USING THE WECHSLER ADULT INTELLIGENCE SCALE-REVISED

TO PREDICT VOCATIONAL APTITUDES OF ADOLESCENTS

WITH LEARNING DISABILITIES

by

William H. Brown

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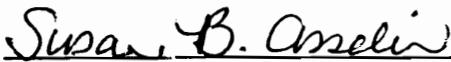
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APPROVED:

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Thomas H. Hohenshil, Chairperson

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Susan B. Asselin   Douglas T. Brown

_____   _____
Jimmie C. Fortune   Sharon Ferguson

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(ABSTRACT)

Recent national longitudinal studies of special education students indicate that schools should concentrate on developing students' skills matched to the requirements of their potential occupations. Evidence suggests that the experience of career development among adolescents with learning disabilities is especially frustrating without early exploration and planning. This study investigates the value of using available psychometric data in assisting the school psychologist and other professionals to make initial exploratory estimates of vocational aptitude without referring the student for specialized vocational assessment.

General Aptitude Test Battery (GATB) and Wechsler Adult Intelligence Scale-Revised (WAIS-R) scores were used in multiple regression analyses to examine the predictive relationships existing between the two instruments. The population studied included 172 adolescents with learning disabilities enrolled in a public school division. The analyses in this study reveal a high degree of validity

between the GATB and WAIS-R. However, the prediction equation appears unsuitable for using the WAIS-R subtests for predicting GATB aptitudes. Aptitude F explains the highest degree of variance. Other squared multiple regressions range as low as .13 for Aptitude Q to as high as .52 for Aptitude S. Results suggest that even though the GATB and WAIS-R share common variance, there is enough independent information provided by each test to warrant employing both in order to insure that the students' vocational aptitudes are fully diagnosed.

Implications for school psychologists and other professionals doing exploratory assessments of vocational aptitude from available WAIS-R subtests are discussed, as are assessment issues regarding adolescents with learning disabilities. [140 References]

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CHAPTER I

Introduction

The profession of school psychology, which was traditionally concerned with issues related to the education of elementary school aged students, has experienced tremendous growth over the last two decades due to legislation regarding the rights of individuals with disabilities. During the past decade school psychologists have taken responsibility for development, use, and interpretation of psychometric tests related to the ability and aptitude of secondary special education students to help them in career planning. It is crucial that this population of students be given the appropriate guidance in order for them to make a successful transition from school to the world of work.

Hohenshil (1987) stressed that the National Association of School Psychologists (NASP) saw vocational assessment and consultation a necessary part of a school psychologist's repertoire of skills. NASP has also included vocational assessment and consultation in its service provision standards since 1984.

Brody-Hasazi, Salembier, and Finch (1984) indicated that prior to the early 1970's most secondary special education programs emphasized the mastery of skills and knowledge not acquired at the elementary level such as functional reading and arithmetic as well as self care. Since today a large number of students with disabilities have already mastered

those skills prior to entering secondary level programs, these students as well as their parents began to expect the school curriculum to include vocational skills needed to secure employment following graduation from high school. Some students with disabilities require only minor adaptations in the regular vocational curriculum, some students require none, while others need individualized programs and additional work placement experiences. Although increased attention has been given to the vocational preparation of students with disabilities, a recent Department of Education report (Wagner, D'Amico, Marder, Cox, Newman, Butler-Nalin, & Jay, 1991) indicated that only 46% of parents reported that their disabled offspring currently had a paid job two years after leaving secondary school. Rates of current employment ranged from 8% of youth with multiple disabilities to 58% of youth with learning disabilities.

The Individuals with Disabilities Education Act (U. S. Congress, 1990) generated new dimensions for special education programs in Virginia. The Act expanded the definition of transition and mandated a statement of transition needs, as well as services, in the Individual Education Program (IEP) of every special education student by the age of sixteen. Cooperative planning by educators, parents, students, post-secondary education and human service agencies is now needed for students with disabilities to adjust effectively to the work force and appropriate vocational assessment is a

necessity in the planning process (Anderson, 1992).

Hohenshil, Levinson and Buckland-Heer (1985) asserted that vocational assessment is necessary for planning for secondary level students with disabilities, and vocational assessment usually includes an evaluation of psychomotor skills, interests, aptitudes, occupational/social skills, work habits, life skills, and vocational style. Also, Hohenshil, Levinson and Buckland-Heer (1985) further contended that assessment techniques are used such as paper and pencil tests, behavioral observations, interviews, work samples, performance tests, and real as well as simulated work experiences. Information is provided which enables school personnel to develop appropriate vocational goals for students who have disabilities as well as to identify the instructional techniques that would be used to reach these goals successfully. Thus, the probability of students with disabilities acquiring skills which may lead to employment following the completion of school is significantly enhanced.

Rationale for the Study

According to a recent national longitudinal transition study of special education students (Wagner, D'Amico, Marder, Cox, Newman, Butler-Nalin, & Jay, 1991) it is especially important that schools develop students' skills and match those skills to the requirements of their occupations. For instance, while students with reading problems had difficulty

finding employment in occupations where reading was important, they often did well in certain sales and managerial positions where the ability to work with people was more important. Hasazi, Salembier, and Finch (1983) as well as Wehman, Kregel, and Barcus (1985) found four essential factors in schools' efforts to match students' skills with prospective jobs: (1) Assessment and Counseling: Identifying the vocational interests and aptitudes of students as well as an optimal matching of a student's abilities and interests with the local labor market's needs is of paramount importance for youth with disabilities; (2) Training: Specialized job skills as well as generalized work skills in the assessed area of interest must be developed using both community-based work experience and classroom training; (3) Job Placement Assistance: Job opportunities available in the local labor market must be identified and the student's job search skills must be developed; (4) Transition Services: Individualized transition plans, linkages with other social service agencies, and follow-up assistance need to be implemented.

Heinlein (1987) conducted a study to explore the utility of the Wechsler Adult Intelligence Scale-Revised (WAIS-R) as an estimate of vocational aptitude. Correlational techniques were applied using the scores of the WAIS-R and the General Aptitude Test Battery (GATB). Prior to this investigation there was only one known study which investigated the Wechsler scales from a vocational perspective, and that study was of

the Wechsler Intelligence Scale for Children (WISC) relative to the GATB using a Mentally Handicapped (MH) sample. Heinlein (1987) used a sample of young adults with learning disabilities in a vocational rehabilitation center. The results of Heinlein's study reveal that the WAIS-R profile could be used to identify vocational factors; however, he stressed that his sample had restrictions. Heinlein stated that "although it is felt that generalization to the population of adult LDs enrolled in such vocational rehabilitation is possible, this group is not specifically typical of LD groups found in public school settings" (p.129). Heinlein stressed the need to further investigate the generalizability of his findings. He suggested that more heterogeneous samples be analyzed such as one in a public school setting rather than a vocational rehabilitation center.

Purpose of the Study

The purpose of this study is to investigate whether the WAIS-R will provide a functional set of scores useful for the estimation of vocational aptitude in a sample population of high school students with learning disabilities. The intent of this investigation is to determine whether correlations existed between the various scores on the WAIS-R and GATB administered to students at the secondary level with learning disabilities in a public school setting.

Research Questions

Two research questions will be considered in this study:

1. Are there predictive relationships among aptitude scores measured by GATB and subtest scores measured by WAIS-R?

2. Can WAIS-R subtest scores or combinations of WAIS-R subtest scores be used to measure vocational aptitudes?

Operational Definitions

1. <u>Learning Disability</u>: The Danville Public Schools adopted the definition of learning disability included under the Regulations Governing Education Programs for Handicapped Children and Youth in Virginia of 1990 (Division of Special Education, 1990).

> Specific learning handicaps means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations. The term includes such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. The term does not include children who have learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, of emotional disturbance, or of environmental

cultural, or economic disadvantage (p. 27).

2. GATB: Complete definitions of as well as statistics for, the General Aptitude Test Battery aptitudes and those of its subtests are given in Appendix B.

3. WAIS-R: Complete definitions as well as technical statistics for the Wechsler Adult Intelligence Scale-Revised and its subtests are provided in Appendix C.

Limitations of the Study

1. Ex-Post-Facto research: Ex-Post-Facto research is a method of investigation in which one does not have direct control because phenomenons among variables have already occurred (Kerlinger, 1973). This approach is used in the present study. Without direct intervention inferences are made about relations among variables.

2. Sample: The sample is restricted to a group of students aged 16 to 20 participating in Individualized Educational Programs for specific learning disabilities in a public school setting. Generalization to other adolescents, or other disabilities will introduce error variance.

3. Restriction of range: Restriction of range referring to test scores means that the test scores for one group are reduced to a small portion of the possible range of scores. This investigation utilized GATB and WAIS-R test scores from one sample of 172 students with learning disabilities which may not be representative of the

broader WAIS-R/GATB standardization groups. Samples from a restricted range will have smaller standard deviations than unrestricted samples. It should be acknowledged that correlations between tests, subtests, or factors in this investigation may be lower for this sample of students with learning disabilities than for samples whose scores are not restricted.

Summary of Chapter I

The purpose of this study is to explore the utility of the WAIS-R (Wechsler, 1981) as an estimate of vocational aptitude. More specifically, is there statistical overlay among subtests measured by the WAIS-R and subtests measured by the General Aptitude test Battery (United States Employment Service [USES], 1970, 1980)? In other words, can the WAIS-R scores be meanfully correlated with GATB scores in a group of adolescents with learning disabilities in a public school setting? It is hoped that scores from the WAIS-R can be interpreted from a vocational perspective.

The accessibility of such a paradigm to school psychologists and other professionals will allow them to interpret available test scores from a vocational standpoint. This would provide additional vocationally oriented information for school psychologists and other professionals to help secondary special education students make vocationally oriented choices and plan transition from school to work.

CHAPTER II

Review of Relevant Literature

A review of pertinent literature to this study is given in this chapter. Studies concerning adolescents with learning disabilities, General Aptitude Test Battery, and the Wechsler Adult Intelligence Scale-Revised are presented. The impact of the learning disability on academic, social, and vocational development is covered.

Research on Vocational Development of
Adolescents with Learning Disabilities

The vocational phase of personality and social development has long been a prominent area of psychological study and practice even though school psychology has only recently been involved in the career development of youth with disabilities (Hohenshil, 1984). The interdependence among personality, social, and career development is well documented in the literature (e.g., Brown, 1981; Brown & Brooks, 1984; Bordin, Nachmann, & Segal, 1963; Erikson, 1968; Ginzberg, 1972; Holland, 1966; Mitchell, Jones, & Krumboltz, 1979; Super, 1957; Super, 1980; Tiedeman & O'Hara, 1963).

There has been a considerable amount of vocational research focused toward population without disabilities. However, less attention has been directed toward vocational research involving individuals with disabilities (e.g., Flynn & Nitsch, 1980; Heinlein, 1987; Herr & Cramer, 1979;

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Hohenshil, 1982; Hohenshil & Warden, 1978).

The area of specific learning disabilities is the most recently established category of learners with disabilities, and there have been many disagreements over the definition (Epps, Ysseldyke & McGue, 1984; Hammill, 1990; Mercer, King-Spears, & Mercer, 1990; Reynolds, Wang & Walberg, 1987; Sarkees & Scott, 1986). Until the 1960s students with learning disabilities were mislabeled and placed in special education programs designed for students with emotional or mental disturbances. However, it is currently well established that individuals with learning disabilities have unique learning difficulties.

The definition of a learning disability used by public schools in the United States was established by federal law in the Individuals With Disabilities Education Act (U.S. Congress, 1990). The definition uses exclusionary and inclusionary criteria to define specific learning disabilities as follows:

> Specific learning disability means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell or to do mathematical calculations. The term includes such conditions as perceptual handicaps, brain injury, minimal brain dysfunction,

dyslexia, and developmental aphasia. The term does not include children who have learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage (p. 1019).

Wagner, D'Amico, Marder, Newman, and Blackorby (1992) stated that research on the general population of youth indicates that it is common for youth to flounder for a period of time after secondary school, but this changes with employment experiences and with the completion of postsecondary education and training. However, the pattern for youth with disabilities may differ. Youth with learning disabilities depend to a large degree on their secondary school experiences, job placements, or services planned for them during secondary school. As job opportunities change with time, some individuals who need continued help may not receive it, and find themselves without initial jobs and resources to find others.

The Individuals with Disabilities Education Act (U.S. Congress, 1990), includes a definition of transition services to resolve this problem. In Section 602 (a) 19 transition is defined as:

a coordinated set of activities for a student, designed within an outcome-oriented process, which promotes movement from school to post-school

activities, including post-secondary education, vocational training, integrated employment, continuing and adult education, adult services, independent living, and community participation. The coordinated set of activities...shall include: instruction, community experiences, development of employment and other post-school adult living objectives, and, when appropriate, acquisition of daily living skills and functional vocational evaluation (p. 1103).

School personnel are required to make appropriate plans for all identified youth with a disability and the plans are to be included in their Individualized Education Program (IEP). The transition plans offer a bridge for students with disabilities to go successfully from school to work.

Hasazi, Gordon, and Roe (1985) contended that vocational education is important for individuals with learning disabilities to make a successful transition from school to the job market. This contention was supported in the First Comprehensive Report from the National Longitudinal Transition Study of Special Education (Wagner, D'Amico, Marder, Cox, Newman, Butler-Nalin, & Jay, 1991). The report indicated that while 63% of students with learning disabilities who had participated in vocational education were employed, 48% who did not take part in vocational education were not employed.

