THE COLUMBIA MENTAL MATURITY SCALE AND THE WECHSLER INTELLIGENCE SCALE FOR CHILDREN: A COMPARATIVE STUDY UTILIZING INSTITUTIONALIZED MENTALLY RETARDED MALES

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INTRODUCTION

Problem

As psychology progresses through the painful and sometimes disillusioning stages of maturation, more and more emphasis is placed on psychometric devices which can be used to make valid estimates of the mental ability of cerebral palsied or otherwise handicapped children with motor and/or verbal dysfunctions (2). The newborn science of psychology is becoming more accepted and more widely presented to the general public, and in turn, is experiencing a greater need for more valid and exacting measuring tools. As more people become aware of the possibility of help, the greater the need becomes for quick and efficient methods of determining the extent of maladjustment, therefore exposing the various avenues of either treatment or training. Our institutions are becoming so overcrowded and under-staffed that a great need is being recognized for abbreviated psychometric instruments which are both efficient, reliable tools and time saving apparatus. The problem of screening for the mentally retarded child is becoming a prevalent problem as more and more systems and institutions initiate programs for the mentally retarded children of our society. At the same time,

however, trained personnel for this task are largely lacking so that shortcut intellectual evaluations are, unfortunately, necessitated (3).

It has been estimated through admissions research that, with respect to the general population of Connecticut, the average annual state hospital census rose 45 per cent during the 1942-1964 period, thus attesting to the ever quickening pace in the utilization of state hospital facilities in this country during this period (4). In the area of mentally retarded and cerebral-palsied children, this general tendency is overwhelming. As a result of the Community Mental Health Centers Acts of 1963 and 1964, states and communities have now completed an assessment of the extent of mental disorders and of the facilities, programs and manpower available to cope with the need.

> The outstanding finding is that the need is so enormous and facilities so limited, manpower so scarce and programs so expensive, that it is impossible to simply continue the present approaches and institute more programs to do more of the same. Although there is certainly a need for more services, there is an even more urgent need for other approaches that will help with the growing need and limited manpower (1, p. 5).

William M. Bolman, M. D., in his work in this area found that there was virtually no proof that any institution had an acceptable manpower and therapeutic situation, and it would be necessary to select new approaches and programs based largely on educated hunches and extrapolations from

related fields. This, he pointed out, would be better and more fruitful than to follow past programs which "have led to lack of proof, no interest in studying the areas, thus resulting in no programs" (1, p. 9).

Thus, the problem of obtaining adequate estimates of mental abilities for children with mental handicaps involving motor and/or verbal functioning "has been widely recognized by persons working with such children. Efforts to adapt or modify available intelligence tests to make them suitable for use with these groups have been only partially successful" (3, p. 9).

In an effort to provide a more satisfactory instrument for estimating the mental capacity of these handicapped children, particularly at the very early ages, Bessie B. Burgmeister, Lucille Hollander Blum, and Irving Lorge began in 1947 the work which has led to the production of the Columbia Mental Maturity Scale. The first and primary problem was to devise a test which, while suitable for handicapped children, would give a reliable and valid estimate of their mental abilities. After much deliberation, it was decided that a pictorial classification type test would suit the purpose. This would take into consideration the almost universal inability of the handicapped child to express himself verbally.

Preliminary reports on the Columbia Mental Maturity Scale pointed out the fact that on standard performance

scales, it

> is apparent that tests which emphasize speed penalize children with severe motor handicaps such as cerebral palsy. Even where speech is understandable, a number of items call for motor manipulation. Therefore, the Columbia Mental Maturity Scale is to be a power test; he may take as long as he wishes to answer (2, p. 234).

This pictorial type test would also make it easier to communicate instructions to the child. This type of item has been successfully used in group non-verbal intelligence tests (3). The final result was a 100-item, pictorial type test, the 1954 edition of the Columbia Mental Maturity Scale. It was put into limited use in the latter part of 1954.

Purpose of Study

The purpose of the present study is to compare the 1959 revision of the Columbia Mental Maturity Scale (CMMS) with the Wechsler Intelligence Scale for Children (WISC) for use as a psychometric instrument for determining the mental ability of mentally retarded male children.

Hypotheses

The following hypotheses are herein presented for investigation:

I. The Columbia Mental Maturity Scale will correlate positively with the Wechsler Intelligence Scale for Children, Full Scale I.Q., Performance I.Q., and Verbal I.Q. in a male, mentally retarded population, and reach a level of significance of .05.

