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*Emphasis on Adolescents and Young Adults*

PERFORMANCE AND COMPETENCE  
OF LEARNING DISABLED AND  
HIGH-ACHIEVING HIGH SCHOOL STUDENTS  
ON ESSENTIAL COGNITIVE SKILLS

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## COOPERATING AGENCIES

Were it not for the cooperation of many agencies in the public and private sector, the research efforts of The University of Kansas Institute for Research in Learning Disabilities could not be conducted. The Institute has maintained an on-going dialogue with participating school districts and agencies to give focus to the research questions and issues that we address as an Institute. We see this dialogue as a means of reducing the gap between research and practice. This communication also allows us to design procedures that: (a) protect the LD adolescent or young adult, (b) disrupt the on-going program as little as possible, and (c) provide appropriate research data.

The majority of our research to this time has been conducted in public school settings in both Kansas and Missouri. School districts in Kansas which have or currently are participating in various studies include: Unified School District USD 384, Blue Valley; USD 500, Kansas City, Kansas; USD 469, Lansing; USD 497, Lawrence; USD 453, Leavenworth; USD 233, Olathe; USD 305, Salina; USD 450, Shawnee Heights; USD 512, Shawnee Mission; USD 464, Tonganoxie; USD 202, Turner; and USD 501, Topeka. Studies are also being conducted in several school districts in Missouri, including Center School District, Kansas City, Missouri; the New School for Human Education, Kansas City, Missouri; the Kansas City, Missouri School District; the Raytown, Missouri School District; and the School District of St. Joseph, St. Joseph, Missouri. Other participating districts include: Delta County, Colorado School District; Montrose County, Colorado School District; Elkhart Community Schools, Elkhart, Indiana; and Beaverton School District, Beaverton, Oregon. Many Child Service Demonstration Centers throughout the country have also contributed to our efforts.

Agencies currently participating in research in the juvenile justice system are the Overland Park, Kansas Youth Diversion Project, and the Douglas, Johnson, Leavenworth, and Sedgwick County, Kansas Juvenile Courts. Other agencies which have participated in out-of-school studies are: Penn House and Achievement Place of Lawrence, Kansas; Kansas State Industrial Reformatory, Hutchinson, Kansas; the U. S. Military; and Job Corps. Numerous employers in the public and private sector have also aided us with studies in employment.

While the agencies mentioned above allowed us to contact individuals and support our efforts, the cooperation of those individuals--LD adolescents and young adults; parents; professionals in education, the criminal justice system, the business community, and the military--have provided the valuable data for our research. This information will assist us in our research endeavors that have the potential of yielding greatest payoff for interventions with the LD adolescent and young adult.

## ABSTRACT

This study was designed to measure performance differences of learning disabled and high-achieving high school students judged crucial to academic learning and to determine teacher performance standards on those same crucial learning skills. Learning disabled and high-achieving students completed the Adult Performance Level Functional Literacy test and a set of domain-referenced tests designed for the study. These instruments were designed as pre-instructional probes in five areas: knowledge of test-taking, scanning for information, monitoring errors, taking notes from lectures, and listening comprehension.

Results showed that high achievers performed significantly better than LD students across the complex, and within every domain, of learning skills assessed. When common variance between a test of functional adult competence and the domain-referenced test of crucial learning skills was controlled, significant group differences remain due to learning skills. In addition, significantly greater proportions of LD students fall below teacher-derived standards of minimal competence in all skills areas assessed than do high-achieving students.

PERFORMANCE AND COMPETENCE OF LEARNING DISABLED AND  
HIGH-ACHIEVING HIGH SCHOOL STUDENTS ON ESSENTIAL COGNITIVE SKILLS

Academic achievement at the secondary school level has been thought to depend on student proficiency in the basic skills. Within the past ten years, patterns of declining scores on achievement tests, and disenchantment with educational frills have led to a "back to the basics" movement in many communities throughout the United States (Brodinsky, 1977, Pursell, 1976). This movement has resulted in a clamor for legislatively mandated minimal competency examinations (Chall, 1979). Advocates of different curricular philosophies disagree on the scope of those learnings which might be considered basic. Although the public defines the basics as reading, writing and mathematics (Gallup, 1978), support for courses in specific subject matter (Ogletree, 1979) and for general goals such as development of moral standards and understanding of self (Evans & Harmon, 1979) continues. It seems clear, upon analysis, that the word basic can be a term to fit all occasions.

Learning as a Basic Skill

The debate over the role of the public school and the nature of basic learning requirements continues. What is clear is that whatever society wishes to teach in schools must be learned by children. The degree to which children are capable of learning course content is a critical variable in education. A pivotal question underlying the entire curricular debate is seldom raised: Is there a set of skills or learning abilities which enables a competent learner to address and master various types of course content?

Those persons engaged in the curricular debate often fail to note that many students are failing to learn either skills or content. They often charge that failure in one, especially skills, is due to an inordinate focus on the other. This charge may be valid. Perhaps intensive instruction in skills at the expense of content would benefit some students. The pattern of failure extending across both skills and content may also indicate that there is a deficit in the way children approach a learning situation which results in observed achievement lags. If the latter assumption were true, the instructional focus should shift from "what to learn" to "how to learn."

#### Skills Basic to School Success

Studies designed to explore the constituent factors leading to school success have looked at affective, cognitive, and environmental variables (Fillbrandt & Merz, 1977; Lehrer & Heironymous, 1977; Manuaryk & Schuerger, 1974; Ziarko, 1976). Cognitive variables have generally included intelligence quotients and abilities in the tool skills, most often reading. Cognitive factors have proved to be those most highly related to school achievement. A major investigation of learning disabled students (Warner, Alley, Schumaker, Deshler & Clark, 1980) also found the cognitive dimension to be most highly related to school performance. Although the importance of the cognitive domain was underscored by these studies, they were not designed to provide information about the importance of specific skills or components of the cognitive domain.

A few studies have attempted to break the cognitive domain into independent variables that represent more specific demands which teachers place on students. In an attempt to determine the affective and cognitive correlates of classroom achievement, ten predictor variables were regressed

on the criterion variable of social studies grades (Gable, Roberts & Owen, 1977). Within the final six-predictor regression equation were four cognitive variables (speed of comprehension, interpretation, vocabulary and recognition of assumptions) and two affective variables (motivation toward school and usefulness of school). Of the cognitive factors entering the equation, three (speed of comprehension, interpretation, and recognition of assumptions) are not directly and consistently taught within the public schools.

A similar study investigated the relationship of cognitive abilities and affective and demographic factors to achievement in mathematics (Taylor, Brown & Michael, 1976). The only predictor variables that attained significance were within the cognitive dimension. The five most predictive factors were the ability to do quantitative thinking (problem solving), mental ability, correctness and appropriateness of expression, ability to interpret literary reading materials, and ability to interpret reading materials in the natural sciences. Once again, factors highly related to academic achievement included several either not directly or consistently taught within the public school curriculum (interpretation of literary and natural science material and problem solving). Performance on these cognitive dimensions was even sufficient to make significant distinctions among high achievers, average achievers, and low achievers which were consistent with the teachers' ratings of mathematics aptitude and grades earned. Results of these studies indicate that the performance of nonhandicapped students in school is related to a set of learning skills and behaviors within the cognitive domain. Learning disabled students often perform more poorly than do their nonhandicapped peers. One possible explanation for this performance difference could be that these students are unable to apply the learning skills and thus, fail to exhibit the learning behaviors that have been shown to be highly related to academic success.

The learning disabled student has recently been a focus for research on the learning process. A number of discrete pieces of evidence point, increasingly, toward deficiencies of learning disabled students in certain learning skills. Wong (1979), in a comparative study of reading disabled and normally-achieving fifth grade students found that textually presented questions would increase reading comprehension scores significantly. She concluded that disabled readers were inactive learners, not formulating questions as part of the reading act. A further finding was that learning disabled students were less able to recall main ideas than were students in the comparison group. Haines and Torgeson (1979) found that learning disabled children differ with regard to the use of rehearsal as a strategy to increase memory. Alley, Deshler and Warner (1979) found that secondary school learning disabilities teachers, most of whom had experience teaching "normal" learners, identified problems in the areas of organization, study skills and test taking in greater than 90% of learning disabled students. In other work by Alley and Deshler (1979), performance distributions of learning disabled and normal students on error monitoring and problem-solving tasks differed markedly.

#### Need for Instruction in Learning Skills

In a survey conducted by Carlson (see Note 1), secondary learning disabilities teachers presented with six programming options for LD adolescents indicated a need for and preference for teaching learning skills related to academic performance. This preference was based on knowledge of teacher and curriculum demands and LD student ability.