The mandated transition services appear to be helpful

over time for the population of individuals with learning disabilities. In the Second Comprehensive Report from the National Longitudinal Transition Study of Special Education Students (Wagner, D'Amico, Marder, Newman, & Blackorby, 1992) it was reported that:

> When they had been out of secondary school 3 to 5 years, their rate of employment was virtually equal to those of youth in the general population. Forty percent or more were living independently 3 to 5 years after leaving school, a sizable increase in residential independence over the earlier time period. These youth were among the most socially active; few were socially isolated (pgs. 5-6).

However, youth with learning disabilities experienced the highest dropout rates compared to any of the disabilities categories. A very small portion had returned to complete their secondary education 3 to 5 years after exiting school. Furthermore, only approximately 15% of youth with learning disabilities had finished a postsecondary education program, and a very few were still working toward that goal (Wagner, D'Amico, Marder, Newman, & Blackorby, 1992).

Research on Adolescents with Learning Disabilities

A review of literature concerning the adolescent with learning disabilities population revealed two major areas of investigation. Studies were primarily concerned with issues

related to either: (1) academic/cognitive, or (2) social/personality. A brief survey of studies which are pertinent to the two addressed areas will be given.

Academic Characteristics of Adolescents with Learning Disabilities

An abundance of research was conducted on the academic characteristics of adolescents with learning disabilities. The majority of the studies focused on reading ability; however, many dealt with issues involving written language, spoken language, and math ability. Also, varied techniques of academic intervention were reviewed. Halmhuer and Paris (1993) noted that to be classified as learning disabled, a student must demonstrate a specific deficit in a psychological process necessary for education such as writing, spelling, reading, language usage, or arithmetic. Cohen (1985) stated that learning becomes more complex and demanding as children reach adolescence. Both academic demands and pressure related to college or career path increase at this stage. Furthermore, adolescents are increasingly expected to work with less supervision and support from teachers and parents.

Houck (1984) indicated that basic skill proficiency is assumed by the secondary level, and content teachers are not prepared to deal with the instructional needs of students with learning disabilities. Cohen (1985) contended that adolescents with learning disabilities experience two

configurations of problems with learning which are as follows: (1) Problems resulting from the cognitive disability itself; and (2) Problems resulting from psychological factors which are directly and/or indirectly related to the learning disability. Houck (1984) pointed out that even though the need is recognized, the organizational structure and caseload of each teacher causes the task to be more difficult. As the students with learning disabilities progress through the grades, the new pressures they meet require the use of varied strategies if they are to achieve. However, Smith and Dowdy (1993) emphasized that students with learning disabilities currently make up the largest single disability group served in special education.

Research indicated that learning disabilities remain with an individual throughout the life span (e.g., Kroll, 1984; Scarborough, 1984; & Velluntino, 1987). Although the disability remains, Perlmutter (1987) stressed that by the time students reach adolescence it seems many youth with learning disabilities have learned to compensate for their disabilities. Individuals with auditory processing problems have learned they can compensate in class by taking copious notes. He or she may learn to compensate for poor listening skills by transforming the task of auditory comprehension into one of written comprehension. As a blind individual trains him or herself to attend to tactual and auditory input, many adolescents with learning disabilities, after realizing their

weakness, have learned to compensate by using their strength. However, there are many students with learning disabilities who are not so fortunate.

Byring and Pulliainen (1984) discovered that neurological deficiencies remain in older adolescents with dyslexia including problems of fine motor skills, manual sequencing, phoneme manipulation, auditory sequential processing, and generalized disfunction of the left cerebral hemisphere. The discoveries of psycho-educational and neuro-psychological dysfunction have for the most part been seen in all socio-economic classes of individuals with learning disabilities as well as in all cultural and national settings (Michelsson, Byring, & Bjorkgren, 1985; Scarborough, 1984).

Haig and Paterson (1981) reported that the following academic characteristics were still being exhibited by individuals with learning disabilities into adulthood: Confusion with words, word comprehension difficulties, immature hand-writing skills, spelling difficulties, mono syllabic speech, problems remembering math processes from day to day, poor performance in some areas while excelling in others, difficulty organizing time, difficulty organizing notes, and difficulty organizing ideas. Although many adolescents with learning disabilities have severe problems with academic tasks, with the appropriate teaching techniques they can learn (Hutchinson, 1993; Minskoff & Demoss, 1993; Zawaiza & Gerber, 1993; Zentall & Ferkis, 1993).

Smith and Dowdy (1993) stated that students with learning disabilities were receiving ample services in public school programs, but they left secondary schools without skills needed to be successful adults. In the Second Comprehensive Report from the National Longitudinal Transitional Study of Special Education Students (Wagner, D'Amico, Marder, Newman, & Blackorby, 1992) it was reported that about one-third of youth with learning disabilities dropped out of secondary school, and only a few had returned to finish their secondary education 3 to 5 years after leaving. Furthermore, just about one-third of youth with learning disabilities had enrolled in postsecondary schools of various types, only about 15% had received a certificate, license, or degree, and fewer were continuing to work toward finishing programs.

Leonard, (1991) stressed that youth with disabilities entering the postsecondary educational arena are at a greater disadvantage than they were in the secondary one if they are not provided some specialized services to meet individual needs. However, Cohen (1985), and Strichart and Mangrum (1985) discussed procedures students with learning disabilities could use to find appropriate colleges or postsecondary programs.

Social and Personality Issues

There has been growing concern about the social and emotional features of adolescents with a specific learning

disability. An Interagency Committee of Learning Disabilities (LaGreca and Vaughn, 1992) recommended the adoption of a new definition of learning disabilities which included social skills deficits as a specific learning disability. However, neither Congress nor the United States Department of Education has approved the adoption of the definition.

In the past, learning disabilities were thought to significantly affect only the academically related skills of an adolescent, but it has become apparent that learning disabilities have just as great an impact on social and personality development. Schulman (1984) asserted that only recently have two major misconceptions about learning disabilities been exposed. First was the concept that the learning disability was, in most cases, a temporary delay in the maturation of that part of the central nervous system that controlled the affected function(s) and that the disability would correct itself spontaneously during puberty. Second, a learning disability had in the past been thought of as only affecting academic skills, but it has become increasingly clear that a learning disability has a great impact on the social and emotional experiences of a developing individual as well. Cohen (1985) found in a review of some six studies that "specific cognitive deficits usually do not disappear with age. In fact, they affect learning and psychological development during adolescence and beyond" (p. 178). It appears well established that the information processing

problems of children with learning disabilities remain unchanged into adulthood (e.g. Pihl & McLarnon, 1984; Sitlangton & Frank, 1990).

Schulman (1984) stressed that youth with learning disabilities rarely grow up in an environment where their disability is sufficiently understood. As a result of this lack of understanding, few avoid significant emotional scarring. Cohen, (1985) asserted that there were virtually no adolescents with learning disabilities who did not experience significant psychological conflicts. In a review Wiener (1987) found that of 19 studies, 15 found students with learning disabilities were not accepted as well as their nondisabled peers; however, none of the studies found students with learning disabilities to demonstrate better social functioning. Longitudinal research has shown that low levels of peer acceptance during the fifth and sixth grades predict adolescent dysfunction indexed by such behavior as dropping out before completing high school (Parker and Asher, 1987).

The adolescent with a learning disability certainly needs more than appropriate assessment techniques and remedial teaching (Wetherley, 1985). Although by definition the term learning disability excludes individuals whose learning problems are primarily caused by emotional disturbances, a close association with emotional difficulties is usually reported (Schachter, Pless, & Bruck, 1991).

Bender (1987) concluded from a study that adolescents

with learning disabilities exhibited secondary personality and behavioral difficulties in school. Differences were found between groups of adolescents with learning disabilities and without learning disabilities in the areas of locus of control, self-concept, problem behavior, and social acceptance. The group with learning disabilities exhibited overall deficits in each area. Omizo, Cubberly, and Longano (1984) found adolescents with learning disabilities to experience higher levels of anxiety, external locus-of-control, and lower aspirations. Maag and Behrens (1989) discovered that depression was a prevalent condition among many adolescents with learning disabilities. These studies clearly suggest significant learned psychological dysfunctions in the population of adolescents with learning disabilities.

Raviv and Stone (1991) indicated that adolescents with learning disabilities often experience social difficulties as a result of social-perceptual deficits. Many of them did not read interpersonal cues correctly and did not perceive and interpret subtle distinctions necessary for successful social interactions. Pearl, Bryan, and Herzog (1990) found that many adolescents with learning disabilities had expectations for particular situations that made them more vulnerable to proposed misconduct by other students. For example, because students with learning disabilities expected requests to be made directly rather than by persuasive strategies, they did not really understand what was being asked of them when

persuasive tactics were employed.

Grande (1988) found that male adolescents with learning disabilities are targeted as possible candidates for delinquent behavior. Bryan, Pearl, and Herzog (1989) conducted a study to investigate adolescents with learning disabilities vulnerability to crime through a survey of their social concerns and experiences. The results indicated that although most illegal activities are of low frequency, the adolescents with learning disabilities are at higher risk to be involved than their classmates without learning disabilities.

Schumaker (1992), through a review of research, concluded that adolescents with learning disabilities are not social isolates, but are less involved in formal social activities than their peers. Adolescents with learning disabilities have less developed social skills than their nondisabled peers and perform socially in similar ways to other socially at-risk individuals. In addition, not only can these youngsters learn social skills strategies at rates and levels of mastery compatible to their peers, they can learn to generalize newly learned social skills strategies to naturally occurring situations.

It appears conclusive that many adolescents with learning disabilities need counseling for a variety of reasons. Wetherley (1985) stressed that individual counseling is an effective way to help adolescents with learning disabilities.

Omizo, Cubberly, and Longano (1984) suggested that group counseling may be useful in order to help eliminate self-defeating behaviors and feelings while showing these adolescents that they have internal control over self-defeating behaviors. Schumaker, Hazel, Sherman, and Sheldon (1982) suggest that training in the areas of deficiency might be an effective technique for youths with learning disabilities who exhibited social skills deficiencies. Also, Maag, Rutherford, and Parks (1988) recommend that cognitive-behavioral techniques be used to remediate social deficits in students with learning disabilities. Schumaker (1992) concludes from a review of current studies that "carefully programmed generalization training can enhance youths' generative use of social skills strategies across settings and naturally occurring situations" (p. 396). Bellafiore (1993) stresses that one of the biggest challenges every adolescent faces is deciding what direction his or her life should take and finding a place in society. For the student with learning disabilities who has problems seeing himself or herself as part of the social context to begin with, this challenge becomes ever more complex.

Research Pertinent to WAIS-R:

Wechsler Adult Intelligence Scales-Revised

In this section a review will be done of studies concerning the statistical properties, score analysis, and the

vocational as well as adolescent with learning disabilities application of the WAIS-R. For details with respect to administration, scoring, and statistical properties, the WAIS-R Manual (Wechsler, 1981) should be consulted. Definitions of WAIS-R subtests, the six global factors, reliabilities, and standard errors of estimate for each subtest are given in Appendix B.

WAIS-R Standardization, Reliability, and Validity

The norms of the WAIS-R are composed of a group of 1,800 individuals ranging in age from 16 to 74 years inclusive. Following the 1970 census reports, this sample was stratified according to gender, nine age groups, four levels of region, two levels of race, five levels of education, six levels of occupation, and by urban or rural residence. The adequacy of the standardization compared to other editions and other instruments has been well established (Herman, 1982; Matarazzo, 1985; Matarazzo & Herman, 1984). Individuals with learning disabilities were not specifically included.

The reliabilities reported in the standardization sample for the WAIS-R are overall superior for psychometric instruments and comparable to the reliabilities and standard errors reported for the WAIS-R (House & Lewis, 1985). Ryan, Prifitera, and Larsen (1982) conducted a study of the split-half reliabilities and standard error of measurement using a diagnostically heterogeneous sample of Veterans Administration

patients. Reliability coefficients and standard errors of measurements for the subtests were found to be similar to those reported in the standardization group with the exception of Arithmetic. Also, internal consistency appeared to be adequate. Ryan, Georgemiller, Geisser, and Randall (1985), using a similar sample of Veterans Administration patients, found stable Verbal, Performance, and Full Scale IQ global scores. The same results were discovered by Matarazzo and Herman (1984).

Validity data was not reported in the manual for the WAIS-R; however, references were made to the data backing the validity of the Wechsler-Bellevue, and WAIS. House & Lewis (1985) asserted that this explanation appeared easily justifiable considering the basic identity and very significant overlay in item content between the tests. Matarazzo (1972) presents an extensive review of the validity data on the earlier tests, and the WAIS-R manual (1981) reported his findings. The correlation between the WAIS Full Scale IQ and Stanford-Binet Intelligence Scale IQ test in school was about .50. Also, the manual reported results from Wechsler (1955) of a study including prison inmates which indicated a correlation between the WAIS Full Scale IQ and Stanford-Binet Intelligence Scale IQ of .85.

Kevale and Forness (1984) conducted an extensive study meta analysis of the validity of the Wechsler scale profiles and recategorizations. On the one hand, they found sound

validity indexes based on the Verbal, Performance, and Full Scale IQs. On the other hand, no basis was established for the scales to be used for profile and scatter analysis. In other words, according to their study, there is no basis for using the Wechsler Scales for a differential diagnosis of learning disabilities. However, the scales have proven valid and reliable for assessing the intelligence of students with learning disabilities.

In summary, the WAIS-R appears to demonstrate a high level of reliability for both split-half and test retest. The global IQs have proven very reliable as well as the subtest scaled scores (Kaufman, 1985). Concurrent validity has been verified with the original WAIS and the Stanford-Binet. The WAIS-R has proven quite adequate content validity as will also be shown later in the review of factor studies.

