LEARNING ABILITY IN RETARDED, AVERAGE, AND GIFTED CHILDREN[1, 2, 3]

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How do children classified for educational purposes as *"mentally retarded"* differ in their learning abilities from children who are average or above average in measured intelligence and scholastic aptitude? The literature on this topic is not very enlightening. The main reviews are those of McPherson (1948, 1958) and Dunn and Capobianco (1959). There are two main reasons why studies in this field have been ambiguous and conflicting.

These reasons are primarily methodological. In the first place, many studies have used learning tasks on which there were large individual differences in initial ability. In order to overcome this source of variance in the learning task, to get at only *rate* of learning, investigators have used "gain scores", which are arrived at by subtracting some measure of the subject's first-trial performance from a measure of his performance at the end of practice. This gain score, then, is correlated with the IQ or other measures of cognitive ability. When improvement with practice is thus measured from a different baseline for every subject, the results can be confusing and are often uninterpretable. A subject who is initially good at the task is already near the asymptote of his learning curve and can therefore show but little gain or improvement with practice. The slowest learners can often show the greatest gain. Consequently, correlations between gain scores on various learning tasks and psychometric measures of intelligence usually average close to zero (McPherson, 1948, 1958). The other major cause of difficulty, in studies comparing the learning abilities of retarded and normal subjects, results from not knowing whether the subject understands the instructions for the learning task. Since instructions are usually verbal, it is not surprising that retarded subjects often

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[1] This research was aided by a grant from the National Science Foundation to the Center for Human Learning.

[2] The writer is indebted to Mr. Marvin Groelle, of the Department of Special Education, Oakland Public Schools, for his assistance in the selection of subjects for this study and for his helpful comments on the first draft of this article.

[3] An abstract of this study was presented at the 1962 meeting of the California Educational Research Association.

fail to understand. The subject's own statement that he has understood the instructions and understands what it is he is supposed to learn has practically no validity among the retarded. What is needed is objective evidence that the subject understands the requirements of the task.

The present study is an attempt to overcome these two methodogical difficulties in comparing the learning ability of educationally retarded children with that of the normal and the gifted. The learning task consisted of a simple form of trial-and-error learning in which the correct responses to be learned were equally *unknown* to all subjects at the beginning of practice and yet were equally accessible to all subjects. Objective evidence that all subjects understood the instructions and the nature of the task was obtained, essentially, by elaborating the instructions and by making the task sufficiently easy to begin with, so that every subject showed learning, *i.e.*, improvement with practice).

Aside from a theoretical interest in the comparative learning abilities of retarded and normal children, there are practical reasons for devising direct tests of learning ability. Standard IQ tests are, fundamentally, "achievement" tests, and tell us more about what the child has learned outside the test situation than about his learning capacity, *per se*. Only when we can safely assume that the children whose IQs we wish to measure have had quite similar opportunities for learning the kinds of knowledge and skills measured by IQ tests can these tests be said to reflect "learning" ability. An innately slow learner and an innately fast learner, passing through the *same* environment, will presumably differ on a test of the information and skills that could be acquired in that environment. If, however, they had passed through quite different environments, or unknown environments, we would be at a loss to assess their actual capacity for learning by means of the usual intelligence tests. On the other hand, a test that can measure directly the child's ability to learn in the test situation itself will have advantages not offered by the usual achievement-type intelligence tests. Such a task has been devised for the present study.

METHOD

Subjects

All the children in the retarded classes in the seventh, eighth, and ninth grades in a large junior high school, located in a metropolitan area, served as subjects (Ss). Smaller groups of average and gifted children were selected from the same school. None of the Ss had sensory or motor handicaps. Judging from the father's occupation and the neighborhood of residence, the socio-economic status of the Ss was predominantly middle class, though there were also a few Ss of the lower-middle and upper-middle classes.

Retarded group (N=36). These Ss were placed in special classes for the educable mentally retarded on the basis of several criteria, of which IQ was only one. All had recent Stanford-Binet IQs from 50 to 75, and all were markedly retarded in school achievement and were apparently unable to profit from the instruction provided in the normal classroom. The group was composed of 22 white children, eight children of Mexican parentage, and six Negroes. There were 21 boys and 15 girls.

Average group (N=24). These Ss had IQs from 90 to 110 on the California Test of Mental Maturity, which in this IQ range, is quite comparable to the Stanford-Binet. Two of the Ss in this group were Negro; the rest were white. There were 12 boys and 12 girls.

Gifted group (N=13). The main purpose of this group in the present study was to determine an "upper limit" of performance on the learning task among this particular school population. They were selected only from the ninth-grade class. All had Stanford-Binet IQs above 135 and all excelled in scholastic achievement. There were two Japanese-Americans in the group; the rest were white. There were three boys and ten girls.

Table 1 shows the mean IQ and chronological age (CA) of the three groups.