A list of crucial learning skills developed by Project STILE, a Child Service Demonstration Center in Lawrence, Kansas (Carlson, see Note 2) was modified and used in a study by Link (1980) to rate the importance



of learning skills. Raters included secondary school special education teachers, regular education teachers and various regular education administrative personnel. The skills rated as most essential were the following:

1. Following oral and written directions
2. Making logical deductions
3. Reading at grade level
4. Recalling information for tests (memory)
5. Locating answers to questions
6. Turning in assignments on time
7. Asking relevant questions
8. Expressing ideas clearly through writing
9. Locating information in a textbook
10. Participating in discussions

Of the 10 skills rated most highly, only two, reading at grade level and expressing ideas clearly through writing, are among the skills commonly stressed as basic.

It might be assumed that these essential learning skills are not given a specific place within the curriculum but are so vital they are incorporated into instruction in both the tool skills and the specific academic content areas. A study by Keimig (1980) did not support such an assumption. Keimig surveyed secondary school classroom teachers in order to ascertain the importance, difficulty, and teachability of textbook skills. Among the findings of the study were the following:

1. Skill in using a textbook was rated essential or important by 89.4% of the teachers surveyed.
2. Teachers believed that 51% of learning disabled and 22% of non-learning disabled students are deficient in this skill.

3. Eighty-one percent of the teachers rated textbook skills as easy or medium in terms of teaching difficulty.
4. Fifty-eight percent of all teachers surveyed did not provide instruction in how to use a textbook.

Based on the results of the studies cited, it is feasible that many of the students currently failing in school are deficient in skills that might enable them to learn either tool skills or academic content more efficiently. Classroom teachers have validated the existence of a complex of crucial learning skills. Various studies have shown learning disabled populations deficient in many of these skills. None of the various schools of curricular thought advocate direct instruction in such skills, and regular classroom teachers do not, necessarily, teach such skills even if aware of student need. Educational Programs That Work (1977), a publication of the United States Office of Education, lists exemplary educational programs to be used as models of quality instruction. Of the programs listed, none dealt with learning skills in other than a peripheral manner.

Public schools are currently bearing the criticism of activist community groups and undertaking efforts of self-appraisal and evaluation. It should be carefully noted that learners who have not developed independent study behaviors (Brown, 1978) or who have not been equipped with efficient learning strategies (Alley & Deshler, 1979) may not profit from quality instruction in an area which all agree is basic to the

#### Research on Learning Skills

Instruction in learning skills has been shown to promote student performance in a number of areas. Most research in this area has been conducted with nonhandicapped students at the secondary school and

college level. Whimbey (1977) has increased student ability to proceed through a sequence of analytical steps which, he contended, is the "the foundation of all higher-order reasoning and comprehension" (p. 255). A course at the University of West Virginia called Guided Design (Wales & Stager, 1977) and a similar course in problem solving developed by Whimbey and Lochhead (1979) have been used to successfully develop reasoning skills in college populations across such areas as Spanish, mathematics, physics and writing (Lochhead & Clement, 1979). Stauffer (1975) has advocated direct instruction in purpose, reasoning and judging as a means of developing efficient reading. Sexton and Poling (1973) designed a program to train verbal comprehension, word fluency, number fluency, memory, visualization and spatial-ability, perceptual speed, induction, and divergent thinking. The program was used to raise the mean IQ of an unspecified group of subjects from 116 to 141 in only ten weeks of training. Since IQ is highly correlated with school performance it might be cautiously inferred that at least some of the abilities related to school success had been positively altered. Dansereau (1979), by teaching a seven-step learning strategy, was able to increase comprehension and retention of text material by 20%. Skimming and scanning techniques taught to increase reading flexibility have been shown to be effective (Homistek, 1979). Studies conducted with underachieving and handicapped populations have also shown positive benefits of direct training in learning skills. Lee (1980) increased the performance of learning disabled junior high school students in test taking through instruction in a systematic procedure which included scheduling time, using clue words, omitting difficult questions, reading carefully, estimating answers and reviewing work. Torgeson and Goldman (1977) were able to increase children's ability to remember by using a task previously shown to facilitate the use of rehearsal.

## Summary

A body of evidence exists which supports the following:

1. Specific learning skills are related to academic performance.
2. Direct instructional in learning skills is not a major curricular emphasis, even though perceived as highly important by teachers.
3. Learning skills are teachable behaviors.
4. Learning disabled students may be less efficient in the application of, or may entirely fail to use, appropriate learning skills.

A more comprehensive data base is needed on differences between learning disabled and normal-achieving learners on cognitive tasks directly related to academic performance.

The purpose of this study was to further explore the existence and magnitude of such differences. Furthermore, the study was designed to determine teacher performance standards on the same learning skills.

Questions to be answered within this study included the following:

1. Do high-achieving and learning disabled high school students differ in their performance within and across a complex of learning skills?
2. What level of student performance within these skill areas do teachers accept as minimally competent?
3. Do these skills have an impact on learning across both academic and functional dimensions?

## Method

### Subjects and Judges

The subjects for this study were high school students in grades 10 through 12 from three different school districts in Oregon, Indiana and Kansas. A decision to choose subjects from different geographical locations was made in order to:

1. minimize the effects of any systematic teacher training bias which might affect student performance. The distribution of research sites should help assure a range of teacher philosophy, expectation and practice.
2. minimize the impact of district effect on the selection of learning disabled students. District effect has been shown (Warner et al., 1980) to account for differences in students categorized as learning disabled across educational settings.

The pool from which subjects were drawn included all high-achieving and learning disabled students who met selection criteria as described below. Initial rosters of potential subjects were generated through inspection of special education records and lists of achievement and grade report records.

Each of the research sites used a multidisciplinary evaluation team and attempted to carefully implement special services in a manner consistent with the dictates of Public Law 94-142. More specifically, learning disabled students were selected in a manner consistent with the Regulations for Implementation of Public Law 94-142, Learning Disabilities.

Learning disabled subjects. All students formally categorized as learning disabled by their schools and who met other selection criteria as described below comprised the selection roster for the learning disabled population. Subjects were queried regarding their willingness to participate and included within or excluded from the sample accordingly. A total of 49 learning disabled subjects were selected. Of these, 43 were males and 6 females. There were 19 tenth-grade students, 20 eleventh-grade students, and 10 twelfth-grade students. The mean age was 17.4 years ( $SD = 1.16$  years). Selection criteria for students included within the learning disabled sample were as follows:

1. The student was currently classified as learning disabled by the school.
2. The student currently received at least one class period of direct service from a state department of education certified learning disabilities teacher per day.
3. The student's classification as learning disabled was sustained following review of demographic data by three independent raters. Raters were persons serving on the Validation Team of the University of Kansas Institute for Research in Learning Disabilities. Raters were certified by the Kansas State Department of Education as school psychologists or learning disabilities teachers (see Note 3).

Only subjects meeting all three selection criteria were included in the data base. Of the three sites participating in this study, two required intelligence testing prior to categorization as learning disabled. The third, consonant with federal regulations, employed no strict IQ cutoff score, therefore, did not routinely test students

referred for learning disabilities services. Only when members of the district's evaluation team questioned the intellectual potential of individual students was an individual intelligence test administered. Intelligence data on six students categorized as learning disabled and included within the study indicated functioning well within the normal range. Since testing was recommended in only the more questionable cases, this sampling was assumed to be indicative of normal intellectual abilities within the larger population of learning disabled subjects drawn from this site.

All learning disabled students meeting selection criteria in each site were asked to participate. Informed consent was obtained from as many as possible. Site coordinators detected no obvious selection bias and felt subjects ultimately included to be representative of the larger group of all LD student at each site.

High-achieving subjects. An initial roster of 50 to 75 high-achieving students was generated at each research site. Students were selected randomly from this list, and they and their parents were queried regarding participation. A total of 47 subjects whose past school performance was considered to be better than average were selected. The sample of high achievers included 15 tenth-grade students, 17 eleventh-grade students and 15 twelfth-grade students. The mean age was 17.22 years (SD = .83 years). Criteria for selection as a high achiever were as follows:

1. The student had received a total achievement score at or above the 50th percentile on a standardized achievement test recently administered within the school district of attendance, i.e., Stanford Achievement or Metropolitan Achievement tests.

2. The student had a cumulative grade point average of at least 2.5 on a four-point grade scale for his or her entire high school career.
3. The student had received no special education services during his/her formal educational experience.

Both grade and achievement criteria were included as elements of school success. Grades were taken to be indicators of the degree to which students met the standards and expectations of individual teachers. Standardized achievement test data were taken as a wider measure of actual content and skill learning. The third criterion, no history of special education services, was added to ensure that learning skills measured were those obtained through the standard curriculum or through experiential learning. Students included in this sample most often had no history of intellectual assessment, and intelligence data were not available.