II. The correlation between the Columbia Mental Maturity Scale and the Performance I.Q. of the Wechsler Intelligence Scale for Children will be positive and significantly ($P>.05$) higher than the correlation between the CMMS and the Verbal I.Q. of the WISC.

III. The mean Columbia Mental Maturity Scale I.Q. will be significantly ($P >.05$) lower than that of the Wechsler Intelligence Scale for Children Full Scale I.Q. mean.

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CHAPTER II

DESCRIPTION OF ORIGINAL COLUMBIA MENTAL MATURITY SCALE

The 1954 Edition of the Columbia Mental Maturity Scale was released with the expectation of supplying a quick, efficient and reliable measure of the mental ability of both handicapped children and "normal subjects" (1). This test was comprised of 100 cards, 6 by 9 inches. Each item consisted of a series of from 3 to 5 drawings. The designs or objects depicted on each of these cards were, in general, within the range of experience for most children, even the handicapped whose environment may have been limited (1). In each item, the task of the subject was to select one of the drawings which was different from, or unrelated to others in that series. The intellectual discrimination required was thought to be that of recognizing the picture which did not belong with the others. It was based on a theory of education involving the principle of organizing stimuli selectively so as to exclude just one because of some distinguishing or differentiating factor. The basic determining factors ranged from gross color differentiations to subtle factors such as relation of one object to another. The items were arranged in increasing levels of difficulty. The time estimated to be needed for administration of the Scale was from fifteen

to twenty minutes. The suggested age range for this original scale included mental ages of from three to twelve years. It differed from other such scales in that it required no verbal response and a minimal amount of motor response. In fact, verbal naming responses were discouraged since the child could later fail to designate a correct response because he could not actually name the object.

Responses and notes were kept on an individual record blank. The examiner recorded the number of the subject's choice in the blank opposite the card number. Thus recorded, the examiner could tell at a quick glance which items were correct or incorrect. Response positions on the cards read from the examiner's left and the child's right, with the child facing the card and sitting opposite the examiner (Figure 1).

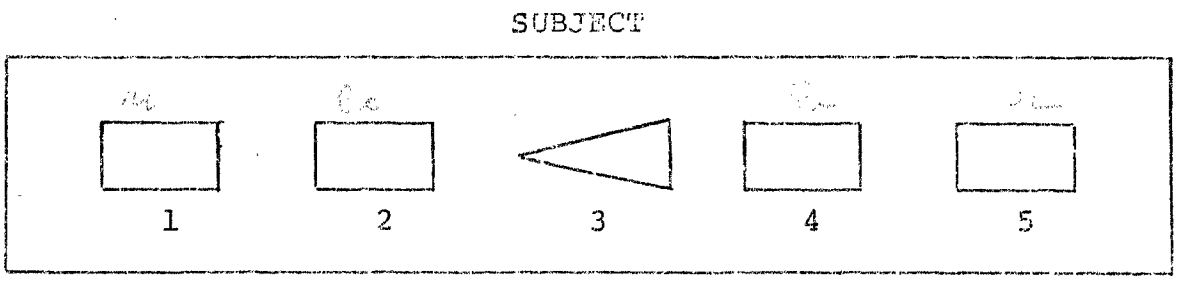

Fig. 1--Columbia Mental Maturity Scale card and response positions.

For example, if on card one, the child chose the second item from his left, this being the second item from the examiner's right, it would be recorded as response number

four on item number one. The examiner exposed each card in numerical order until the child failed (i.e., answered incorrectly or not at all) twelve cards in any sequence of sixteen cards. This was pointed out in the original manual as being at the chance level of occurrence (1). Thus the scoring became quite automatic, consisting simply of comparing the response with the key for each item until the proper number of items were failed. The score was obtained for each subject by counting the number of correct responses. This resulted in a raw score which was converted to a mental age by reference to the Mental Age Conversion Table. For example, a score of thirty was equivalent to a mental age of sixty months; a score of forty, to sixty-eight months, etc. An I.Q. was obtained in the customary way, by dividing mental age in months by chronological age in months.

Standardization was based on a sample of 957 presumptively normal children ranging in age from 3 to 12 years, each of whom also took the Stanford-Binet (L) at the same time. The distribution of these cases by age is given in Table I, together with the mean and standard deviation of both the Stanford-Binet (L) and the Columbia Mental Maturity Scale I.Q.'s. Table I also shows the correlation between the Columbia Mental Maturity Scale and the Stanford-Binet (L) I.Q.'s.