TABLE 1

MEANS AND *SD*'S FOR IQ AND CHRONOLOGICAL AGE OF RETARDED, AVERAGE, AND GIFTED GROUPS

Group	IQ		CA
	Mean	*SD*	Mean
Retarded (N = 36)	66.17	7.13	14.24
Average (N = 24)	103.04	8.06	14.23
Gifted (N = 13)	142.54	4.94	14.29

Procedure

Apparatus. The apparatus used in this study has been described in detail elsewhere (Jensen, Collins, and Vreeland, 1962). The entire testing procedure, except for the instructions to the S, was programmed on teletype tape and was run automatically, thereby insuring uniformity in the learning task for all Ss. Essentially, the apparatus somewhat resembles a teaching machine. The S sits before a stimulus display screen, which is at about eye level, and directly in front of the S is the response panel, consisting of a number of pushbuttons in a circular array (Fig. 1).

Stimuli consisting of colored geometric forms—triangles, squares, and circles colored red, blue, yellow, and white—appeared one-at-a-time against a black background. The S's task was to learn by trial-and-error which

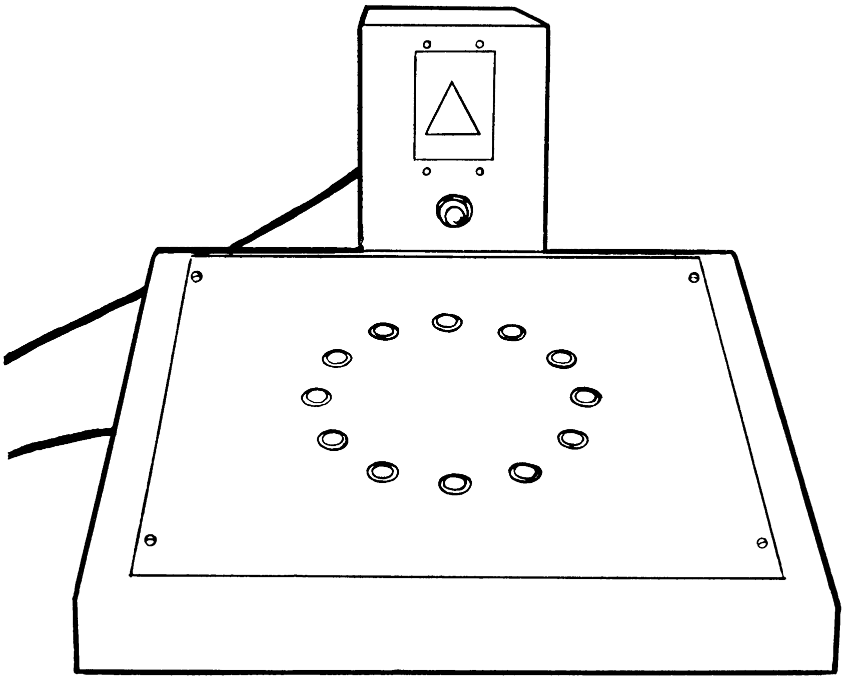

Fig. 1. The stimulus display unit (above), with reinforcement light under the screen, and the response unit (below) with a circular array of pushbuttons. In the present experiment only five and six-buttons arrays were used. The triangle appearing on the screen is two and five-eighths inches in height.

pushbutton would elicit reinforcement (a green light below the screen) for each stimulus. Each pushbutton corresponded to one of the stimuli. The number of stimuli presented in a particular task was always the same as the number of response alternatives. Thus, the task may be conceptualized as a selective, learning, multiple S-R (stimulus-response) problem. The stimuli always appeared in a random order, except that the same stimulus was never repeated in succession. The rate of stimulus presentation was governed by the S. The stimulus would remain on the screen until the S pushed one of the response buttons, whereupon, after a one second delay, the next stimulus would appear. If the S pressed the "correct" button, a green light would go on and stay on during the one second interval until the next stimulus appeared. If the S pushed the "wrong" button, a relay would make all the other buttons go immediately "dead," so that further responding was useless until the next stimulus appeared, which was always one second after a button had been pushed. In the present experiment, the apparatus was set up for five S-R, connections and six S-R learning tasks. Equivalent forms of the tasks were made possible simply by randomly "scrambling" the connections between the stimuli and the buttons, which is accompanied by the turn of a dial on the control unit of the apparatus. The S's performance throughout the course of learning was observed by the Experimenter (*E*) and was automatically tabulated by a bank of electrical counters on the Experimenter's control unit. Throughout the testing, the S sat in front of the stimulus-response units (Fig. 1), while the *E* and the control unit were out of sight behind the S.

It should be pointed out that this learning task is not essentially a sensorimotor task, since among a group of Ss without marked visual or physical handicaps practically none of the variance in performance on this task could be said to be associated with individual differences in sensorimotor abilities.

Instructions. The instructions for the first task were the same for all Ss:

> On this screen (*E* points to the screen) you will see five different pictures, just one at a time. When a picture comes on the screen, I want you to push one of these buttons, like this (*E* demonstrates). Each button goes with a different picture. When you press the *right* button, this green light goes on. I want to see how many times you can make the green light go on. After enough practice you should be able to learn all the right buttons and be able to make the green light go on every time you press a button.

The *E* then asked if the S understood the task, and if not, it was explained further. The S was then told, "You don't have to hurry because the picture on the screen will not change until you press one of the buttons." The apparatus was turned on for 200 stimulus presentations following the S's first reinforced response. The test was terminated after 200 trials, whether the S had mastered the task or not.

