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ABSTRACT

Proposed is the assessment of learning potential through a test-train-retest paradigm in addition to the traditional intelligence test with mentally handicapped or disadvantaged children. Discussed is a rationale for the approach which posits that poor and/or nonwhite children do not have equal access to school-preparatory experiences though they may exhibit adequate adaptive behavior in their nonschool environment. It is explained that if intelligence is the ability to profit from experience then the test-train-retest approach allows the child to perform at his optimum level by familiarizing him with test contents thus increasing his sense of competence. It is suggested that improvement following training indicates learning competence on reasoning tasks, and that learning potential assessment should be differentially effective with children from different socio-economic backgrounds and tested IQs. Research is reported which corroborates these hypotheses. Also discussed are two learning potential assessment instruments, the Kohs Block Designs and the Raven Progressive Matrices. Stressed during the training sessions is teaching the principles involved in problem solution. It is recommended that assessment of learning potential lead to pinpointing cognitive processes which need remediation followed by appropriate remedial instruction. (DB)

STUDIES IN LEARNING POTENTIAL

MEASURING LEARNING POTENTIAL:

AN ALTERNATIVE TO THE TRADITIONAL INTELLIGENCE TEST

By

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MEASURING LEARNING POTENTIAL: AN ALTERNATIVE TO THE TRADITIONAL INTELLIGENCE TEST[1]

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Children from poor and/or nonwhite homes tend to score at below average levels often in the mentally retarded ranges on tests which purport to measure intelligence. The IQ difference has been explained by the handicaps that poor and/or nonwhite children bring to the testing situation. They are fearful of the testing process, expect to do poorly, are often insensitive to speed requirements, are poor test takers, and are unfamiliar with the problem contents.

IQ tests measure the degree to which children can demonstrate that they have spontaneously acquired from their natural environment the skills and knowledge which cumulatively predict academic school success. The plausible assumption is made that a child who learned informally at the same rate as his chronologically aged peers prior to entering school will continue to learn--formally and informally--in and out of school. But this assumption is violated because children from nonmiddle-class homes do not have as equal and frequent access to appropriate school-preparatory experiences. They may learn differently and in ways that are not consonant with the middle class bias evident in school curricula. This cognitive discrepancy results in lower IQ scores, and we tend to view these children as less intelligent.

Yet, many of these same low IQ children are competent problem-

solvers in their nonschool environment, having mastered the skills, knowledge, and strategies necessary to maintain a successful adjustment. In other words, these children can learn and profit from relevant experience more successfully than their IQ scores and record of school achievements indicate.

The Heber AAMD Manual (1961) describes two criteria for diagnosing an individual as mentally retarded: his intellective competence, i.e., his IQ, and his adaptive behavior. For school age children, adaptive behavior is defined by school adequacy, since this is the focal concern of this age period. The two criteria are almost completely confounded since the most potent scholastic outcome predictor is IQ. The dual criterion for classification is not operative for school age children.

What is required for the low IQ child are measures of his capability that depend minimally on his demonstrated school failure. These measures must enable us to distinguish the low IQ child who is relatively unintelligent, i.e., does not readily profit from experience, from the child who is relatively competent in nonschool-related areas of his life. By the narrow application of the IQ criterion, this latter child is frequently misclassified as mentally retarded because we lack measures by which to test the hypothesis that the low IQ does in fact indicate a more pervasive failure to learn and profit from experience.

Jastak (1949) has argued that evidence contrary to the

diagnosis of mental retardation is supplied by any single subscale score on intelligence test batteries that exceeds the prescribed level for mental retardation, i.e., the third percentile. If the child's scores fall uniformly below the third percentile by this criterion, the child is diagnosed as mentally retarded. Thus Jastak argued for an extensive battery of tests that allowed the child to demonstrate his competence in a wide variety of tasks. The difficulty with this formulation is that all tasks found in intelligence test batteries are not equally predictive of ability to reason and conceptualize. Hence, a high score on digit span, indicating good memory for digits, would not be predictive of later school success. Perceptual and perceptual motor tasks, which do relate to early school success, do not relate to success on school subject matters which occur in the later years of [illegible]mentary and high school. The task(s) chosen as indices of [illegible]ity to perform more adequately must relate to later school or occupational success.

Mercer (1972) has described a measure to assess the child's adaptive behavior in his home, neighborhood and community which is presented in an interview format to the child's mother or mother substitute. By utilizing the WISC as the measure of IQ, the Adaptive Behavior Inventory will provide evidence of the child's competent functioning outside the school. Low adaptive behavior scores taken together with the low IQ would indicate mental retardation. High IQ but low adaptive behavior scores would indicate maladjusted children from the vantage point of their community's and family's perspectives.