WAIS-R Factor Studies

A profusion of factor analytic studies of the structure of the WAIS and WAIS-R is found in the research literature. Most of the factor analytic studies are in accordance with and explained from the perspective of two paradigms. The first by Vernon (1950) consists of a general (g) factor and two major group factors including a verbal-education (v:ed, and spatial-perceptual (k:m). The second paradigm proposed by Cohen (1957) makes up three factors (Perceptual Organization, Verbal Comprehension, and Factor III: Memory, or Freedom from

Distractibility). Matarazzo (1972) reviewed these studies in detail. Many of them were replicated using the WISC-R.

Heinlein (1987) states that a number of factor analytic studies were completed with the WAIS-R, but most using the standardization sample. Silverstein (1982a) employed principal-factor analysis for the nine age groups. A two-factor solution was selected for all age groups, while an additional three-factor solution was used for the three youngest groups. The Vocabulary, Comprehension, Similarities, and Comprehension subtests loaded highest on the first-factor. Object Assembly and Block Design loaded the second factor. Silverstein assumed that these were fundamentally the Verbal Comprehension and Perceptual Organization factors earlier identified for the Wechsler-Bellevue and WAIS. He concludes that his results justify the interpretation of the WAIS-R Verbal and Performance global IQs. The third factor which was found for the three youngest age groups demonstrated inconsistency across the age groups. For the age groups 16 to 17, as well as 20 to 24 years, it appeared to be the earlier illustrated Factor III, Freedom from distractibility, with high loadings on Arithmetic, Digit Span, and Digit Symbol. However, for the 18 to 19 age group the highest loadings were found on Picture Arrangement, and Object Assembly. Furthermore, Silverstein checked specific variance for the WAIS-R and found that Arithmetic, Digit Span, Picture Completion, Picture Arrangement, Block Design, and Digit

Symbol retain adequate variance to warrant specific interpretation.

Silverstein (1982b) later considered the statistical difficulties in producing multiple comparisons of subtest scores and gave a solution depending on the standard error for the comparison of an individual's score on each of the various Verbal and Performance subtests in conjunction with an average Verbal or Performance subtest score or the overall average. Silverstein (1982c) gave the differences needed for significance at the .05 and .01 levels in comparing the subtest scores of the WAIS-R. Silverstein (1985) subsequently replicated these factors analytic studies and found almost identical results.

Parker (1983) also carried out a principal-factor analysis of the standardization data which was followed by a varimax rotation. He found two, three, and four factors for each age group. Parker concludes that the two-factor solutions reinforce the Verbal and Performance breakdown. He determines that the three-factor solution generated, apart from the 18 to 19 and the 45 to 54 year old groups, the Perceptual Organization, Verbal Comprehension, and Freedom from Distractibility factors. Parker states that the four-factor solution resolves the confusion of pattern in the two age groups. He reports that Picture Completion and Picture Arrangement have test specificity to a high degree and seemingly measure constructs apart from the other subtests.

Blaha and Wallbrown (1982) did an additional analysis of the standardization data utilizing a hierarchical factor solution. Three identified factors were as follows: (1) a general g factor, which loaded highest on Comprehension, Information, Similarities, and Vocabulary; (2) group factor called "verbal educational" with the highest loading on Comprehension, Information, Similarities, and Vocabulary; and (3) a minor group factor called "spatial-perceptual" with the highest loading on Block Design and Object Assembly. Their findings give additional evidence for the construct validity of the WAIS-R as a test of general intelligence. They found that the general intelligence factor accounted for about 47% of the total subtest variance for the nine age groups. Wechsler's separation of the Verbal and Performance IQs was also supported. Also, Blaha and Wallbrown (1982) conclude from their analysis that the significant discrepancies between the Verbal and Performance IQs as well as specific subtests could be used to form clinical hypothesis. However, they warn that the examiner should be very cognizant of the limitations and treat the hypothesis as tentative.

Nagliere and Kaufman (1983) used the WAIS-R standardization data to investigate various objective methods for determining the correct number of factors which would best show the factorial structure of the WAIS-R. They found that the two and three factor solutions were the most justifiable. The ones identified were a Verbal Comprehension factor, a

Perceptual Organization factor, and sometimes, a Freedom from Distractibility factor. Nagliere and Kaufman (1983) conclude that Freedom from Distractibility factor should be interpreted when one of the subtests most often defining it, including Arithmetic, Digit Span, and Digit Symbol, deviates significantly from its respective scaled score mean.

Insua (1983) conducted a factor analytic study using data independent of the standardization group. He studied a sample of white Americans and one of Spanish speaking foreign nationals utilizing a principal factor analysis. His findings provide additional support for the three-factor solutions in both samples.

Atkinson and Cyr (1984) also conducted a factor analytic study utilizing data independent of the standardization group. They used a sample of 114 psychiatric inpatients and identified a three factor solution much like the investigations of the standardization sample. However, Ryan, Rosenberg, and DeWolfe (1984) found only two factors in their study of a small group of 85 veterans receiving vocational rehabilitation.

In summary, there appeared to be enough evidence to support the three factor composition of the WAIS-R. It appears conclusive from the studies that there are at least verbal and spatial factors. Furthermore, most of the investigation supported the existence of a concentration factor. In addition the reviewed studies suggest that there

was enough specific variance observed among the subtests to justify clinical hypothesis being made from a pattern of subtests.

Vocational Application of the WAIS-R

Professionals in the field of vocational evaluation and counseling make regular reference to the individual intelligence test primarily concerning its utility for predicting the clients potential for achieving at a particular education or occupational level. The relationship between occupational level and IQ test scores has been reported by many researchers. Matarazzo (1972) completed a comprehensive review of this literature. House and Lewis (1985) addressed the contributions the WAIS-R has made to vocational assessment and planning.

Herman (1982) indicates that the standardization data of the WAIS-R revealed a moderately strong relationship between mean IQ and occupational level. Considering the employed individuals which were included in the norms, there was a mean scatter of 22 points between individuals in occupational groups 1 and 5 (high/low categories of employed) which reflects a moderately strong relationship between job level and mean IQ.

Heinlein (1987) pointed out that the first reference regarding the use of the Wechsler Adult Intelligence Scale (WAIS) in a specifically vocational context with a disabled

group was Drasgow and Dicher (1965). The WAIS was one test of a battery utilized to predict whether psychiatric clients were ready for vocational rehabilitation. Drasgow and Dicher (1965) concluded from this study that the global IQ scores were predictive of vocational rehabilitation success.

The first validation study of the WAIS intended for the purpose of predicting potential achievement in both a clinical and vocational setting was by Webster (1974). He studied the relationship between the Block Design and Object Assembly subtests of the WAIS to six different types of practical work samples. The hypothesis was that individuals with divergent types of disabilities would show divergent predictability patterns on the WAIS with regards to their level of proficiency on the actual work samples. Webster found no significant differences, but he strongly recommends the use as well as the investigation of the WAIS in future vocational prediction studies. Weakness of his design were noted such as a sample of 160 individuals with physical, psychiatric, and neurological disabilities, and 29 t tests as the only analysis.

Webster (1979) changed his method in a later study by investigating the use of the WAIS Block Design, Object Assembly, Performance IQ and Full Scale IQ in combination with age, degree of emotional severity and psychiatric disability to predict the vocational success of 180 psychiatric outpatients. He stated that "although no significant

statistical differences were found that favored the use of regression equations derived for each individual psychiatric group as opposed to those derived from the total sample, obvious differences in predictive utility can be found as a function of psychiatric disability" (115). His study supports the use of statistical methods to predict vocational success utilizing the WAIS.

The arrival of the WAIS-R during the early eighties brought about an impetus to examine the new instrument in regard to factor Structure. Ryan, Rosenberg, and DeWolfe (1984) conducted a study to examine the WAIS-R factor structure in a clinical group undergoing vocational counseling and job preparation training. This structure was compared to the one described by Silverstein for the normative group and he found the two-factor solution for this group including Perceptual Organization and Verbal Organization.

Heinlein (1987) investigated the utility of the WAIS-R in predicting vocational aptitude. WAIS-R and General Aptitude Test Battery (GATB) scores of a group of 148 learning disabled young adults in a vocational rehabilitation program were subjected to a multivariate, canonical correlation analysis. His results suggest that the WAIS-R and GATB test similar, but independent dimensions of the same three psycho-educational constructs. The use by psychologists of clinical profiles of the WAIS-R scaled scores to make exploratory estimates of vocational ability and aptitude is discussed.

Fass and D'Alonzo (1990) evaluated the clinical use of the WAIS-R to assess the value of WAIS-R IQs and subtest scores in predicting successful employment. Eighty-six individuals with disabilities who range from 18 to 59 years of age composed the sample. They found that the WAIS-R Comprehension subtest composing the comprehension cluster predicted best a successful transition from school to the job market. Also, successful individuals scored significantly higher on four of the six WAIS-R verbal subtests including the following: 1) Comprehension, 2) Information, 3) Vocabulary, and 4) Similarities. In addition, high scores on the Information and Vocabulary subtests in combination point to a successful transition from school to employment.

Little research has been attempted to examine the specific vocational characteristics of WAIS or WAIS-R. Heinlein (1987) did a correlational study of young adults in rehabilitation and found some support for the use of the WAIS-R in a vocational context. He urged for additional ones to be done, such as a sample of individuals with learning disabilities in a public school setting. Also, Fass and D'Alonzo (1990), who studied WAIS-R scores as predictors of employment success and failure among individuals with learning disabilities, stressed the need for additional research concerning the vocational characteristics of the WAIS-R.

WAIS-R Research on Adolescents with Learning Disabilities

Numerous researchers have addressed the usefulness of the Wechsler tests as diagnostic instruments. They have done so by either analyzing the grouping of subtests or examining the individual subtest patterns. Also, there have been many studies conducted regarding the usefulness of the Wechsler tests with individuals with learning disabilities. There is much research available regarding the children's forms of the WISC and WISC-R, but far less dealing with adolescents with learning disabilities and the WAIS, or WAIS-R.

Grossman (1983) as well as Knight (1983) investigated the standardization sample of the WAIS-R with regard to discrepancies between Verbal IQ and Performance IQ. Their findings were, for the most part, in accord with Wechsler's that a discrepancy of 15 or more IQ points should warrant a further investigation.

Frauenhein and Heckerle (1983) conducted a longitudinal study concerning the Verbal Performance IQ differences in a sample of severely dyslexic individuals. On the WAIS, average differences of 21 IQ points were found while on the WAIS-R, 19 points differences. The average Performance IQ was found higher than the Verbal IQ in both administrations. After the time lapse of about 17 years, the Verbal, Performance, and Full Scale IQs were approximately the same. The Performance IQs were within the average to superior range of classification while the Verbal IQs were within the borderline

to average range. The Full Scale IQ ranged in classification from low average to average.

Roger (1982) discussed the significance of the Verbal-Performance IQs differences. She reports that a 15 point difference between these scales could be an indicator of a specific learning disability. She proposes that the WAIS or WAIS-R be utilized as part of a comprehensive evaluation. Also, she asserts that the WAIS-R provided clinical information regarding right and left brain aptitudes such as visual and auditory sequential memory.

In a study by Snow, Koller, and Roberts (1987) the WAIS-R was given to a sample of adolescents with learning disabilities and adults, and the results were factor analyzed. A three-factor solution was found from the analysis which is consistent with past studies. Factor scores were computed for each individual and used in a cluster analysis. The formation of seven subgroups resulted from the analysis, which suggests that the WAIS-R is sensitive to variation of cognitive abilities. It seems that this test was most valuable in distinguishing language difficulties. They state that "in this sense, the WAIS-R should be used in conjunction with a number of different measures for diagnosis and remedial programming of LD adolescents and adults" (p. 12).

Several studies were reported which utilized the WAIS-R to investigate the characteristics of students with learning disabilities entering college. Salvia, Gajar, Gajria, and

Salvia (1988) made a comparison of WAIS-R profiles of nondisabled college freshman and college students with learning disabilities. No significant differences were reported between the group with learning disabilities and the group without learning disabilities on Performance IQ and Verbal IQ discrepancies. However, more subtest variance was noted in the performance of the students with learning disabilities than was found in the performances of the random sample of college freshmen. Therefore, the performances of the two groups was for the most part indistinguishable.

A study by Leonard (1991) used the WAIS-R to assess the potential for success of students with learning disabilities at the college level. Data from the WAIS-R, GPA after two semesters of full-time enrollment, and selected student characteristics were obtained and used in a regression analysis. In sum, the WAIS-R scores did not prove helpful in predicting success; however, the Similarities and Comprehension subtests were significantly correlated to GPA.

In summary, the reviewed research plainly supports the utility of the WAIS-R Verbal and Performance IQs discrepancy, and subtest pattern analysis. Evidence is clearly provided to justify the possibility of identifying a learning disability by using the WAIS-R in conjunction with other evaluative data in a comprehensive diagnosis process with adolescents.

Research Pertinent to GATB:

General Aptitude Test Battery

The GATB (United States Employment Services [USES], 1970, 1980) has been a focus of study by USES for about a half a century. Also, various occupations to establish the GATB predictive norms, Occupational Aptitude Patterns (OAPs) which were designed to predict differential occupational success have been investigated diligently (USES, 1979a, 1979b). More than 460 occupations were analyzed, and criterion-referenced with the GATB and OAPs (USES, 1980). The GATB is today the most frequently and widely used multi-aptitude test in existence for the use of vocational guidance. Appendix C provides a complete discussion of the GATB test, as well as GATB aptitudes.

GATB Standardization, Reliability, and Validity

The GATB was developed by the United States Employment Services in 1947 and has been under continuous development by them since its introduction (Keesling, 1985). A Form A of the battery of 12 subtests was first formed on an expansive representative occupational sample of 4,000. Form B was introduced as a parallel form of Form A. Form C and D were presented in 1981. Separate Occupational Aptitude Pattern (OAP) cutoff scores of the GATB for adults, ninth, and tenth graders enhances counseling versatility. The comprehensive test-retest reliability data on the GATB presented by USES

(1970, 1979b, 1980, 1983a, 1983b) obtained on samples of 23,428 indicated satisfactory levels, varying from the mid .70 on three years for several of the manual performance subtests to .90 over three years for Aptitude G (Intelligence).