Special procedures in the retarded group. The first-task instructions (given above) were entirely adequate for the average and gifted Ss. In fact, many of these Ss seemed rather impatient, having caught on to the idea of the test long before the *E* had finished giving the standard instructions. The fact that all these Ss showed immediate, systematic improvement in performance with practice, is objective evidence that they had no trouble understanding the task.

On the other hand, it was not all all certain that all the Ss in the retarded group understood the instructions, although all of them said that they did. Many evinced no sign of improvement over the 200 trials; they seemed to push the buttons in a random fashion and obtained no more reinforcements (correct responses) than one could attribute purely to chance. Therefore, it was decided to give each retarded S equivalent forms of the five S-R tasks, until the S showed evidence of learning, that is, by obtaining significantly more reinforcements in 200 trials than could be attributed to chance. Ss were never given more than one form on any one day and were always given 200 trials. A sequence of procedures was carried out with each S, using equivalent forms of the five S-R task, until the S produced evidence of learning. These procedures, in the order in which they were applied, were as follows:

1. *Verbal reinforcement by experimenter.* All the retarded Ss were given a second test, with the same instructions as before. But this time when the S pushed the correct button and turned on the green light, *E* would say such things as, "Good!," "That's it!," or "That's right!" If Ss had failed to learn on the first test because they had not really understood the function of the green reinforcement light, this verbal reinforcement procedure should have helped to overcome this obstacle. As soon as it was seen that the S's performance rose above the chance level of correct responding, the verbal reinforcement was discontinued.

Most of the retarded Ss began to learn with this procedure, and some did strikingly better. Those who still seemed not to "catch on" were called in the next day for another five S-R problem, using the following procedure.

2. *Stimulus naming.* The original instructions were given again, but this time the S was first required to name each stimulus as it appeared, without pressing the buttons. The rate of presentation was controlled by *E* and the S had to persist in this pratice until he could name the stimuli quickly and accurately, saying, "blue triangle," "red circle," etc. Then the S began the learning task, the *E* giving verbal reinforcements until there was evidence of learning. The S was not required to continue naming the stimuli aloud. All but three Ss demonstrated learning after this procedure. Those who did not were tested the next day on another equivalent five S-R task, with the following procedure.

3. *Stimulus naming while learning.* This procedure was the same as "stimulus naming" except that this time the S was required to go on naming each stimulus before pushing the button. This insured that the S was attending to the stimulus on every trial. One S clearly did not learn, and the third S was doubtful. The latter two Ss were called in the next day for the following procedure with still another five S-R task.

4. *Delayed response following reinforcement.* The idea for this procedure occurred to the investigator while testing the average and gifted Ss. For most of these Ss, the first few reinforcements had the effect of *delaying* the next response. After a reinforcement, especially if it was the first time the particular response was reinforced, the S would pause briefly before making the next response, as if to let the newly acquired S-R connection "set." The last two retarded Ss, who so far had not learned in this five S-R task, seemed to be totally lacking this delay tendency. So it was decided to force it upon them. A switch on the control unit, operated by the *E,* would hold both the stimulus and the reinforcement light "on" for three seconds before changing to the next stimulus; this delay occurred

only when the S pressed the correct button. These correct responses were obtained at first, of course, only by chance. The first few times that the machine delayed the presentation of the next stimulus after a reinforced response, the *E* said to the S, "Look at the picture and look at the button you just pushed." Both Ss began learning with this procedure, which was discontinued before the S had been given 200 trials, since the Ss fairly quickly got the habit of delaying their responses. For one of these Ss (who had an IQ of 50), the *E* had to demonstrate the delay procedure by playing the S's role.

Last test. This test consisted of a new set of six S-R connections to be learned. It was given to all Ss in all three groups. Instructions were the same as for the first test, but no additional instructions were given and Ss in all three groups were treated exactly alike. This test, with one more S-R connection than the previous tests, is somewhat more difficult. However, it was safe to assume that all Ss taking the six S-R task knew how to go about learning this type of problem, since all had demonstrated learning on the five S-R task. In other words, the retarded Ss presumably were not handicapped on the six S-R task because of not understanding the nature of the task.

RESULTS

Index of Learning

In order to measure performance on both the five S-R and the six S-R tasks, on the same scale, having a range from zero to 100, an "Index of Learning" was devised. The index may be interpreted as the percentage of maximal possible performance above the level of chance performance. In order to reduce to some extent the effects of chance success on the first few responses, the S's performance was counted only after the first correct or reinforced response; each S was given 200 trials following the first correct response. This slightly improves the reliability of the S's score, since the errors made before the first reinforcement are more or less random and the first correct response is hit upon by chance. The Index of Learning is obtained for each S as follows. The percentage of correct responses in the first 200 trials, after the first reinforcement, is determined. From this is subtracted the percentage that could be correct by chance. Since the chance level on the five S-R task is one-fifth or 20 per cent, this is subtracted from the S's percentage of correct responses on the five S-R task. On the six S-R task, the chance of getting a correct response by pushing the buttons at random is one-sixth or 16.67 per cent, and this figure is subtracted from the S's percentage correct on the six S-R task. Thus, a chance score would be, on the average, equal to zero. But now the highest possible score for the five S-R task would be 100 per cent minus 20 per cent equals 80 per cent and on the six S-R task it would be 100 per cent minus 16.67 per cent equals 83.33 per cent. So that the highest possible score for each task will equal 100 per cent, the score for the 5 S-R task is divided by .80, and for the six S-R task it is divided by .8333. This converts the scores on both tests, to a scale on which the scores range from zero to 100.

