intellect & Stanford-Binet	Intellectual
Mercer & Lewis, 1978	System of Multicultural Pluralistic Assessment (SOMPA)	Social & Intellectual
Chambers, Barron, & Sprecher,	IPAT Culture Fair IQ Test, Wallach-Kogan Tests of creativity, Barron symbol Equivalence test, & Rating scales	Intellectual & Creative 1980

emphasize weaknesses and ignore strengths of these children.

Disadvantaged students are identified by their inability to produce an adequate or high enough Normal Curve Equivalent (NCE) score (40+) on a standardized reading test and a high enough score on the teacher ratings to receive help in a Chapter I Program. As a result, a very large number of disadvantaged students are identified for the Chapter I program, while very few are identified for the program for the gifted.

When studies were conducted in schools in which the majority population was disadvantaged, the most serious deficiencies in the disadvantaged child occurred in the areas of cognitive functioning, language skills, and reading. These problems were evident from the first years of school (Hunt, 1964).

Sisk (1973) states:

> "presumably, individual potential is evenly distributed among all groups of people. If there are differences among people with respect to functioning intelligence, the causes must be environmental conditions which inhibit or fail to facilitate the conversion of potential into functioning intelligence" (p. 5).

Studies also have shown that high-ability students consistently receive more active instruction, more comprehensive instruction, and more opportunities for comprehension monitoring. In contrast, teachers who perceive their students to be low achieving tend to assume that these students cannot attain higher-order objectives and consequently provide mainly drill and practice, decoding, and algorithms for rote memorization (Jones, 1988).

McClelland (1958) has observed that students from impoverished backgrounds and from racial and ethnic minorities have achieved when provided with appropriate educational opportunities. They have demonstrated "talent potential may be fairly widespread, a characteristic which can be transformed into actually talented performance of various sorts by the right kinds of education" (p.25). Davis, 1948, Riessman, 1962, Taba, 1966, Deutsch, 1967, Torrance, 1977, and Presseisen, 1988; all concur and have supported McClelland's observation. McClelland states further "emphasis should shift from identifying talent potential to studying the process by which talent becomes actual, by which it develops" (p. 25).

The challenge to administrators, program directors and educators alike (Passow & Schiff, 1987) has become the following: We must bridge the gap between developing the potential talents of the disadvantaged student and the current methods of identification of the gifted population.

Chapter I

"The largest compensatory educational effort in the United States is the federally funded Title I of the Elementary and Secondary Educational act of 1965 (ESEA) now revised as Chapter I of the Educational Consolidation and Improvement Act of 1981 (ECIA)" (Allington, 1984, p. 1). In the past years billions of dollars were allocated to school districts across the country. This funding was allocated to "provide financial assistance to local education agencies serving areas with high concentrations of children from low-income

families to expand and improve their educational programs" (Kirst and Jung, 1980, p. 4). Traditionally, services from Chapter I have been pull-out programs in which the resource teacher gave the students lower level drill and practice work in reading and mathematics. This practice can be traced back to behaviorism as a focus of psychology (Resnick, 1987). The structure of many remedial lessons seemed to foster a dependence on the teacher rather than to develop independent work habits that would serve the students in a regular classroom. These programs also were completely separate from the rest of the curriculum (Allington, 1987). Research shows that current Chapter I programs rarely help children overcome learning failure (Allington, 1984). The culturally deprived child comes to school with deficits in learning sets and the ability to "learn to learn" (Bloom, Davis and Hess, 1965).

Bloom, Davis and Hess (1965) charge:

> "The schools must recognize the complexity of the educational problem of these children and must not expect to solve these problems by some single change such as a new textbook, a more favorable teacher-pupil ratio, a teaching machine, etc. The basic problem is to start with the child where he is and to proceed by a carefully developed and sequential program to bring him up to a level where he can learn as well as other children and eventually under the same conditions as other children" (p. 23).

In the early 1970s research began in which the behaviorist point of view was challenged. Presseisen (1988) states that today's vision of learning results from a concept of the model learner as someone actively working to construct meaning, to plan strategically, to monitor comprehension and problem solving, to integrate new information with

prior knowledge, and to apply what is learned.

Cognitive psychologists recognize that differences exist in aptitude among high- and low-achieving students. However, they consistently support teaching at-risk students a repertoire of cognitive and metacognitive strategies such as problem solving, representation, elaboration, summarizing, clarifying, using graphic organizers and organizational patterns, comprehension monitoring, self-questioning, verbal self-instruction and self regulation, hypothesis generation and study skills (Jones, Tinzmann et al., 1987; Palincsar and Brown ,1985; Schoenfield, 1988; Singer and Donlan, 1982; Weinstein and Mayer, 1986). In fact, some argue that training in generalizable cognitive strategies has more powerful and longer-lasting effects than does teaching discrete cognitive skills (Bransford et al., 1986; Corno and Snow, 1986). But substantial evidence in this same literature shows that students at risk may not apply these strategies spontaneously without sustained, explicit strategy instruction (Presseisen, 1988).

HOTS

Dr. Stanley Pogrow also believed that students in Chapter I programs were bright and was frustrated at the repeated failures of traditional approaches to instruction in programs for disadvantaged low-achieving students. He designed The Chapter I Higher Order Thinking Skills Project (HOTS) (1988) which replaces the traditional drill and practice approach in grades 4 to 6 with higher order thinking activities. Pogrow, (1990) states that Ann Brown (1982) has concluded that the main stumbling block to the learning of content is not a

content problem, but rather a consequence of inadequate thinking skills. She argues that the absence of metacognition skills is the main cause of learning problems in learning disabled students and those placed in Chapter I Programs. Pogrow (1990) states "remedial approaches are probably needed before fourth grade to build up a basic inventory of knowledge. However, what's beneficial early on, prior to the fourth grade, becomes harmful later" (p. 17). Pogrow (1990) also claims " after third grade, the fundamental learning problem faced by at-risk students is that they do not understand 'understanding'. The more the content is retaught, the less they will be able to learn and understand content" (p. 18). The HOTS Program is an intervention to help the students develop ability to integrate information and grasp a complex issue the first time it is taught.

The HOTS Program is primarily based on information processing theories of cognition. Pogrow (1990) acknowledges that the support for the techniques used in this program come from the works of Gagne and White (1978), Gagne, (1985), Vygotsky (1978), Haller, Child and Walberg, (1988), Brown (1982), and Montague & Bos, (1989). See Table 3 for a summary of teaching strategies studied by these researchers. The program includes computer use, together with specifically designed curricular materials and Socratic teaching strategies. No workbooks are used. Instead, Socratic dialogues are conducted around computer-use activities. Computers are used because their use enhances motivation and response to students' ideas are provided at the rate at which students think of them. The feedback generated by the computer provides a

continuous flow of information for the students to process, which leads to improvements in comprehension and problem solving. The dialogues are designed to develop the thinking skills of (a) Metacognition, (b) Inference from context, (c) Decontextualization, and (d) Information synthesis (Pogrow, 1988).

Pogrow (1988) claims that HOTS is the only program nationally that treats Chapter I students similarly to gifted students, relying strictly on activities that challenge them intellectually.

Summary

The literature and studies pertaining to identification of giftedness in disadvantaged students and Chapter I programs suggest that changes in teacher expectations, teaching strategies, and evaluation procedures must be made for a program to be effective for the disadvantaged population. Pogrow's (1988) HOTS program has addressed these changes. This study was designed around finding out the effectiveness of these changes in a group of educationally disadvantaged HOTS students. Formal testing, informal observations, and rating scales were used to determine which skills, abilities, and potential were enhanced by the program.

Table 3

Summary of Cognitive Concepts

Researcher(s)	Date	Concept(s)
Vygotsky, L.S.	1978	Challenging at high intellectual levels
Tobias, S.	1982	Stimulating high levels of student interest
Siengler, R.	1983	Controlled floundering
Gagne, E.	1985	Linkages (Generalizability of concepts)
Gagne, E.	1985	Incomplete instruction
Montague, M. & Bos, C.	1989	Strategy formation and disformation

Statement of the Problem

The preceding review of studies concerning Disadvantaged Gifted Students and Chapter I students shows evidence that Pogrow's "Higher Order Thinking Skills" (HOTS) program is one of the first in Chapter I to bridge the gap between the disadvantaged and the gifted. No formal studies have been done in this area. For this reason, standardized, objective test measures as well as informal data on disadvantaged children's progress in the thinking skills has been obtained for the purpose of determining the value of the HOTS program in the identification of giftedness.

Specifically, the purpose of this study was to determine whether a program that was designed for Chapter I could become a useful nontraditional tool for identification of disadvantaged gifted students. Gains in the Cognitive Abilities Test and Woodcock-Johnson fluid reasoning subtests of Chapter I eligible students who did not receive the HOTS instruction are compared with gains of students in the program. If differences were noted between the two groups of children, the nature of these differences was explored.

The following questions will be answered:

1. Do the scores of the experimental and comparison groups differ significantly on the Cog AT after treatment?
2. Do the experimental and comparison groups differ significantly in growth in each of the specific areas of verbal, nonverbal, and quantitative reasoning?

3. Within the HOTS (experimental) group, what differences in growth in W-J subtests of analysis/synthesis, concept formation, spatial relations, and analogies can be seen?
4. Within the HOTS (experimental) group, what differences in growth on each of the ten items on the teacher's rating scale can be observed?
5. How many students in both groups would be identified as gifted (based on TUSD and Arizona requirements) both before and after treatment?

CHAPTER 2

METHODS

Based on the preceding review of literature, one can conclude that insufficient experimental study has been directed toward the investigation of whether a Chapter I program could be used as an approach to nurture the needs and thus identify disadvantaged gifted children. The purpose of this study was to determine whether the gains in the thinking processes of children who were in the HOTS Program differed from the gains of those who were qualified for but did not receive such instruction.