USES (1984) conducted a study utilizing meta-analysis research techniques to determine whether there existed discrepancies in GATB validities and test scores between samples from western, southern, and northern census areas. The sample was composed of 26,111 subjects from 122 Specific Aptitude Test Battery (SATB) validation on revalidation studies examined since 1972. No meaningful discrepancies in the GATB validities between geographic areas were found.

In another study done by USES (1987) meta-analysis research techniques were used to examine the effect of age, education and work experience on GATB validities. Education indicated positive correlations for all nine aptitudes with the lowest correlations for the psychomotor aptitudes, and the highest correlations for the cognitive aptitudes. Validities were found higher for individuals with more than 12 years of education, specifically for the cognitive aptitudes. Validities decreased an average of .01 correlation points when education was controlled.

A study provided by USES (1988) replicated an earlier analysis (USES, 1983c). The earlier study was the basis for the Validity Generalization system utilized by the United States Employment Services. The data used in this

investigation (USES, 1988) was composed of 755 General Aptitude Test Battery validation studies composed of 74,187 subjects. Analyses were done for the total sample, the original sample as well as the new one. The beta weights provided by the earlier study (USES, 1983c) were compared to the ones obtained for the total population. Validity coefficients from the two studies were essentially identical. The conclusion confirmed that there was no need to change the beta weights which had been used.

A concurrent validity study of the GATB with self-estimates of secondary level students was conducted by Briscoe, Muelder, and Michael (1981). No correlation was found in either a sample of females or males who were eligible for a CETA job training program. They concluded with recommendations that (1) all secondary level students should be given the chance to learn about their aptitudes with the GATB and (2) beginning in the ninth grade, aptitude testing should be done for students with special needs.

There have been a number of investigations that examined the concurrent validity of other multi-aptitude tests which used the GATB as criterion. For example, Hakstian and Bennett (1978), using the GATB as criterion, included their Comprehensive Ability Battery (CAB) and the well recognized Differential Aptitude Test (DAT) in a validity study. This study as well as others similar ones obtained support for their aptitude tests as a result of making comparisons to the

GATB.

A validity study with secondary level vocational students was done by Hanner and Bishop (1975). They found from their investigation that Aptitude G was the best predictor of success. In addition, they discovered that for predicting success in vocational classes, the best combination of variables was the G, N, P, F, and M aptitudes.

Kujoth (1973) investigated the validity of the GATB regarding the educationally deficient. He concluded that there was a need for a less restrictive policy concerning pre-test coaching and retesting. Also, Kujoth (1973) stressed the need for research on the effects of remedial education on aptitudes scores.

USES (1980) followed Kujoth's (1973) recommendations and implemented such studies. As a result, special populations can be accommodated with their pre-testing orientation programs (USES, 1980).

Modahl (1980) studied the GATB aptitude profile in relationship to the WAIS for mentally low average and mildly deficient. The population was composed of 65 vocational rehabilitation clients in Wisconsin. The results showed that both Aptitude G and Aptitude S was a fair predictor of the WAIS Full Scale IQ and together they accounted for 99.6% of the variance of the WAIS Full Scale IQ.

In his 1987 dissertation Heinlein investigated the GATB aptitude profile in relation to the WAIS-R for 148 young

adults with learning disabilities in a state supported vocational rehabilitation program. He concludes that there is evidence that WAIS-R and GATB estimate similar, but fundamentally independent, measurements of the same three psycho-educational constructs. The usefulness of the WAIS-R scaled scores to make exploratory estimates of vocational ability and aptitude was considered.

In summary, the GATB has been proven time and again to have satisfactory validity and reliability with respect to many divergent samples of the job market. The research and development division of the United States Employment Services has provided over 700 studies showing the extent to which GATB predicts future job success (USES, 1988). Heinlein (1987) stated that "GATB is considered without any serious contention the multi-aptitude battery to which all others are compared" (p. 43).

Factor Studies of GATB

A long term continuous study of the underlying dimensionality of the GATB has been launched by USES (1983a, 1983b) in attempts to strengthen its validity claims. They reported that the validity generalization research of GATB reveals that the GATB is a valid predictor of successful performance for 12,000 jobs (USES, 1988).

The U. S. Employment Services is now equipped to reference GATB for every job in the Dictionary of Occupational

Titles (DOT) which includes over 12,000 occupations, but prior to the validity generalization research, the GATB covered about 400 jobs (USES, 1983a). The USES (1983a) report stated that "before the Validity generalization solution could be applied to the GATB, it was necessary to satisfy two statistical assumptions: (1) that the nine individual GATB aptitudes represent some orderly underlying factor structure; and (2) that the validity evidence reported in over 500 studies can be attributed to these general underlying factors" (p. 2). With samples of over 23,000 multivariate procedures utilized to confirm these assumptions demonstrated that the nine aptitudes break into three general factors: A cognitive one defined by the Aptitude G, V, and N components (Intelligence, Verbal, Numerical); a perceptual factor containing the Aptitude S, P, and Q components (Spatial, Form Perception, Clerical Perception); and psychomotor factor containing the Aptitude K, F, and M components (Motor Coordination, Finger Dexterity, Manual Dexterity).

The confirmatory factor analysis of the GATB Aptitudes reported by USES (1983a, 1983b) provided intercorrelation matrices of Aptitudes as well as factors. The cognitive and psychomotor factors were comparatively independent; however, both were linked closely to the perceptual factor. A multiple regression analysis proved that ability shown on the perceptual factor was almost perfectly predicted by the cognitive and psychomotor elements. The results of the

analysis gave justification for combining the individual aptitudes into these three factors with no sizable loss of predictive power. The correlation obtained between the Cognitive and Perceptual factors was .88 while between the Perceptual and Psychomotor was .75. On the other hand, the obtained correlation between the Cognitive and Psychomotor factors was .46.

USES (1983a) found that most of the variance of the GATB was connected to the major factors. Therefore, it is asserted that generalized composites should prove good predictors of job success since they account for most of the variance. The cognitive composite account for 80%, perceptual 79%, and the psychomotor 75% of the total variance of the GATB for the respective nine aptitudes.

The evidence suggests that the GATB exhibited three factors passing over two fields (USES, 1983b). The cognitive factor differed from the accepted concept of intelligence because it was clearly distinguished from the perceptual factor. The correlations obtained the factors as well as additionally obtained data on age revealed the perceptual factor to be predictable from the others and causally dependent on them.

Two theories relating ability to job success were discussed by USES (1983b). Specific aptitude theory contends that job success is predicted best when the content of the test was comprised of aptitudes more similar to the task. The

specific aptitude theory held that "intelligence is only indirectly correlated with job performance because it is correlated with relevant specific aptitude" (p. 399). Further that "general ability theory asserted that job performance was learned as a new aptitude in its own right. Specific aptitudes will be valid only indirectly because they were correlated with general intelligence" (p. 39). USES studies clearly support the general ability theory. However, this may not hold true for artistic and scientific jobs because general perceptual abilities were less valid than spatial aptitude.

The GATB was originally based on the factor analytic work presented in an comprehensive report by the staff of the Division of Occupational Analysis (Staff, 1945). Utilizing a total of 59 tests eight factor analyses were conducted. In addition to the factor analytic work done by the Division of Occupational Analysis, independent factor studies were completed. Studies by Watts and Everitt (1980), and Hammond (1984) appear to be the most notable. Watts and Everitt (1980) investigated the correlational structure of the GATB to examine whether it truly measured the nine separate aptitudes as purported. They found that a three-factor solution was needed to account for the computed correlation data they studied. Watts and Everitt (1980) gave the name Symbolic Factor to the GVN cluster which was identical to the Cognitive Factor of USES. They referred to the SPQ cluster as the Perceptual Factor and the KFM cluster as Psychomotor Factor.

Hammond (1984) scrutinized the GATB factorial structure using data collected from a sample of 1,084 employed Irish females and males varying in age from 15 through 67 with a mean age of 26.6. The GATB was re-standardized to be used with the Irish population. A four-factor structure is reported in this investigation. The evidence is clear-cut for the Cognitive/Symbolic Factor (GVN), and Perceptual Factor (SPQ). But Hammond (1984) saw some evidence to divide the traditionally regarded Psychomotor Factor into a Finger Dexterity Factor and a Manual Dexterity Factor.

Another study of particular interest was done by Miller (1977/1978). He investigated the Wechsler Intelligence Scale for Children (WISC) subtest scores as predictors of GATB Occupational Aptitude Patterns (OAPs) for a sample of 72 educable mentally disabled (EMD) secondary level students in an occupational orientation program. Miller wanted to find out if vocational aptitude information could be drawn from the WISC. Correlational techniques were utilized in the analysis. Several conclusions were drawn from the study. First, although the various subtest score means for the EMD group were significantly lower than norm group subtest means, the WISC subtest scores were scattered in the same manner as the subtest scores for the normative sample; Second, for each WISC/GATB pair with the exception of the GATB Manual Dexterity at least one significant correlation was present; and Third, linear regression, hinged on significant correlations between

the GATB aptitude scores and the WISC subtests, provided vocational information for EMD individuals in this group.

One additional study needs to be examined before completing this review of the GATB literature. Heinlein (1987) conducted a correlational study between the WAIS-R and GATB. The pairs of scores from a sample of 148 young adults with learning disabilities participating in a state supported vocational rehabilitation program were used in a multivariate, canonical correlational analysis. Evidence was obtained that the WAIS-R and GATB measure similar, but independently different segments of the same three psychoeducational constructs. "Analysis of the structure correlations suggests that the first pair of canonical variates [Rc=.87] share a general intelligence, or verbal comprehension factor. A second pair [Rc=.73] share a perceptual and motor coordination construct. The third pair of canonical variates [Rc=.61] define a perceptual speed, or psychomotor construct that overlaps both the GATB and the WAIS-R set of test scores" (p. 112).

Summary of Chapter II

Chapter II provides a summary of pertinent literature in this study which includes the concept of adolescent learning disability, General Aptitude Test Battery, and the Wechsler Adult Intelligence Scale-Revised.

The present study will investigate the assessment value

of the WAIS-R in psychological evaluations to measure vocational aptitude among adolescents with learning disabilities. The issue is certainly important for professionals interested in bridging the gap between school and the world of work for adolescents with learning disabilities. The WAIS-R is a state-of-the-art instrument. The GATB is a well established vocational aptitude measure appropriate for the criterion in this study.

CHAPTER III

Methodology

This chapter contains a discussion of the methods used to investigate the research questions in this study. It is composed of sections which will describe the variables, research conditions, and analytic methods in order that the study may be duplicated. A final section will include a succinct summary of the methodology.

Characteristics of Population Studied

Paired General Aptitude Test Battery (GATB) and Wechsler Adult Intelligence Scale-Revised (WAIS-R) test scores were obtained ex-post-facto from 172 male and female subjects. The tests were administered on two separate occasions. The GATB was administered to each student either upon entering the ninth grade, entering a program for students with learning disabilities, or entering the school division if the student had not previously received a vocational evaluation. The WAIS-R was administered to a student as a result of a triennial evaluation, referral for evaluation for a learning disability, or for an additional evaluation. The GATB was administered to students ranging in age from 14 through 19 while the WAIS-R was administered to students ranging in age from 16 through 19. For each student the time range between administrations of the two tests was as short as one week or as long as three years. The GATB was administered by a

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certified vocational evaluator at an area department of rehabilitative services evaluation unit, while the WAIS-R was administered by a certified school psychologist or licensed psychologist in a public school setting.

The students in this study were identified as having a specific learning disability by a public school eligibility committee following comprehensive assessments. All students were participating in Individualized Education Programs in the Danville Public Schools developed to provide appropriate services for their specific learning disabilities.

The Danville Public Schools have a total student enrollment of 8,343. Of this enrollment, the number of students classified as disabled is 828 with 322 participating in Individual Education Programs for specific learning disabilities.

Variables

The GATB is composed of 12 aptitude tests which will present nine (9) standardized aptitude scores to access vocational aptitude for each of the individuals involved in the study. One set of the variables for this study is nine standardized aptitude scores of the GATB with a mean of 100 and a standard deviation of 20.

The WAIS-R includes a total of fourteen (14) standardized scores to access intelligence for each of the subjects involved in this study. Three WAIS-R IQ scores, and eleven

(11) standardized WAIS-R subtests scores were collected from each student. The second set of variables are the eleven (11) standardized subtest scores with a mean of 10 and a standard deviation of 3. Since the three additional IQ scores of the WAIS-R are linear combinations of the original eleven (11) subtest scaled scores, they will not be used in the primary statistical analysis of this study.

GATB and WAIS-R variables are attribute variables because they are measured rather than manipulated. The two sets of variables are treated as continuous since they are capable of forming an ordered set of values. Descriptions of these two sets of variables can be found in Appendix B and Appendix C.

Data Collection Procedures

Nine (9) GATB aptitude scores, and eleven (11) WAIS-R subtests scores as well as three (3) IQ scores were collected for the 172 subjects involved in the investigation. The scores were obtained from the addendums of the psychological and vocational evaluation reports in the Special Education Category II Files.

Formal permission was obtained from the Danville Public Schools. A copy of the letter of permission for this study is presented in Appendix A.

Analysis of the Data

A multiple regression approach was employed to address the two research questions. First, are there predictive

relationships among aptitude scores measured by GATB and subtests scores measured by WAIS-R? Second, can WAIS-R subtest scores or combinations of WAIS-R subtest scores be used to measure vocational aptitudes? Nine (Stepwise) multiple regression equations were constructed on the WAIS-R based on significant correlations among the 11 subtest scores and the nine (9) GATB aptitude scores. Additional stepwise and forward regression analyses were completed to address the two research questions. These analyses were performed with the Number Cruncher Statistical System (Hintze, 1987). Standard descriptive statistics and correlational data are presented for each of the variables included in the investigation.