The Logic of Learning Potential Assessment.

In our research, we have adopted an alternative strategy to the usual IQ test paradigm. Rather than restrict testing to the child's present level and ability to respond to information already acquired with existing problem-solving strategies, Learning Potential assessment permits the student to learn how to solve the particular reasoning problems. Assessment involves a test-train-retest sequence. The student views and attempts solution of the reasoning problems in a traditional format. Subsequently, either in a group or individually, he is shown how these kinds of problems may be solved and is offered a strategy for solution and opportunities to practice it. Following this training session, the child is retested.

The intent is to obtain an estimate of general ability derived from reasoning problems of suitable difficulty which the child has had an opportunity to learn how to solve and which permit a comparison with the low scholastic aptitude score (e.g., the Binet IQ). If the child can demonstrate, following a short period of training on a nonverbal reasoning task that he can perform at the level approximating his agemates' performance, then clearly he is not mentally retarded. We define intelligence in this assessment paradigm as the ability to profit from experience.

The Learning Potential test-train-retest assessment paradigm minimizes the artificiality of the test situation by helping the child become familiar with the test contents in a context calculated to help him see that he can become competent. That is, the training allows him to understand how to think about solving the problems when the contents of the problems may be strange the appropriate strategies or information requested not readily

apparent to him. The repeated administrations and the opportunity to learn provide the poor, school-failing child with an increased sense of competence to offset his initially demoralized feelings when taking a test oriented toward school types of problems. Without this competence boost he tends not to perform at his best, implicitly expecting failure (Zigler, 1967). The essence of this assessment strategy, then, is to impose some control on the potentially negative effects on his school performance of prior life experiences. Improvement following training on the Learning Potential task indicates competence, and hence, allows one to question the validity of the low IQ score. The adaptive behavior measures indicate socially demonstrated competence outside of school; the Learning Potential assessment indicates competencies on reasoning tasks, which to date have been largely nonverbal and performance oriented. In both instances, then, the potential for higher attainments in school and in life are described, and the challenge is posed to the school-based professionals to seek ways to translate these evidences of more satisfactory functioning to an individual educational plan that will allow the child to maximize the capabilities he has demonstrated.

Beyond providing more salutary emotional climate and more suitable (to him) nonverbal reasoning materials for the assessment, Learning Potential measurement also provides the child with access to, and practice with, the strategies necessary to solution of the reasoning

problems. This is hypothesized to be particularly critical for the child from a poor and/or nonwhite background, who may learn different cognitive structures in different expressive formats than those presumed to be available by school personnel. The training helps the child to narrow the cognitive gap between his native problem-solving strategies and those implicit to the problems he must ordinarily solve on the middle-class-biased tests he encounters.

Learning potential assessment, then, should be differentially effective with children from different socio-economic backgrounds who differ in tested IQ. High IQ children, who have demonstrated their capability with the knowledge and strategy base of school should perform as well prior to as following training. That is, they either know the solution or know how to develop the solutions to the reasoning problems prior to learning potential training. These children's pretraining scores should therefore approximate their posttraining scores and the dispersion of scores should decrease since training should help the laggards perform better on the task. Low IQ students from economically poor circumstances, who suffer from the middle class bias of the IQ test should do poorly on the trial prior to training. Training should increase the mean level of these scores and their dispersion.

Some low IQ children are misclassified as mentally retarded because of their failure to cope satisfactorily with the IQ test. Others appear to profit little from various training and learning experiences and may be functioning as retarded persons in an

everyday sense. Those misclassified by the IQ criterion should markedly improve their scores following training while those classified correctly by the IQ score will not. The mean post-trained scores should increase but the dispersion of scores should reflect the differential impact of the training on the low IQ students.

Babad and Budoff (1971) have presented data which support these predictions. High IQ, middle-class students (IQ >115) scored high on the pretest. Following training, they improved

their scores to an asymptotic level on the task, with a narrow spread of scores. Low IQ students (IQ <80) scored low on the pretest, showed an overall mean increase following training, but with an increased dispersion of scores. In short, some of these students markedly improved their scores, while others did not.