$$\text{Index of Learning (5 S-R)} = \frac{X\% - 20\%}{.80}$$

$$\text{Index of Learning (6 S-R)} = \frac{X\% - 16.67\%}{.8333}$$

In this formula, X per cent equals the S's percentage of correct responses in the 200 trials, *i.e.*, opportunities for responding, after the first correct response. In order to plot performance curves, index scores were obtained in a similar manner for successive blocks of ten trials.

Comparison of the Retarded, Average, and Gifted Groups

Table 2 presents the means and standard deviations of the Index of Learning for the three groups. Analysis of variance followed by t tests show that on the first test each of the groups differs significantly (.01 level) from each of the others. The retarded group is far below the average and the gifted group is above the average. The retarded group improved significantly on the second test, in which verbal reinforcement was added.

TABLE 2

INDEX OF LEARNING FOR RETARDED, AVERAGE, AND GIFTED GROUPS

Group	First Test 5 S-R		Second Test 5 S-R		Last Test 6 S-R	
	Mean	SD	Mean	SD	Mean	SD
Retarded (N = 36)	46.64	32.85	64.10	30.73	65.36	16.94
Average (N = 24)	77.90	14.79	—	—	80.09	12.16
Gifted (N = 13)	88.66	6.64	—	—	87.05	5.11

On the last test (six S-R) the groups still differ significantly (the retarded differs from the others at the .01 level, and the gifted and average differ significantly at the .05 level), but the retarded group has shown a marked improvement as a result of the intervening steps taken to insure that they understood the task. Figures 2 and 3 show the learning curves of the three groups on the five S-R and six S-R tasks.

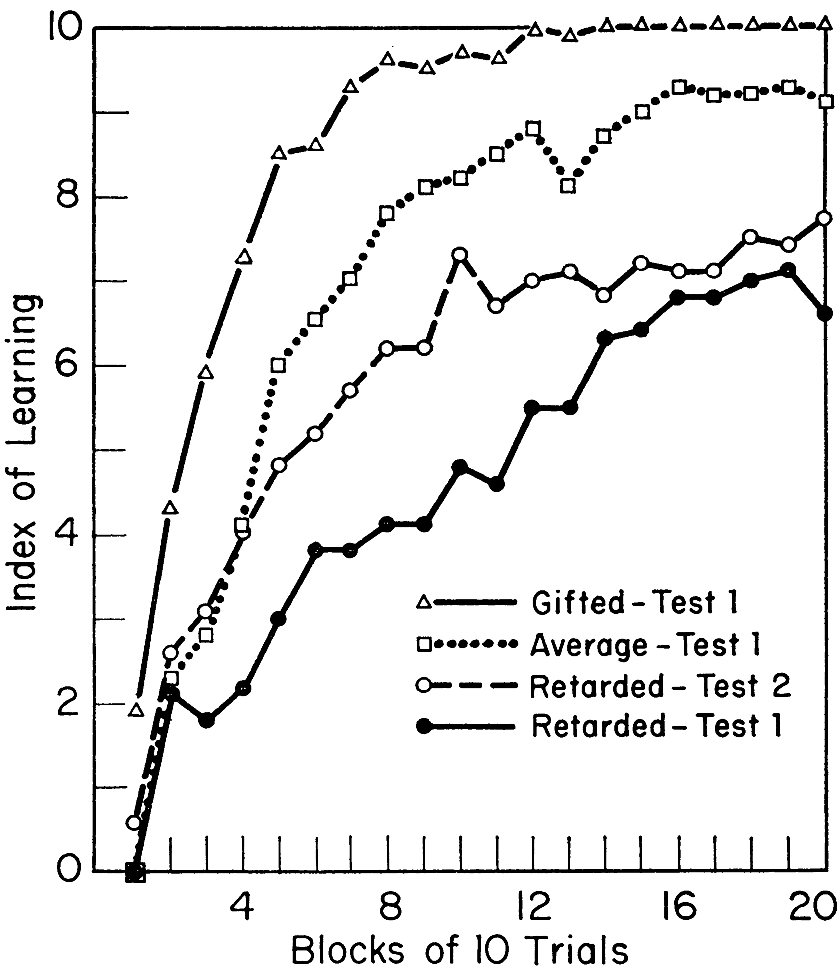

Fig. 2. Learning curves of the retarded, average, and gifted groups on the first test. Also shown is the second test of the retarded group. All tests consisted of five S-R connections.