Subjects

The study was conducted in an elementary school (Pre-kindergarten through sixth grade) with a population of 340 students. This school was located in a low socio-economic neighborhood with a highly transient population. The school was considered to be qualified for services from Chapter I based on the percentage (98.5%) of families with low incomes in the school that qualified for the federally funded free or reduced lunch program (National Student Lunch Act). According to the district's School Ethnic Report for 1990-91, the ethnic makeup of this school is 68.39% Hispanic, 14.52% White, 9.03% Black, 5.81% Asian, and 2.26% American Indian. The school is a part of the second largest school district in the state, covering an area of approximately 228 square miles. The district contains 103 schools (elementary, middle and high) with the total ethnic makeup of 52.0% White, 36.0% Hispanic, 6.0% Black, 4.1% American Indian, and 1.9% Asian (Figures are based on the

district's School Ethnic Report for 1990-91). One emphasis of the district was to increase minority achievement.

The study began with 43 students in fourth, fifth and sixth grades. Thirteen students were in the Comparison group and 30 in the Experimental. However, due to unforeseen absences on test dates, relocations to other schools, and movement out of the program, thirteen students' data were dropped from the study. The remaining subjects were twenty-three students in fourth, fifth, and sixth grades. The comparison group consisted of three fourth graders, and five sixth graders. The experimental group consisted of ten fourth graders, eight fifth graders and five sixth graders. As seen in Table 4, an uneven match exists in the number of students in the comparison group and experimental group.

This condition was the result of two circumstances; 1) an unusually low number (13) of students who qualified for the HOTS Program were not admitted to the program and 2) of that low number five were dropped because they were not able to complete the post-test due to absences and relocations to other schools.

An uneven representation of ethnic groups in the different classes also became a factor to consider. Table 5 summarizes the numbers.

Children in the comparison group were matched with the experimental group based on their Normal Curve Equivalent (NCE) scores on the Iowa Test of Basic Skills (ITBS) Reading Test. NCE scores range from 1 to 99 with a midpoint of 50. The midpoint of 50 indicates the national average on the test. Students also were matched on teacher ratings and on reading skills.

Table 4

Summary of Numbers in Comparison and Experimental Groups

Grade	Comparison	Experimental
4	3	10
5	0	8
6	5	5

Table 5

Ethnic Summary of Comparison and Experimental Groups

Group	Asian	Black	Caucasian	Hispanic	Native American
Comp:	0	0	2	6	0
Exp:	4	2	4	12	1

To qualify for the experimental HOTS group in this investigation, the children had to have a NCE score of 40 or less in the total reading score of the ITBS and a teacher rating in reading of 5 and under. Exceptions to this rule were the "continuing needs" students whose NCE scores were less than 50 and who had a low teacher rating in reading. The comparison group met the same criteria. These children all

could be described as "educationally disadvantaged." Their ethnic makeup was Hispanic, Caucasian, Black, Asian, and Native American. They all lived in a low socio-economic neighborhood (but not all of them were living in poverty) and their achievement has been below their grade level since they entered school. These students had no known learning disabilities.

Instruments

To assess the cognitive ability levels of the students, the Cognitive Abilities Test (Cog AT) (Thorndike and Hagen, 1986) was given as a group pre and post test. This measurement is a timed, norm referenced assessment in the areas of Verbal, Quantitative and Nonverbal reasoning skills. All answers were indicated by marking an answer sheet. This instrument was chosen because of its substantial correlation with the Iowa Test of Basic Skills (ITBS) for the Verbal, Nonverbal and Quantitative Batteries. In addition, it is used widely throughout the Southwest as an instrument for identifying giftedness. The Cog AT technical manual (Thorndike & Hagen, 1986) shows data on the retest reliability of the Multilevel Edition. These data were based on retesting with the same test form after an interval of six months. For example, the correlations for grade five were .91 in Verbal, .87 in Quantitative and .86 in Nonverbal.

Four subtests of the Woodcock-Johnson Psycho-educational Battery: Part One (W-J) (Woodcock and Johnson, 1978) also were included in the battery of tests administered to the Experimental group (HOTS). These subtests included Spatial Relations, Analysis-Synthesis, Concept

Formation and Analogies. All of the subtests require verbal answers with no writing involved. The subtests were given individually. In a review of the W-J, Jack A. Cummings states that data provided in the technical manual indicate that the scales and subtests are generally quite reliable. The median reliability coefficient for the broad cognitive scale is .97, with a range of .96 to .98 across age levels. The median reliability of the knowledge aptitude falls at or above .89 and should therefore be considered satisfactory. Impressive concurrent validity coefficients for the tests of the knowledge clusters in conjunction with appropriate anchor tests are presented in the technical manual. For example, the sample at grades 3, 5 and 12 of the W-J Broad Cognitive scale correlated .79, .79, and .83 with the Wechsler Intelligence Scale for Children-Revised (WISC-R).

A teacher observation and checklist on the Experimental Group was incorporated into the study, (See appendix A). This checklist is used by the district for nomination of students into classes for the gifted. It involves rating ten characteristics of giftedness from 1 (rarely) to 4 (most of the time) and some general questions concerning the student. Through this measurement I was able to ascertain what visible gains in the areas of giftedness could be perceived by the classroom teacher as a comparison to pre/post assessment of the group. This instrument also was helpful in assessing growth in motivation and self-confidence.

The pre and post NCE scores on the Total Reading section of the ITBS were used to determine the match between academic achievements of the Comparison group and Experimental group. Since this test is adopted

by the state of Arizona, The reliability and validity statistics are not cited. Results of all such tests were above acceptable levels and are reported in Hieronymus, A.N., Linquist, E.F., & Hoover, H.D., (1982). Manual for School Administrators: Iowa Tests of Basic Skills for Form 7/8.

Procedure

This study is a comparison of two groups using the quasi-experimental pre-posttest design.

The HOTS and the comparison groups were selected based on the Normal Curve Equivalent (NCE) Scores of the Total Reading Section on the ITBS. These scores ranged from 1 to 48. No NCE score was over 48. These students also received a teacher rating in Reading Skills of 1 to 5 (See appendix B). The HOTS group was selected based on the "most in need" (As defined by Chapter I guidelines). The control group consisted of the students who qualified, but were waiting for an opening in the HOTS Program.

Four subtests of the W-J were given individually to each HOTS student. All were given in the following order:

1. Spatial Relations (measures visual perceptual fluency and nonverbal conceptual processing),
2. Analysis/Synthesis (measures abstract reasoning and problem solving),
3. Concept Formation (measures abstract reasoning and rule learning),

4. Analogies (measuring vocabulary comprehension, conceptualization, and expression).

Each child completed all the subtests in one sitting. The subtests were scored according to the accompanying instructions in the test manual and were correlated by a computer program from the company. All the subtests were administered by the primary investigator in a private room with minimum distractions. These subtests were chosen because they represented some of the fluid reasoning skills presented in the total battery that correlate with the goals and objectives of the HOTS program.

Both the comparison and HOTS group were administered the Cog AT both before and after the program. This test was administered by a trained Gifted and Talented Education (GATE) Resource teacher. Both groups were tested together in two 1 and 1/2 hour sittings in the school's cafeteria. The groups were tested in the order of Verbal, Quantitative and Nonverbal Reasoning skills. The tests were scored by the primary investigator under the direct supervision of qualified GATE personnel.

Throughout the research period, the primary investigator kept a journal that included observations of progress, attitudes, and behavior of the experimental group.

The "treatment" applied in this study is the attendance of the HOTS students in a 45 minute HOTS class four days a week for a period of twenty weeks. This resulted in 60 hours of HOTS instruction. The class size varied from seven to eleven students. No more than eleven students

ever were scheduled for an instructional class. The HOTS class began with ten to fifteen minutes of prediscussion of the concept(s) to be taught that day. Throughout the discussion period the instructor asked open-ended questions and continually encouraged the students to elaborate or expand on their thinking. The words "I don't know" were not allowed, therefore, the instructor made use of "wait time" to allow the students to collect their thoughts. The students then used a program on the computer that helped them to apply and internalize the concept(s), (See Appendix C for sample script symbols and lessons). The class ended with a short discussion and the students wrote pertinent data in their journals. The primary investigator presented the HOTS Curriculum (Pogrow, 1990) exactly as written to insure validity of the study. Nineteen HOTS students were presented the second year's curriculum and four were presented the first year's curriculum. The comparison group attended computer class once a week for 45 minutes. They were involved in pre and post discussions and their computer work occurred in a large class setting.

CHAPTER THREE

RESULTS

The purpose of this study was to investigate the possibility of using the HOTS Program as a nontraditional approach in identification of giftedness in children. Specifically, the following questions were asked:

1. Do the scores of the experimental and comparison significantly on the Cog AT after treatment?
2. Do the experimental and comparison groups differ in growth in each of the specific areas of verbal, nonverbal, and quantitative reasoning?
3. Within the HOTS (experimental) group, what growth in W-J subtests of analysis/synthesis, concept formation, spatial relations, and analogies can be seen?
4. Within the HOTS (experimental) group, what differences in growth on each of the ten items on the teacher's rating scale can be observed?
5. How many students in both groups would be identified as gifted (based on TUSD and Arizona requirements) both before and after treatment?

Since the low number in the control group was a concern, an independent t test was performed for the pre Total Reading NCE on the ITBS. An analysis showed no significant differences in the two groups, which validated the use of this group as a comparison.

Question 1

To answer Question One, the Scale scores (See Table 6) were analyzed using the t Test for Independent samples of differences in means on the Cog AT, (Thorndike and Hagen, 1986). Individual scores are presented for each subject in Table 6. A summary of the posttest results showing the means, standard deviations, t value and probability is presented in Table 7. No significant differences were present across the independent measures of Verbal, Quantitative and Nonverbal posttest scale scores. In Table 7 the results of the analysis of the Cog AT Posttest Scale Scores for both groups are summarized.

Question 2

A t Test for dependent samples was used to determine if the experimental and the comparison group differed significantly in growth in each of the specific areas of Verbal, Nonverbal, and Quantitative Reasoning (Question Two). As shown in Table 8, highly significant differences were found in the three areas of Verbal, t (22) = 4.32, p= .000, Quantitative, t (22) = 3.81, p=.001 and Nonverbal, t (22) = 3.01, p=.006 based on the pre and post Cog AT scale scores of the experimental group.