What happened following training can be viewed by comparing pre- and posttraining performances of the low IQ, educable retarded sample to the pretest levels of a sample of dull normal to average students (mean IQ 85 ±7) and high IQ (mean IQ 113 ±12). On the pretraining test, 16% of the educable retarded sample fell at or above the dull normal initial mean, and 36% fell at or above one standard deviation below that mean. Following training, the proportions were 36% and 63% respectively. The trend is even more dramatic, although the proportions are lower when the bright normal group is taken as a comparison group for the EMRs (note that there is a 45-point mean diiference between the mean IQs of the two groups). While none of the EMRs reached the bright normal mean and only 3% reached the -1 SD point prior to training, the final test proportions were 13% and 20%, respectively. Some low IQ students still did not become more proficient on the task. These students' continuing inability was predicted by the low IQ score.

Our data with the Learning Potential measures indicates that the low IQ students whose performance was more proficient following training were probably misclassified as "retarded" by the traditional IQ score. In our studies, when middle class students do appear in special classes for the mentally retarded, they tend

not to improve following training, supporting the thrust of this finding. That is, since their experiential background is congruent with the cultural biases and expectations of the school and IQ test, their consistently poor performance indicates relative inability, and their response to training on the learning potential task supports these findings.

These results using nonverbal reasoning tasks (Level 2 tasks) parallel Jensen's (1971) findings with the learning tasks of Level 1. Jensen argues that simple learning tasks, e.g., associative or serial learning, do not discriminate ability by socio-economic status background. The learning scores of poor low IQ black, Anglo or Chicano children overlap those of higher IQ middle class children, while low IQ middle class children's learning scores remain low. The score of the low IQ middle class child reflects his "true" ability because there are no cultural differences between the middle class child and the IQ test. The low learning scores confirm this judgment of inability. The findings with the learning potential assessment extend Jensen's argument to Level 2 reasoning tasks. Significant proportions of poor low IQ students who come from culturally different environments do perform at the pretraining levels of the middle class children when they have had opportunities to learn how to perform on the task. This requirement of training approximates the situation with the laboratory learning tasks which constitute the tasks of Level 1. Learning lists of words or stimulus-response pairs permits a feedback process in which the child can test his sense of adequacy on the task. The repeated

trials permit the child to become comfortable in the "game," to see the task as within his ken, and to experience the positive feedback provided by being increasingly correct on the task.

The situational arrangements for the child share many of the components of the LP assessment approach. Some of our early validity measures were paired associate tasks. We found the low IQ child's performance on these tasks to be related to his post-training performance on the Learning Potential task only when the cognitive load of the learning task was markedly increased to parallel with the cognitive strain of the reasoning task. Thus, there were no differences when the load was minimal, e.g., six meaningfully related picture pairs. The discrimination of ability following Learning Potential training was most evident when the learning task consisted of 18 meaningful picture pairs illogically coupled in stimulus-response pairs. Low IQ children who did well following learning potential training also learned this heavy load of paired associates with fewest errors. In contrast to Jensen, who argued that the lack of correlation on Level 1 tasks and IQ indicates that low IQ, low SES children should be educated and prepared for jobs that do not require reasoning skills, these LP data indicate that training on reasoning tasks can substantially alter the performance of these children. Jensen's conclusions are not warranted by extension to Level 2 tasks, because he failed to use a paradigm parallel to the one he employed with Level 1 laboratory learning tasks which also, incidentally, predict school achievements particularly poorly.

The real dilemma with these low IQ children is that of translating evidence of ability to reason adequately on LP assessment and curriculum units in the nonverbal and manipulative mode (Budoff, Meskin, & Harrison, 1971), to school learning situations in which verbal conceptual competence and expressiveness are so critical. Jensen's findings with Level 1 tasks and the LP findings with Level 2 reasoning tasks indicate that the programmatic teaching contents and vehicles of the school must be re-arranged. The child must be allowed the opportunity to gain some proficiency and successes early in his school career, while the problem-solving styles of learning and thinking appropriate to the middle class school are carefully and consciously trained in the child and then consciously nurtured in him. That is, if the child can be shown in the micro-situation of LP assessment to be able to master nonverbal reasoning problems at the level of his more academically successful middle class peer and if the implicit problem-solving processes can be identified, the child can be helped to become proficient in using them with academic types of materials and he should be able to learn more effectively in school.

There appear to be clear implications for school practice of learning potential approach. If we can identify the processes which underlie successful learning in school, we should be able to train the child deficient in one or more processes to become more proficient. Further, we must help him to learn to apply the strategies he has learned that are appropriate to particular problems or contents. To do this we must analyze the school

curriculum from the viewpoint of process, rather than the usual concerns with content and train teachers to foster development of ways of learning as well as the contents or facts.