Expert judges. A jury of expert judges was selected to provide information on performance standards which teachers expect of students. The jury was drawn from the pool of all teachers meeting selection criteria at each school building. Site coordinators, working through recommendations made by administrative and counseling staff, and employing their own knowledge of teachers within each building asked individual teachers to take part in the study. Selection criteria for expert judges were as follows:

1. Permanent certification in the current area of teaching assignment.
2. Two years teaching experience.
3. No certification in special education.



Incentive monies were offered as a means of ensuring that teachers who might not otherwise participate would do so. It was felt that this strategy might help eliminate a selection bias working toward inclusion of only teachers interested in research or the immediate problem under investigation. An effort was made to include teachers who worked with a heterogeneous population of students. The selected jury was comprised of 23 high school content teachers drawn from school districts across four states. The mean number of years of teaching experience was 11 with a standard deviation of 6.6 years. The median number of years of teaching experience was 10. Teachers comprising this group represented six major instructional areas (social studies/history, language arts/English, mathematics, science, business, health/physical education).

### Setting

One of the school districts selected for inclusion in the study was a university community of 60,000 persons, another was a small but affluent suburb of a major city and the third was a medium-sized community with several different ethnic groups. This third city has a large industrial base and a generally lower socioeconomic level than the other two sites. None of the research sites had a high proportion of minority students in attendance. All data were collected within the attendance center of each student. All participating schools were three-year (grades 10, 11, 12) high schools serving a cross-section of socioeconomic levels within the community.

### Commercially Available Measurement Systems

Functional literacy. As a means of establishing levels of functional literacy, the Adult Performance Level Functional Literacy Test (APL) was used (Northcutt, 1978). This is a criterion-referenced test which uses

40 items to measure student functional literacy across five areas: consumer economics, government and law, health, occupational knowledge, and community resources. The APL is a power test that calls on students to use the tool skills of reading, writing, computation, and problem solving in order to successfully answer test items. Standardization of the APL was based on the performance of approximately 4,000 eleventh and twelfth grade students representing a variety of racial groups, educational programs, and socio-economic levels. Statistical characteristics for eleventh and twelfth grade populations included a Kuder-Richardson KR-20 reliability for the total battery of .85 and .86, a split-half reliability of .85 and .87 and a standard error of measurement of 2.32 and 2.21, respectively. Item stem readability was approximately 5th grade level.

Since subjects had previously been selected, in part, for their performance in basic skill areas the skill subscores of the APL were not computed. The scores of interest were those within the content areas which measured student success in the practical application of tool skills. For purposes of this investigation, the sum of the content area subscores for each student was computed and treated as a functional literacy score.

#### Constructed Measurement Systems

As a means of determining student performance on crucial learning skills, five domain-referenced tests (DRT) were designed. These instruments were specifically designed to function as pre-instructional probes. The characteristics of the instruments reported within this study are based solely on their use as pre-instructional probes. They differ from fully developed criterion-referenced tests (Gronlund, 1973) or domain-referenced tests (Popham, 1978) in that their use following instruction has been tested.

Knowledge of test taking. Subject knowledge about principles and practices of taking tests was measured by a total of 29 items. This was a power test which utilized binary-choice, matching and multiple choice items. Table 1 presents sub-areas within the domain of test-taking knowledge and number of items within each sub-area.

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Insert Table 1 about here

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Scanning for information. The ability of subjects to quickly locate an answer in text and provide a response to a specific question was assessed using a scanning task. This was a timed test. Time parameters were 15 seconds for items one through nine and 30 seconds for items 10 through 20. Time intervals were established through pilot testing of the instrument with learning disabled and normally-achieving high school students and through the opinion of expert judges. Tape recorded directions and specially numbered stimulus materials were used to assure student compliance with item time limits. Stimulus materials were pages taken from textbooks used in a variety of different academic classrooms at one of the research sites. Subjects were required to listen to a question, locate the proper answer on a textbook page in the stimulus materials and record the selected answer on an answer sheet. Correct answers were in text and subjects were neither required to formulate nor spell correctly any answer. Different contextual cues which can be used to locate answers served as sub-domains for this probe. A total of 20 items were used. Sub-domains and item frequencies are presented in Table 1.

Monitoring errors. The ability of subjects to identify errors in text was assessed using a total of 39 items. The subjects were presented

with three written passages taken from currently used textbooks. Each passage was modified to include errors in spelling, punctuation and capitalization. Pilot testing with both groups was conducted in order to determine time parameters and difficulty. An eight-minute time limit was exceeded by none of the subjects in the pilot testing. This can be considered a power test. Subjects in the pilot testing experienced no frustration with the instrument. Subjects were asked to indicate with a circle the location of an incorrect omission or the location of an incorrect spelling, mark of punctuation, or capitalization. Numbers of errors correctly identified comprise the area and domain scores. A total of 39 items were used. Sub-domains and item frequencies are presented in Table 1.

Taking notes from lectures. The ability of subjects to take notes from content area lectures was assessed using two lectures from the Intervention Research Packages designed and validated by the University of Kansas Institute for Research in Learning Disabilities (in preparation). A tape recording of two short lectures on energy and ESP was played. Subjects were asked to listen carefully and to take notes as they normally would. This task required simultaneous listening, summarizing, and writing ability. Notes were scored for the appearance of specific key words and phrases or equivalent ideas. Item frequency by lecture is presented in Table 1. A total of 23 items were used.

Listening comprehension. Following the notetaking activity, subjects were asked to answer 10 questions taken from the lectures on ESP, energy, and a third lecture over dreams. Subjects had also been asked to take notes from the lecture on dreams for comparability of task even though data from this third lecture were not included in the notetaking score.

## Validity of Constructed Measurement Systems

Content validity. Popham (1978) in a discussion of a priori versus posteriori validation of criterion-referenced tests supported a priori procedures. Seven classroom teachers who were not included in the group of expert judges discussed previously were selected. These teachers met the same selection criteria as the expert judges and were from one of the research sites. Each of the seven teachers rated each of 121 total test items. A bi-valued yes/no scale was used for item rating. A yes rating indicated similarity of knowledge assessed by an item to an actual content classroom demand or expectation. One judge selected three items for negative rating. Two judges found two items to be flawed. Four judges rated all 121 items positively. Discussion with judges resulted in the modification of the seven indicated items so that each modified item was commonly accepted as valid.

Concurrent validity. Concurrent validity of the Learning Skills Test was assessed using the APL competency test instrument developed by Northcutt (1978). This instrument was selected because of its common use with high school students. Concurrent validity was determined by giving both tests to learning disabled (N=37) and high-achieving (N=19) students within the larger research samples. A Pearson product-moment correlation between the two tests was calculated for each group. A ceiling effect with high achievers on the APL restricted variance and resulted in a spuriously low correlation within the high-achieving (HA) group. High correlations, exceeding the .01 level of significance, were obtained for the learning disabled (LD) and combined group, however. These data are presented in Table 2.

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Insert Table 2 about here

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## Reliability of Constructed Measurement Systems

Interscorer reliability. Interscorer reliability was assessed through the independent scoring of 10% of all performance tests by a rater not involved in the initial scoring. The scoring key and rating criteria used in the original scoring was provided to an untrained volunteer. This volunteer was one of the classroom teachers used to rate items for content validity. An item-by-item comparison was made, and agreement was defined as exact correspondence between ratings assigned by each rater for each item. Uncorrected copies of student responses were used by the second rater so that no scoring cues would be available. Percent agreement was calculated using the following formula (Hall, 1971):

$$\frac{\text{Agreements}}{\text{Total number of items}} \times 100 = \% \text{ agreement}$$

Table 3 presents interscorer reliability by performance test.

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Insert Table 3 about here

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Test-retest reliability. Test-retest reliability was assessed by a second administration of the Learning Skills Test to randomly selected groups of high-achieving and LD students. The number of students tested varied slightly by group and test but ranged from a high of 32 to a low of 23. Table 4 presents specific frequency data. An interval of 14 to 28 days passed between test administrations. All procedures were followed in a manner identical to the original testing. Retesting on the APL was not required.

Table 5 presents Pearson product-moment correlations between test and retest performances for individual and combined groups by performance area tested. All correlations but one were significant at  $p < .01$ . Test-retest reliabilities for the combined groups ranged from a low of .75 for test taking to a high of .95 for error monitoring. Test-retest reliability across the entire learning skills battery was .96.