Table 9 show significant difference in the Verbal, t (7) = 2.62, p=.035 and a borderline significant difference in the Nonverbal, t (7) = 2.31, p=.054 but none in the Quantitative area based on the pre and post Cog AT scale scores of the comparison group.

The statistics cited above indicate that, although little or no significant differences were found in the Cog AT posttest results of the

Table 6

Cog AT Pre and Post test Scores of HOTS and Comparison Groups

	Pretest Scale Scores			Posttest Scale Scores		
Grade	V	Quan	NV	V	Quan	NV
			HOTS Students (n = 23)			
4	214	215	214	215	231	200
4	206	236	201	198	227	198
4	190	215	203	194	219	228
* 4	211	202	206	214	219	229
4	217	206	220	222	213	222
4	201	212	188	213	204	185
4	203	202	201	218	212	237
4	201	208	194	210	200	210
* 4	206	226	237	225	246	250
* 4	235	224	210	228	241	222
* 5	213	224	241	231	240	236
* 5	214	224	217	218	242	225
5	228	216	220	236	229	239
5	341	232	231	256	232	259
* 5	233	212	219	241	234	229
5	213	212	205	221	220	212
5	201	234	234	207	239	225

Table 6 (Cont.)

Cog AT Pre and Post test Scores of HOTS and Comparison groups

	Pretest Scale Scores			Posttest Scale Scores		
Grade	V	Quan	NV	V	Quan	NV
5	213	214	212	224	236	228
* 6	232	236	235	231	247	242
6	219	231	201	228	223	201
6	241	249	229	234	242	213
* 6	232	244	233	244	252	249
6	244	259	249	257	284	254
	Comparison Students (n = 8)					
4	222	213	213	235	212	222
4	206	200	200	218	204	216
* 4	214	215	205	218	208	200
6	232	250	224	256	252	253
6	257	241	242	270	275	259
* 6	239	232	213	235	229	213
6	232	252	225	256	254	256
* 6	224	227	222	237	236	229

Note. * Indicates bilingual student based on the Language Assessment Survey (LAS) and/or the Home Language Inventory

Table 7

Summary of HOTS and Comparison Groups Results on Cog AT Posttest

	HOTS (a)		Comparison (b)			
Test	M	SD	M	SD	t	p
Verbal	224.57	15.98	238.00	17.63	-2.00	.055
Quant	231.83	17.97	230.63	23.99	.15	.882
Nonverb	225.78	19.15	225.62	20.55	.02	.984

Note. Results are scale scores

(a) n = 23

(b) n = 8

All statistical tests utilized an alpha of .05.

Table 8

Comparison of HOTS Group on Pre and Post Cog AT Scores

	Pretest		Posttest			
Test	M	SD	M	SD	t	p
Verbal	217.74	15.17	224.57	15.98	4.32***	.000
Quant	223.17	15.14	231.83	17.97	3.81**	.001
Nonverb	217.39	16.39	225.78	19.15	3.01*	.006

Note. Results are scale scores

* $p < .01$, ** $p = .001$, *** $p < .0001$

All Statistical tests utilized an alpha of .05.

experimental and comparison groups, extreme and significant differences in score gains were found when each of the groups was examined carefully.

Question 3

A t test for dependent samples also was used to ascertain what differences in growth can be seen within the experimental group (HOTS) in areas such as Analysis/Synthesis, Analogies, Concept formation and Spatial Relationships as stated in Question 3 (Table 10 shows the actual data). A comparison of the pre and posttests was made. The HOTS Group made highly significant gains in all the subtests after treatment (Spatial Relations, t (21) = 5.06, p=.000, Analysis/Synthesis, t (21) = 3.17, p=.005, Concept Formation, t (21) = 6.70, p=.000, and Analogies, t (21) = 4.25, p=.000. An informal comparison of differences between the means and standard deviation on raw scores was made and is presented in Table 11.

Question 4

To answer Question 4 using teacher ratings, a dependent t Test was used comparing each item with its posttest pair. Table 12 reveals no significant differences in four out of the ten items. No significant differences were seen in Use of good vocabulary, Using complex sentences, Demonstrating an unusually good memory and Demonstrating an outstanding talent or special ability. A borderline significant difference was seen in Attention span and Becoming intensely involved in projects (t (22) = 2.04, p=.053). Highly significant differences were seen in Reasoning Skills (t (22) = 4.06, p=.001),

Curiosity (t (22) = 3.35, p=.003), Originality in products and ideas (t (22) = 3.51, p=.002), Sense of humor (t (22) = 3.56, p=.002), and Imaginative Skills (t (22) = 3.54, p=.002).

A final comparison of the HOTS and the Control groups can be gained from an examination of the graphic representation presented in Figure 1. This graph makes possible a comparison of the HOTS and Comparison groups to each other and themselves. Figure 1 shows this comparison for the pooled data of all Cog AT Batteries in each group using scale score data from pre and post tests. Figures 2 and 3 show the comparison of differences found in tests that were given to the HOTS group only. Inspection of these graphs reveals an overall upward trend in thinking skills and self concept.

Question 5

Finally, after reviewing the individual outcomes of the test scores, the GATE Instructor for our school will be investigating 3 of the HOTS students from this study to possibly enter them into the program based on the their performance on the Quantitative and Nonverbal test scores of the Cog AT. Prior to the program, none of the students in the comparison or experimental group were considered for placement in the program for gifted students.

Table 9

Comparison of the Comparison Group on Pre and Post Cog AT Scores

	Pretest		Posttest			
Test	M	SD	M	SD	t	p
Verbal	229.13	16.13	238.00	17.63	2.62*	.035
Quant	226.25	16.21	230.63	23.99	.96	.371
Nonverb	216.50	12.97	225.63	20.55	2.31	.054

Note. Results are scale scores

* $p < .05$

All statistical tests utilized an alpha of .05

Table 10

Comparison of the HOTS Pretest and Posttest on the Woodcock Johnson Subtests

Pretest					Posttest			
Grade	Spa/Rel	Anal/Syn	Con/form	An	Spa/Rel	Anal/Syn	Con/Form	An
4	26	18	17	15	31	16	25	17
4	32	11	8	15	40	13	23	14
4	36	14	12	12	41	17	24	17
4	40	16	15	13	39	18	16	15
4	38	19	16	14	42	23	25	21
4	29	9	15	15	38	14	17	17
4	41	9	3	15	46	19	12	15
4	29	17	6	10	39	23	19	18
4	28	18	20	15	46	19	26	18
4	32	16	18	13	39	20	24	18
5	41	14	15	16	46	18	21	12
5	44	13	6	11	42	18	16	17
5	48	19	13	18	49	18	24	19
5	43	22	23	15	52	17	26	21
5	40	12	17	15	47	14	20	17
5	44	18	24	18	46	23	32	22
5	40	16	23	17	47	21	23	20

Table 10 (Cont.)

Comparison of the HOTS Pretest and Posttest on the Woodcock Johnson Subtests

	Pretest				Posttest			
Grade	Spa/Rel	Anal/Syn	Con/form	An	Spa/Rel	Anal/Syn	Con/Form	An
6	38	19	20	20	49	16	25	22
6	35	17	9	14	35	17	13	11
6	26	17	24	19	48	17	22	25
6	48	25	20	19	48	24	23	24
6	49	18	20	20	54	26	26	21

Note. Results are raw scores.

Spa/Rel is Spatial Relations.

Anal/Syn is Analysis/Synthesis.

Con/Form is Concept Formation.

An is Analogies.

Table 11

Comparison Results of HOTS Group on Woodcock Johnson Subtests

	Pretest		Posttest			
Test	M	SD	M	SD	t	p
Spatial Relations	37.59	7.17	43.82	5.66	5.06**	.000
Analysis/Synthesis	16.23	3.89	18.68	3.44	3.17*	.005
Concept Formation	15.64	6.18	21.91	4.79	6.70**	.000
Analogies	15.41	2.77	18.23	3.60	4.45**	.000

Note. Results are raw scores

* $p < .01$, ** $p < .0001$

All Statistical tests utilized an alpha of .05.

Table 12

Pretest and Posttest Results of the HOTS Group on Teacher Ratings

	Pretest		Posttest			
Source	M	SD	M	SD	t	p
Vocabulary	1.96	.83	2.17	.72	1.23	.233
Complex Sentences	1.78	.85	2.09	.73	1.67	.110
Good Memory	2.00	.91	2.26	.75	1.19	.25
Attention Span	2.04	1.02	2.52	.79	2.04*	.053
Reasoning Skills	1.91	.85	2.61	.78	4.06***	.001
Curiosity	1.91	1.00	2.57	.59	3.35**	.003
Original Prod/Ideas	1.70	.97	2.43	.66	3.51**	.002
Sense of Humor	2.04	.88	2.87	.85	3.56**	.002
Imaginative	1.65	.86	2.30	.82	3.54**	.002
Talent/Spec Abil	2.04	1.26	2.48	.99	1.64	.116

Note. *p=.05, **p<.05,***p=.001

All Statistical tests utilized an alpha of .05.