Measurement of Learning Potential

Two LP instruments available for use by school and clinic personnel will be discussed. The procedures are based on training appropriate to Kohs Block Designs and to Raven Progressive Matrices. A third measure, the Series Learning Potential Test, is presently in a beginning stage of development and will not be discussed.

The Block Design Learning Potential Procedure.

Budoff (1967, 1969, Budoff & Friedman, 1964) first measured learning potential by using Kohs'(1923) original Block Design Test. Using enlarged designs drawn to the scale of 1" cubes for testing and training, he devised a training program which taught strategies useful for solving block design problems. This particular task was selected because (1) it does not involve verbalization or verbal exchanges with the tester, (2) is not previously associated with school types of work and the subjects have not experienced failure with the task, and (3) it involves a large component of reasoning but a few basic strategies can be taught which can allow the intelligent S to solve quite difficult sixteen block problems (4 x 4 designs).

Training is directed toward teaching the principles involved in the construction of the block designs. The materials consist of a test series of 15 of the original Kohs Block Designs, including five designs with sixteen blocks. The designs are arranged in order of increasing difficulty. Design 7 from the Wechsler Adult Intelligence Scale was added. The designs are printed on 5 x 6 inch white cards to double the scale of the original Kohs designs so that the stimulus designs and the block constructions are equivalent in size. A design of four blocks is drawn as a two-inch square; one of nine blocks as a three-inch square; one of 16 blocks as a four-inch square. This modification was suggested by Goldstein and Sheerer's (1941) adaptation as a means of simplifying the task for the student. The four colors, i.e., red, white, blue, and yellow, are retained. The usual one-inch cubes were

used as the blocks. The five coaching designs consist of three four-block designs (C from WISC; 3 and 7 from the Kohs series) and two nine-block designs (5 from the WISC and 8 from the WAIS). The coaching designs are printed in the same format and dimensions as the test designs.

The 15 test designs are administered individually three times: prior to coaching, and then one day and again one month following coaching. Kohs instructions for administering the block design test are used at each test session. A sample problem is demonstrated by the examiner. The child has to construct it correctly before the remainder of items are presented. Testing is discontinued after three successive failures.

The coaching procedure emphasizes the following principles: (1) the subject's probability of success on a coaching item is maximized by the possibility of working down to the simplest elements in the design. Praise and encouragement are freely given. (2) The principle of motorically checking his construction, block by block, against the design card is built into the coaching procedure. It was assumed that the retardate is distractable and displays poor work habits. He is required, therefore, to actively point, block by block, to his constructed design and the corresponding blocks on the design cards. This is done on all the stimulus cards in which all the blocks on a stimulus card are outlined to encourage a more planned and systematic work approach and to allow the subject to see concretely the success he is achieving. (3) The concept of two-color blocks is emphasized repeatedly as

the elements composing the design, e.g., the process of building a stripe is demonstrated.

The coaching sequence for an item was so designed that the subject has to solve the problem initially from a stimulus card in which the blocks are undifferentiated. If he fails to solve the problem, he is presented one row of the design at a time. Initially the blocks composing the row are not outlined. On succeeding presentations, if the subject fails to align the blocks correctly, the blocks are progressively outlined.

With adolescent educable mentally retarded subjects, coaching did not uniformly increase all scores. Rather, the subjects divided into three groups: subjects who demonstrated little or no gain following coaching (nongainers), subjects who demonstrated quite marked gains (gainers), and a third group who scored high on the pretest, demonstrating initial ability which could not be enhanced by the coaching because of ceiling effects (high scorers). (For further details, see Budoff & Friedman, 1964, and Budoff, 1967).

Our research program then proceeded to try to define the meaning of these differences in response to the training procedure on the Kohs Learning Potential task.

Some social history and test correlates of learning potential status based on a community EMR sample of 383 subjects drawn from a variety of communities in Massachusetts, indicate some of the characteristics of the three learning potential groups.

Of the total sample, 60% of the special class children born in the northeastern part of the United States attained gainer or

high scorer status; 40% were nongainers. One has a maximal probability of attaining gainer and high scorer status if one is white, over 15 years, male, from the lower socio-economic groups or living in situations that have been classically associated with poor school performance, e.g., if one is a member of a family of recent immigrants, or one's parents do not speak English, or one's family is large. The suggestion is that when the child is not from the middle class, but his family is at least benign emotionally, the child will tend to demonstrate ability on the nonverbal learning potential task. When there are instances of family instability, e.g., divorce, separation, or desertion, the child has a higher probability of being a nongainer, although as he grows older, he may develop sufficient ego to function more adequately on the particular learning potential task used.