From these statistical findings, it was supposed that "the Scale appeared to function best in the age range from

TABLE I

STANDARD DEVIATION, MEAN, AND PEARSON CORRELATION FOR THE COLUMBIA MENTAL MATURITY SCALE AND THE STANFORD-BINET (L)

Age	Number of Cases	Stanford-Binet I.Q.		Columbia I.Q.		r
		Mean	SD	Mean	SD	
3-0 to 3-11	89	110.8	19.2	113.7	20.0	.70
4-0 to 4-11	139	107.4	17.9	106.1	21.0	.77
5-0 to 5-11	113	105.0	13.3	102.8	17.7	.71
6-0 to 6-11	124	105.7	15.2	111.3	23.1	.71
7-0 to 7-11	125	102.0	15.3	106.4	22.1	.73
8-0 to 8-11	127	97.6	17.2	99.3	23.2	.66
9-0 to 9-11	82	100.5	20.8	104.6	26.0	.71
10-0 to 10-11	79	97.8	22.7	99.9	26.6	.78
11-0 to 11-11	51	102.3	23.3	102.0	25.9	.88
12-0 to 12-11	28	101.3	26.3	100.4	25.0	.76

four to nine years" (1, p. 11). The reliability of scores on the Scale was investigated by the authors for selected age groups by computing correlations between odd- and even-numbered items of the Scale. The resulting coefficients may be found in Table II.

TABLE II

CORRELATION IN THE STANDARDIZATION SAMPLE FOR THE COLUMBIA MENTAL MATURITY SCALE BY AGE GROUPS

Age	r	Number of Cases in Sample
4	.89	139
5	.91	113
9	.91	82
10	.92	79

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CHAPTER III

RELATED RESEARCH ON ORIGINAL SCALE

Preliminary studies with normal children have been carried out to determine what abilities are measured by the Columbia Mental Maturity Scale. Mill and Turner (8), using seventy-five normal (non-handicapped) children ranging in age from seven to eleven years, eleven months, found that the Columbia Mental Maturity Scale was heavily weighted with reasoning and understanding of ideas. In comparison with the SRA Primary Abilities Tests, a moderate measure of numerical ability and the ability to perceive small details quickly and accurately were found. They also found indications of possible space perception measurement. The test itself correlated .63 with the total SRA I.Q. and .62 with Non-reading I.Q.'s. Their conclusion was that the Columbia Mental Maturity Scale did not provide a coefficient of correlation in that instance which was high enough to warrant the use of the CMMS as an individual measure of intelligence.

Barrett (1) found that the Columbia correlated higher with the WISC Verbal Scale than with the Performance Scale of that same test. Using seventy fourth grade, normal (non-handicapped) subjects from rural and urban areas, ranging in age from nine years, two months to ten years, one month,

the author attempted to find whether or not the CMMS could be substituted for the WISC. The reason prompting this study was that the entire WISC cannot always be administered because of time limitations or physical handicaps. Therefore, it would be helpful and rewarding to find out if the CMMS could be used in substitution for the WISC if such use were in conjunction with other tests. Results suggested that this might be accomplished when the CMMS is used with other reliable instruments. The resulting correlations in this study can be found in Table III.

TABLE III

CORRELATIONS AND COMMENT ON THE WECHSLER INTELLIGENCE SCALE FOR CHILDREN, THE COLUMBIA MENTAL MATURITY SCALE AND THE PROGRESSIVE MATRICES

Types of Subjects	N	Ages	CMMS	r	Comments
Normal fourth grade children	70	9-2 to 10-1	WISC FS	.606	Study also gave range of r in WISC sub-test/ CMMS comparison: .13-.68
			WISC V	.478	
			WISC P	.576	

Estes, Kodman, and Akel (5) confirmed Barrett's findings and further added that the CMMS consistently results in higher I.Q.'s than the WISC and, through factor analysis of the CMMS and WISC sub-tests, found all measures loaded on one factor which they suggested to be representative of "general intelligence." In this study, the authors used fifty subjects

from elementary schools in middle class suburban schools in Kentucky. The chronological age range was from seven years, two months, through nine years, four months, with the mean age being eight years, two months. The resulting correlations between the CMMS and WISC sub-tests ranged from .05-.51, which they termed from "low to moderate." The conclusion was that the validity of the CMMS was not upheld by their study. The CMMS should not be used as a substitute for the WISC. They did, however, suggest that within a test battery of reliable tests, it might be used as supplementary material.