Figure 1 COG AT Pre & Post Scale Score Comparison

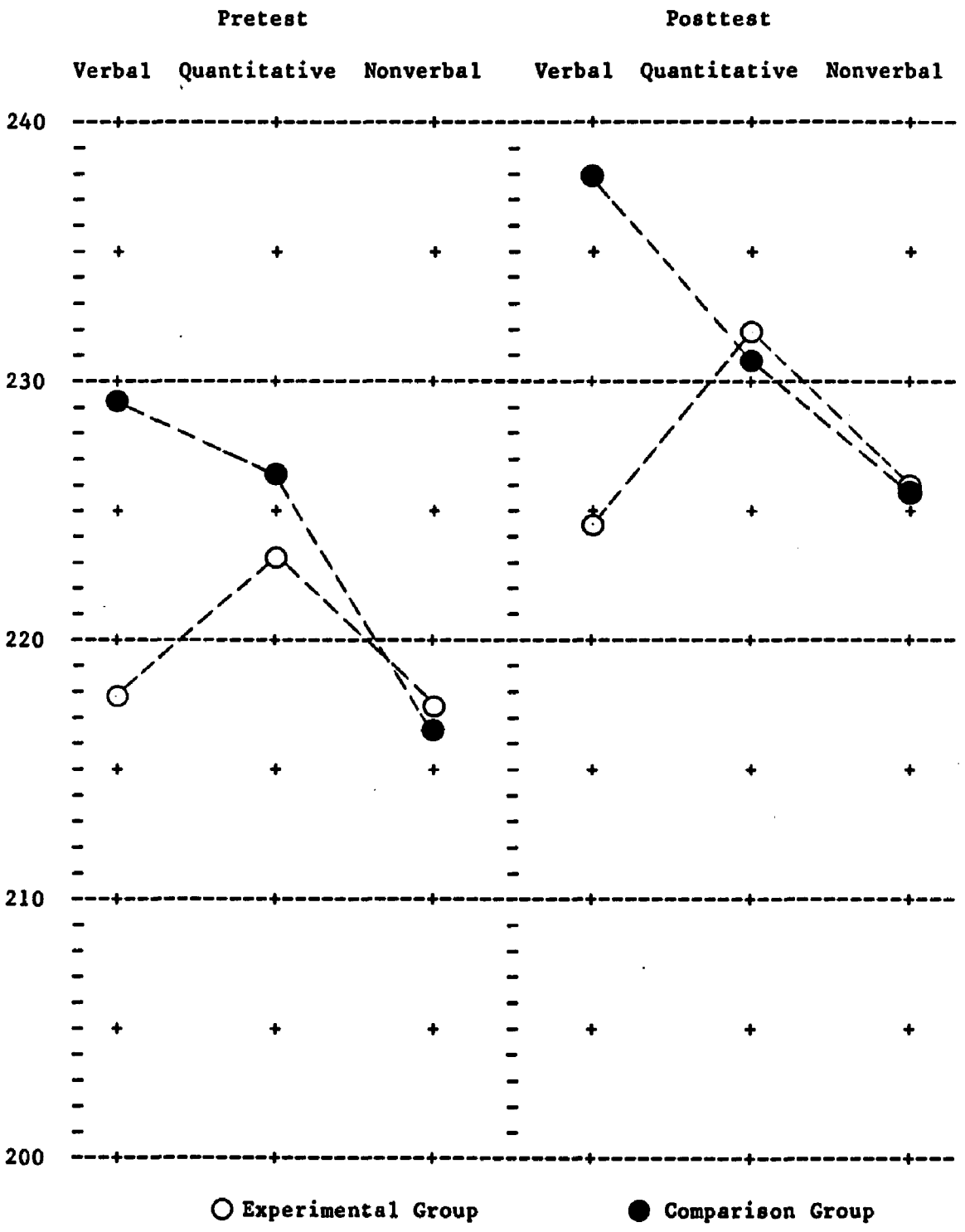


Figure 2

Woodcock Johnson Pre & Post Comparison

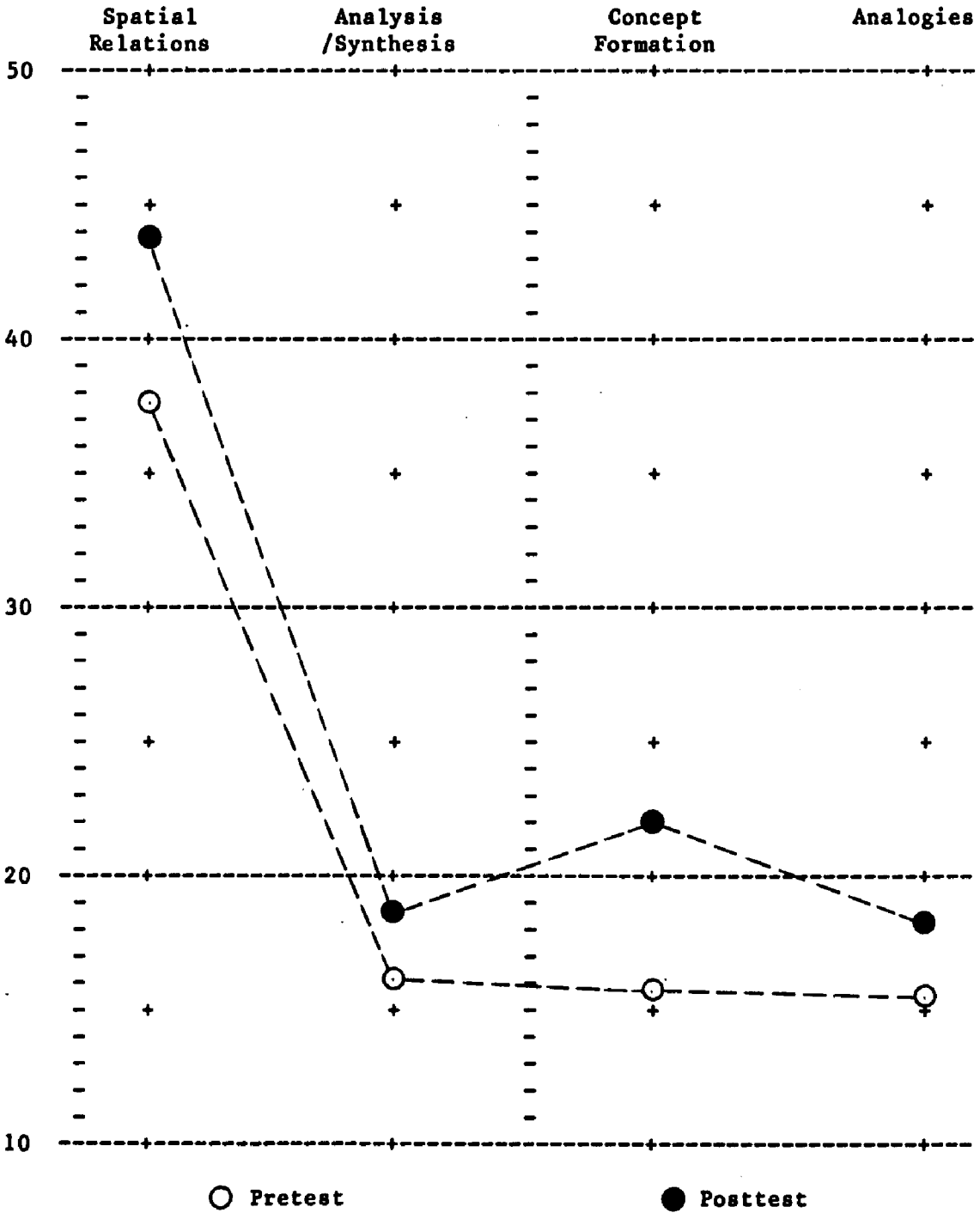
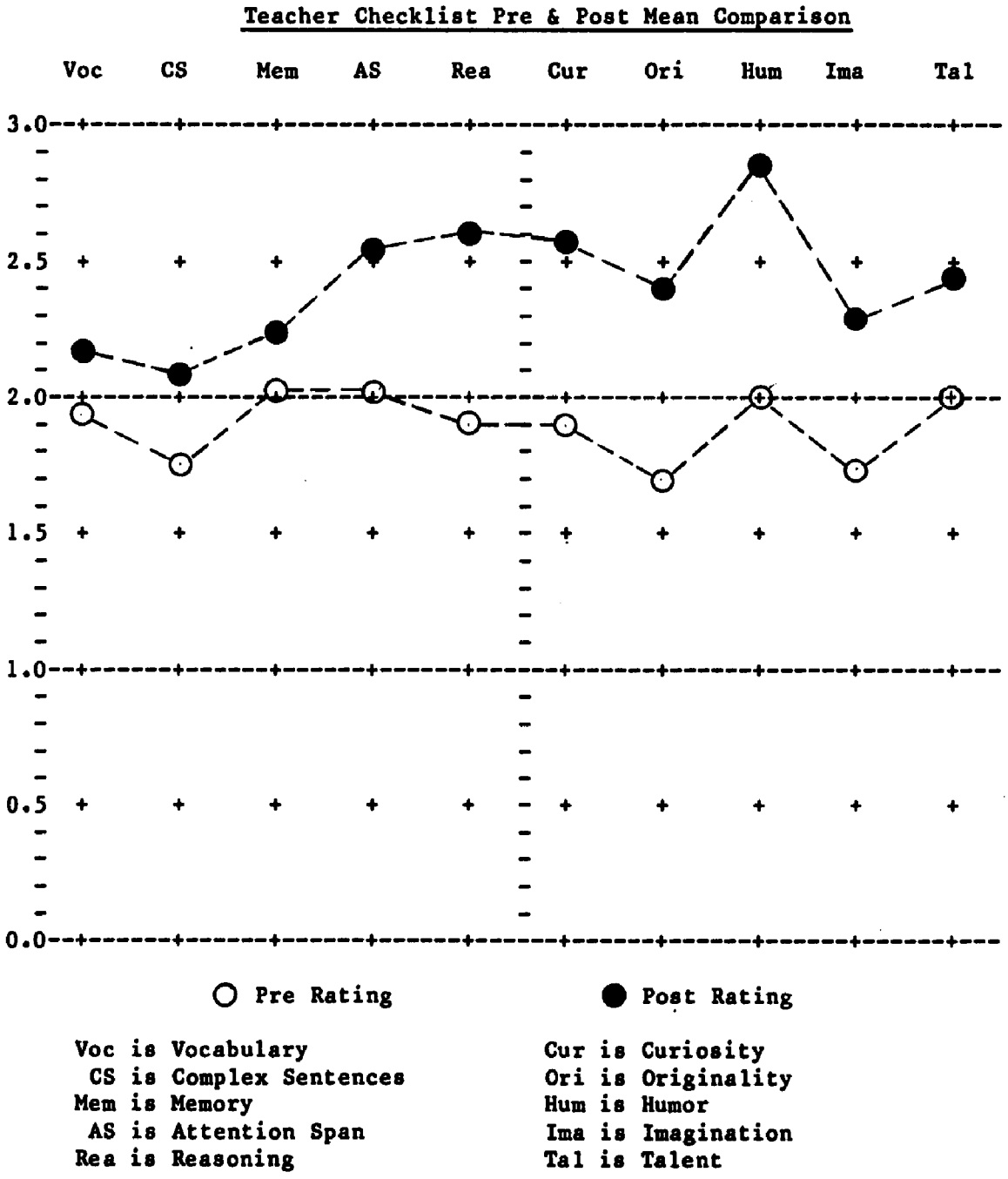