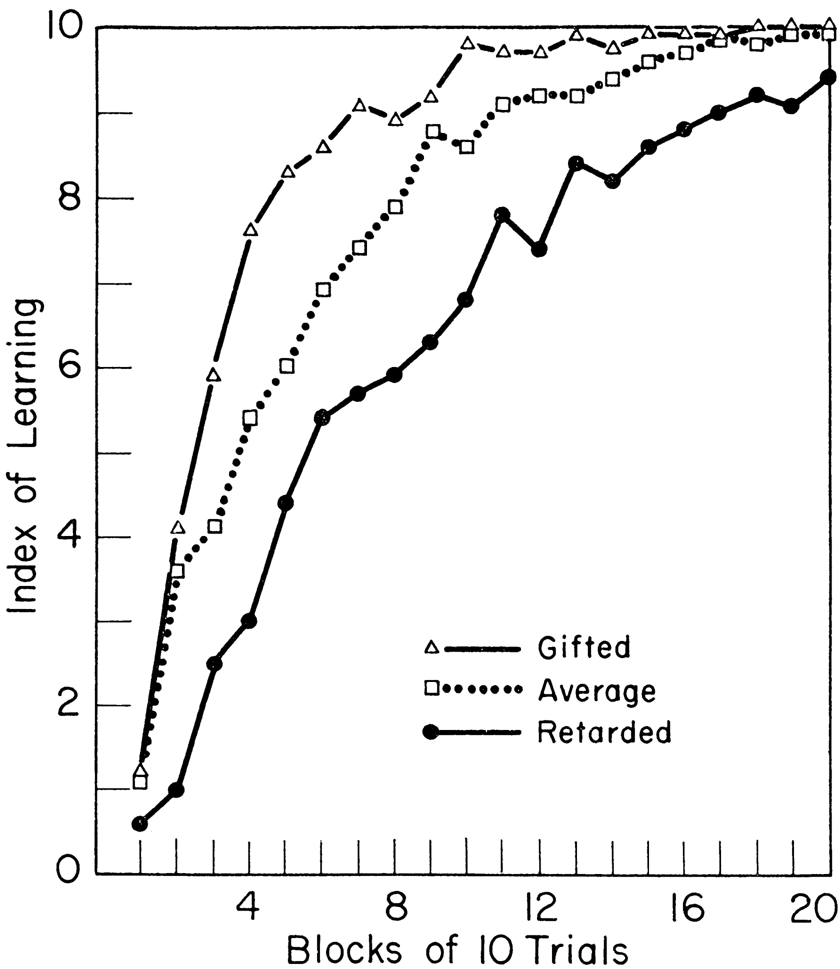

Fig. 3. Learning curves of the three groups on the final test, which consisted of six S-R connections. All Ss had demonstrated ability to learn on the five S-R test before being given this final six S-R test.

Within-group variability. The most striking feature of these data is the much greater variability in scores among the retarded Ss as compared with the average and gifted. The within-groups variance in *IQ* is not significantly different for the three groups. The variances of the learning scores, however, differ enormously. The statistical significance of the differences between the variances is determined from the ratio of one variance to another, the so-called variance ratio, or F. Table 3 presents the variance ratios comparing the variability of the three groups, along with their significance levels.

TABLE 3

VARIANCE RATIOS ON INDEX OF LEARNING, COMPARING THE RETARDED, AVERAGE, AND GIFTED GROUPS

Variance Ratio	First Test	Last Test
	5 S-R	6 S-R
Retarded/Average	4.94 $p < .01$	1.94 $p < .05$
Retarded/Gifted	24.49 $p < .01$	10.98 $p < .01$
Average/Gifted	4.96 $p < .01$	5.65 $p < .01$

It is clear that the retarded Ss had by far the greatest variability in their learning scores, and the gifted had the least. When the *coefficient of variation* (Guilford, 1956, p. 101) is used, instead of the variance, thereby measuring variation of each group in relation to its mean, the picture is essentially the same as that shown in Table 3. In going from the first to the last task, the variance in the retarded group decreased by a factor of 3.46, which is significant at the .01 level. The average and gifted groups did not show a significant change in variance from the first to the last test.

Comparisons Within the Retarded Group

The most interesting and important findings are within the retarded group. While this group was as homogeneous as the average and gifted, in terms of IQ, it was far more heterogeneous in learning ability as measured by the present technique. The potential of this technique, as a means of obtaining a more complete and more highly refined diagnosis of the learning ability of children classified as mentally retarded than is afforded by standard intelligence tests, is shown by the reliable discriminations in learning ability that can be made within the retarded group.

In order to determine some of the sources of variance of the index scores, the retarded group was divided into a number of categories representing different variables, the statistical significance of which could be determined by analysis of variance. This analysis supports the following conclusions:

1. There was a highly significant improvement from the first (five S-R) test to the last (six S-R) test ($F = 7.96$, $df = 1/62$, $p < .01$).
2. Age in this sample was not a significant variable on any of the tests. This could be due to the restricted range of ages, from 12 to 15 years.

3. When the group was divided according to IQ level (High = 66-75, Low = 50-65), the high IQ group had a significantly higher mean index of learning than the low IQ group ($F = 6.95$, $df = 1/62$, $p < .01$). Thus, there was a significant relationship between IQ and learning ability, even within the Retarded Group.