Summary of Chapter III

Chapter III provides a description of the population studied, variables, setting, data collection procedures, and analyses of the data for this investigation.

A selection of 172 adolescent students participating in a Special Education Individualized Education Programs for a specific learning disabilities in a public school setting was made from a total of 328. Sets of variables including eleven (11) WAIS-R subtest scores plus three (3) IQ scores and nine (9) GATB aptitude scores and background information for each of these students were collected for the analyses. The study addressed two research questions:

1. Are there predictive relationships among aptitude scores
    measured by the GATB and subtest scores measured by the
    WAIS-R?

2. Can WAIS-R subtest scores or combinations of WAIS-R
    subtest scores be used to measure vocational aptitudes?

Analysis of data to address these questions required a
stepwise multiple regression procedure as well as a forward
multiple regression procedure to construct equations to
estimate nine (9) dependent variables (GATB) from a
combination of independent variables (WAIS-R).

CHAPTER IV

Results of the Study

The analyses of the data for the study are given in this chapter. Summary data concerning the characteristics of the population studied are presented, as are discussions of the characteristics of the WAIS-R and GATB data sets, and the predictive relationships among subtests measured by the GATB and subtests measured by the WAIS-R.

Characteristics of the Population Studied

All subjects in this study were found eligible for special education by a public school eligibility committee following comprehensive assessments, and were participating in Individualized Education Programs for specific learning disabilities (LD) in a Public School Division. Ages ranged from 16 through 19. From a pool of 328 students with learning disabilities, all 172 individuals for whom pairs of complete WAIS-R and GATB subtests scores existed were selected.

Distribution of Gender

Female students accounted for 52 or 30% of the total population studied, while male students accounted for 120 or 70% of the population studied. The approximate 1:3 female to male ratio is consistent with the accepted incidence of learning disabilities by sex in the general population (e.g., Vellutino, 1987).

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Characteristics of Data Base

The data base of the study is composed of 172 sets of GATB data paired with 172 sets of WAIS-R data and background information of the 172 adolescents. A selection of 172 adolescents with learning disabilities were made from a pool of 328 adolescents with learning disabilities in a public school setting. For each of the 172 individuals, 9 GATB scores were collected, paired with 14 WAIS-R scores, and gender. Of the 328 pool, 156 did not have complete data sets.

Analysis of the

WAIS-R and GATB Data

Relation of WAIS-R Data to WAIS-R Norms

The mean Full Scale IQ (FSIQ) for the population studied is 90 (SD=11.4) and the mean Verbal IQ (VIQ) is 90 (SD=12.0). The mean Performance IQ (PIQ) is 92 (SD=13.9). The mean subtest score of the Verbal Scale is 7.64 (SD=2.94), and the mean subtest score on the Performance Scale is 8.70 (SD=2.76).

The standardization group for the WAIS-R has mean scores for FIQ, VIQ, and PIQ of 100 (SD=15). The WAIS-R scaled scores have a mean of 10 (SD=3). The population studied is generally within the norm group parameters, but the population studied may be over-representative of the lower limits of the average range on the WAIS-R continuum measure.

Table 1 provides WAIS-R means, standard deviations, and standard errors for the eleven variables in the study as well as the statistics for the three additional scaled scores.

Table 1

Means, Standard Deviations, and Standard Errors

for the WAIS-R Data ($\underline{n}$=172)

WAIS-R		MEAN	SD	STD ERROR
INFO:	Information	7.34	2.10	.16
DSPAN:	Digit Span	7.38	2.63	.20
VOCAB:	Vocabulary	7.05	2.20	.17
ARITH:	Arithmetic	7.27	2.15	.16
COMP:	Comprehension	7.68	2.53	.19
SIM:	Similarities	9.12	6.01	.46
PC:	Picture Completion	9.29	2.60	.20
PA:	Picture Arrangement	9.77	2.48	.19
BD:	Block Design	7.99	2.73	.21
OA:	Object Assembly	8.51	3.30	.25
DSYMBOL:	Digit Symbol	7.92	2.71	.21
VIQ:	Verbal IQ	89.59	11.97	.91
PIQ:	Performance IQ	92.36	13.85	1.06
FSIQ:	Full Scale IQ	89.90	11.40	.87

Standard deviation and standard errors for all subtests and
scaled scores have characteristics similar to those described
by Wechsler (1981) for the WAIS-R norm group, but tend to be
consistently lower in value.

Tables 2 and 3 give correlations among the WAIS-R
variables and provide an index of the magnitude of
relationship among these measures. The highest correlation is
between Object Assembly and Block Design (.64). Also, high
correlations are between Vocabulary and Information (.62) as
well as Similarities and Vocabulary (.59). All other WAIS-R
Subtest intercorrelations are low to moderate. This pattern
is generally similar to the intercorrelation pattern in the
WAIS-R standardization group (Wechsler, 1981, p. 46). Also,
the WAIS-R IQ Scale intercorrelations show a pattern similar
to the normative group.

Relation of GATB Data to GATB Norms

A total of 172 sets of GATB aptitude scores were
obtained. Mean aptitude scores, standard deviations, and
standard errors are presented in Table 4. The standardization
group has aptitude means of 100 (standard deviation = 20).
Table 4 shows that the population studied may be restricted in
range. Two of the nine mean aptitude scores for the
population studied are slightly below the first deviation in
relation to the norm group mean.

The lowered mean performance on the GATB is noted in the
verbal/cognitive aptitudes (Aptitude G, and Aptitude N).
Performance on the psychomotor aptitudes, and

Table 2

Pearson Correlations among Subtests of WAIS-R Data (n=172)

WAIS-R	INFO	DSPAN	VOCAB	ARITH	COMP	SIM	PC	PA	BD	OA	DSYMBOL
INFO	1.00	.19***	.62***	.44***	.46***	.30***	.25***	.20**	.30***	.34***	.18*
DSPAN		1.00	.29***	.47***	.21**	.02	.00	.23**	.27***	.16*	.12
VOCAB			1.00	.47***	.59***	.24**	.09	.07	.13	.15	.07
ARITH				1.00	.49***	.17*	.05	.16*	.28***	.35***	.29***
COMP					1.00	.15*	.08	.07	.10	.24**	.26***
SIM						1.00	.10	.13	.10	.09	.19**
PC							1.00	.48***	.40***	.51***	.28***
PA								1.00	.31***	.38***	.19**
BD									1.00	.64***	.21**
OA										1.00	.28
DSYMBOL											1.00

***p < .001   **p < .01   *p < .05

Table 3

Correlations among the WAIS-R Scale Data ($\underline{n}$=172)

WAIS-R	FSIQ	VSIQ	PSIQ
FSIQ	1.00	.84***	.83***
VSIQ		1.00	.41***
PSIQ			1.00

***$\underline{P}$ < .001

Table 4

Means, Standard Deviations, and Standard Scores

for GATB Data ($\underline{n}$=172)

GATB APTITUDES	MEAN	SD	STD ERROR
G: General Intelligence	71.15	12.06	.92
V: Verbal Aptitude	79.22	9.07	.69
N: Numerical Aptitude	72.01	15.28	1.17
S: Spatial Aptitude	89.49	49.34	3.76
P: Form Perception	97.47	26.17	1.20
Q: Clerical Aptitude	97.02	16.39	1.25
K: Motor Coordination	91.81	20.73	1.58
F: Finger Dexterity	78.36	22.11	1.69
M: Manual Dexterity	87.73	26.56	2.03

perceptual/spatial aptitudes is within expected limits. This pattern indicates that the population studied is slightly biased towards the lower limits of the average continuum as defined by the GATB. Furthermore, it appears to be consistent with the previously noted WAIS-R Full Scale IQ mean of 90, mean Performance IQ of 92, and mean Verbal IQ of 90.

Table 5 contains correlations of the GATB aptitudes among components. The highest interaptitude correlation is between Aptitude G and Aptitude N (.77). Another high interaptitude correlation is between Aptitude F and Aptitude M (.68). The remainder of the correlations show a high-moderate to low-moderate within set correlation consistent with patterns found in the GATB norm group (USES, 1970, pp. 34, 269), but generally lower in degree.

Table 6 shows correlations between GATB and WAIS-R. The highest correlations are between Aptitude K and Digit Symbol (.57) as well as Aptitude F and Digit Symbol (.57). The remainder of the indices reveals a low to moderate between set correlation.

Multiple Regression of GATB and WAIS-R

A series of multiple regression equations were computed to predict each of the nine GATB aptitudes from some set of WAIS-R Subtest scores. This set of analyses addresses two research questions. They are:

1. Are there predictive relationships among aptitude scores measured by GATB and subtest scores measured by WAIS-R?

Table 5

Pearson Correlations Among Aptitudes

of GATB Data ($\underline{n}$=172)

APTITUDES	G	V	N	S	P	Q	K	F	M
G	1.00	.64***	.77***	.23**	.45***	.31***	.07	.30****	.20**
V		1.00	.49***	.25****	.28****	.23**	.09	.17*	-.05
N			1.00	.05	.37***	.38***	.05	.21**	.14
S				1.00	.11	.06	.05	.16*	.01
P					1.00	.58***	.37***	.55***	.42***
Q						1.00	.31***	.34****	.21**
K							1.00	.39****	.59****
F								1.00	.68***
M									1.00

***$\underline{p}$ < .001   **$\underline{p}$ < .01   *$\underline{p}$ < .05

Table 6

Pearson Correlations among the GATB Aptitude Variables

and the WAIS-R Subtest Variables ($\underline{n}$=172)

	APT G	APT V	APT N	APT S	APT P	APT Q	APT K	APT F	APT M
INFO	.20***	.25***	.23**	.16*	.07	-.03	-.05	-.03	.06
DSPAN	.31***	.31***	.27***	.07	.23**	.03	.13	.16*	.14
VOCAB	.34***	.40***	.24**	.16*	.05	.07	.03	-.07	.00
ARITH	.43***	.36***	.40***	.12	.11	.03	.10	.10	.05
COMP	.38***	.35***	.22**	.13	.15*	.03	.04	.16*	.11
SIM	.20**	.17*	.07	.09	.09	.09	.11	.03	-.03
PC	.22**	.01	.11	.09	.24**	.00	.10	.30***	.18*
PA	.32***	.15*	.26***	.08	.27***	.11	.36***	.37***	.18*
BD	.38***	.11	.22**	.07	.34***	.04	.33***	.33***	.20**
OA	.38***	.06	.20**	.13	.36***	.08	.41***	.41***	.23**
DSYMB	.25***	.17*	.19**	.13	.29***	.25***	.57***	.57***	.46**

***$\underline{p}$ < .001   **$\underline{p}$ < .01   *$\underline{p}$ < .05

2.   Can WAIS-R subtest scores or combinations of WAIS-R
     subtest scores be used to measure vocational aptitudes?

A stepwise selection method for the regressions was
chosen for the set of analyses since it is considered the most
efficient one for use in predictions (Pedhazur, 1982;
Tabachnick & Fidell, 1989). The equations began empty and
WAIS-R variables were added one at a time, provided they met
statistical criteria, but they were taken out at any step
where they no longer added significantly to the regression.
Forward regressions were also computed for additional
information. The results of these regressions are given in
Table 7 and Table 8.

Significant relationships are seen between the
independent variables (WAIS-R Subtest) and eight of the nine
dependent variables (GATB Aptitudes) as can been seen in Table
8. The Aptitude Q-Clerical Perception is the only GATB
Aptitude that shows no predictive relationship. The remaining
GATB Aptitudes reveal relationships for prediction by
combinations of WAIS-R Subtests.

Generally speaking, the GATB Aptitudes appear best
accounted for by combinations of WAIS-R Subtests rather than
by any single WAIS-R Subtest. The Arithmetic, Comprehension,
Picture Completion, and Similarities subtests contribute most
to the GATB Aptitude G-Intelligence. The GATB V-Verbal is
best accounted for by Vocabulary and Digit Span whereas GATB
Aptitude N-Numerical is best accounted for by combinations of

Table 7

Regression Analysis Predicting GATB Aptitudes

from WAIS-R Subtest Scores

GATB APTITUDE	MULTIPLE $\underline{R}$	$\underline{R}$ SQUARE	STD ERR	$\underline{df}$	$\underline{F}$
G: GENERAL	.667	.445	6.08	4/167	17.62****
V: VERBAL	.572	.327	5.23	6/165	6.97****
N: NUMERICAL	.550	.303	8.78	6/165	6.24****
S: SPATIAL	.718	.515	10.12	7/164	12.90****
P: PERCEPTION	.612	.375	17.23	9/162	5.52****
Q: CLERICAL	.356	.127	13.51	9/162	1.34
K: MOTOR	.597	.357	14.87	11/160	4.10****
F: FINGER	.799	.638	10.72	11/160	12.98****
M: MANUAL	.590	.348	17.51	12/159	3.55****

****$\underline{P}$ < .001

Variables in equation appear in Table 8.