Studies with cerebral-palsied subjects have generally been hampered by difficulties in classifying the subjects and obtaining adequate, independent criteria of their intellectual ability. The original CMMS was reported to have been able to rank cerebral-palsied children according to intelligence level about as well as other standardized testing instruments (3). Using thirty subjects ranging in chronological age from five years through seventeen years, four months, Canter (3) found that many subjects perseverated (pointed to the same position consistently regardless of correctness of response) for more than three successive cards. He points out that this tendency is rewarded in some instances by having three or four correct answers in a succession being in the same response position. This, he states, raises some doubt about the suitability of the arrangement of the test items on the cards. Conclusions of this study suggested

that there was a need for considerable revision in the 1954 Columbia Mental Maturity Scale.

Shontz (9) used the Columbia Mental Maturity Scale, Knox Cubes from the Arthur Point Scale and the Wechsler Memory Scale to determine the interchangeability of these three tests with hemiplegic individuals. He stated that the original CMMS provided an adequate evaluation of the intellectual capacity of the hemiplegic child. Using fifty hemiplegic children with a mean chronological age of six years, three months, he found a correlation of .60 between the Knox Cubes and the CMMS, and a correlation of .47 between the CMMS and the Wechsler Memory Scale. The findings indicated that it would be appropriate to use the CMMS to evaluate the intellectual capacity of the hemiplegic child as it "does not require the use of expressive language or manual skills" (9, p. 268).

Several investigators (6, 7, 10) have reported that the mentally retarded (as with normal subjects) generally obtain higher I.Q.'s on the CMMS than on other intelligence measures. This same general conclusion was reported earlier by Estes, Kodman, and Akel (5), and Barrett (1). Taylor (10), allowing for the relatively large standard deviation on the CMMS, found that as a quick measure of intelligence, the Columbia Mental Maturity Scale was a satisfactory screening device for special classes for the mentally retarded, provided the cutting I.Q. was set low enough on the Scale. One study (4)

using the Columbia with bilingual pupils concluded that the Scale had considerable validity in predicting the achievement of bilingual pupils.

M. J. Berko (2) found, in his correlational study of the Stanford-Binet (L) and the Columbia Mental Maturity Scale, that, contrary to previous findings, brain-damaged children obtained a lower mean score on the Columbia than on the Stanford-Binet. In seven cases the scores were from fifteen to twenty-four points lower on the Columbia. Only three subjects out of the total of thirty scored higher on the CMMS than on the Stanford-Binet, and these were one, three, and four I.Q. points. In an effort to explain this rather "startling discrepancy," the author suggested that the CMMS heavily relies on visual perception, categorization, and abstraction. He pointed out that these factors are commonly impaired in children with brain injuries and other such dysfunctions. He reported a study which was then in progress at the Institute of Lobopedics, where, in 100 cerebral-palsy cases, 62 had abstracting and categorization difficulties, while 44 showed marked deviations in visual perceptions. From all of this information, Berko concluded that the results of the CMMS must be accepted with reservation. He further stated that more studies were needed to determine what type of subjects were best represented by the Columbia Mental Maturity Scale results.

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CHAPTER IV

DESCRIPTION OF REVISED COLUMBIA MENTAL MATURITY SCALE

In 1959, the final report on research conducted under UCP Research and Educational Grant R-27-S56 for the revision and re-standardization of the Columbia Mental Maturity Scale, was released by the Institute of Psychological Research, Teachers College, Columbia University. Following the lead given by those who had investigated the original edition of the Scale, Burgmeister, Blum, and Lorge reconstructed the Scale in certain areas to attempt an improvement in its usefulness and acceptance.

Nature of Content Revision

Reviewing the results of past investigations of the Scale, the creators of the Columbia agreed that certain changes were needed in the content. Academic items, it was ascertained, needed to be eliminated. These relied too heavily on past in-school learning, such as recognition of printed number-symbols, words, etc.

Secondly, there seemed to be a need to add more difficult items at the upper levels of the Scale to provide better discrimination. The original Scale did not satisfactorily progress in the rate of difficulty.

Finally, it would be necessary to eliminate ambiguous items from the Scale. Specifically, items which had been validly criticized in concern with scoring, as a result of actual use and experimentation of the CMMS, were eliminated.

Accordingly, revision of the CMMS was made and forty-six new items were selected and used to replace seventeen of the items on the 1954 edition. The items replaced were at various levels in the Scale. In addition, two new items were selected to be inserted as sample items before item number forty, to introduce a new type of item to the subject.

Norming Program

The 1959 Columbia Mental Maturity Scale was given to a group of 1,000 subjects, male and female, distributed at each age level from 4 years to 12 years. Each subject also took at least one other individual intelligence test. On the basis of the data from this testing, mental-age norms were established for the revised Columbia. The new norms for the revised CMMS resulted in appreciably lower I.Q.'s for high scoring subjects.