4. There was a significant difference between Ss on total score, based on the mean of the first and last tests for each S ($F = 2.41$, $df = 31/32$, $p < .01$). In other words, the test was shown to be capable of making reliable discriminations between Ss. The reliability of the test, as indicated by the correlation between the first and the last test, is .69. Actually, this correlation is an underestimate of the reliability of the last test, since a good deal of rearrangement of the rank order of the index scores took place as a result of the interpolated instructional factors between the first and last tests. These rearrangements in rank-order from one test to the next were certainly not due to random fluctuations in the index scores, but represent psychologically meaningful and reliable changes in the S's comprehension of the task.

The potential usefulness of this kind of learning test as a diagnostic device is suggested by its significant, but *low,* positive correlation with the IQ. The learning test is not just another intelligence test which adds no more to the diagnostic picture than is already given by the IQ. In the retarded group, the rank-order correlations between the index of learning and the IQ were .50 for the first (five S-R) test, .19 for the second (five S-R) test, and .35 for the last (six S-R) test. The highest correlation with IQ was on the first test, probably because the same ability to understand instructions which played an important part in performance on the learning task, is also one of the crucial factors in the Stanford-Binet intelligence scale. By the time the last (six S-R) test was taken, however, it was certain that all Ss understood the instruction and knew how to go about learning the S-R problem, so that the correlation of .35 with IQ was not based on the S's ability to comprehend the nature of the task, *per se,* but was based on the speed with which he could learn the S-R connections. The correlation of .19 between the second test and IQ is not significantly greater than zero. It was on the second test that most of the rearrangement of rank-order of index scores occurred. Many who had not adequately understood the requirements of the learning task on the first test, did understand it in the second. Some of these Ss, who showed practically no learning on the first task, once they really understood the instructions, were among the fastest learners in the retarded group.

Fast and slow learners in the retarded group. The great variability in index scores of the retarded group was due both to inter- and to intra-individual variability. There were large, consistent individual differences in speed of learning, which were not affected to any appreciable extent by elaboration of the instructions or by additional practice. An example of such inter-individual variability is shown in Fig. 4, which presents the learning curves of the first and last tests for the four fastest and the six slowest learners in the retarded group. *These fast learners were all above the mean of the gifted group on all the tests!* This certainly gives some idea of the heterogeneity of learning ability in the retarded group.

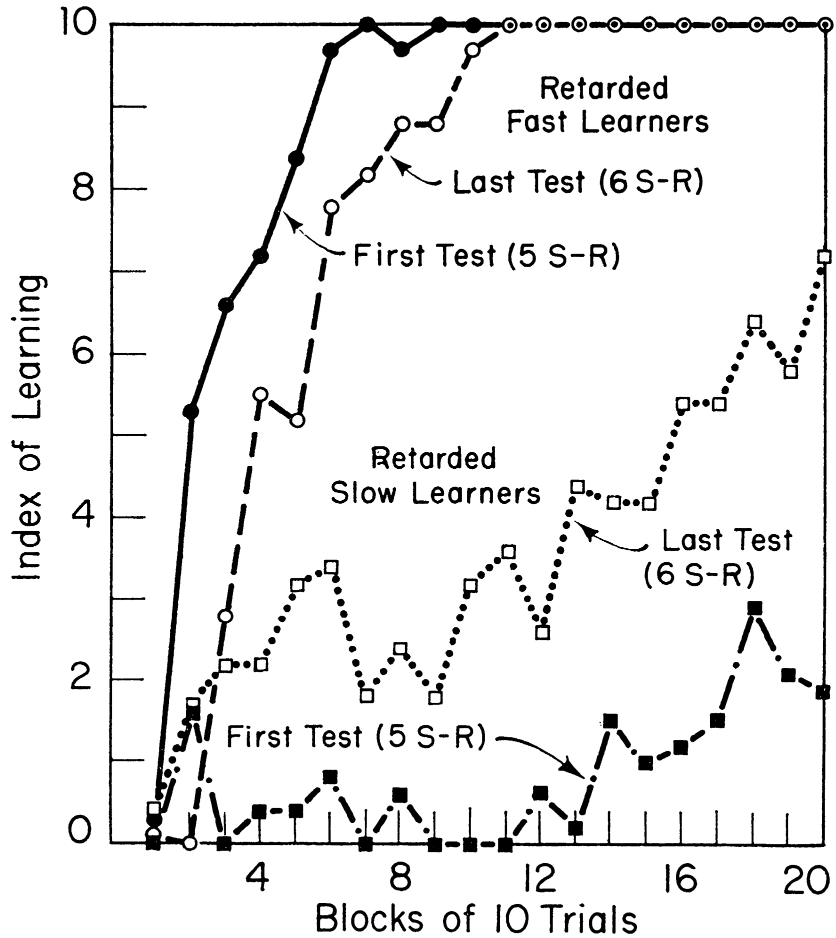

Fig. 4. Learning curves on the first and last tests of four retarded Ss who had learning scores above the mean of the gifted group, and curves on the same tests of the six slowest learners in the retarded group.