Table 8

Regression Beta Weights for WAIS-R Subtests to Predict GATB Aptitudes

	APT G	APT V	APT N	APT S	APT P	APT Q	APT K	APT F	APT M
INFO							-2.875**	-4.102****	-.858
DSPAN		.743*	-.521	-.493	1.329	-.878	.466	1.627**	.884
VOCAB		.989*	2.175***	.733	-.129	.322	2.642*	.525	.092
ARITH	1.769***	.574	2.647***	-.333	-1.189	-.783	2.224*	-2.284***	-1.246
COMP	1.250***	.576	-.656	1.203*	1.213	.641	-1.480	1.241*	.899
SIM	.999**								-2.061*
PC	1.541****				-3.376***	-2.525***	-3.242***	-.642	-1.418
PA		.421	1.626***	1.235**	1.279	1.269	.895	.740	.277
BD		.320	.802	3.296****	2.582**	.343	-1.684	.106	-1.007
OA					4.226****	1.742	1.474	3.698****	2.836*
DSYMB				-7.370***	16.288***	11.293***	3.725****	3.082****	4.431****
GEND							-2.784	5.526	-1.641
R-SQUARE	.445****	.327****	.303****	.515****	.375****	.127	.357****	.638****	.348****
CONSTANT	27.342****	55.704****	24.368****	49.758****	25.681	74.548*****	82.571*****	35.993*****	68.803****
STD ERR	6.076	5.229	8.781	10.118	17.231	13.513	14.874	10.722	17.508

****p < .001   ***p < .01   **p > .05   *p > .10

Arithmetic, Vocabulary, and Picture Arrangement. Comprehension, Picture Arrangement, Block Design, and the factor Gender contributes to a predictive relationship to GATB S-Spatial. The GATB Aptitude P-Form Perception is best accounted for by WAIS-R Picture Completion, Block Design, and Object Assembly subtests as well as the factor Gender. The Information, Arithmetic, Vocabulary, Picture Completion, and Digit Symbol subtests contribute a positive non zero predictive relationship regarding the GATB Aptitude K-Motor Coordination whereas Aptitude F-Finger Dexterity is accounted for by Information, Arithmetic, Digit Span, Comprehension, Object Assembly, and Digit Symbol. The GATB M-Manual is accounted for by combinations of subtests including Similarities, Object Assembly, and Digit Symbol.

Additional stepwise and forward regressions were computed for a further analysis of the validity of using WAIS-R Subtests to predict GATB Aptitudes. The results of these regressions are given in Tables 9 and 10. Significant predictive relationships are revealed when the FIQ, PIQ, and VIQ of the WAIS-R are the dependent variables and all GATB Aptitudes as well as gender are the independent variables. The most favorable predictive relationship is seen between the WAIS-R PIQ and GATB Aptitudes. Also, a predictive relationship is seen between the WAIS-R FIQ and the GATB Aptitudes (V, S, F). The variance accounted for by the former is 58% and the latter 51%. The WAIS-R VIQ does not show as strong a predictive relationship with the GATB Aptitude. The

Table 9

Regression Analysis Predicting GATB Aptitudes

from WAIS-R Subtest Scores

GATB APTITUDE	MULTIPLE R	R SQUARE	STD ERR	df	F
FSIQ	.72	.51	9.08	5/166	*
VIQ	.64	.42	10.79	3/168	*
PIQ	.76	.58	10.83	6/165	*

*p < .0001

Table 10

Regression Beta Weights for GATB Aptitudes to Predict WAIS-R Scales

	FSIQ	VSIQ	PSIQ
APT G	.150		.225
APT V	.317**	.607****	-.972
APT N			
APT S	.270****	.207**	.231***
APT P	.808*	-.105*	-.111
APT Q			
APT K			-.158***
APT F	.160***		.379****
R-SQUARE	.511****	.415****	.580****
CONSTANT	26.152***	24.773**	40.423****
STD ERR	9.083	10.794	10.830

****p < .001   ***p < .01   **p < .05   *p < .10

regression analysis between the VIQ and GATB Aptitudes (V, S, P) accounted for only 41%.

Generally speaking, the analysis shows a high degree of concurrent validity between the GATB and WAIS-R instruments; however, the sizes of the relationships are not adequate to indicate use of the individual subtests for prediction. Therefore, the prediction equation may be unsuitable in terms of using the WAIS-R subtests as predictors of the GATB Aptitudes. The standard errors of the estimate range from 5.2 for Aptitude V to 17.5 for Aptitude M. Aptitude F accounts for the highest degree of variance (63.8%). Other squared multiple correlations range from .13 for Aptitude Q to .52 for Aptitude S.

Although high predictive levels are not generally shown for any subtests, a general overall predictive ratio across subtests is shown. Components of each instrument are shown as dependent variables as well as independent variables, and some strong relationships are seen. In light of an absence of validity concerns regarding the two instruments, the evidence suggests that even though the GATB and WAIS-R show a relationship, there is enough independent information provided by each test to warrant employing both. In other words, each test provides unique, valuable information that is essential in the construction of individual educational plans.

Summary of Chapter IV

Chapter IV consists of the analysis of data obtained from a population of adolescents with specific learning disabilities and composed of a male-female ratio of 3:1. The 172 WAIS-R and GATB data sets closely approximate their respective normative groups with respect to distribution and intercorrelations.

The regression analyses to predict individual GATB aptitudes from WAIS-R subtest scores suggest that the sizes of the relationships are not adequate for using the prediction equation. Although generally acceptable predictive relationships are not shown for the subtests, a general overall predictive ratio across subtests is shown. Overall, the analysis suggests that even though the WAIS-R and GATB show a relationship, there is enough independent information provided by each test to warrant administering both.

CHAPTER V

Discussion and Recommendations

Chapter Five includes a review of the purpose and the results of the investigation, emphasizing a discussion of results relative to the literature, and relative to implications for professionals. The chapter concludes with recommendations for future research regarding the assessment use of the WAIS-R and the GATB.

Summary of the Study

The purpose of the study is (a) to investigate whether predictive relationships exist among aptitudes measured by the GATB and subtests measured by the WAIS-R, and (b) whether WAIS-R subtest scores or combinations of WAIS-R subtests scores can be used to measure vocational aptitudes. This could help school psychologists and other professionals give students with learning disabilities the appropriate guidance required to make successful transitions from school to the job market.

The primary question in the study is: To what degree can school psychologists and other professionals rely on available psychometric data such as the WAIS-R to make vocational aptitude predictions? All subjects were participating in Individualized Educational Programs in a public school developed to provide appropriate services for their specific learning disabilities. There were N=172 subjects with sets of

WAIS-R and GATB scores used in the analysis. The age ranged from 16 years to 20 years with 70% of the population studied male, and 30% female.

Nine GATB standardized aptitude scores and 11 WAIS-R standardized subtest scores plus 3 WAIS-R IQ scores were the variables of study collected ex-post-facto for each subject. The two test instruments were administered to subjects by certified or licensed examiners.

Two research questions were proposed for the study and will provide a foundation for summarizing findings, concerns, and conclusions.

1. Are there predictive relationships among aptitude scores measured by the GATB and subtest scores measured by the WAIS-R?

2. Can WAIS-R subtest scores or combinations of WAIS-R subtest scores be used to measure vocational aptitudes?

Analysis of data to address these questions required a stepwise multiple regression procedure to develop equations to estimate nine (9) dependent variables (GATB) from a combination of eleven (11) independent variables (WAIS-R). Additional stepwise multiple regressions were developed using the three WAIS-R IQs as the dependent variable and the nine GATB Aptitudes as the independent variables. Forward regressions were computed for additional information. Also, distribution statistics and correlational data are given

regarding the population studied for each of the 23 variables under investigation.

Summary of WAIS-R Data

Analysis of the distribution of WAIS-R data reveals that the mean subtest score for the Verbal Scale is 7.64 (SD=2.94) which is not significantly different from the mean of the standardization groups. The mean subtest score for the Performance Scale is 8.70 (SD=2.76) which, again, is not significantly different from the mean of the standardization groups. The mean Verbal IQ for the population studied was 90 (SD=12), the mean Performance IQ was 92 (SD=13.9), and the mean Full Scale IQ was 90 (SD=11.4). The population studied means are below the standardization group, but not to a significant degree.

The WAIS-R correlational data indicate that intercorrelations within set are, for the most part, low between non-verbal and verbal tests, and moderate for scores within each scale. The correlations of the population studied are congruent with patterns reported in the standardization groups, but lower in degree. Also, the WAIS-R IQ Scale intercorrelations show a pattern similar to the normative group.

Summary of GATB Data

Examination of GATB data shows that the mean of Aptitude

P-Form Perception, Aptitude Q-Clerical Perception, and Aptitude K-Motor Coordination closely reflect the GATB standardization with respect to mean performance. Although the means are lower for Aptitude S-Spatial, and Aptitude M-Manual Dexterity, they are within a standard deviation of the normative group means. Means, particularly with respect to Aptitude G-Intelligence and Aptitude N-Numerical, are lower than expected based on the norms (USES, 1970; 1980).

Correlational data of the GATB scores for the study indicates that aptitudes within set are all low to moderate and consistent with patterns in the GATB standardization group.

Summary of Multiple Regressions

In an effort to investigate whether predictive relationships exist among aptitudes measured by the GATB and subtests measured by the WAIS-R, multiple regression equations were computed. The results of the regressions suggest that the prediction equation for categorical use are unsuitable for using the WAIS-R subtests for predicting the GATB Aptitudes. Aptitude F shows the highest degree of variance (63.8%). Other squared multiple correlations range from .13 for Aptitude Q to .52 for Aptitude S. The standard errors of the estimate are large, ranging from 5.2 for Aptitude V to 17.5 for Aptitude M.

The analysis shows a high degree of concurrent validity between the GATB and WAIS-R instruments; however, the sizes of

the relationships are not adequate for using the individual subtests for prediction. Components of each instrument are shown as dependent variables, as well as independent variables and some high positive non zero relationships are revealed. Since there is an absence of validity concerns regarding the two tests, it is suggested that even though the GATB and WAIS-R show some component relationships, there is enough independent information provided by each instrument to warrant administering both.

Discussion of Findings

Methodological Issues

Certain methodological issues concerning this study and its sample need to be addressed. The primary weaknesses of this study are: (a) the restricted, homogeneous population of adolescents with learning disabilities, and (b) the variable - to -subject ratio.

Restriction in range means that the test scores for groups are concentrated in a small portion of the possible range. Groups of this type have been demonstrated to have smaller standard deviations (Pedhazur, 1982). The scores may be concentrated in a particular range within the domain of possible score distributions. Therefore, the correlations among scores may be lower for the homogeneous group than within one not so restricted.

The means and other measures of central tendency for the

GATB and WAIS-R are all lower than measures obtained for the norm group. Also, the GATB and WAIS-R within set correlations are lower in measure than for the norm groups. The conclusion is that the adolescents with learning disabilities comprising the population in this study are biased towards the low average ability. This tendency can often be associated with groups of individuals with learning disabilities (e.g., Vellutino, 1987).

Forward and stepwise multiple regressions were used for the analyses in this study. Tabachnick and Fidell (1989) suggested that 20 times more cases than IVs (Independent Variables) are a favorable ratio for either standard multiple or hierarchical regressions, and as many as 40:1 for stepwise regressions. However, Borg and Gall (1979) recommended that for stepwise regression, one should have 30 cases for the first IV and 10 cases for each additional IV. The literature indicates that the number-of-cases to IVs issue is as yet undecided. Although the appropriateness of the ratio of cases to IVs in this study may be debated, the results reveal several correlations that are fairly strong given the amount of variance they account. Overall, the population size for this study is adequate to answer the research questions.

GATB and Adolescents with Learning Disabilities

There has been no previous study which examines the GATB within a sample of adolescents with learning disabilities.

However, Heinlein (1987) conducted a study involving a group of adults with learning disabilities, and found that the means were generally lower than the standardization group. Heinlein (1987) concluded that Aptitude Q and Aptitude P are not particularly valid for adults with learning disabilities.

The pattern of GATB Aptitudes for the adolescent group shows similarities to the adult group. The means for Aptitudes G, V, N, K, F, and M are lower for the two groups with learning disabilities than for the standardization group, while Aptitudes S, P, and Q parallel to a higher degree the norm group.

These aptitudes correlate to a high degree with the psychomotor factor as well as the perceptual factor (USES, 1983a). Many individuals with learning disabilities experience difficulty with visual perceptual analysis (Perlmutter, 1987). Therefore, these results are understandable.

The lower means obtained by the group of adolescents with learning disabilities suggest a restriction in range. However, this may also indicate that the GATB underestimates the vocational aptitude of adolescents with learning disabilities. This apparent flaw implies that GATB scores used alone as measures of vocational aptitude would be inappropriate for vocational guidance among adolescents with learning disabilities.

WAIS-R and Adolescents with Learning Disabilities

Means and standard deviations for the WAIS-R data from the adolescents with learning disabilities differ from those of the standardization group. Mean Full Scale (90), Verbal Scale (90), and Performance Scale (92) are at a lower degree of measure, but not significantly different from the norm group. There are no mean differences of significance (+-3) between any of the six subtest means scaled scores and the overall mean of the Verbal Scale (7.9). Also, there are no significant mean differences between the Performance Scale scores and the overall means of its scale (8.7).

The pattern of WAIS-R data does not reflect the typical profile associated with adolescents with learning disabilities. For example, a typical profile would indicate that the Verbal IQ is significantly lower than the Performance IQ or vice versa, and/or a particular subtest score (S) is significantly lower than another. These findings are congruent with results from a meta-analysis of over 90 studies related to global and subtest Wechsler score interpretations done by Kavale and Forness (1984). Kavale and Forness (1984) asserted that such patterns are best avoided for establishing a criteria for learning disabilities.

Predictive Relationships between GATB and WAIS-R

The analysis shows a high degree of validity between the GATB and WAIS-R tests. The sizes of the relationships are not

adequate for using individual subtests for prediction. Although high predictive levels are not shown for any one subtest, a general overall predictive ratio across some subtests are shown. However, the prediction equation appears unsuitable for using the WAIS-R subtests for predicting the GATB Aptitudes. The standard errors range from 5.2 for Aptitude V to 17.5 for Aptitude M. Aptitude F accounts for the highest degree of variance (.64) while Aptitude S the lowest degree of variance (.13).