New Item Analysis

The responses of subjects in the norming group to each item of the revised Columbia were analyzed for successive one-year age groups, and new difficulty values calculated. As a result, new sequences of items were established. In the published edition, the items were arranged according to this new sequence.

Relation of New and Original Editions

The version of the Columbia administered in the norming program included both the original 100 items and the new items. This was done to attain a score on both of the scales for each subject. The two resulting scores were correlated to obtain equivalent scores on the new Scale. The correlation between the original and the revised Scales was acceptable and indicated that subjects were ranked in almost the same order by the original and the new Scales. The data, of course, reflected the fact that the new material introduced was at the upper end of the Scale and had little effect on the performance of younger subjects, many of whom do not reach the latter items. Correlations were very high for the lower age groups and only slightly less at the upper ages. The comparison of the mean scores on the original and revised sets of items indicated that the Scale had been made slightly more difficult for older subjects, as intended.

These changes in converted scores are reflected in the old and new tables for "Mental Age Corresponding Scores" (1). Whereas in the original edition, a score of thirty gave a mental age of sixty months, the 1959 Scale's table converts a score of thirty to a mental age of fifty-three months; in the original table, a score of forty equaled a mental age of sixty-eight months, where on the revised table a mental age of fifty-nine months is obtained. The method of obtaining the I.Q. of a subject remained unchanged: the mental age in

months divided by the chronological age in months. A revised record blank was also constructed to provide proper keying for revised items.

Summary

In conjunction with a Federal Research Grant, revisions were made in the content and administration of the Columbia Mental Maturity Scale. Deletions and additions were made to item content so that the functional use of the Scale would be improved. New normative data were developed to establish the Scale as a more "effective method of appraising motor- and verbally-handicapped subjects" (2). The validity of the Scale itself was improved by thorough experimentation and revision. Upon completion of this revision, and the release of the new Scale, it was felt that "the revised Scale . . . gives evidence of usability in a very satisfying way with handicapped children in the mental age range of from three to ten years" (2).

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CHAPTER V

RELATED RESEARCH ON REVISED 1959 SCALE

When the revised edition of the Columbia Mental Maturity Scale was completed, it was released for general use and criticism. Dunn and Harley (1) were two of the first investigators to take an interest in this new, revised instrument. Their experimental group was comprised of twenty cerebral-palsied children ranging in chronological age from seven years, one month to sixteen years, two months. Their purpose was to determine the usefulness of the Columbia Mental Maturity Scale in predicting school success of cerebral-palsied children. The test was compared with the Peabody Picture Vocabulary, Ammons, Van Alstyne Picture Vocabulary, and teacher rankings. The results showed a high correlation between the CMMS and each of the other measures. Although the mean mental age of the CMMS was lower than each of the other tests used, the lower standard deviation of the CMMS and high correlations prompted the authors to conclude that the revised Columbia Mental Maturity Scale could be used safely and reliably to predict the school success of cerebral-palsied children.

Levinson and Block (5), in their research of the revised Columbia, investigated this new scale in a comparison study

with the Stanford-Binet (L). Their pre-school population numbered thirty-nine and was comprised of normal (non-handicapped) children. The chronological age range was from four years to five years, nine months. As in a previously reported study (1), the standard deviation of the Columbia was small, in this case smaller than the Stanford-Binet, and the mental ages were closely correlated. The outcome of full I.Q. correlation, however, was less than acceptable. The correlation of only .39 was too low for positive conclusions. These results induced the authors to point out certain factors which they felt were detrimental to valid results and might be changed or modified. Perseveration was the primary criticism. They pointed out that indicating the same position (i.e., second from the left) consistently, regardless of correctness of answer, was prevalent. This, they pointed out, seemed to be due largely to the fact that in several series, the same position was correct for three, four and five cards in a row, and then this correct answer changed, causing the subject to continue the same position response. Another shortcoming of the Scale seemed to be the rigidity of the scoring method. A child is not credited for indicating a correct response even though he knows it and names it, as long as he does not point it out. They also pointed to faults in the order of difficulty. Card number twenty-six, for example, was failed more than cards twenty-seven through thirty-six, and forty-six was failed more than cards forty-seven through fifty-one. This study came to the conclusion

that further revision in item arrangement, administration procedures, and scoring was called for before it could be fully accepted without reservation.