The middle class child, by contrast, tends to be a nongainer. In this case, where there is no cultural difference by which to explain the lack of school success, this inability may be due to the effects of very strong negative emotional pressures because of the parental expectations for satisfactory achievement, a "true" retardation, or an interplay of the two sets of factors.

Learning potential status, on this task, is correlated with chronological age. The incidence of nongainers from 12 years to the post-school years (16 to 19 years) decreases from 60% to 33%. By contrast, about 1/3 of the samples at each age from 9 to 19 years are gainers. Because of the difficulty of the task, high scorers represent only 1/12 of the chronological age groups

below 11 years, but about 1/3 of the post-15 year olds.

Institutionalized, as compared to community EMRs, tend to fall into the nongainer group (53% versus 40%). This finding might be expected since these children come from much more unstable homes and have lived in a more difficult and restrictive environment, at least in a state (Massachusetts) which has special classes available in most communities. Children with IQs in the borderline and mildly retarded ranges tend to be institutionalized when the family cannot care for the child adequately.

Nongainers have lower Stanford Binet and WISC Verbal Scale IQs than gainers and high scorers, though the mean scores are within the retarded ranges. (Stanford Binet--68.78, 74.07, and 75.35; WISC Verbal Scale IQ--68.23, 72.88, and 75.89 for the nongainers, gainers, and high scorers, respectively). Similarly, scores of the gainers and high scorers were significantly higher than those of the nongainers on a group administered Raven Progressive Matrices (Series A, B, C, D, E). Many scored above the fifth percentile, which represents the cutoff of the lowest group for the English norms (Budoff, 1970).

Budoff (1971 / in-house) carried out a follow-up study of institutionalized patients of a state institution for the retarded who had been tested several years earlier. High learning potential subjects (gainers and high scorers) were found to have left the institution without permission and never returned or discharged, while low learning potential subjects (nongainers) tended to be still residing in the institution or to have been transferred to another institution. In a study of community special class students (now

in their twenties), high LP subjects tended to have been competitively employed more than 75% of the time since leaving school, and/or to have been admitted to the armed forces, while low LP subjects tended to be employed intermittently and to be economically and socially dependent.

Studies of the personality correlates of LP indicated that the high LP subjects tended to react less extremely to frustration, demonstrated less disruption and faster recovery following a period of relaxation (Pines & Budoff, 1970); expressed more positive expectations for coping with interpersonal and task-oriented difficulties and situations (Folman & Budoff, 1971); show more flexibility on a concept-shift task that was unrelated to prior social deprivation (Budoff & Pagell, 1968); showed more realistic level of aspiration; their goal setting behavior was less disrupted by failure (Harrison, Singer, Budoff, & Folman, 1972); and their self-concept was more positive (Harrison & Budoff, 1972).

These findings, systematic across various studies, provide support for the hypothesis that the LP measurement uncovers a significant psychological dimension which is not tapped by the traditional measures of intelligence testing. The evidence points to the existence of different groups among the IQ-defined EMRs, a distinction that holds across many measures and situations, but a distinction which cannot be made on the basis of IQ scores.

The educational significance of the learning potential argument was also studied. If, as we argue, the high learning potential child is educationally retarded, then his performance on a properly designed educational curriculum should indicate an

ability to learn similar to CA controls, and most particularly, to low achieving CA controls, who are also educationally retarded.

An educational unit that taught simple electrical concepts by allowing the student to manipulate flashlight batteries, bulbs, and copper wires was adapted from a unit produced by Educational Development Center (1966). The investigators formulated a nonverbal test by which to evaluate how much the students knew about electrical circuits prior to the course, and then retested them following the close of the unit. This test was nonverbal in the sense that the students could demonstrate their understanding by pointing to electrical circuits mounted on pegboards to indicate which bulb would light in one section. Or, in the second part, when they were given their own simple circuit including a lighted bulb and one battery, they merely had to indicate whether the bulb specified in the circuit on the pegboard would light or not, and if so, whether it would be brighter, dimmer or of the same brilliance as the standard bulb which they held lit in their own hands. This format was also repeated in a written version where they answered simple questions on printed diagrams that closely resembled what actual circuits looked like, and, in a second section, from schematic or symbolic representations of these circuits as they might appear in a physics text. Responding to the test required no verbalization, although at specified times we did ask the S why they had given the particular answer.

The evaluation of the laboratory science classes supported the argument that high learning potential status students are

educationally rather than mentally retarded. That is, the level of scores on the evaluation instrument did not differentiate between the EMR or nonEMR CA control groups, but after teaching differentiated within the total sample regardless of school placement, on the basis of their learning potential status.