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Insert Tables 4 and 5 about here

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### Applied Measurement Systems

Minimal competence. Minimal competence scores were generated through application of the Ebel procedure (1979). Each test item of each learning skills sub-test was rated for both importance and difficulty by the 23 expert judges (Teachers who rated content validity were not included in the group of 23 who rated minimal competence.) The importance scale included the values essential, important, acceptable, and not important. The difficulty scale included the values easy, medium, and hard. Each item was assigned a value for both importance and difficulty. These values were recorded by the expert judges and analyzed by summing the pairs of values (i.e., difficulty and importance) assigned each item by each judge into the proper cell of a 4 x 3 matrix (Figure 1).

Importance of items	Difficulty level of items		
	easy	medium	hard
essential	5		
important			
acceptable			
not important			

Figure 1. Difficulty/Importance Matrix for Minimal Competence

In this example, a specific judge would have rated five items of one learning skills sub-test as both essential to successful performance and easy to answer or perform correctly. This analysis was continued until each of the 12 cells was filled for each sub-test by each judge. Each judge was then asked to generate a performance standard for each cell. In essence, a judge responding to the easy/essential cell in Figure 1 would ask: "Given the universe of easy/essential items in this learning skill domain, what percentage should be successfully performed by the minimally competent student?" Each cell of the matrix was thereby assigned two numbers, the number of sub-test items of a given difficulty/importance rating and the estimated percentage of such items necessary for minimal competence. The product of these two numbers yielded a minimal competence score point cutoff for each cell (5 easy/essential items x 90% minimal competence standard = 4.5 items of this type necessary for minimal competence). Summation of these minimal competence cutoff scores across each of the 12 cells yielded a total minimal competence cutoff score for the learning skills sub-test under consideration. Averaging across individual sub-test cutoff scores for all judges yielded composite sub-test cutoff scores. A cutoff score is a score below which students



are considered functionally incompetent in a given skill. For purposes of this study this score is called the minimal competence scores.

### Procedures

Testing procedures. Each research site was supervised by a site coordinator who took responsibility for the gathering of demographic data, parent and student contacts, obtaining informed consent statements, arranging test administration and assuring compliance with all test procedures. Site coordinators were special educators certified by their respective state departments of education. Site coordinators were familiar with administrative personnel, policies, and teaching staff at the building and district level.

Prior to the administration of tests, an audio recording was made which:

1. Provided an explanation and overview of the Learning Skills sub-tests
2. Gave instructions for the coding and manipulation of all test materials
3. Provided a standard oral presentation of all items on the test taking, scanning, note taking, and listening comprehension tests
4. Standardized times for administration of the scanning test

The entire tape recording was played during testing of all learning disabled students. Subjects were permitted to work ahead of the tape during a given test. This provided subjects with an opportunity to work at a faster pace if desired, or to listen to orally presented items if reading difficulties made this necessary.

Pilot testing had shown that high-achieving students became bored and inattentive during administration of the tape-recorded version for the

total testing period. During the present study, high-achieving students were read the instructions for each sub-test and were allowed to read the items of the tests themselves rather than listen to the recorded version. The personally administered version of the Learning Skills Test differed from the totally taped version only in that common directions were read by different voices and since items were read individually, total testing time was shorter. Subjects in the high-achieving group were selected, in part, for their achievement in reading on a group administered achievement test (i.e., percentile achievement scores  $\geq 50$ ). All site coordinators felt that this procedure resulted in improved student performance. The Adult Performance Level Functional Literacy Test (Northcutt, 1978) required subjects to read test items and this convention was upheld with both groups.

All testing materials were distributed individually prior to each sub-test. This precluded the possibility that students might start a timed test prematurely. All materials were placed inside a manilla pocket folder upon completion and were not used again. This safeguard was used to prevent work on a timed test beyond the allowable limits.

Testing time. Subjects within the learning disabled group were administered all tests during normal classroom time in their learning disabilities classrooms. Subjects within the high-achieving group were administered all tests at a time and location which was most convenient to them. In some cases, students in this group were tested during study halls or free periods. Most subjects in this group elected to be tested in the afternoon when the school day was over. Testing was spread across two sessions with the learning disabled group and was completed in a single session by the high achievers. A single class period was of

insufficient duration to allow completion of the entire test battery. In no case was the administration of any one test spread across two sessions. Total testing time for the learning disabled group was approximately one hour and twenty minutes. Total testing time for the high achievers was approximately 50 minutes. All site coordinators agreed that the time differences resulting from one group (LD) being read the test items while the other group (high achievers) was not required to do so were less significant than the problems arising from an entirely common test administration across both groups. Pilot testing had shown the performance of high achievers to be affected negatively by the lengthy oral reading of test items.

#### Research Design

A correlational design (Campbell & Stanley, 1963) was used in this study. The relationships underlying the performance of different groups of students were the central concern. This concern was most directly addressed through application of a correlational design.

#### Hypotheses

The following null hypotheses were investigated in this study:

1. There is no difference in the performance of learning disabled and high-achieving students across the complex of locating information, knowledge of taking tests, monitoring writing errors, taking notes from lectures and listening comprehension.
2. There is no difference in the performance of learning disabled and high-achieving students within the areas of locating information, knowledge of taking tests, monitoring writing errors, taking notes from lectures, and listening comprehension.

3. No statistically significant relationship exists between subject performance on a complex of skills related to academic performance and skills related to functional adult competence.
4. No difference in the performance of learning disabled and high-achieving subjects on a complex of skills related to academic performance exists after scores have been adjusted to control for common variance with the covariate, a measure of functional adult competence.
5. Proportions of learning disabled and high-achieving subjects who perform above and below a teacher-derived standard of minimal competence will not differ significantly. This will hold true within all tests of crucial learning skills.

All hypotheses were tested at the  $p = .01$  level of significance.

#### Statistical Analysis

Performance differences within and across the Learning Skill Test Battery were analyzed through application of Hotelling's  $T^2$  test. Relationships between learning and functional literacy test scores were determined by computing a Pearson product-moment correlation coefficient. Analysis of covariance was used to control common variance between the Learning Skills Test Battery and the APL test so that the significance of remaining variance due to the learning skills tests could be determined. A Chi square test of proportions was used to test for proportions of students within each group who fell above and below teacher-derived standards of minimal competence.

#### Results

##### Minimal Competence Standards

Item ratings provided by high school classroom teachers were used

to generate minimal competence standards for the Learning Skills Test Battery. The mean cutoff score, standard error of measurement, actual cutoff score to be used in rating students and the maximum possible score for each test is presented in Table 6. In order to "pass" a test, students were required to meet or exceed the actual cutoff score (mean cutoff score rounded to the next whole number).

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Insert Table 6 about here

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#### Minimal Competence Ratings by Subject and Group

Ninety-two subjects took the five learning skills sub-tests. An additional four subjects took some, but not all, learning skills sub-tests. The numbers and percentages of subjects in each group meeting or exceeding minimal performance standards for each test and for the total test (i.e., passing) is presented in Table 7. Table 8 presents the number of subjects within each group who met or exceeded minimal performance standards for cumulative numbers of tests. Eighty-five percent of all high achievers met or exceeded minimal competence on four or more tests. No learning disabled student met or exceeded minimal competence on four or more tests. Ninety-eight percent of all high achievers met or exceeded minimal competence on three or more tests while the corresponding figure for learning disabled subjects is 10 percent. Conversely, 22 percent of learning disabled subjects met or exceeded minimal competence on no test, while no high achiever failed to pass a single test.

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Insert Tables 7 and 8 about here

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### Group Differences Across Performance Areas

The null hypothesis of no significant difference in the performance of learning disabled and high-achieving high school students across a complex of skills including knowledge of test taking, locating information, monitoring writing errors, taking notes from lectures and listening comprehension skills was investigated. Since the performance of two groups across five dimensions was to be analyzed, a multivariate procedure was indicated. Hotelling's  $T^2$  test was employed. An obtained  $F$  value of 71.56 with 5 and 86 degrees of freedom and a  $p$  of  $< .01$  indicated a difference across all tests on the classification variable. The null hypothesis of no group difference across performance areas was rejected.

### Group Differences Within Performance Areas

The distribution of all subjects across a common axis on each performance area is presented in Figures 2 through 6. Table 9 presents descriptive statistics by group for all performance tests. These data relate to the investigation of the following null hypotheses: There is no difference in the performance of learning disabled and high-achieving students within the areas of knowledge of test taking, monitoring writing errors, locating information, taking notes from lectures, and listening comprehension.

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Insert Figures 2, 3, 4, 5, and 6 about here

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Insert Table 9 about here

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Subject performance by group within each skill sub-test was tested for equality of variance. In all cases, variances were deemed equivalent and pooled. Individual  $t$  tests were employed to analyze group differences on skill sub-tests. Group differences within each skill area were significant at  $p < .01$ , and the null hypotheses of no group difference within skill areas were rejected. Table 10 presents the differences between groups by performance area.