Figure 5 presents the learning curves on the first, second, and last tests, of the four Ss who showed the greatest improvement from one test to the next. No such improvement was found in the average or gifted groups, who understood the task from the beginning and were thus able to use their normal learning ability equally on both the first and last tests.

"Racial" differences. The Mexican-American children were significantly lower ($p < .05$) than the rest of the group on the first test. This was only true of the *first* test, however. On subsequent tests, the Mexican subgroup

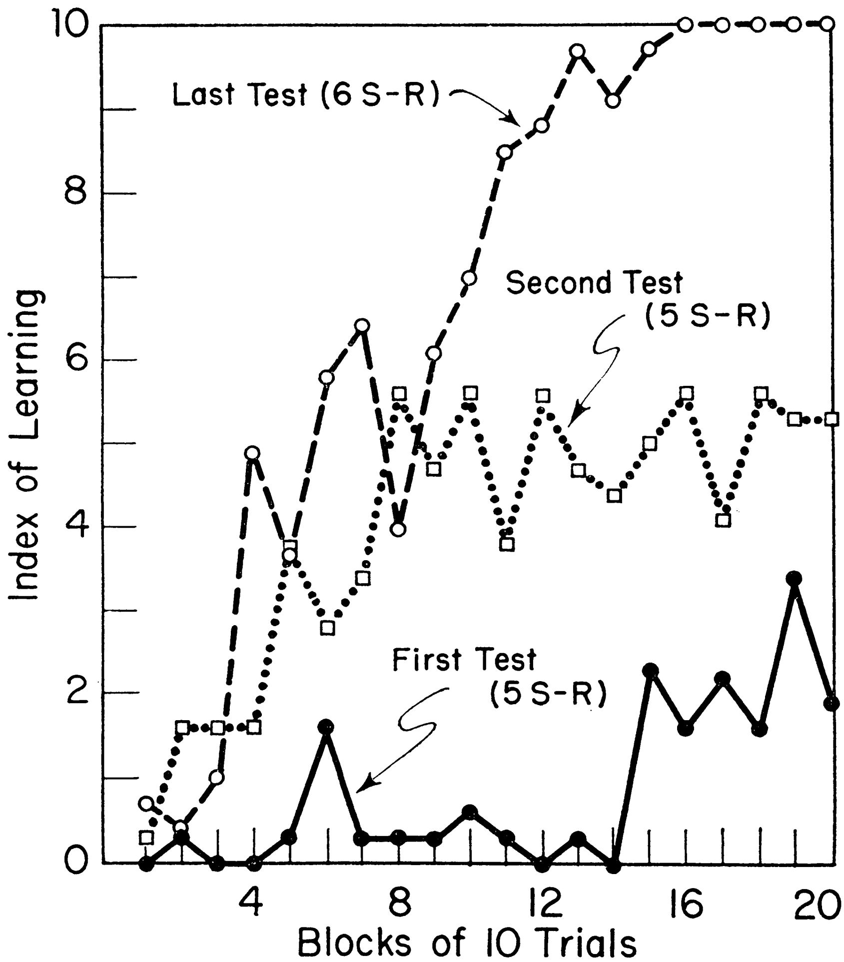

Fig. 5 Learning curves on the first, second, and last tests of the four retarded Ss who showed the greatest degree of improvement from one test to the next. The first two tests consisted of five S-R connections, the last test of six S-R connections.

improved markedly and did not differ significantly from the rest of the group. Most of these Mexican children spoke Spanish in the home, and though they seemed normally conversant in English, much of their difficulty on the first test was probably due to not fully comprehending the instructions or the nature of the task.

No significant differences was found between Negroes and whites, and there was no evidence of a sex difference.

DISCUSSION

The two fastest learners in the entire study had IQs of 147 and 65! One was in the class for "gifted" children, one was in a class for the mentally retarded. One excelled in scholastic achievement, the other was far below the norm for his age. One's first reaction to such a finding is apt to consist of questioning whether the learning test used in this study has anything to do with intellectual ability. But this is certainly not the answer. The learning test correlates with intelligence at all levels; it discriminates significantly not only between the retarded and the average, but also between the average and the gifted. Furthermore, when this test was used with a group of institutionalized young adult mental retardates, it was found that they performed at a much lower level than the retarded Ss in the present study. Many were never able to master the five S-R task, even after many hours of coaching and practice. Yet the IQ's of these institutionalized Ss did not differ appreciably from the IQs of the Ss in the present study. The learning test is clearly a measure of some important aspect of mental ability.

It is also worthy of note that all of the misclassifications made by the learning test were in the retarded group. That is to say, some of the retarded were above the mean of the average group, and some were above the mean of the gifted group. On the other hand, no S in the average group had a learning score as low as the mean of the retarded group on any of the tests, and no S in the gifted group was below the mean of the average group. In other words, the learning test did not yield any "false positives," *i.e.*, Ss above an IQ of 90 who fall near the mean of the retarded group in learning ability. But the retarded group spanned the entire range of learning ability in this school population, as measured by this test. It must be emphasized, of course, that the "misclassified" children in the retarded group had not been misclassified in terms of school achievement. They all rightly belonged in special classes, and their IQs were much more indicative of their scholastic achievement than were their scores on the learning test.