This was most clearly evident when the performance of the low achieving CA controls was compared with the EMR samples. The low achieving controls were defined as those students whose mean grade point average for the major subjects for four of the five marking periods fell below a 2.0 or C average. What was interesting in these comparisons was that the superior level of performance on the pretest of the low achieving CA controls was no longer evident on the posttest. There were no differences between the two groups when posttest or improvement scores were compared, but almost all the significant F-ratios were lodged in the main effect for learning potential. Thus, even more consistently than with the larger sample of CA controls which included some high and average achieving students, the low achieving students' level of knowledge on the electricity test was indistinguishable from that of the special class students taken as a group, following exposure to a suitably designed curriculum unit. High scorers, gainers, and nongainers, in that order, disregarding special or regular class placement displayed knowledge of electricity in accordance with their learning potential status. Further, when subjected to a sign test, the mean gain scores for the special class high scorers and gainers were slightly higher on each section

of the electricity posttest when compared with gainers and high scorers in the regular classes.

The differences between the special and regular class students became evident when the students were asked to verbalize a reason for their correct empirical choice. The special class students, regardless of LP status, tended not to give causal reasons for their choices, while large proportions of the regular class Ss did. Thus, though the special class students verbalized their empirical understanding of the principles of electricity less effectively, they had learned and applied these principles as well as their regular class peers (Budoff, Meskin, & Harrison, 1971).

The implication of these findings is that the high scorer, especially, and the gainer, probably, are more clearly educationally retarded. They suffer ignominiously in the usual special classes because they are compelled to work with materials that continue to expose their weaknesses in language arts and reading. They do not have the opportunities to learn in situations in which expression of their ability may become evident, that is, when learning in school taps their proficiencies.

The Raven Progressive Matrices Learning Potential Measure.

The consistency of the findings in studies with the block design learning potential procedure indicated the psychological significance of the learning potential dimension. Considering the gravity of the implication of these results to the classification of children as mentally retarded, it became apparent that a second measure was needed which could be used with younger children (CA <11 years) and with adolescents as further evidence of the ability displayed on the Kohs LP task. If a child failed to

respond to the block design task, availability of the second measure permitted a further examination to determine amenability for training.

Budoff chose the Raven Progressive Matrices (1956, 1958) as the new measure for following up the work of Feuerstein, personal communication, 1967, in Isreal with Moroccan non-Western children. Feuerstein's studies and preliminary work by Paul Jacobs(1971) using double classification training, repeatedly found a high degree of relationship between Raven Matrices and Kohs Learning Potential status. Feuerstein's procedure with pre- and posttests, using Series A, A_B, and B around training to double classification problems, proved to be inadequate, as there are only six double classification problems in set B of the Raven Matrices, and Feuerstein trained to these particular problems and their various permutations. Jacobs' and Vandevarter (1971) work had shown that first grade children were not easily trained on double classification problems. However, the A, A_B, and B series contained other types of problems, e.g., pattern completion, orientation, etc., and it was felt that training to these problems would be suitable for children seven to nine years of age who might be in some academic difficulty and had attained low IQ scores. To extend the applicability of the Raven Learning Potential assessment to older Ss, training procedures were developed to various principles appropriate to the solution of 3 x 3 matrix problems (Series C, D, E).

In this procedure, Raven Matrices are group administered in both pre- and posttest, while the coaching may be done individually

or in groups. Young children (CA <9 years) are given only Series A, A_B, and B while older children (CA >9 years) are given Series C, D, and E as well.

Throughout the training period, a number of principles were adhered to:

1. No problem which appears in Raven Matrices is presented in the training series so that there is no training for specific test problems.

2. Great efforts are made to be certain that the child understands the demands being made of him on the task. The training procedure is not a strictly standardized one but allows for a number of variations to ascertain whether the child does understand what is required before the conclusion is drawn that he is unable to master the particular type of item.

3. The requirements of the task are demonstrated initially on materials that are pictorial amd meaningful, e.g., an American flag for the pattern completion tasks.
Successive problems in a training series require the child to deal with geometric presentations. This adheres to the basic format of the matrices test presentation.

4. The requirements of the task are concretized in motoric performances, e.g., having the child draw the item that completes the pattern before perusing the various alternative solutions presented under the problem. In the double classification problems, it was found that children could easily define one attribute at a time but often did not hold the first attribute

in mind while they derived the second relevant attribute. During development of the training procedure, the child's understanding was facilitated by having him draw the relevant attributes, one at a time, as he derived them. This helped concretize the elements of the solution process so that many children, who followed this procedure, could correctly solve the double classification problems mentally with little trouble.