In a study of 100 normal subjects, chronological age range from 6 years, 11 months through 8 years, 10 months, Smith (7) studied the feasibility of substituting the Columbia Mental Maturity Scale for the Wechsler Intelligence Scale for Children (WISC) at the second grade level. She found that the standard deviation of the CMMS was some seven points higher than that of the WISC. The mean I.Q. for the WISC was 102.8 and that of the Columbia, 98.2. The resulting correlation between the two instruments was .55. The Columbia correlated with the WISC Verbal I.Q. and the WISC Performance I.Q. at levels of .45 and .32, respectively. She concluded that this was not a sufficiently high correlation to warrant substitution of the Columbia Mental Maturity Scale for the Wechsler Intelligence Scale for Children.

Warren and Collier (8) felt that some commonly used tests such as the Stanford-Binet and WISC could not be given to some subjects. "Efforts to adapt them to these subjects has been only partially successful" (8, p. 916). Where verbalizations are not required on such tests as the Otis, CMMS, PMA, etc., all or most tests of this type require the use of a writing instrument. This is a handicap to mentally retarded children and children with motor and visual impairment. Where a large number of individuals are to be screened

in a given length of time, "an instrument which would yield a valid estimate in a short period of time could be desirable if one were available" (8, p. 916). The authors therefore investigated the CMMS in comparison to the WISC to determine whether or not it could be used as an efficient and reliable testing device in place of tests now used which require even minimal motor functioning abilities and comparatively long periods of time for administration. Their population was comprised of forty-nine mentally retarded, institutionalized females ranging in chronological age from nine to thirty years. These subjects were given the WISC, WAIS, and the Columbia Mental Maturity Scale. The standard deviation of the Columbia approximated the standard deviation of the other two tests within a range of .50. The resulting Full Scale I.Q.'s reached a mean of 60.6 for the WISC and 63.14 for the WAIS. The mean I.Q. for the Columbia was 62.50. The correlation was .68. It is not made clear by the authors whether they used WISC or WAIS I.Q.'s, or the average of the two, to obtain these results. The conclusion was drawn that the Columbia Mental Maturity Scale was applicable to obtain the I.Q.'s of institutionalized, mentally retarded females within a chronological age range of nine through thirty years. The mental age of these subjects was not reported in the study.

In a study with children suffering from articulation disorders, mental retardation, delayed speech, cleft palates,

and hearing difficulties, Hirschenfang (3) used the Columbia Mental Maturity Scale and the Stanford-Binet (L) to determine the reliability of the Columbia in its use with such subjects. Forty-five children ranging in chronological age from three years, four months through fourteen years, six months (mean age being eight years, three months) were given the Stanford-Binet (L) first and then followed up with the Columbia. This order of testing was followed in all cases. The author stated that "the Columbia Mental Maturity Scale does not require the utilization of language nor does it involve to any degree, manual dexterity" (3, p. 916). With this premise, he conducted the study and found that the Columbia could be used to estimate the intellectual functioning of children with speech disorders, but penalized children under the age of three years, six months because those subjects cannot comprehend the instructions. It was further concluded that more revision and experimentation was necessary, especially in the area of CMMS scoring procedures.

A later study by Hirschenfang (2) explored the Scale further by comparing it with the Goodenough "Draw-A-Man" Test. Sixty-one children with speech disorders ranging in chronological age from four years, six months through fifteen years, five months were tested to determine the interchangeability of the Columbia Mental Maturity Scale and the Goodenough "Draw-A-Man" Test. In his previous study, Hirschenfang (3) had found a correlation between the Stanford-

Binet (L) and the Columbia of .88. In this study, the Goodenough and the Columbia correlated at .82. The Columbia I.Q.'s were also found to be consistently higher. This, and the previous study's findings, led to the conclusion by the author that the Columbia could be used in the evaluation of the intellectual functioning of children with speech disorders.

Kodman, Waters and Whipple (4) also found positive correlation in their study of the Columbia Mental Maturity Scale and the Non-verbal Otis Alpha (Form B) (6). The resulting correlation of .73 caused the authors to surmise that the Columbia did not correlate well enough to generalize to individual prediction. The "positive and moderate correlation does suggest, however, that more revision is necessary in scoring and the progressive levels of difficulty" (4, p. 278).

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CHAPTER VI

METHOD

Subjects

The subjects were thirty male residents in Denton State School for the Mentally Retarded. The age range of these subjects was from nine years, three months, to fourteen years, eleven months, the mean age being twelve years, eight months. Selection procedures began with selecting all male subjects who fell within a mental age range of from three to ten years (based on previously administered Wechsler Intelligence Scale for Children, scores being located in the master file). All subjects who were unavailable for various reasons (e.g., vacation, illness, etc.) were discarded and only those known or expected to be available in the school during the expected course of experimentation were retained. The remaining thirty subjects comprised the total population of this study. The mental age range of these subjects, as reflected in their personal records, was from three years, six months to eight years, seven months, the mean mental age being five years, six months. All of the subjects were from two dormitories, 20C and 7A. Placement in these dormitories was based on I.Q. scores and ages: I.Q. 50-70, ages 12-15, and I.Q. 50-70, ages 6-12, respectively.