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Insert Table 10 about here

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#### Relationship of Functional and Learning Skills

The null hypothesis of no significant relationship between skills related to functional adult competence and learning skills related to academic performance was tested. The total score from the Learning Skills Test Battery for each student was treated as a learning skills domain score. A Pearson product-moment correlation coefficient was calculated for 56 subjects who had taken both the Adult Performance Level Test and the Learning Skills Test Battery. Nineteen high achievers and 37 learning disabled students constituted group membership. A coefficient of .72 was obtained which is significant at  $p < .01$ . The null hypothesis of no relationship between functional and learning skills was rejected.

#### Performance Differences Across Learning Skills After Control of Common Variance with Functional Skills

The null hypothesis of no performance difference between groups on the Learning Skills Test Battery after controlling for common variance with the APL test was tested. Analysis of covariance was employed. The APL

was used as covariate and the sum of obtained scores across learning skills sub-tests as the dependent variable. The regression of the dependent measure onto the covariate was significant,  $F = 18.16$ ,  $p < .01$ . This is indicative of the concomitance of both measures. An  $F$  test indicated that performance differences by group did exist at a level of significance of  $p < .01$ . The null hypothesis was rejected. Table 11 presents the means, standard deviations, and adjusted means of the APL and Learning Skills Test Battery composite scores. Table 12 summarizes the results of the  $F$  test.

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Insert Tables 11 and 12 about here

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#### Minimal Competence in Learning Skills by Group

The null hypothesis that equal proportions of each group fall above and below a teacher-derived standard of minimal competence was tested through application of a Chi Square test of proportions. A 2x2 contingency table was derived for each performance test. Subject classification by group comprised the rows, and numbers above and below the obtained cutoff score for each test comprised the columns. The lowest expected non-zero value for any learning skills sub-test was 9.72. Table 13 presents Yates Corrected Chi Square, degrees of freedom and  $p$  values for all sub-tests. Results indicated that group membership was significantly related to subject competence in all skills assessed. Sources used for the 2x2 contingency tables on which Chi Square values are computed can be found in Table 7. The null hypothesis was rejected.



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Insert Table 13 about here

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## Discussion

### Summary of Results

Five domain referenced tests which proved valid and reliable as pre-instruction performance probes were designed to measure learning skills rated essential to high school success. Expert judges, rating items contained on these tests, provided standards of minimal competence against which student performance could be evaluated. Subjects within the high-achieving group were able to meet or exceed minimal competence to a greater degree than learning disabled students both within and across performance areas. Formal statistical analysis of student performance yielded the following results:

1. High achievers perform significantly better than learning disabled students across the complex of learning skills assessed.
2. High achievers perform significantly better than learning disabled students within every domain of learning skills assessed.
3. Skills required to do well on a test of functional adult competence relate significantly to those required to do well on a domain referenced test of several learning skills.
4. When common variance between a test of functional adult competence and a domain referenced test of several learning skills is controlled, significant group differences remain due to learning skills performance.

5. Significantly greater proportions of learning disabled students fall below teacher-derived standards of minimal competence than do high-achieving students. This holds true in all skill areas assessed.

### Conclusions

Results of this study are consistent with those that have identified factors within the cognitive domain other than reading, writing and mathematics as related to school success (e.g., Gable, Rogers & Owen, 1977; Taylor, Brown & Michael, 1976). The importance of these findings is underscored by the selection by classroom teachers of skills assessed in this study as essential to academic success (Link, 1980). Teachers base assignments and course grades on certain minimal expectations for student performance. The only learning skill area in which the learning disabled group achieved minimal competence was knowledge of test taking. Even in this skill area mean performance was at the cutoff point for minimal competence meaning that nearly 50% of the group would be classified as functionally incompetent. In all cases, high achievers as a group not only met, but exceeded, the minimal performance acceptable to classroom teachers. Examination of individual test performance of learning disabled students is a further cause for concern. Fifty-seven percent of learning disabled students were able to meet minimal performance standards on two or fewer of the five areas assessed. Only one of 47 achieving students (2%) had a similar profile. It cannot be inferred from these data that school failure is a direct result of inability to demonstrate proficiency in learning skills. Another variable, or complex of variables, could intervene and contribute to school failure as well.

Subject performance on the Learning Skills Test Battery and the APL test correlated at a .72 level. When common variance was controlled using the APL as a covariate, performance differences on the Learning Skills Test Battery were still significant. These data may indicate either that learning skills necessary to learn academic content may also be necessary to learn the content of a functional, life skills curriculum or that cognitive abilities of some sort are related to learning both essential learning skills and functional skills.

Training applications. Many persons have advocated training students in essential learning skills (e.g., Burmeister, 1976; Piercy, 1976; Whimbey & Lochhead, 1979). A few have specifically recommended that learning disabled students should be taught such skills (e.g., Alley & Deshler, 1979; Brown, 1978). Attempts to do so have been made by a few Child Service Demonstration Centers on the secondary school level (see Note 4). One problem encountered in training learning skills is the lack of empirically derived performance criteria. Results of this study could provide such criteria in each of the five skill areas assessed. Procedures used in this study could also be used to generate similar criteria for other essential learning skills.

Cutoff points, which are a level of minimal acceptable performance, could be used to establish a training floor across the five learning skill areas investigated in this study. Students who are able to perform at these levels should be better able to successfully meet at least some of the learning demands required in the secondary school.

Another criterion level which could be used in training is the mean performance of high-achieving students. For four of the five subtests, the performance of high achievers exceeded minimal performance

standards. Since learning disabled students may perform more poorly across an even wider range of essential learning skills, it might be desirable to train specific, highly utilitarian skills to a level of excellence that allows them to be competitive with their successful peers.

In absence of alternative forms of the Learning Skills Test Battery that could be used for pre and post-testing as well as ongoing performance probes, there may be utility in converting obtained cutoffs and mean high achiever performance to percentage figures. Such figures drawn from the present study are presented in Table 14. In all but one case (error monitoring) differences in performance of 14% or greater separate these two proposed training targets.

Lee (1980) was able to increase test taking skills of LD junior high students by 20%. Application of those improvement data to performance levels of the present study would result in movement of LD students from a mean score of 64% in test taking, which is just in excess of minimal competence, to a mean of 77% which is the level of proficiency demonstrated by high achievers ( $.20 \times .64 = .13$ ;  $.13 \times 100 = 13\%$  improvement). Lee's study called on students to apply, not just be knowledgeable of, test taking skills; thus, the data from these two studies are not parallel. This example does serve to illustrate the potential application of such criterion levels, however.

Any application of such percentage standards will be accurate only to the degree that tests or probes used are similar to those employed in this study. A rough generalization which can be extruded from these data is that 65-70% of items answered correctly constitute minimal competence. This figure is largely consistent with teacher grading standards where 60% constitutes a D or minimum passing grade in academic

content. These percentage figures must be viewed as only rough approximations until further studies replicate the results of this study.

Diagnostic applications. These measures should not be used to diagnose and categorize learning disabled students. The performance of normally-achieving and low-achieving populations who are not handicapped has not been measured. The task of diagnosis in learning disabilities is, in part, to cull the learning disabled student from a larger population of low-achieving students. The learning skills tests used in this study were not designed to provide such diagnosticity.

#### Limitations

Limitations to this study include the size and composition of the sample, restriction of sample range, the nature of performance tasks required by skills tests, and limitations on the the manner in which the Learning Skills Test Battery should be used.

Size and composition of sample. Group composition within this study was not parallel. The learning disabled group was comprised of 43 males and six females. The sample of high achievers included 18 males and 29 females. Performance differences due to sex were not controlled and may be reflected in obtained scores. Sample size by group was 49 learning disabled subjects and 47 high-achieving subjects. These sample sizes are too small to ensure stability of individual group results. Results reported for the combined group of 96 subjects should be more stable.

Restriction of sample range. Samples selected for comparison in this study are on opposite ends of an achievement continuum. Correlations reported by group will tend to be inflated as a result of this restriction. Conversely, results reported for the entire sample will tend to be suppressed due to the effects of regression toward the mean and the non-inclusion of students representing average performance.

Performance required by learning skills tests. The sub-test of test taking assessed only student knowledge. It is possible for a student to possess knowledge about taking tests while being unable to apply that knowledge in the classroom. The test for monitoring errors employed three modified textbook passages as stimulus material. Seeking errors within text material is not a common school task. The ability to monitor errors in self-generated written language may differ from the performance measured here. The audio lectures used as stimulus material for both note taking and listening comprehension were limited as well. The lectures used were more carefully organized and paced than might be true of a typical classroom lecture. Their length, approximately 10 minutes, may not have allowed for the loss of attention which might occur in a longer presentation. Ceiling effects which restricted the range and variability of high achiever performance in listening comprehension may have been caused by lecture length, organization, and the small number of comprehension questions for each lecture.