Drawing each attribute in turn was adopted as a routine part of the training procedure. For example, when the child decides the shape of the missing figure was a square, he is asked to draw it. After he derives the second attribute, which might be dots throughout the whole figure, he is asked to add them to his drawing. The child's attention is focused wholly on the elements of the problem. After the correct response is drawn, the child's attention is then directed to the choices in the lower half of the page, drawn in the same format as the Raven test booklet, and is asked to point to or cross out (in the group version) the correct response for the problem. The solution process throughout this part of the training is verbalized by a child and/or the trainer.

When a child has difficulty drawing the designs, E draws them for him.

5. During the training on the double classification problems, after the child ceases to draw the alternative and begins doing the problems mentally, the child is required to indicate verbally how he arrived at his solution. This seemed to help the child

maintain the quality of the solution process attained by the drawing and E's accompanying verbalization. A minimal verbal response often in combination with pointing responses by the child sufficed to indicate to E the child was solving the problems with an appropriate concept.

The manner in which LP status was determined was changed. Instead of calculating pre-post differences in score and using gain scores, the child's score on his pre- and posttest was compared with that of children his own chronological age, as the basis for determining learning potential status. The basic principle underlying this strategy is that if a disadvantaged, so-called "retarded" child can attain the pre-training level of his nonretarded control after one hour of training, the child has demonstrated that he is not inferior to his culturally advantaged peers in ability, but that he requires access to appropriate learning experiences. Using Jensen's norms for Series A, A_B, and B, children who scored at .9 of the median for their chronolcgical age on the pretest were considered high scorers; those children who attained that cutoff following training were gainers, and those who stayed below that point following training were considered nongainers.

Data describing the reliability and validity of this instrument is presently being analyzed and will be available shortly (Budoff & Hutten, 1972).

Implications and Discussion

Some implications for our testing and teaching practices follow from

these data. Firstly, we must rethink our position regarding the effects of practice. Traditionally, practice effects have been seen as contaminating the meaning of test scores since they introduce a factor of unequal opportunities regarding the test tasks. Providing opportunities to children to practice items similar in format and/or content to those found on the test, or to the test items themselves, has been frowned upon (see Anastasi, 1958; Vernon, 1960). However, Babad and Budoff (1971) found that repeated administrations, even without training, can markedly increase the scores of poor children whose IQs fall in the dull to average range (85-100). These children seem to require some help in grasping the appropriate strategies for solution of the problems. Merely providing the opportunity to practice and become familiar with the materials facilitates their performance with reasoning problems.

A more difficult task is to conceptualize more clearly the different types of decisions which may result from a testing process. To date, our major preoccupation has been with the prognostic or outcome decision. IQ tests permit us to make the statement with reasonable certainty that children with high scores will probably complete an academic school program successfully, while those with low scores will probably not. Our testing concerns relate to discriminating the potential success from the failure, in terms of such criteria as tested achievement levels, grades, high school graduation, college attendance, etc. This effort yields little/direct educational relevance to the child's teacher,

aside from an excuse to reify the child's failure to learn into a mandate to expect little, and an excuse to challenge the child little. Over time, the prophecy of low scholastic aptitude is fulfilled. There is a real measure of futility to this effort, too often a real danger to the child, and a questionable benefit to society when the test information is used in this manner against the child. We must try to integrate into our thinking the idea that the low scholastic aptitude score does not provide a license to downgrade the quantity and quality of our efforts with the child. Quite the reverse,/ the low IQ score provides us with a danger signal that the child needs help.

We too frequently ignore that school success is not the only desirable or acceptable outcome of the period of childhood. School success is a critically determining event,/since graduation from high school and access to college does broaden the range of occupations available to the young adult, particularly to high status, white collar jobs. But there are many successful adults, by society's standards, who are not high school or college / graduates and who are employed in a broad spectrum of white and blue collar jobs. Many of them make more money than we vaunted white collar professionals. Our present testing formats are so closely related to school success variables, however, that we have a too limited grasp of the types of schooling experiences that might be related to economic and social independence as an adult when more than minimal academic competencies are absent.

The continued use of tests can only be justified if they help us plan the types of school experiences that will

result, not only in college entrance, but in a broader goal of eventual independence in adulthood. As school psychologists, we know essentially nothing about how to proceed along this latter path.