Figure 3


Teacher Checklist Pre & Post Mean Comparison
Voc
CS
Mem
AS
Rea
Cur
Ori
Hum
Ima
Tal
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Pre Rating
Post Rating
Voc is Vocabulary
CS is Complex Sentences
Mem is Memory
AS is Attention Span
Rea is Reasoning
Cur is Curiosity
Ori is Originality
Hum is Humor
Ima is Imagination
Tal is Talent

CHAPTER 4

DISCUSSION

The finding of no statistical differences in the pre Total Reading NCE scores of the HOTS and Comparison group demonstrated the validity of matching the two groups. However, the fact that no significant differences in the Cog AT scores of the two groups were seen after treatment was interesting. A closer analysis of each group separately brought forth some very interesting observations. Each of the batteries (Verbal, Quantitative and Nonverbal) are made up of three tests. All of these tests require the individual to use concepts that he or she has acquired from experience both in and out of school to solve a problem that has not been taught in school. All three of the batteries measure inductive and abstract reasoning. The HOTS students showed significant differences in their pre and post test scores for each of the batteries based on scale scores. However, the Comparison group displayed significant differences only in the Verbal Battery based on scale scores.

The successful gains made by the HOTS group in the three batteries can be directly related to the HOTS students' participation in a systematic program which exposed them to situations where they came to experience the need to think and then shared their perceptions of the thinking process with each other. The social sharing of their ideas helped internalize and sharpen their thinking skills. Also, 17% of the HOTS experimental group were presented Part I of the HOTS Curriculum. The students learned the basic linkage concepts (ie. Traits,

Capabilities, Rules, Patterns, Similarities & Differences, Predictions, Strategies, Composite Structures, Reactions, and Perspective) and began the process of applying them to construct linkages between concepts and ideas in different environments (HOTS class, classroom, home, and play). 83% of the HOTS experimental group were presented Part II of the curriculum. These students used the linkage concepts in a more sophisticated way to form new and more complex sets of linkages and associations through writing. I believe these experiences were the keys as to why the HOTS students made gains in all three areas of Verbal, Quantitative, and Nonverbal.

The comparison group did make significant gains in the Verbal battery of the Cog At but lacked the above experiences to obtain gains in the other two areas. It is uncertain why the Comparison group achieved greater gains in the Verbal battery than the HOTS group. One theory is that two students in the Comparison group who were rated low in their reading skills by the teacher and on the ITBS at the beginning of the study were, in fact, quite able readers. Throughout the year their classroom teacher put great emphasis on Language Arts. Both students greatly admired this teacher and were motivated to do their best. It is believed that, because the comparison group was so small, the scores of these students distorted the actual gains made by the entire group.

One common variable should be noted here. The school-wide goal for this year was to make all of our students from grades 2 to 6 "Test-wise". That is, each of the classroom teachers stressed and had the

students practice test taking skills from January to April, when the ITBS was administered. Both groups, Comparison and HOTS, had access to this instruction and practice.

The finding of significant differences in all of the areas of the W-J subtests of Spatial Relations, Analysis/Synthesis, Concept Formation and Analogies for the HOTS group is noteworthy because the abilities measured with these tests involve processes that have been internalized by the students through the HOTS program. They are not skills that can be taught and memorized. The teaching strategies as mentioned in Chapter One and the program's emphasis on Metacognition (reflecting on cognitive processes, procedures, and knowledge that are brought to a performance of a task), Decontextualization (applying information learned in one context to another), and Information Synthesis (scanning and appropriately linking information from a variety of sources to solve a problem) could have been contributing factors to the students' successful gains on the W-J subtests.

The design of the HOTS program not only contributed to the gains on these subtests but also helped bring out some of the characteristics of the disadvantaged gifted enumerated in Chapter One. The program was designed on inductive reasoning and, as seen from the gains in the Cog AT and W-J subtests, it brought out the natural inductive reasoning skills of the students. The use of the computer and the appeal of popular games were two of the external motivations these students needed to want to learn and think about concepts and ideas. The computer allowed the students to physically try their hypothesis on solving a

problem and produced immediate feedback as to the success of their thinking. The small group settings and discussions promoted creativity and self worth in the HOTS group. One characteristic of a disadvantaged gifted child was that he was "slow and patient". In regular classes (and some gifted) a child was penalized for this characteristic. The HOTS lessons seemed to be designed around this trait. When a child could not answer immediately in discussions, a "wait time" was utilized until the student was able to adequately convey his/her thinking to the group. With the "pressure" of answering quickly gone, many insightful and creative ideas emerged from these "slow" students.

These data, along with the significant differences on the Cog AT, seem to support McClellan's (1958) theory that the "right kinds of education" can indeed transform potential into "actual talented performances." These results also seem to give credibility to the cognitive theories of Gagne(1985), Vygotsky (1978), and Montague & Bos (1989) that Pogrow (1990) used in constructing his HOTS program.

The results from the classroom teacher rating scales were very interesting, indeed. Whether teachers' perception of disadvantaged students as being not very favorable (Riessman, 1962; Bloom, Davis & Hess, 1965; Taba, 1966; Priesseiman, 1988; and Jones, 1988) has changed through the years is unclear but the results of this study indicate that the classroom teachers' overall perceptions of disadvantaged Chapter I HOTS students have changed in a more favorable direction. The fact that the teachers have observed significant differences on the checklist in six out of the ten areas in 6 months is very promising. The HOTS

students had made some (but not significant) gains in the Vocabulary and Complex Sentences ratings, as also was indicated in the Cog AT scores of verbal reasoning. This is not too surprising since 9 out of the 23 subjects, or 39% are bilingual. These students are considered bilingual based on a Language Assessment Scale (LAS) of 4 in both languages or on a Home Language Inventory in which parents report other languages spoken in the home. Of the 39% who are bilingual, 17.5% speak Laos at home with mastery of English as their second language (which they speak at school and with friends), 17.5% speak Spanish at home and in their bilingual classes with mastery of English as their second language, and 4% speak English in the home as well as Papago as their second language. The students who are native English speakers come from environments in which vocabulary or complex sentences are not emphasized in their daily lives. Six months was not enough time to make significant gains in these areas.

The findings of significant differences in attention span, reasoning skills, curiosity, original products/ideas, and imaginative skills fit with the objectives of the HOTS Program. Pogrow's HOTS Program (1990) stimulates thinking by presenting curricular activities that interest students to the point at which they are willing to think deeply about the material. Tobias (1982) states that student engagement is the most important variable in producing learning. Intrigue also is a big part of the program so humor, mystery and drama are integrated into the HOTS activities and discussions. The students must have gained from these experiences in the HOTS Classroom and were encouraged and felt free to expand upon these skills in the regular classroom.

No significant differences were found in the talent/special ability section of the teacher checklist but, through an informal survey of the HOTS students (asking the teachers to list honors achieved by the HOTS students this school year) we found these interesting results: Three students received third place honor for their Science Fair project at the University of Arizona (which was a voluntary assignment), One was elected president of the Student Council, One was elected co-vice president of the Student Council and three were on the Honor Roll. These honors show that the self-concepts of these students were blossoming and 26% of the HOTS students in this study were beginning to take a more active role in civic and academic matters.

A personal journal was kept through the six months of the study to record observations of progress, attitudes and behavior of the HOTS students. The personal progress of two individuals will be related along with records of their pre and post test scores (See Table 17).

Student #1

Student #1 is bilingual in Spanish and English and is in a bilingual classroom. When he entered the program he was not very comfortable with the idea that the class was conducted entirely in English. Even though his LAS at the time was 4 (proficient) in both languages, he felt better about expressing himself in Spanish than in English. Consequently, he rarely spoke during the small group discussions unless he was asked a direct question. He seemed very comfortable working with another student on the computer, though. As time went on, he discovered that we would wait for him to collect his

thoughts before answering and he became more vocal during discussions. By the end of the second month of the study this student was becoming more independent and confident during the HOTS period. His English verbal skills were far more advanced than his writing skills, but he seemed to feel more comfortable with both. By the end of the study, student #1 not only was volunteering answers in our discussions, but also was able to expand on his thinking when challenged. Some of the students began to look to him for explanations when they were not able to grasp concepts on their own. This student also started coming into the HOTS classroom after breaks or before he went home to just say "Hi" or to tell a joke. The growth in self concept and skills was remarkable. This student was not able to meet the standards set by the GATE Department but, judging from the gains that were made during this study, his progress will be monitored closely in the upcoming school year by both the HOTS and GATE resource teachers.

Student #2

Student #2 was very interesting to observe. She is Hispanic in heritage but speaks only English. She is in a regular classroom. This was her first year in HOTS. She entered the study with a self image problem. When the concepts seemed easy for her, her day went very well. She participated by answering the questions presented, but would or could not elaborate on her thinking. However, she was a different person on the days when the concepts were a little hard for her. She would "tune out" to the point of ignoring everyone and everything, and refused to acknowledge the help of anyone around her. She once stared at the

computer for 15 minutes without moving. When the teacher went to her to give individual help, she simply continued to stare at the computer and did not respond to anything until the end of the period when she simply walked out of the classroom.

By the end of the third month a difference in attitude was recorded. Student #2 was vocalizing in discussions and was able to answer some probing follow-up questions. She was coming into HOTS class with a smile, and seemed a lot happier with herself. She still was having her "doubting" moments but she was willing to listen and be helped. The fourth month brought on a tremendous breakthrough. She was having trouble with a concept but kept on working at it by herself. By the end of the period she was achieving success. The final entry on her indicates her taking a very active part in the discussion of the day and presenting some unique insights. She was involved, happy, and self-confident-- quite a different picture from the beginning of the study.