Specific diagnoses were disregarded and the population was, therefore, made up of various disorders. These impairments included cleft palate, brain damage, speech impairment, hearing difficulties, motor retardation, etc. All subjects were, however, termed as "Educable Mentally Retarded."

Cultural and economic backgrounds were uncontrolled, resulting in a variety of backgrounds. Religious, ethnic and family structure background was also uncontrolled, as was the length of time at the Denton State School as a student.

Group placement was performed by merely putting the subjects' names on pieces of paper and drawing the slips at random. Every other name drawn in this manner was placed in Group A and the others were placed in Group B. Group A was to receive the Columbia Mental Maturity Scale first and the Wechsler Intelligence Scale for Children one week later; Group B received the opposite administration.

Procedure

The examiner visited the Denton State School on three pre-experimentation occasions so as to be seen by the students in their classroom building so that when the testing commenced he would be familiar to the subjects and rapport would be more easily established. This procedure also accomplished an unexpected purpose of serving to stimulate and motivate the students to desire participation in the experiment. This increased motivation, it is felt, resulted in increased productivity on the tests.

Group B was selected to be tested first. This was done so that if there were any conversation concerning the testing, it would not concern the Columbia. It was felt that it would be easier to remember how to participate in taking the Columbia than the WISC. Each subject was called from his class by the examiner, and led to the examination room. This room was a classroom in the school building with the subjects. On only two occasions was testing done in other than this room. Upon completion of testing with Group B, Group A was utilized. Testing for both groups was so timed that each subject was tested by the appropriate follow-up instrument one week later. No subjects became unavailable for examination during the course of the testing.

CHAPTER VII

RESULTS AND DISCUSSION

Statistical Procedure

Each of the I.Q. scores obtained from the Columbia Mental Maturity Scale and the Wechsler Intelligence Scale for Children was correlated by means of Pearson's Product Moment Correlation. This statistic was utilized to test Hypothesis I. Analysis of the results pertaining to Hypothesis II utilized Pearson's Product Moment Correlation and the table of t. To determine this, a t test for dependent samples with one variable in common was utilized. In this procedure, the correlations among the three variables are r_{12}, r_{13}, and r_{23}, and R_3^2 (12) is the square of the multiple correlation between the common variable and the weighted sum of the other two. That is,

$$t = (r_{13} - r_{23}) \sqrt{\frac{N - 3}{2(1 - r_{12})\ (1 - R_3^2\ (12)}}$$

The resulting t score was evaluated with a table of t where N - 3 is equal to the degrees of freedom. Hypothesis III underwent analysis by means of Fisher's t.

Results

As stated in Chapter 1, the present research was designed to study the relationship between the Columbia

Mental Maturity Scale and the Wechsler Intelligence Scale for Children, when used with institutionalized, mentally retarded males. Specifically, the following theoretical hypotheses were presented for investigation:

I. The Columbia Mental Maturity Scale I.Q. scores will correlate positively with the I.Q. scores of the WISC Full Scale results, Performance and Verbal results, and reach a level of significance of at least .05.

II. The correlation between the CMMS and the WISC Performance I.Q.'s will be positive and significantly higher than the correlation between the CMMS and the WISC Verbal I.Q.'s.

III. The mean Columbia I.Q. will be significantly lower than that of the mean WISC Full Scale I.Q., and reach a level of significance of at least .05.

The correlations obtained on this population of mentally retarded males were as follows: WISC FS vs. CMMS = .6082, WISC P vs. CMMS = .4627, and WISC V vs. CMMS = .4515. While it can be seen that these correlations seem to be favorable, this statistical analysis is only one criterion for measuring the comparability of scores. Fisher's t was used to determine the significance of each correlation and resulted in t values significant at less than the .05 level for each of the correlations between the CMMS and each of the appropriate WISC I.Q.'s. These results, along with the significance of each, can be found in Table IV. The first hypothesis,

TABLE IV

CORRELATION BETWEEN THE SCALES OF THE WECHSLER INTELLIGENCE SCALE FOR CHILDREN AND THE COLUMBIA MENTAL MATURITY SCALE

WISC Scale	r
Verbal Scale	.45*
Information	.04
Comprehension	.44*
Arithmetic	.47**
Similarities	.17
Vocabulary	.23
Performance Scale	.46**
Picture Completion	.23
Picture Arrangement	.58**
Block Design	.12
Object Assembly	.27
Coding	.43*
Full Scale	.61**

*P less than .05.
**P less than .01.

that the correlation between the CMMS and the three WISC I.Q. scores would be positive and significant at the .05 level, is confirmed and this hypothesis is accepted. The Columbia Mental Maturity Scale does appear to have a positive, significantly linear relationship with the Wechsler Intelligence Scale for Children.