Learning potential assessment represents one step in this direction because it illustrates a paradigm for how one might plumb the potential within a child. More significantly, I think it restructures the basic question on which our traditional testing system has been predicated. Instead of trying to sort children into groups by a criterion of probable outcomes regarding school success, it allows us to ask whether the child who has not grasped a particular problem cannct grasp the problem if he is shown what it is we wish him to understand and utilize in nontrained instances of the problem. If after a short period of training on various types of Raven Matrices problems, the Binet-defined "mentally retarded" child can perform at the level of his chronologically-aged peers, the child clearly is not retarded. But he does have problems that retard his progress in academic learning. As psychologists, we must address ourselves with our teacher-colleagues to the nature of these problems and develop educational plans aimed at helping the child overcome these problems. The interpretive thrust of the learning potential assessment, then, must be in viewing the child, in spite of his handicaps of knowledge in test taking or his past school failures, as an organism who may be able to learn and profit from suitable experiences. It focuses us on what is potential and positive

in the child. In turn, a demonstration of such capability forces us as humane persons to discover and innovate the programs that will enable us to help the child maximize his capability. We turn then from making what are at best often educationally irrelevant judgments, and at worst, very damaging statements--to a helping, facilitating orientation. We become concerned and focused on how we can extract the best performance from the child--to make him look and achieve better than our past training and experience says he can perform, when we base our judgment on the prognostic meaning of the low IQ score.

An interesting anecdote may indicate why such a suspension of judgment is necessary and warranted. One child, who had been placed originally in a special class for the mentally retarded with an IQ of 75, was subsequently integrated into a nongraded school. Two years later, he was performing on achievement tests at grade level, doing satisfactory work in class and had a tested IQ score of 88. The rising IQ score indicated an increased probability of success in school that may continue to rise as the child continues to progress. Successful educational interventions with low IQ "mentally retarded" students may tend to indicate rising IQs. This fact offers further good reason to consider the low IQ not as reified truth about ultimate outcome, but rather as a signal of danger that the child urgently requires an individual educational plan to help him realize his potential so that prophecy of ultimate failure will not be fulfilled and we will not facilitate its fulfillment.

The traditional IQ tests have tended to close our eyes to the complexities of the issues that we confront every day in our task of trying to make decisions of great moment to the child who has failed to progress satisfactorily in school. Also, and more critically to my present thinking, is that the power to reason, to think conceptually outside the verbal and language areas, represents the domain of significance for our work with children who have failed to learn. We have tended to place excessive emphasis on the child's past acquisitions and his ability to verbalize them, and have ignored the child's potential capability to reason outside the verbal domain. The message of the LP argument, in short, is that we must continually ask whether the child could perform more satisfactorily if he understood better what was expected of him, and had the opportunity to practice and learn how to do what he might not have spontaneously learned from his past experiences.

Educationally, then, we must seek instructional formats that will engage the child and allow him to enhance his sense of continuing competence. This is critical especially for the poor, nonwhite child who expects failure on the strange turf of school. This population includes many poor whites from chronically poor families (across generations) as well. The child's siblings, his parents, collateral relatives and friends express their expectations based on their own negative achievements. Our focus then, as school psychologists, should be to form an alliance with his teachers and together plan ways for school provide successes and be competence enhancing for the child

to reverse this early expectation of failure. Rather than stress the language arts and reading only, we should try to incorporate games and puzzles that teach concepts in mathematics, and use manipulative science projects to engage his curiosity and develop good work habits and observation skills. Where possible, work in reading might be programmed in the same game-like context, attached to the student's math and science learning as well as his workaday world of home, community, and school. It may be also critical to help the child learn how to operate conceptually in school to enhance his feelings of belonging on this turf, e.g., help him learn how to take tests, how to remember the materials he has learned, and how to process these materials so he can get a sense of the notion of "abstract concept" which is critical to success in the middle class school curriculum.

We must uncover the cognitive processes underlying successful performances in school, learn to train them in children who are deficient in their use, and help the child learn to apply them appropriately in problem-solving contexts. Education must become process-oriented. Teachers must come to emphasize and focus on processes underlying learning as much as on learning the facts themselves.

In summary, Learning Potential permits one to gain a sense of the child's capability to learn and reason regardless of the child's prior acquisitions and school failures as reflected in his IQ score. The low IQ signals school failure in the future, as the slow progress indicates school failure in the present. Learning Potential assessment may indicate an underlying capability

to learn and reason, which can be primed and utilized to further school learning, albeit using materials and procedures other than those presently utilized. The school psychologist must become the learning engineer who can work with the child's teacher and other pupil personnel specialists to help design the program of activities that will facilitate the child's learning and help him progress at a more satisfactory rate in school.

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Footnotes

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