Use as domain referenced tests. Learning skills measures used in this study were designed to be used as pre-instructional probe tests. They have not been proven reliable as complete domain referenced tests and should be used as post-instruction tests only with caution. It has not yet been ascertained that these tests can reliably distinguish competent from incompetent performers following instruction in the skills measured. Furthermore, the absence of a table of specifications for each test could result in inconsistent interpretation of student performance by item type.

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TABLE 1

## Performance Domains, Areas, and Items

Performance Domain	Area	Number of Items
Knowledge of Test-Taking	Preparing for a test	12
	Test vocabulary	5
	Taking a test	7
	Reviewing a completed test	5
	Total items	29
Scanning for Information	Using topic sentences	5
	Using obvious clues (italics, headings, numerals in text)	5
	Using lists	5
	Using visuals (charts, tables, graphs)	5
	Total items	20
Error Monitoring	Spelling	8
	Punctuation	19
	Capitalization	12
	Total items	39
Taking Notes from Lectures	Energy Lecture	9
	ESP	14
	Total items	23
Listening Comprehension	Total items	10

TABLE 2  
 Concurrent Validity of Learning Skills  
 Tests and APL Test

TEST		
Group	Correlation	N
HA	.089	19
LD	.61 <sup>*</sup>	37
All subjects	.72 <sup>*</sup>	56

\*  $P < .01$

TABLE 3  
 Interscorer Reliability by  
 Performance Test

Performance Test	% Agreement
Test taking	100.00
Scanning	99.47
Error Monitoring	99.32
Note Taking	95.88
Listening Comprehension	98.74

TABLE 4  
Frequencies for Performance Tests by Group

Performance Area	Test		Retest	
	LD	HA	LD	HA
Test Taking	49	47	32	27
Scanning	48	47	32	27
Error Monitoring	49	47	32	27
Note Taking	47	47	23	27
Listening Comprehension	48	45	23	26
Total	47	45	23	26
A.P.L.	38	20	--	--

TABLE 5  
Test-Retest Reliabilities

Area	Group		
	Learning Disabled	High Achieving	All Subjects
Test taking	.62	.72	.75
Scanning	.70	.84	.89
Error Monitoring	.73	.77	.95
Note Taking	.72	.82	.86
Listening Comprehension	.63	.36	.77
Total Test	.77	.91	.96

TABLE 6

Mean Cutoff, Standard Error of Measurement,  
Cutoff and Maximum Possible Scores by Performance Area

Test	Mean Cutoff Score	S.E.M.	Cutoff Score	Maximum Possible Score	
Test Taking	17.49	1.09	18.0	29	62%
Scanning	12.18	.95	13.0	20	65%
Monitoring Writing Errors	26.66	1.66	27.0	39	69%
Note Taking	14.80	.93	15.0	23	65%
Listening Comprehension	6.17	.50	7.0	10	70%

TABLE 7  
Subjects Meeting or Exceeding Minimal  
Performance Standards by Group

Test	High-Achieving			Learning Disabled		
	Total N	Subjects Passing	% of Total	Total N	Subjects Passing	% of Total
Test Taking	47	45	96	49	31	63
Scanning	47	45	96	48	5	10
Error-Monitoring	47	29	64	49	0	0
Note taking	47	42	89	47	4	9
Listening Comprehension	45	44	98	48	23	49

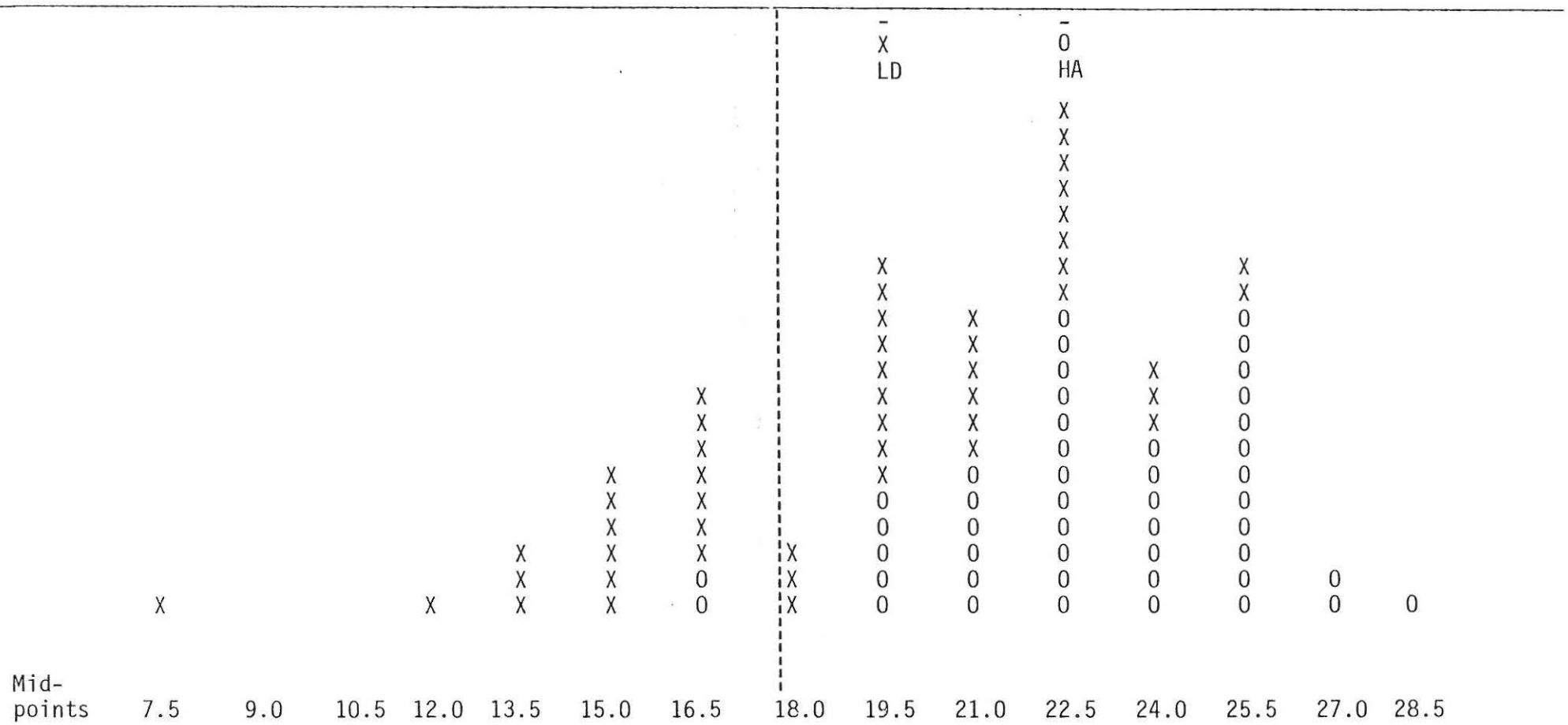
TABLE 8  
Subjects Meeting or Exceeding Performance Standards  
for Cumulative Numbers of Tests

Cumulative Tests	High-Achieving		Learning Disabled	
	Number	Cumulative % of Total	Number	Cumulative % of Total
5	25	53	0	0
4	40 <sup>****</sup>	85	0	0
3	46 <sup>***</sup>	98	5	10
2	47	100	21 <sup>**</sup>	43
1	47	100	38 <sup>*</sup>	78
0	47	100	49	100

- \* 1 subject passed 1 of 2 tests taken
- \*\* 1 subject passed 2 of 4 tests taken
- \*\*\* 1 subject passed 3 of 4 tests taken
- \*\*\*\* 1 subject passed 4 of 4 tests taken

FIGURE 2

Test Taking Performance by Individuals  
within Groups on a Common Axis



X = Learning Disabled (LD)

O = High Achieving (HA)