Components of each test are examined as dependent variables as well as independent variables, and some strong relationships are illustrated. This study suggests that even though the GATB and WAIS-R data show a predictive relationship, there is enough independent information provided by each test to warrant using both.

The results of these analyses indicate that a substantial portion of the variance in the two instruments is not shared. Considering the Cattell (1963) model of fluid versus crystallized ability, it appears from these findings that GATB may be conceptualized as a test of crystallized (concrete) ability. The GATB is more of a performance related test requiring the understanding of specific kinds of work-related skills. The WAIS-R may be better thought of as a measure of fluid intelligence (ability to solve problems). The WAIS-R gives some measure of general information about the world which is not specific and not specifically tied to work

related skills. The study suggests that the WAIS-R measures fluid intelligence to a higher degree than crystallized, while the GATB measures crystallized to a higher degree than fluid.

Implications for Professionals

House and Lewis (1985) stress the value of using the WAIS-R as a tool for vocational assessment and counseling. They indicate that the WAIS-R can contribute more than is generally recognized to vocational counseling. Furthermore, they state that the WAIS-R provides vocationally useful data for developing hypotheses for exploring vocational choices.

Lindermann and Malarazzo (1984) indicate that the WAIS-R hypotheses regarding vocational information have been based on clinical judgement rather than vocationally oriented research. There had been no known vocationally oriented research regarding the WAIS-R until Heinlein's (1987) study. His study was the first to look at the WAIS-R from a vocational perspective using an empirical approach, and the findings of Heinlein's study are reviewed in Chapter II. The results of the Heinlein correlational study of WAIS-R and GATB with adults with learning disabilities in a rehabilitation center are similar to results of the WAIS-R and GATB data in this study of adolescents with learning disabilities. The present study is most significant in being the first to investigate the value of using the WAIS-R scores for assessing vocational aptitudes of adolescents with learning disabilities. Also,

the study contributes to the investigation of the WAIS-R and GATB scores as they determine characteristics of adolescents with learning disabilities in a public school setting.

The WAIS-R data from this study support the appropriateness of administering the instruments to individuals with learning disabilities. In addition, the WAIS-R shows some predictive relationships to the GATB; however, the prediction equation may be unsuitable for using the WAIS-R subtests in predicting the GATB Aptitudes. In other words, WAIS-R scores alone for making inferences about vocational aptitude are unsuitable for placement decisions, but are suitable for making conjectures about further vocational exploration.

The GATB data obtained in this study suggest that the instrument may not be fully appropriate for vocational planning with adolescents with learning disabilities. The means for Aptitude G, V, N, S, F, and M are lower in measure than for the standardization group, while Aptitudes P, Q, and K are in parallel measure with the norm group. Heinlein (1987) found similar results from his investigation. The GATB may underestimate the true aptitude of adolescents with learning disabilities in some areas of psychomotor functioning.

School psychologists and other professionals must address the vocational needs of secondary level students with learning disabilities. This study reveals that these students needs

are difficult to access and are often ignored. It is important to recognize the complexity of individuals with learning disabilities. More than ordinary caution must be taken when assessing the vocational needs of adolescents with learning disabilities. One should use particular caution when using instruments that do not include individuals with learning disabilities in the normative group. Professionals must see the impact of vocational immaturity in adolescents with learning disabilities and begin to provide them with appropriate guidance so they can make a successful transition from school to work. This study provides information about the vocational characteristics of the WAIS-R regarding adolescents with learning disabilities so that school psychologists and other professionals can make some exploratory conjectures about the vocational aptitudes of secondary students with learning disabilities. However, the results of this study suggest that decisions about vocational aptitudes should not be based solely on WAIS-R information.

Recommendations for Future Research

The results of this study open the door for further investigation. It is important to verify the generalizability of the predictive relationships between the WAIS-R and GATB data. Therefore, a larger sample would be desirable so that cross validation could be used to test the generalizability of

the solution. Also, a study with a larger population number may produce stronger predictive relationships. Although general practice indicates that the present study had at least an adequate number for its population, researchers agree that for an analysis using regression, large populations or samples produce better results. Tabachnick and Fidell (1989) even recommended cases to independent variable ratio of 40 to 1 for stepwise regression analysis.

Additional studies need to be done on the GATB regarding individuals with learning disabilities in order to address the incongruence of the GATB data in the present study and the standardization data. An additional study with cross validation of the GATB Aptitudes would help to determine if the data in this study are generalizable to the population of adolescents with learning disabilities. More research is needed to determine if the GATB is appropriate to use in making vocational plans with adolescents with learning disabilities.

It is important to investigate the unexplained variance found from the regression analysis of the WAIS-R as a predictive measure of the GATB aptitudes. A study of short form vocational aptitude tests availability and composition is needed in order to find those instruments which would offer a solution to the variance not accounted for by the WAIS-R. To fill the information gap the study describes, the WAIS-R should be supplemented with short form vocational aptitude

tests which would not be time consuming to administer. If the appropriate supplementary vocational instruments could be identified, those tests along with the available WAIS-R data could provide the same information as the GATB.

Given the outcome of the present investigation, school psychologists and other professionals would benefit from a study to determine the predictive relationship between the Wechsler Intelligence Scale for Children-III (WISC-III) and the GATB as well as continue further study of the relationship between the WAIS-R and GATB. If a significant vocational component could be found in the WISC-III, vocationally oriented information would be available at an early stage for vocational exploration. The richer the fund of vocational information available, the better school psychologist and other professionals can help adolescents with learning disabilities make plans for successful transitions from being a student to being a productive member of the economy.

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APPENDIX A

DANVILLE PUBLIC SCHOOLS LETTER OF PERMISSION

DANVILLE PUBLIC SCHOOLS
TEACHING MATERIALS CENTER
GOODE STREET
DANVILLE. VIRGINIA 24541

April 7, 1993

William H. Brown
115 Westwood Court
Danville, VA   24541

Dear Mr. Brown:

Your request for our assistance in your dissertation research project has been approved. The topic as proposed , "Assessment Value of the Wechsler Scales in Psychological Evaluations to Measure Vocational Aptitude among Students with Learning Disabilities at the Secondary School Level" will provide beneficial information for our school system.

Our primary concern is that we continue to ensure the confidentiality of our students' records which means essentially that the student's identity remain anonymous or that their permission be obtained if specific student information is used. We understand that you will be using only test scores of students who were given both the Wechsler Adult Intelligence Scale-Revised and the General Aptitude Test Battery and no student contact will be made.   The size of your sample (approximately 150) and the statistical techniques employed will ensure that no individual students' profile could be identified.

We are sending a copy of this letter to Dr. Thomas H. Hohenshil, Dissertation Chair as notice of this approval.

If we can assist you in any way with this project, please let us know.

Sincerely,

Ms. Patricia A. Davis
Director of Special Education and Special Services

Dr. Carolyn S. Harris
Instructional Developmental Specialist

c: Dr. Hohenshil

APPENDIX B

WECHSLER ADULT INTELLIGENCE SCALE-REVISED

<u>WECHSLER ADULT INTELLIGENCE SCALE-REVISED</u>

The Wechsler Adult Intelligence Scale-Revised (WAIS-R) is the most widely used psychological test used by school psychologists for the assessment of secondary level students or special education candidates (Heinlein, 1987). The WAIS-R has proven to be a valid diagnostic tool utilized for intellectual assessment and research in most western, English speaking cultures (Kaufman, 1985; Matarazzo, 1985). The WAIS-R has been used to investigate a diversity of rehabilitational, clinical, and research questions in a medley of different samples, conditions, and samples.

David Wechsler developed the WAIS-R in 1981 which is a revision of the WAIS (1955). A well standardized test (N=1880) of intelligence, the WAIS-R contains eleven (11) subtests appropriate for persons aged 16 to 74 years. The WAIS-R is composed of three factor scores which are as follows: (1) Full Scale IQ (FIQ); (2) Verbal Scale IQ (VIQ); and (3) Performance Scale IQ (PIQ). The test has a mean of 100 and a standard deviation of 15. The VIQ is made up of six (6) subtests while the PIQ is made up of five (5) subtests. The FIQ is generated from all eleven (11) subtests.

The WAIS-R subtests provide at least three additional factors other than the ones given by Wechsler. The factors identified other than the Wechsler IQs are as follows: Perceptual Organization Deviation Quotient (PODQ); Verbal Comprehension Deviation Quotient (VCDQ); and Factor III

Deviation Quotient referred to as either the Memory Deviation Quotient or Freedom From Distractibility Deviation Quotient (FDDQ). (Wechsler, 1981; Silverstein, 1982a; Gutkin, Reynolds, & Galvin, 1984).

INFORMATION. Includes 29 items on the Verbal Scale which assesses general information acquired through educational experiences. Subjects are requested to respond verbally to general information questions. Some changes were made on the Information Subtest of 1955 WAIS. Wechsler (1981) reported in the manual that the average test-retest reliability coefficient to be .89 with little variation by age group. The average standard error of measurement is .93 across ages. This subtest may access cultural opportunities, interests, reading, and memory (Sprandel, 1985). Gutkin, Reynolds, and Galvin (1984) found this Information Subtest to load highly on the Verbal Comprehension Deviation Quotient Factor.

PICTURE COMPLETION. Contains 20 timed items on the Performance Scale. It assesses alertness to details in pictures, visual analysis, and long term visual memory (Sprandel, 1985). The subject is asked to identify a missing part of an incompletely drawn picture. Minor changes are seen in comparison from the WAIS (1955) version. The split-half reliability coefficients average was reported by the manual to be .81 with some age group variation. The test-retest coefficients were reported to range from .86 to .89. The average standard error of measurement was found to be 1.25. The Picture Completion Subtest exhibits notable variation by

age groups particularly with older individuals. It does not consistently load on any other factor.

DIGIT SPAN. Consists of series of numerals, each progressively one digit more than the previous one. After the subject repeats digits forward series, the subject is requested to repeat digits backwards or in reverse order. The Digit Span Subtest is part of the Verbal Scale. Administration directions and scoring were the only changes made on the subtest. The test-retest reliability coefficients are reported to average .83 with little discrepancy across age groups. The manual reported 1.23 as the average standard error of measurement. Two kinds of cognitive functioning is thought to be included in this subtest. Cooper (1982) stated that digit forward calls for short-term memory while digits backward calls for divergent processes which include short-term memory as well as visualization of the sequence ability. Sprandel (1985) provided reasons to justify Digit Span being an estimate of susceptibility to distractibility, short-term memory and anxiety. Silverstein (1982a) indicated that this subtest is usually associated with the Factor III Deviation Quotient.

PICTURE ARRANGEMENT. Includes a series of comic-strip-like pictures which the subject is asked to re-arrange into an order that tells a story. This subtest belongs to the Performance Scale. Ability to comprehend whole situations, perceptual organization, and social knowledge are required for the Picture Arrangement Subtest. Sprandel (1985) indicated

that the subtest measures the ability to organize visual materials into a sequential, logical order that reflects social comprehension or intelligence. The content, administration, and scoring of the subtest were changed from the earlier one. As measured by split-half correlations the, Picture Arrangement Subtest has one of the lowest average reliabilities (.74). Also, the test-retest reliability coefficients average of .76 is low. The average standard error of measurement across age groups is reported at 1.41. No consistency has been reported in correlations with other subtests or other factors. Of all the subtests, this subtest displays the greatest degree of cultural bias.

VOCABULARY. Contains an estimate of both expressive and receptive parts of language. Wechsler (1958) saw this subtest as being the best single estimate of general intelligence. Part of the Verbal Scale, the Vocabulary Subtest contains 35 words progressively more difficult to define and given through visual as well as auditory channels. Seven words were deleted from the 1955 WAIS and two were added for the new version. Split-half reliabilities are reported to be consistently high ranging from .94 to .96 across all age groups. The test-retest reliability coefficients which range from .93 to .96 are the highest of all the WAIS-R subtests. The average standard error of measurement is.61 which is the lowest of all subtests. The Vocabulary Subtest measures verbal conceptualization and abstract thinking (Sprandel, 1985). Also, it is an estimate of verbal comprehension and loads on

the Verbal Comprehension Factor (Gutkin, Reynolds, & Galvin, 1984; Silverstein, 1982a).

BLOCK DESIGN. Includes perceptual organization skills, recognition of part-whole relationships, visual-motor coordination, the reproduction of visually presented abstract block designs, and ability to work under time limits pressure. Only one of the ten (10) designs of the 1955 WAIS was changed; however, the rules for scoring were changed. With an average of .87 for split-half reliabilities, the Block Design Subtest has the highest of any Performance Scale subtest. Also, with an average of .98, the Block Design Subtest has the highest standard errors of measurement. This subtest is thought to be a measure of nonverbal, synthesizing, and abstract ability. The task required analysis of the Block Design Subtest to be copied, a decision about arrangement of the blocks to duplicate a design, and visual motor integration (Sprandel, 1985). Block Design loads on the Perceptual Organization Factor (Gutkin, Reynolds, & Galvin, 1984; Silverstein, 1982a). Chastian and Joe (1987) found evidence to suggest that the subtest measures manual dexterity for males.

ARITHMETIC. Contains a timed estimate of the ability to manipulate numbers mentally while solving problems of mathematical reasoning. Only elementary level mathematics are required for the most difficult of the 14 items. There are only minor changes from the earlier edition. Split-half reliability coefficients average for all ages is .84. Coefficients range is from .73 at ages 16-17, .81 for ages 18-

19, and up to .87 for ages 55-69. For test-retest reliability coefficients range from .80 for ages 25-34, to .90 for ages 45-54. Standard error of measurement average is 1.14. This variance has been attributed to the influence of education and the day to day use of mathematics from year to year (Sprandel, 1985). Arithmetic is considered an estimate of mathematical ability, as well as concentration ability. This subtest factors on the Freedom from Distractibility Deviation Quotient (Silverstein, 1982a). Sprandel (1985) asserted that even though gender bias has been suggested, no evidence has been reported.