To account for these seemingly discrepant facts, a number of hypotheses are suggested. First of all, learning ability should not be thought of as a single, unitary ability. There are probably a number of relatively independent "dimensions" comprising learning ability, but these dimensions have not yet been isolated or identified (Jensen, 1962). It is quite probable that in the retarded group other experimental procedures than those involved in the present S-R task would have resulted in a different rank-ordering of the Ss' learning scores. Low IQ Ss, who were fast learners on the present task, might show up as slow learners on some other learning task which taps other dimensions. Since a number of dimensions may be required for success in many forms of school learning, a deficiency in one or more dimensions may result in retardation in school achievement and in intelligence tests, which are essentially only a more general type of achievement test. Evidence that the present learning task taps dimensions that are important in school learning is found in the fact that none of the normal achievers in schoolwork performed poorly on the task. A variety of such learning tests, which tap different dimensions, are needed for the precise diagnosis of the mentally retarded, not to establish the fact of retardation, which is shown by the IQ and is usually quite apparent to the child's teachers, but to determine the specific nature of the child's disability. Only when the basic dimensions of learning ability have been discovered, and independent measures of them have been devised, can a really useful precision in diagnosis be achieved. Not only learning ability, but also retention must be assessed, for the two abilities are not highly correlated (Stroud and Schoer, 1959). Some of the retarded Ss who performed normally on the learning task, for example, might be deficient in the retention of what they have learned.

Another hypothesis is that the normal and fast learners in the retarded group are not really retarded in a primary sense, but are children who, at some crucial period in their development, have failed to learn the kinds of behavior which are necessary as a basis for school learning and for the acquisition of the kinds of knowledge and skills tapped by IQ tests. School learning probably depends tremendously upon transfer from previously learned habits of verbalization and other symbolically mediated behavior. The habit of making verbal responses, either overtly or covertly, to events in the environment seems to be one of the major ingredients of the kind of intelligence that shows itself in school achievement and in performance on intelligence tests. Without this habit, even a child with a perfectly normal nervous system in terms of fundamental learning ability, will appear to be retarded, and indeed *is* retarded so long as he does not use verbal mediators in learning. Some of the fastest learners among our retarded group, for example, were those who showed no appreciable learning until they were required to make verbal responses to the stimuli. Spontaneous vocal or subvocal behavior during learning was much more apparent in the average and gifted groups than in the retarded. Apparently, verbal behavior greatly facilitates the acquisition of the S-R connections. Many of the retarded group were lacking in this spontaneous "labeling" behavior. The reasons for this lack are at present not known. In some cases, the cause is probably to be sought in environmental factors, and in other cases there might be some organic defect. Further investigation of these kinds of factors might explain why some of our Ss changed from being very slow learners to being very fast learners when taught to verbalize, while other slow-learning Ss showed no change in performance after the same treatment.

Also, it appears that the reinforcement stimulus must elicit some kind of verbal "confirming" response in the S, in order to be effective. The green reinforcement light seemed ineffective for a number of the retarded until it was accompanied for a number of trials by the *E*'s exclamations of, "Good!," or "That's right!" In essence, what the normal S is probably doing in the present kind of learning task, is linking-up a number of different responses he is capable of making in the situation, and the linking takes place on a verbal level, these verbal responses being the Ss *own* already-learned responses. The essential elements of the task elicit already-learned responses from the S and these verbal discriminative and mediating responses facilitate the acquisition of the S-R connections, which constitute the formal learning task. Ss who do not bring these verbal habits to the task are markedly handicapped. Though learning can take place without the verbal mediation, as of course it does in animal learning, it is exceedingly slow and rarely attains the level of mastery. Until specially instructed, some of the Retarded Ss seemed to learn on this basis. With instructions to verbalize, simply by *naming* the stimuli, their performance in some cases improved dramatically.

The present study suggests that one of the potentially most fruitful areas for further investigation of the environmental factors involved in mental retardation is the psychology of "labeling" behavior and the facilitative effects of verbalization on learning. Why some children apparently fail to acquire these spontaneous verbal habits which facilitate learning is still obscure.

SUMMARY

Junior high school children classified as "educationally mentally retarded" and also having Stanford-Binet IQs from 50 to 75 were compared on a selective learning task with average (IQs 90-110) and gifted (IQs above 135) children in the same school. The task consisted of learning, by trial-and-error, to associate five or six different stimuli (colored geometric forms) with five or six different responses (an array of pushbuttons). There were highly significant differences between the groups, and the rate of learning correlated with IQ even within the retarded group. Variability was much greater among the retarded, who also showed much greater improvement with practice on successive forms of the learning task. Some of the retarded Ss learned as fast as the gifted. Adding verbal reinforcement and requiring Ss to verbalize (by naming the stimuli) while learning, resulted in marked improvement of the learning rate of some Ss. The

results were discussed in terms of hypotheses involving as yet undiscovered "dimensions" of learning ability, and in terms of the facilitative role of discriminative and mediating verbal behavior in learning.

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