Again, she did not attain the score that would qualify her for the GATE program, but the gains she made in all her test scores, as well as motivation and self-confidence, certainly warrants that her progress next year be monitored closely.

The claim that these two students made the above growths strictly because of HOTS cannot be made, but clearly the HOTS program was a very strong factor involved in achieving the gains that are graphically shown in Figures 4 and 5.

Limitations of the study

One limitation of this study was the difference in size of the Comparison and Experimental groups. One could question whether the individual breakdown of the two groups in the Cog At would be so diverse with higher numbers in the Comparison group.

Another question would be test-retest reliability. Data related to the Cog AT's retest reliability are included in its manual, but the same data are not available in the W-J. The primary investigator made certain that these tests were given 6 months apart. During the six months, the test was put away so none of the HOTS group could see it. If a student was tested by this measure for other reasons, that person was excluded from the study. The only control that the primary investigator did not have was whether the students discussed individual items informally among themselves.

The short duration of the study also would be considered a limitation. A longer period of time would have given a clearer assessment of gains in all areas, especially in the Cog AT Verbal subtest.

Conclusions and Recommendations

In spite of a few shortcomings, the data from this study were significant enough to show that the Higher Order Thinking Skills (HOTS) Program (Pogrow,1990) could be used as a nontraditional program to help bridge the gap between the Non-disadvantaged gifted and the disadvantaged gifted. The HOTS program helped provide the experiences,

expectations and motivations that were lacking in the disadvantaged environment. In this thinking environment, the child was able to discover capabilities and talents that were seldom or never used. The teacher of HOTS in the Chapter I schools, with high populations of disadvantaged students, should work very closely with the GATE Program Teacher in the school to develop some coordination in the identification and nurturing of talents in educationally disadvantaged students.

Educators should use the results of this study as statistical proof that educationally disadvantaged students are more capable than they appear to be. Not all disadvantaged students are gifted, but this study is an indication that the HOTS program will help nurture any intellectual, creative, or leadership potential that a child may have. Therefore, implementing the HOTS program in Chapter I schools would be a very positive step in helping these children.

The results from this study indicate the need of educators in the field of giftedness to redefine characteristics and methods presently used in identifying giftedness in educationally disadvantaged students. Every teacher of the disadvantaged should know these characteristics and use them in observing and evaluating their students.

This study also indicates the need for educators in schools with a disadvantaged population to challenge their students intellectually by becoming familiar with and using any of the higher level teaching models as designed by Taba (1964), Parnes (1966), Guilford (1967), Renzulli (1977), or Pogrow (1990). If the school is presently using HOTS as a Chapter I program, all teachers should incorporate HOTS techniques and

strategies in their classroom teaching.

Finally, HOTS program could be used as a "potentially gifted" program. When educators see potential in students, which does not come across in test results or classroom work, they would be able to use this program to give the students the experiences and motivation needed to succeed in being admitted to a regular program for the gifted.

Recommendations for future research would include:

1. A similar study using larger samples with a longer time span.
2. A longitudinal study on a selected HOTS group, not only through the years in HOTS but also the years following being exited from the HOTS program, to see if growth in thinking skills is maintained or advanced further.
3. Conduct experimental studies of the effects of HOTS as a program for the gifted for kindergarten through second grades.
4. Conduct experimental studies of the effects of HOTS as a "potentially gifted" program for children in second and third grades.

Table 13

Comparison of Pre and Post test Scores on Two Sample Students

	Student #1		Student #2	
Measures	Pre	Post	Pre	Post
Verbal	19	26	25	27
Quantitative	15	27	15	24
Nonverbal	19	29	22	37
Spatial Relations	40	47	40	39
Analysis/ Synthesis	16	21	16	18
Concept Formation	23	23	15	16
Analogies	17	20	13	15
Vocabulary	3	3	1	2
Complex Sentences	3	3	1	2
Good memory	3	4	1	2
Attention Span	3	3	1	2
Reasoning Skills	3	4	1	2
Curiosity	3	4	1	2
Originality	3	3	1	2
Sense of Humor	4	4	1	2
Imaginative	3	3	1	2
Talent/Special Ability	4	4	1	1
NCE (Total Reading)	13	28	12	26

Note. All scores (except NCE) are raw scores

Figure 4 Comparison of Pre & Post test Scores on Two Sample Students

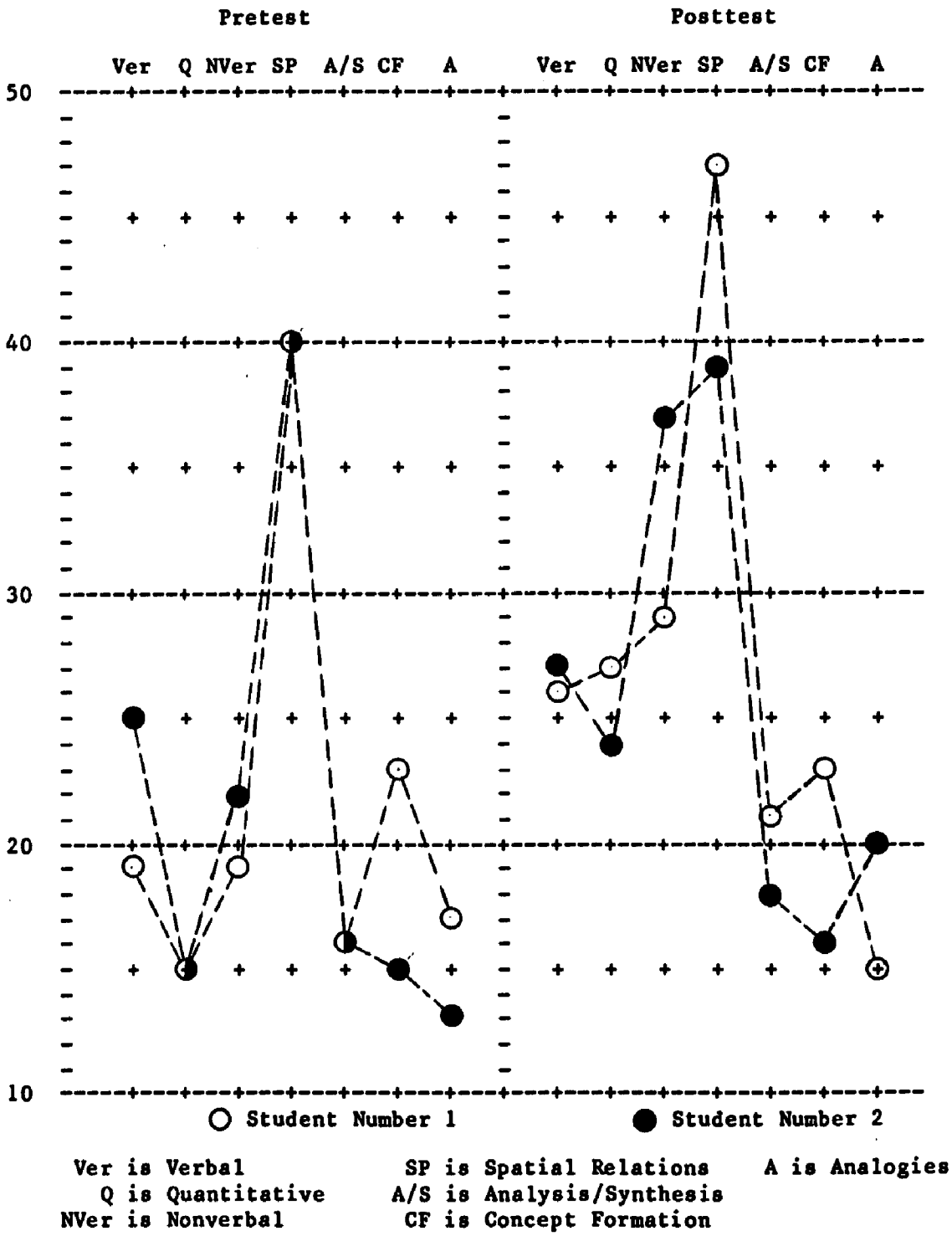
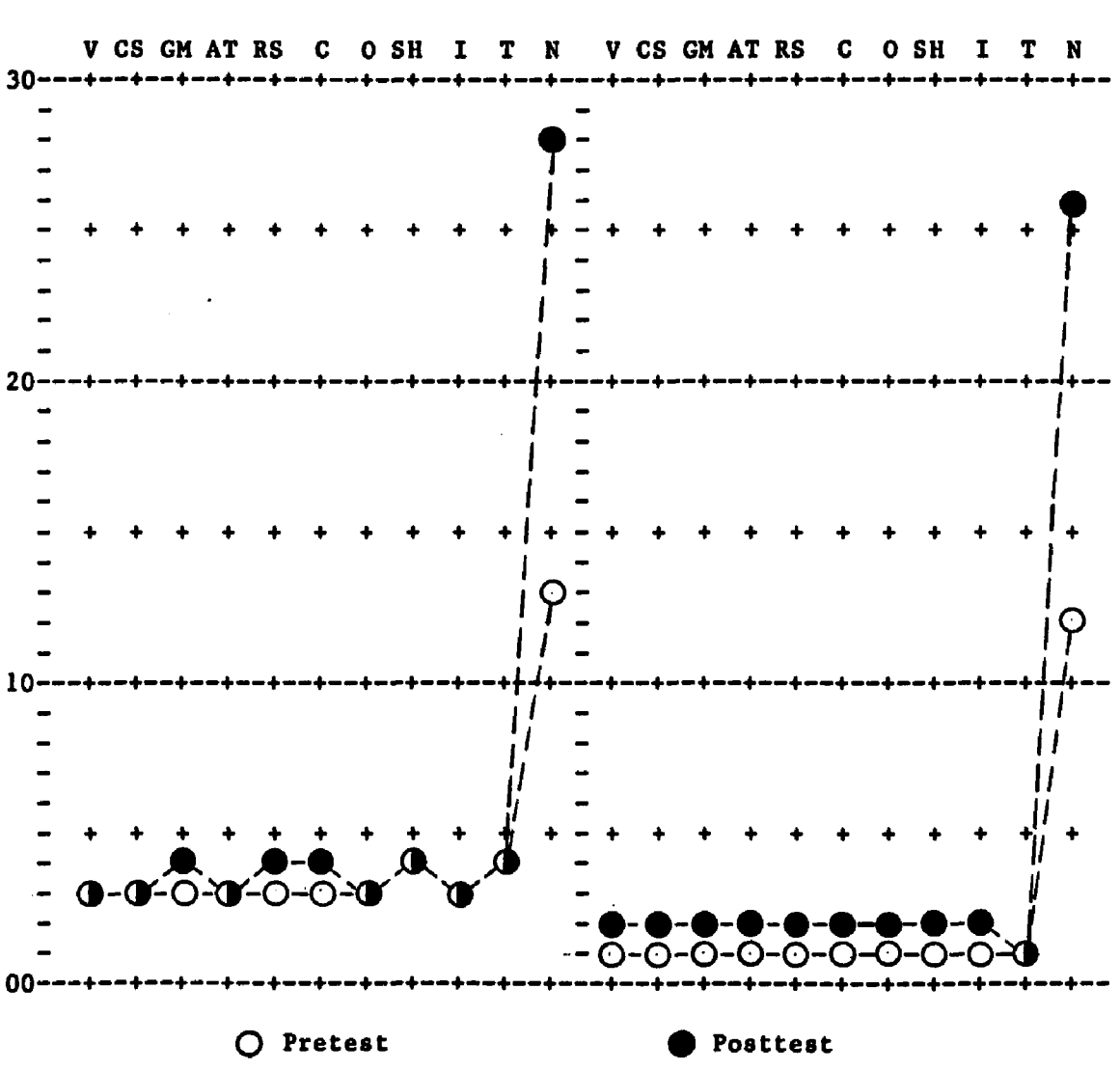