OBJECT ASSEMBLY. Contains a set of jigsaw like puzzles. The Object Assembly is timed and a subtest of the Performance Scale. It is thought to be an estimate of visual psychomotor ability, and ability to deal with part-whole relationships (Sprandel, 1985). Visual-motor coordination and related perceptual organization are required. One puzzle was changed from the 1955 WAIS. The average of the split-half reliability coefficients is .68 with a range from .52 to .73. More consistency is found on the test-retest coefficients which range from .67 to .72 across age groups. The average standard error of measurement is 1.54 which is the largest of any of the WAIS-R subtests. The Object Assembly provides a measure of visual perceptual organization ability and problem solving ability (Sprandel, 1985). This subtest loads on the Perceptual Organization Factor (Gutkins, Reynolds, & Galvin, 1984; Silverstein, 1982a).

COMPREHENSION. Consists of verbal comprehension and verbal conceptualization. This subtest is on the Verbal Scale and considered one of the most interesting subtests because of the clinical as well as educational insights it provides. It is considered a measure of social judgement and verbal conceptualization (Sprandel, 1985). Some major changes were made to the 1955 edition to develop the current revised edition. The WAIS-R edition is composed of sixteen (16) items which can give practitioners an understanding of some psychological aspects of the subject as well as to their understanding of social concepts. Split-half reliability coefficients were found to range as high as .90 for the 65-69 age group to as low as .77 for the 20-24 age group. Although test-retest correlations were found to be the lowest of the Verbal Scale subtests, they were found satisfactory with a range of .79 to .82. The standard error of measurement average is 1.20. The Comprehension Subtest loads on the Verbal Comprehension Factor (Gutkin, Reynolds, & Galvin, 1984; Silverstein, 1982a). Faas and D'Alonzo (1990) found that the Comprehension Subtest is the best predictor of a successful transition from school to work. Leonard (1991) reported that this subtest is strongly correlated with Grade Point Average.

DIGIT SYMBOL. Includes nine symbols paired with nine numerals on the Performance Scale. The subject is required to fill in the blank the appropriate symbols under associated numbers within a 90 second time limit. This subtest is essentially the same on the revised edition as on the 1955

WAIS. The Digit Symbol subtests measures visual memory, visual acuity, visual fine-motor coordination, and speed (Sprandel, 1985). Concentration and freedom from distractibility are needed to be successful on the subtest. This timed subtest is not appropriate for split-half reliability computations. However, an average of .82 was found using test-retest calculations. The average standard error of measurement was found to be 1.27. The Digit Symbol usually loads on the Factor III, Freedom from Distractibility (Silverstein, 1982a).

SIMILARITIES. Consists of verbal comprehension, abstract reasoning, and analysis. Minor changes were made in the 14 paired associate items from the 1955 WAIS to the 1981 WAIS-R. The average split-half reliability of .84 is satisfactory with a range from .78 to .87 showing a trend toward increased reliability with increased age. Also, the manual reports test-retest reliability to be in the eighties. The average standard error of measurement is 1.24. Sprandel (1985) indicated that fluidity of thought, synthesis of knowledge, long-term memory, and creativity are required for this subtest. The Similarities Subtest loads on the Verbal Comprehension Factor (Gutkin, Reynolds, & Galvin, 1984; Silverstein, 1982a). Leonard (1991) found a strong relationship between success on College Grade Point Average and success on the Similarities Subtest.

APPENDIX C

GENERAL APTITUDE TEST BATTERY

GENERAL APTITUDE TEST BATTERY

The General Aptitude Test Battery (GATB) is the most frequently and widely used vocational aptitude test. The GATB was published by the Division of Counseling and Test Development of the United States Employment Services (USES, 1970, 1980) which is a branch of the U. S. Department of Labor, Employment and Training Administration. It was developed in 1947 for the national United States Employment Service to be used in vocational counseling and placement services. Over 500 studies exist showing the extent to which the GATB predicts future job performance (USES, 1983a). Zytowski and Borgin (1983) asserted that the GATB has no equal considering the size of its occupational data base. Heinlein (1987) stated that "the history of the GATB is extensive and instructive in the development of over 400 criterion-related Occupational Aptitude Patterns (OAPs) keyed to 12,000 occupations statistically defined in the Department of Labor's Dictionary of Occupational Titles" (p. 173).

The GATB is considered a well standardized measure (N=4,000) of multi-aptitudes appropriate for grade nine through adulthood. It can either be machine or hand scored. The GATB includes eight (8) paper-and-pencil, and four (4) apparatus tests developed to estimate nine (9) aptitudes proven to be important for performance in jobs. Standard scores have a mean of 100 and a standard deviation of 20. The nine standardized scores are next utilized to develop

percentiles and pass/fail Occupational Aptitude Patterns (OAPs). GATB is one part of the comprehensive USES Counselor Assessment and Occupational Exploration System now utilized in 50 states. Also, the Dictionary of Occupational Titles as well as the Guide for Occupational Exploration (USES, 1979a) are included in this integrated cross-references system. Administration time for the GATB is about 2.5 hours. Although it was planned as a group test, the GATB can be administered individually. The USES program provides GATB pre-testing orientation exercises. The GATB should be given under USES license and by USES certified testing specialists. There has been ample research to justify the reduction of the new aptitudes to three factors referred to as the GATB Cognitive Factor, the GATB Perceptual Factor, and the GATB Psychomotor Factor (Watts & Everitt, 1980; Hammond, 1984; USES, 1983b).

GATB Subtests

Part 1 - Name Comparison. Consists of two columns of names. The subject examines the various pairs of names and indicates whether the two names are the same or different. The subtest is a measure of Aptitude Q - Clerical Perception. Name Comparison loads on the GATB Perceptual Factor (Hammond, 1984).

Part 2 - Computation. Contains paper-and-pencil arithmetic exercises including ones of addition, substraction, multiplication, and division of whole numbers. This subtest, plus Part 6, estimates Aptitude N-Numerical. This subtest

loads on the GATB Cognitive Factor (Hammond, 1984).

Part 3 - Three-Dimensional Space. Includes a series of exercises consisting of a stimulus figure and four drawing of three dimensional objects. The stimulus figure is shown as a flat piece of metal that is to be either rolled, bent, or both. Lines show where the figure is to be bent. The subject notes which of the four drawing could be constructed from the stimulus figure. This subtest, along with Parts 4 and 6, estimates Aptitude G-Intelligence and alone estimates Aptitude S-Spatial. This subtest loads on GATB Cognitive Factor and Perceptual Factor (Hammond, 1984).

Part 4 - Vocabulary. Contains sets of four words. The subject notes which two words has either the opposite or same meaning. This subtest, plus Part 3 and 6 estimates Aptitude G-Intelligence and alone Aptitude V-Verbal. Part 4 loads on the GATB Cognitive Factor (Hammond, 1984).

Part 5 - Tool Matching. Contains exercises including a stimulus drawing as well as four black and white drawings of simple shop tools. The subject notes which one of four is the same as the stimulus drawing. Only in the distribution black and white do variation exists. Tool Matching, along with Part 7, estimate Aptitude P-Form Perception. Tool Matching loads on the GATB Perceptual Factor (Hammond, 1984).

Part 6 - Arithmetic Reasoning. Includes arithmetic problems expressed in a verbal manner. This subtest, along with Parts 3 and 4 estimates Aptitudes G-Intelligence which with Part 2 estimates Aptitude N-Numerical. Part 6 loads on

the GATB Cognitive Factor (Hammond, 1984).

Part 7 - Form Matching. Contains two groups of varying line shaped drawings. The subject points out which figure in the second group is the same as each figure in the stimulus group. This subtest, together with Part 5, estimates Aptitude P-Form Perception. This subtest loads on the GATB Perceptual Factor (Hammond, 1984).

Part 8 - Mark Making. Includes a series of squares, and the subject is required to make three pencil marks as quickly as possible. The marks required are very short lines, two vertical lines and one horizontal line beneath them. This subtest estimates Aptitude K-Motor Coordination. Mark Making loads on the GATB Psychomotor Factor (Hammond, 1984).

Part 9 - Peg Placement. Contains a rectangular pegboard divided into two parts, each including 48 holes. The upper part has 48 cylindrical pegs. The subject transposes the pegs from top section to the corresponding empty bottom section. Two pegs are moved simultaneously, one peg in each hand. This task is repeated three times with the subject trying to transpose as many pegs as possible during each timed trial. This subtest, together with Part 10, estimates Aptitude M-Manual Dexterity. Peg Placement loads on the GATB Psychomotor Factor (Hammond, 1984).

Part 10 - Peg Turning. Includes the same materials used in Part 9 with the lower part of the pegboard housing the 48 pegs. The subject takes pegs from holes, turns them over so that the opposite ends are up, and returns them to the hole

from which they were taken. Using the preferred hand, the subject turns and replaces as many pegs as possible during the time limit. The subject is given three trials. This subtest together with Part 9 estimates Aptitude M-Manual Dexterity. Peg Turning loads on the GATB Psychomotor Factor (Hammond, 1984).

Part 11 - Assembly. Consists of a Finger Dexterity Board made with 50 holes and a supply of small washers and rivets. Using a preferred hand the subject takes a small metal rivet from a hole in the upper section of the board while simultaneously taking a small metal washer from a vertical rod with the other hand. The subject places the washers on the rivets and puts assembled pieces into the corresponding holes in the lower part of the board. The subject attempts to transpose as many objects as possible during the allotted time. This subtest as well as Part 12 estimates Aptitude F-Finger Dexterity. The Assembly loads on the Psychomotor Factor (Hammond, 1984).

Part 12 - Disassembly. Includes the same apparatus described in part 11. The subject takes the metal rivet in the assembly from a hole in the lower section of the board, moves the washer to the bottom of the board, places the washer on the rod with one hand and the rivet into the corresponding hole in the upper section of the board using the preferred hand. During the time limit the subject works to move as many rivets and washers as possible. This subtest, together with Part 11, estimates Aptitude F-Finger Dexterity. Disassembly

loads on the GATB Psychomotor Factor (Hammond, 1984).

GATB APTITUDES

Aptitude G-Intelligence. Consists of the ability to understand instructions, to reason, and make judgments (USES, 1970, 1980). It is estimated by Parts 3, 4, and 6. Aptitude G loads on the Cognitive Factor of the GATB and has a reported reliability of .88 (USES, 1983b).

Aptitude V-Verbal. Includes the ability to understand word meanings and to utilize them effectively (USES, 1970, 1980). It is estimated by Part 4. Aptitude V loads on the Cognitive Factor of the GATB, and it has a reliability of .85 (USES, 1983b).

Aptitude N-Numerical. Consists of the ability to make quick and accurate arithmetic operations (USES, 1970, 1980). It is estimated by Parts 2 and 6. Aptitude N loads on the Cognitive Factor of the GATB and has a reported reliability coefficient of .83 (USES, 1983b).

Aptitude S-Spatial. Contains the ability to make mental manipulations of geometric forms (USES, 1970, 1980). It is estimated by Part 3. Aptitude S loads on the Perceptual Factor of the GATB, and has a reported reliability coefficient of .81 (USES, 1983b).

Aptitude P-Form Perception. Includes the ability to see details in graphic material and ability to make visual discriminations of differences in shapes and shadings (USES, 1970, 1980). It is estimated by Part 3. Aptitude P loads on the Perceptual Factor of the GATB and has a reported

reliability coefficient of .79 (USES, 1983b).

Aptitude Q-Clerical Perception. Consists of the ability to perceive pertinent detail in verbal or tabular material, to proofread words and numbers, to avoid perceptual errors in arithmetic computations, and ability of speed of perception required in many jobs even though the job may not have numerical or verbal content (USES, 1970, 1980). It is estimated by Part 1. Aptitude Q loads on the Perceptual Factor of the GATB and the reliability is reported at .75 (USES, 1983b).

Aptitude K-Motor Coordination. Includes the ability to coordinate eyes and hands rapidly, and accurately in executing precise movements (USES, 1970, 1980). It is estimated by Part 8. Aptitude K loads on the Psychomotor Factor of the GATB and the reliability coefficient is reported to be .86 (USES, 1983b).

Aptitude F-Finger Dexterity. Consists of the ability to use ones fingers to manipulate small objects rapidly and accurately (USES, 1979b). It is estimated by Part 11 and 12. Aptitude F loads on the Psychomotor Factor of the GATB and reliability is reported to be .76 (USES, 1983b).

Aptitude M-Manual Dexterity. Includes the ability to move ones hands easily and skillfully in executing placing and turning motions (USES, 1970, 1980). It is estimated by Parts 9 and 10. Aptitude M loads on Psychomotor Factor of the GATB and the reliability coefficient is reported to be .77 (USES, 1983b).

AUTHOR'S VITA

William Howard Brown was born July 28, 1946, the son of Lillie Epps Brown and Cabel Howard Brown, South Boston, VA. He attended Averett College where a Bachelor of Arts Degree (Cum Laude) in Psychology was earned. While attending Averett, he was nominated a member of Alpha Chi Honor Society, Psi Chi, and Who's Who in American Colleges and Universities. William received the Master of Education Degree and advanced training in School Psychology from James Madison University in 1975 and 1976 respectively. He completed a one year internship in School Psychology during 1977 in the Danville Public Schools and was employed by the Danville Public Schools as a school psychologist the following year. William returned for graduate study at Virginia Polytechnic Institute and State University during 1986. At present, the author is employed as a school psychologist by the Danville Public Schools.

William H. Brown