$\bar{X}$  = Mean LD

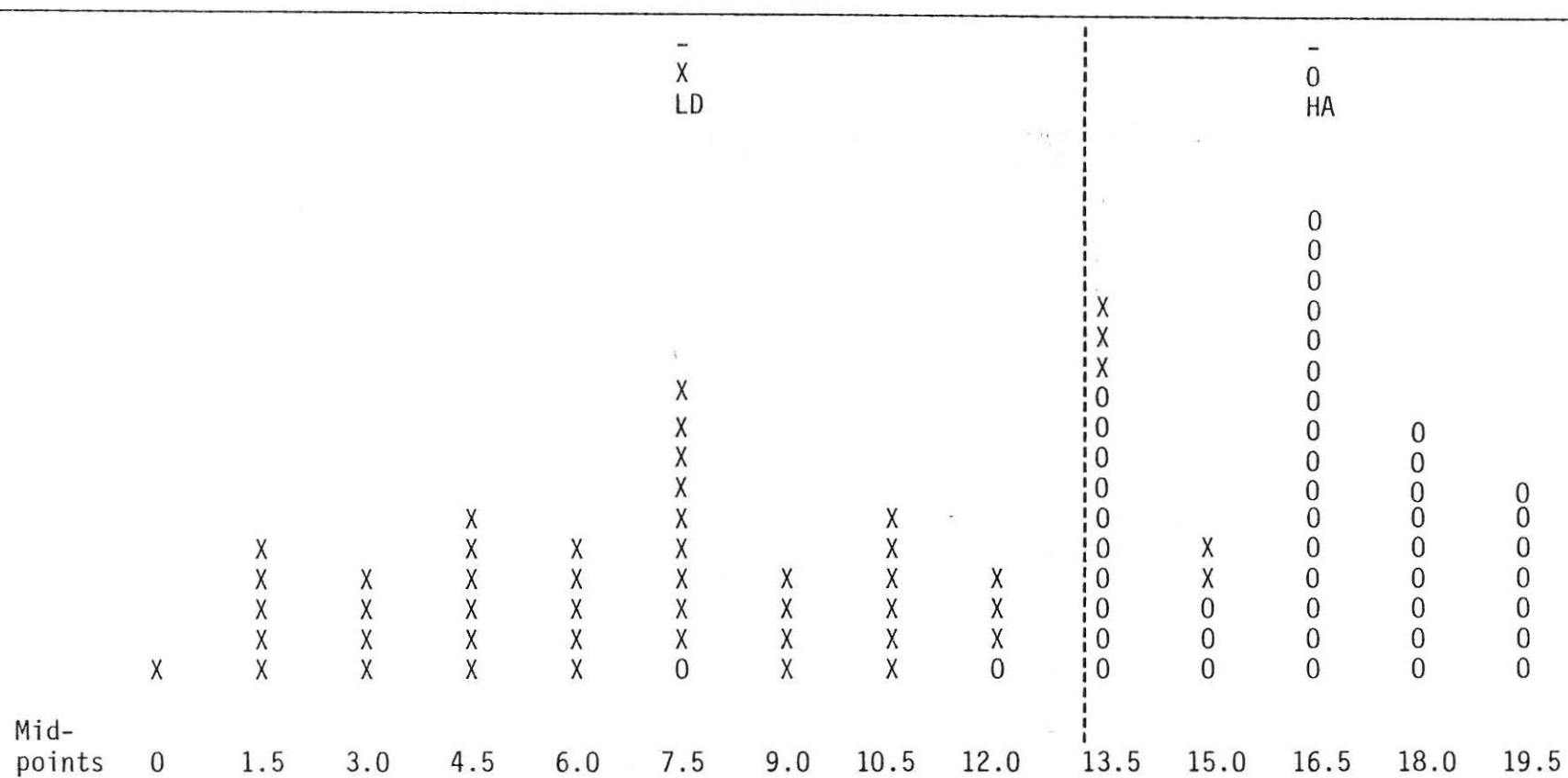
$\bar{O}$  = Mean HA

⋮ = Cutoff Score



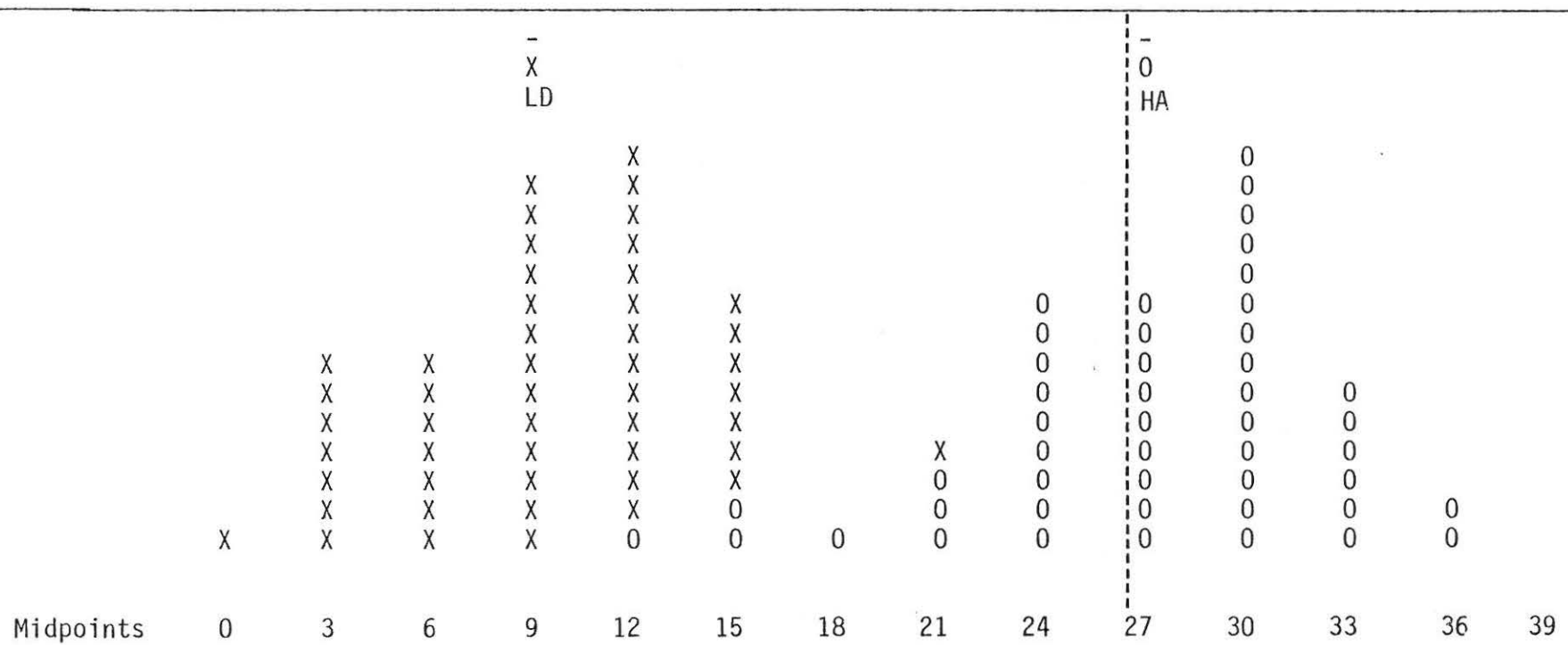
FIGURE 3

Performance in Scanning by Individuals  
within Groups on a Common Axis



X = LD  
 O = HA  
 $\bar{X}$  = Mean LD  
 $\bar{O}$  = Mean HA  
 | = Cutoff Score

FIGURE 4  
Error Monitoring Performance by Individuals  
within Groups on a Common Axis