Figure 5

Comparison of Pre & Post Teacher Ratings on Two Sample Students



Note. All scores (except NCE) are raw scores.

V is Vocabulary
CS is Complex Sentences
GM is Good Memory
AT is Attention Span
RS is Reasoning Skills
C is Curiosity
O is Originality
SH is Sense of Humor
I is Imaginative
T is Talent/Special Ability
N is NCE (Total Reading)

APPENDIX A

Tucson Unified School District

Gifted and Talented Education
Teacher Checklist of Student Behavior

Child's Name_____Age: Yrs.___Mos.___Grade___EC__

School_____Classroom teacher_____

Person Initiating Referral_____

To what degree does this child exhibit the following characteristics when compared with other children of the same age.

	Rarely	Occa-sionally	Often	Most of the time
1. Uses unusually good vocabulary, particularly in dominant language. If bilingual, is able to function successfully in both languages and helps children who are less proficient.	1	2	3	4
2. Uses Complex Sentences.	1	2	3	4
3. Demonstrates an unusually good memory.	1	2	3	4
4. Has a long attention span and becomes intensely involved in projects of the student's own choosing.	1	2	3	4
5. Reasons things out, thinks clearly, recognizes relationships, comprehends meanings.	1	2	3	4
6. Displays curiosity and is keenly observant about a variety of topics.	1	2	3	4

7. Produces original products or ideas.	1	2	3	4
8. Readily understands jokes and has a good sense of humor.	1	2	3	4
9. Uses good imaginative skills-Examples: writes or tells very imaginative stories. Asks provocative questions.	1	2	3	4
10. Demonstrates an outstanding talent or special ability.	1	2	3	4

List talent or special ability:_____

Total_____

Do you have specific concerns regarding this student?

_____

_____

Please give specific examples which indicate to you that this child is gifted:

_____

_____

Would you recommend this student for placement in the GATE program? Please check appropriate box.

/__/Without Reservation /__/ Yes /__/Perhaps /__/Questionable /__/No

Please return this form as per instructions on the cover letter or to the GATE office. Thank you for your cooperation.

Teacher's Signature_____Date_____

NQ/dmg
GATE
10/88
Opinion

APPENDIX B

English Reading
Referral Form for Chapter I-Grade 4-6
Reading/Language Resource Teacher (RLRT) Project

(Student's Name) _____ (Teacher, Principal or Counselor) _____

(Grade) _____ (Referral Date) _____

Greatest Need: Oral Language Development _____

Written Language Experiences _____

Reason for Referral: _____

_____

Rating	Functional Reading Level (Circle One)
1	Beginner; inconsistent, small-sight vocabulary and few word attack skills.
2	Very low reading proficiency; severe difficulty in using reading as a medium for learning.
3	Slight proficiency in reading materials that considerably below grade level (18 mo. or more); has difficulty working independently.
4	Uneven proficiency in reading materials that are 18 mo. or below grade level; sometimes has difficulty working independently.
5	Moderate proficiency in reading; can work independently on materials that are approximately one year below grade level.
6	Above average.

Chapter I Teacher:

Selection into Chapter I Project yes__ No__ Date of entry__

Rating from TUSD Teacher Rating Scale_____

Test Name _____ Month & Year of Test_____

NCE _____ (or) Percentile _____ Other _____

To Teacher:

_____ has/has not been selected for participation in
(Name) Chapter I English Reading Project.

_____
(Chapter I Reading/Language Resource Teacher)

CH I Forms
Updated 8/20/86

APPENDIX C
Script Symbols

Instructions are indicated in regular print. What the teacher says to the class is indicated by larger bold print. Where the teacher asks a question, it is usually followed by regular printed material in parentheses. This indicates the answer(s) that teachers should anticipate or try to obtain. For example:

> Flip a quarter in the air and ask the students: **How many pennies in a quarter?** (25)

This sequence tells the teacher to perform the act of flipping a coin and then to ask a question and hope that the students will give an answer of 25.

Where the question is particularly difficult or tricky, there are usually additional suggestions for how to elicit the desired response(s). This is indicated by a row of question marks before and after the supplementary suggestions. For example, if the sequence above was followed by:

> ???

> Give a student 30 pennies and ask the student: **How many of these pennies would you give me for a quarter?**

> ???

This indicates that the teacher should hand out the pennies and ask this question only if the students did not get the original question correct. If the students originally answered correctly, then the teacher should skip over the material between the question marks.

A question with a dotted line above and below it indicates an alternative question or approach for younger or older students because the basic question is too easy or difficult for a specific subgroup. For example:

> ----------

> For third grade students, ask: **How many pennies in a nickel?** (5)

> ----------

This sequence indicates that this question should be substituted for the original for the youngest or least able students.

The symbol, ##, enclosing a question refers to a **'Common Element Question.'** Such questions ask students to find a common element in a series of words/concepts. An example would be:

What's a word that describes a car, a dog and a picture?

New key vocabulary words appear in capital letters, in outline form, and enclosed in quotation marks. For example,

'TRAIT'

These key vocabulary words, such as 'trait' should be emphasized and reinforced.

A word that appears in the answer with a double underline indicates that until the students have included this word, or a synonym, in their answers, they have still not grasped fully the meaning of the concept. Consider the dialogue below:

> **There are many types of patterns. Where have you heard the word patterns before?** (Sewing, clothes, and possibly others.) Hold up a piece of cloth with a pattern and ask: **Is this called a pattern?** (Yes) **Why?** (Because the lines and shapes repeat themselves.)

Until students tell you that the piece of cloth has a pattern because it has things that are repeating, they do not fully understand the concept of a pattern. Until they articulate the concept of repetition, you must keep on probing and waiting rather than accept more vaguely worded answers.

While most questions can be paraphrased, a box indicates that this question is so critical for decontextualization that it must be asked exactly as written. For example:

Why do you think that the options you worked with yesterday in the DAZZLE DRAW program were called tools? (Because you can make things with them.)

means that this question is a critical one that should be asked exactly, and not paraphrased by the teacher—lest its decontextualization value be lessened.

Information contained between »» «« are coaching suggestions you can use when the students go to the computers. For example:

»» As students write, tell them the correct spelling if they ask for help on a particular word ««

indicates that if the students ask for help with spelling, do not let them get bogged down on that detail while they are at their computers. Help them with their spelling so that they can focus on their ideas.

FINAL NOTES: The lessons are written in a language designed to be an approximation of how a teacher might talk to young at-risk students. All the questions and statements made by the teacher can be paraphrased into a language he/she feels comfortable with—except for questions enclosed in a box which must be asked exactly as written.

In addition, the reader should not expect that the anticipated answers listed in the lesson follow directly from the question. Eliciting these answers requires the HOTS teacher to invent several follow-up probes. The listed answers are, therefore, the result of a Socratic process rather than expected immediate responses.

ON YOUR OWN

UNIT TITLE: INTRODUCTION TO STRATEGY DEVELOPMENT

SOFTWARE: RIDE THE WIND—Side 2 of MICROZINE #2 disk

Pre-class setup: Load the program in the students' computers under the option 'How It Works' and press RETURN twice till the screen titled **'The Balloon'** comes up. Have the computer flying the balloon on the demonstration computer when the students come in.

Materials: Balloons (small balloons work better than large ones), posters and pictures having to do with hot air balloons.

STRATEGIES FOR PREDICTING UNKNOWN WORDS

1. Look for small words inside the big word
2. Use the context of the sentence and surrounding sentences

Day # of Unit: 1

PRE-TEACHING ACTIVITIES (Demos, linkages, result to be achieved):

Have the actual balloon race on the computer as the students come in, with the computer doing the racing. It would also be nice to have a picture showing people flying hot-air balloons and also have balloons flying around the room. (The more the better.) Explain that: **The computer is trying to land the balloon on the spot marked 'X.' Will it do it? Would you like to race a balloon on the computer? Okay! Can you figure out how to make a balloon go to a particular spot in the classroom (such as the door) without using your hands?** (Blow on it.)