X = LD

O = HA

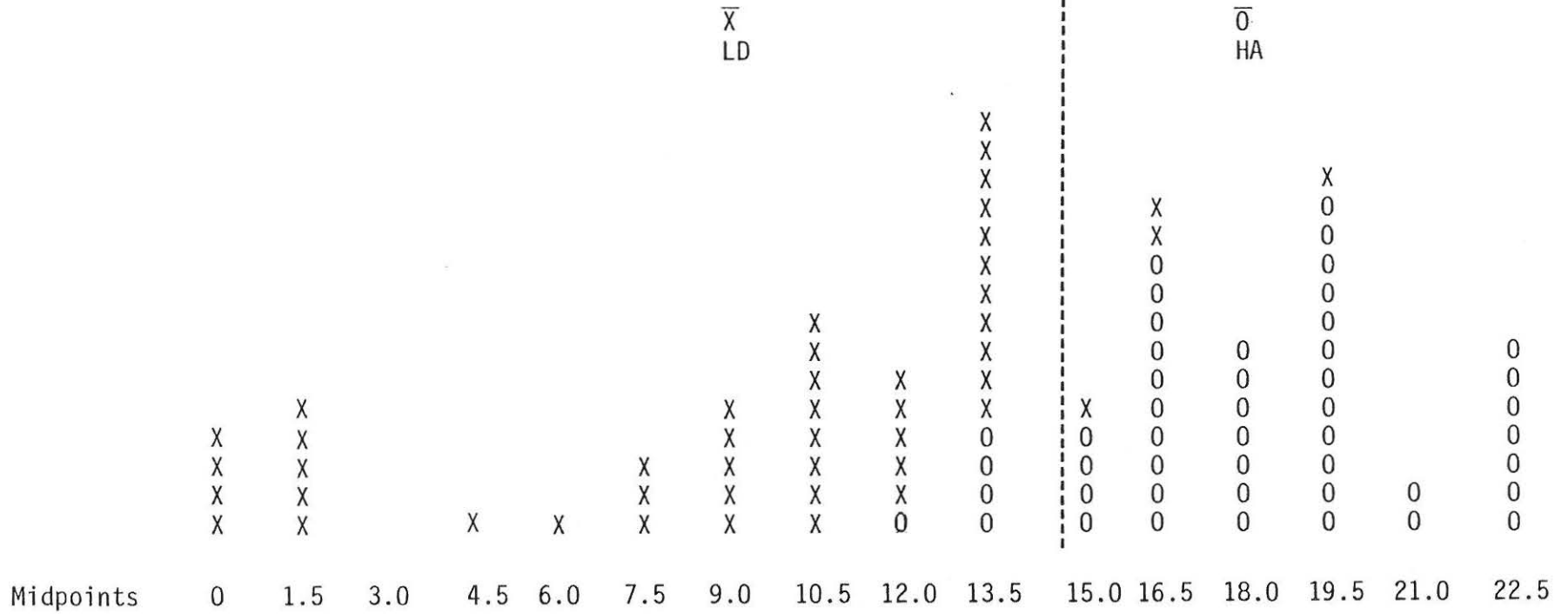
$\bar{X}$  = Mean LD

$\bar{O}$  = Mean HA

| = Cutoff Score

FIGURE 5

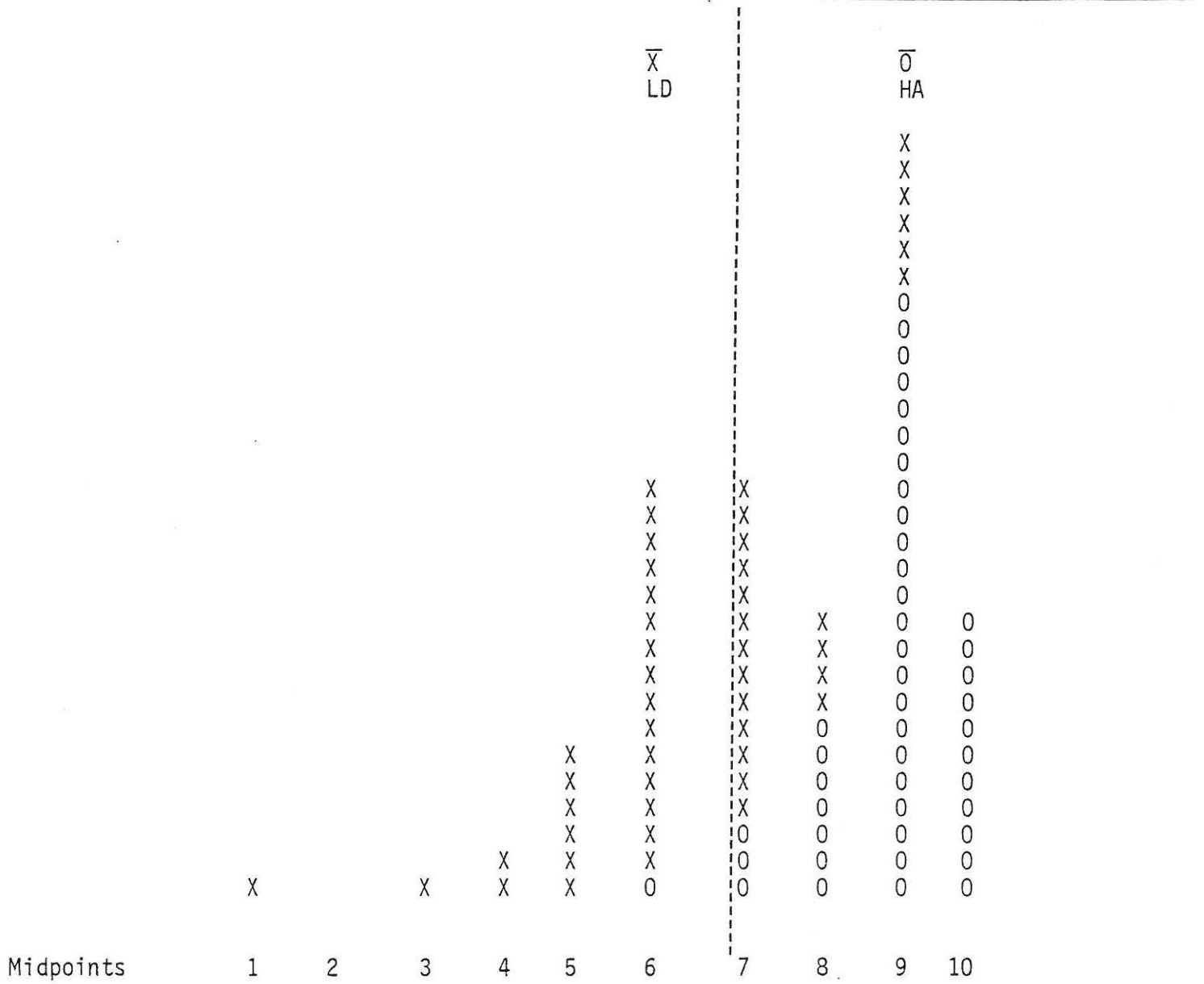
Note Taking Performance by Individuals  
within Groups on a Common Axis



X = LD  
O = HA  
 $\bar{X}$  = Mean LD  
 $\bar{O}$  = Mean HA

⋮ = Cutoff Score

FIGURE 6  
Performance in Listening Comprehension by Individuals  
within Groups on a Common Axis



X = LD  
 O = HA  
 $\bar{X}$  = Mean LA  
 $\bar{O}$  = Mean HA  
 | = Cutoff Score

TABLE 9  
Descriptive Statistics by Group for Performance Tests

Area	N	Maximum Possible Score	Minimum Obtained Score	Maximum Obtained Score	Mean	S.D.	S. E. M.
<u>Test Taking</u>							
High Achieving	45	29	17	28	23.08	79% 2.62	.39
Learning Disabled	47	29	8	25	18.70	64% 3.74	.54
<u>Scanning</u>							
High Achieving	45	20	8	20	16.11	80.5 2.40	.36
Learning Disabled	47	20	0	15	7.21	36. 3.93	.57
<u>Error Monitoring</u>							
High Achieving	45	59	13	36	27.15	46% 5.40	.80
Learning Disabled	47	39	1	20	9.40	16% 4.26	.62
<u>Note Taking</u>							
High Achieving	45	23	12	23	18.16	79% 2.85	.43
Learning Disabled	47	23	0	20	9.47	41% 4.95	.72
<u>Listening Comprehension</u>							
High Achieving	45	10	6	10	8.89	.93	.14
Learning Disabled	47	10	1	9	6.40	1.61	.23

TABLE 10

## Differences Between Groups by Performance Area

Performance Area	Statistics		df	P Value
	Test	Obtained Value		
Test Taking	F (for variance)	6.58	1,90	< .302
	t (Pooled)	6.49	90	< .01
Scanning	F (for variance)	11.70	1,90	< .229
	t (Pooled)	13.03	90	< .01
Error Monitoring	F (for variance)	1.97	1,90	< .522
	t (Pooled)	17.55	90	> .01
Note Taking	F (for variance)	10.48	1,90	< .242
	t (Pooled)	10.25	90	< .01
Listening Com- presension	F (for variance)	8.46	1,90	< .268
	t (Pooled)	9.00	90	< .01

TABLE 11

Means, Adjusted Means, and Standard Deviations for APL  
and Learning Skills Test Composite Scores

Group	APL		Learning Skills Test		Adjusted Learning Skills Test Means
	M	SD	M	SD	M
HA	35.79	3.66	92.79	10.24	86.95
LD	23.57	8.92	49.84	11.14	52.83

TABLE 12

Summary Table of Analysis of Covariance for the  
APL and Composite Learning Skills Test

Source	S.S.	df	M.S.	<u>F</u>	<u>P</u>	Beta
Classification	9114.20	1	9114.20	101.94	<.01	
Covariate (APL)	1623.76	1	1623.76	18.16	<.01	.723
Error	4738.4	53	89.40			

TABLE 13

Yates Corrected Chi Square, Degrees of Freedom  
and P Value by Performance Area

Performance Area	Yates Corrected Chi Square	df	<u>P</u> Value
Test Taking	13.44	1	< .01
Scanning	65.97	1	< .01
Monitoring Writing Errors	40.44	1	< .01
Note Taking	58.28	1	< .01
Listening Compre- hension	26.24	1	< .01



TABLE 14

## Training Targets by Percentage of Items Correct

Performance Area	Minimal Competence	Proficiency
Test Taking	.62	.77
Scanning	.65	.83
Error Monitoring	.70	.70
Note Taking	.65	.79
Listening Comprehension	.70	.90