Let's see if we can have three volunteers to blow the balloon, and let's see if you can blow it to the door. REMEMBER! NO HANDS! When they finally get it done, continue by telling students:

Today you are going to learn to be 'AERONAUTS'. Refer to the strategies poster, and ask: **Which of the first two strategies can we use to figure out what aeronaut means?** (Neither) **Why not?** (There are no sentences, or small words that we know.) Then say:

Metacognition

Correct! Then let's use the last strategy and look at the setting of the room. Judging from the setting you see around you what do you think an aeronaut is? As students respond, ask them which of the physical clues (e.g., Balloons and posters) their suggested answer is or is not consistent with. **##**

Inference from context

If students have trouble guessing the meaning of aeronaut, probe with: **Since we cannot use the context of a sentence to predict what aeronauts are, and there are no words inside it, we need a different technique. This technique is called 'sounds like'. What word do you hear a lot on TV news that sounds like the word aeronaut?** (Astronaut) **What is an astronaut?** (Someone who flies a space vehicle.) **So what do you think an 'aeronaut' is?** (Balloon pilot.)

Decontextualization

If students do not have trouble guessing what an aeronaut is, say: **In addition to using the setting to find out the meaning of the word, we can guess what an aeronaut is because it sounds like an 'astronaut'. Actually, we could have used the second strategy, as there are small words within the words. 'Astro' in astronaut means 'space', and what word does 'aero' in aeronaut remind you of?** (Air) **What does that have to do with flying a balloon?** (Flies on the air, uses hot air to fly, etc.) Then ask:

What determines the direction in which the balloon flies? (Where the wind blows.)

The wind blows in different directions at different heights. In order to control the balloon so that you fly in the direction in which you want to go, you move the balloon up and down to catch the right wind. The height of the balloon is measured in 'FT'. Does anyone know what this stands for? (Feet) **Show me with your hands about how big one foot is! The height is also called 'ALTITUDE'. The computer will tell you how to adjust the altitude of the balloon.** Then explain to the students:

In a real balloon race, the pilot tries to land the hot-air balloon first in a particular spot by using the wind to move it to where he/she wants to go. If you want to race a balloon on the computer screen, you are first going to have to figure out how to fly it—and you are going to have to figure it out on your own because I am scared of heights. As a result, I want you to go right to the computer, which is going to explain to you how to fly. Then say:

Information synthesis

I want you to work with a partner and race one balloon at a time by using your names for the balloons. Each should taken turns being the captain, with the other assisting.

Decontextualization

<u>NEW COMPUTER USE SKILLS</u>: Reading gauges.

<u>NUMBER OF STUDENTS PER COMPUTER</u>: Two. Each student pilots one balloon and assists on the other.

<u>POST-TEACHING</u>: **Why do you think the first balloon is called the 'Hare' and the second the 'Hound'?** (In hunting and everyday life the hound dogs chase the rabbit.)

EXPERIMENTAL HYPOTHESIS FORMULATION/TESTING

UNIT TITLE: INTRODUCTION TO STRATEGY DEVELOPMENT

SOFTWARE: RIDE THE WIND—Side 2 of MICROZINE disk #2

Pre-class setup: Have a poster, or blackboard space, available to write ideas for why balloons crash.

Materials: Stickers for successful pilots. (You may want to use stickers of other things that fly such as birds, planes, insects, *etc.* The most important thing, however, would be that the stickers would be highly motivating.) You may also want to keep up the chart from the previous day.

Day # of Unit: 3

PRE-TEACHING ACTIVITIES (Demos, linkages, generation of hypotheses):

A 'STRATEGY' is a way of doing something that improves our scores or helps us do things better. Let's see why the balloon is crashing. What do you think causes a crash and how can we avoid it? Have students discuss reasons why the balloon may crash and how they can avoid this problem. They should realize that if the balloon is too high up when they get over the target, it will crash. If they crash in the middle of the flight, it is likely that they have been flying all the time, or too long, at the maximum height which burned up all the fuel. List on the board all the reasons students suggest. There are others such as flying off course, hitting a bird, *etc.* If they do not get either of the first two reasons, probe as follows:

??

Why do you think you might crash during landing? What happens if you drop a water balloon off a roof? (It will explode because it is dropping from high up.) **Would you like to be high up in a balloon and drop straight down to land—What would happen?** (You would become soup.) What does this tell you about how to fly the balloon? (Keep the balloon as low as possible when you come in for the landing.) Then say:

I won't tell you what the lowest altitude is you can fly at to get ready for your landing because you are smart enough to figure it out. Did anyone crash in the middle of the flight? What did we talk about the first day that would explain that? (Burn too much fuel from heating up the air all the time, crash into trees.) **How can we avoid that problem?** (Do not fly at maximum altitude all the time.) **What's another reason why we might crash in the middle of a flight?** (Fly too low near a building or tree.)

??

Does that mean we should try a strategy of keeping the balloon close to the ground all the time—How many of you say 'yes'? How many say 'no'? Write 'possible strategy' on the blackboard, along with 'keep the balloon low at all times.' Have someone who guessed 'yes' come up and try to play the game, keeping the balloon low on your computer. Make sure the student keeps the balloon under 800 feet. The student will quickly run into problems. Ask the student:

Metacognition

Why is this strategy not working? (Cannot control the direction to get to the target spot.)

Does anyone remember the word used to describe the many different ways that things look or act? (Traits)

Decontextualization

Sometimes thinking about the traits of objects in a problem helps us develop a strategy for solving it. How many traits were there for the Moppets? (4—color, height, fat, Bibbit or Gribbit.) **The balloon also has several traits that determine how it acts. Height is one of them, what is another?** (Direction) **That's right. We, therefore, need a strategy that uses both traits, height and direction, for landing the balloon.**

How do we know a strategy is no good? (The problem is not solved, and you get a poor score.) **What do we do if we find out that a strategy does not work?** (Try another one.)

CHALLENGE ACTIVITY (Principle/strategy to be deduced, or tested):

I want you to try to figure out a better strategy to keep from crashing the balloon and write it in your notebooks. Go to the computer with your partner, and each of you control one of the balloons, flying them one at a time. When you land and score a bull's-eye call me over for a sticker for your notebook. Watch your gauges carefully.

NEW COMPUTER USE SKILLS: Reading gauges.

NUMBER OF STUDENTS PER COMPUTER: Two. Each student pilots one balloon and assists on the other.

Metacognition

POST-TEACHING: **What strategies did you find to be successful for landing the balloon? List your strategies.** (Most will realize that they need to drop down (south) in a way that gets them close to, but west of, the target so that they can catch the low altitude east wind which they can ride at 200 feet (the lowest possible altitude to fly at in order to land). It is important to be close to the target when you get west of it because the east wind is the slowest so you do not want to fly it for long distances.)

EXPERIMENTAL HYPOTHESIS FORMULATION/TESTING

UNIT TITLE: PATTERN MIND MAGIC

SOFTWARE: THE BANK STREET WRITER III

Pre-class setup: Loadt each computer with THE BANK STREET WRITER III and insert a student data disk. Prepare the demonstration computer with the demonstration data disk generated the previous day. Wear the THINKING WHIZard hat. The hats/patches /ribbons for each class reside on a table near the demonstration computer.

Make sure printers are ready to print. Set THE BANK STREET WRITER III for 40 column REGULAR print.

Materials: None.

Day # of Unit: 4

PRE-TEACHING ACTIVITIES (Demos, linkages, generation of hypotheses):

Today you are going to print your magic words. Does anyone remember which menu we used yesterday to retrieve and save our files? (File menu.) **And why is it called the 'File' menu?** (Get students to articulate that they are moving a file of information between the computer and the disk.)

Is anyone interested in printing out their writing? (Yes) **Which menu do you think you would to print?** (File.) **Why the 'File' menu?** (A file of information is to be printed.) **What does options mean?** (Choice) **Could the 'options' menu contain option to print?** (Yes) **Could it be the 'disk' menu?** (Probably not)

Inference from content

Between options and file, which would do you think would be involved in printing, and why? (File, because you are printing a file. It's the better answer, or it's closer to the truth.)

I am going to switch to the file menu and choose the 'Print File' option. The computer then asks a series of questions. You can answer them by simply pointing to the box with the word 'RETURN'. Quickly demonstrate how to start the printing process.

If you want to get fancy, see if you can figure out how to print two copies? Before you start printing, I want to show you one more thing. I am now going to be an editor. Does anyone know what the 'EDITOR' of a newspaper does? (Decides on the stories and fixes things in the stories that the reporters write.)

English analog

Which menu do you think I would use to change things that I have written? (Edit) Move the mouse until it points to 'Erase'.

What does the first word 'ERASE' mean? What do you predict it does in a word processor? List student hypotheses.

English analog

What do you predict the choice 'MOVE' does? List student hypotheses.

CHALLENGE ACTIVITY (Principle/strategy to be applied or tested):

When you finish printing or while you are waiting for the printer to become available, experiment with the 'Erase' and 'Move' options. When you click the options the computer gives you clues on what to do. Anyone who can demonstrate what these capabilities do, and how to move the first word to the end of the page, gets a sticker/star on their THINKING WHIZard hat/ patch/ribbon. Just play around. You don't have to worry about messing things up because they can be fixed.

»» Students who figure out the answers quickly should be encouraged to explore other EDIT menu options. ««

NEW COMPUTER USE SKILLS: Moving between menus, using the file catalog, retrieving a file, modifying a file using Edit commands, printing and saving a file.

NUMBER OF STUDENTS PER COMPUTER: Two.

EXPERIMENTAL STRATEGY (Method of data collection by student):

Seeing results of use of commands on screen.

POST-TEACHING:

If students succeed in doing any editing, write EDIT on THINKING WHIZZard hats. Put a star on their hat/patch/ribbon if they demonstrate moving the first word on the page to the end of the page. **What did the 'Erase' and 'Move' commands do? How did you find out? How can you move a word from the beginning to the end of the page?** Have students articulate their findings and discoveries.

NOTE: If students do not press RETURN at the end of a partial line, the writing on that line will be stretched across the page. If you see that occur in a student's printout, point out the difference between what they see on the screen and their printout, and quickly insert the RETURNS and let the students print again (if there is time).

Note. From The Hots Approach to Using Computers With At-Risk Students (pp. 224-232) by S. Pogrow, 1990, Tucson, Az:Thinking With Computers.

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