The second hypothesis, that the correlation between the CMMS and the WISC Performance I.Q.'s would be positive and significantly higher than the correlation between the CMMS and Verbal I.Q.'s, was, in essence, rejected.

With twenty-seven degrees of freedom, the resulting t of .0848 was not significant at the expected .05 level. This

suggests, therefore, the rejection of Hypothesis II. Although the correlation between the CMMS I.Q. and the WISC Performance I.Q. was, indeed, positive as hypothesized, it was not significantly higher than the correlation between the CMMS I.Q. and the WISC Verbal I.Q.

Hypothesis III was evaluated with Fisher's t to determine the significance of the difference between the mean CMMS I.Q. and the mean WISC FS I.Q., the expectation being that the mean Columbia I.Q. would be significantly lower than the mean WISC FS I.Q. Table V shows the data utilized in this process. The results indicated acceptance of Hypothesis III.

TABLE V

NUMBER OF SUBJECTS, MEAN, STANDARD DEVIATION, t SCORE, AND RANGE OF THE COLUMBIA MENTAL MATURITY SCALE AND THE WECHSLER INTELLIGENCE SCALE FOR CHILDREN I.Q.'S

Scales Used	N	Mean	SD	Range	t
CMMS	30	51.4	8.24	39-71	1.777*
WISC	30	54.8	6.26	46-69	

*P < .05, one-tailed test.

Table V shows the mean I.Q. for the Columbia Mental Maturity Scale to be 3.4 I.Q. points lower than that of the mean I.Q. for the Wechsler Intelligence Scale for Children, FS. Two-thirds of the Columbia Mental Maturity Scale I.Q.'s, in fact, were below the mean WISC FS I.Q., analyzed subject for subject. This difference (t being 1.777) with twenty-nine degrees of freedom, was significant at less than .05, the acceptance

level of the hypothesis. This evaluation indicated that the mean CMMS I.Q. was significantly lower than the WISC FS I.Q.

Due to an unexpected high correlation between the Columbia Mental Maturity Scale and several WISC sub-tests, these were also evaluated to determine the significance of the correlations. Arithmetic (.4722) and Picture Arrangement (.5791) both correlated with the CMMS at a level of significance less than .01, while Comprehension (.4397) and Coding (.4348) reached a level of significance of less than .05. There are indications, therefore, that the Columbia Mental Maturity Scale and the aforementioned WISC sub-tests share a major common factor. This hypothesis was not investigated further, however, as this factorial analysis was not within the scope of this study.

Discussion

The first hypothesis stated that there would be a positive, significant correlation between the Columbia Mental Maturity Scale and the Wechsler Intelligence Scale for Children, Full Scale, Verbal, and Performance I.Q.'s. The findings indicate that each of the appropriate correlations is both significant and positive. This makes acceptance of this hypothesis necessary. The Columbia Mental Maturity Scale does appear to compare very favorably with the Wechsler Intelligence Scale for Children.

The second hypothesis stated that the correlation between the Columbia Mental Maturity Scale and the WISC Performance I.Q.'s would be positive and significantly higher than the correlation between the Columbia and the WISC Verbal I.Q.'s. The data relating to this hypothesis reveal that the level of significance attained is more than .05. Since this fails to reach the desired level of significance, this hypothesis was rejected.

The third hypothesis stated that the mean Columbia I.Q. would be significantly lower than that of the WISC Full Scale I.Q. mean. Statistical analysis of this data prompts the acceptance of the hypothesis due to the fact that the level of significance for the statistical comparison was less than .05.

One possible reason for the rejection of Hypothesis II is that, other than general diagnosis of mental retardation, specific physical dysfunctions were uncontrolled. Some subjects performed adequately on motor function problems while others found it difficult and sometimes impossible to do so. This resulted in wide variations in Performance I.Q. scores (S.D. 10.46) while, comparatively speaking, the Verbal I.Q. scores remained low, but fairly stable (S.D. 5.92). Therefore, some attained above group-average Performance I.Q.'s while the majority scored extremely low. These extremely low scores brought the over-all Performance mean down while the Verbal abilities (or uniform lack of them) remained comparatively level.

Acceptance of the first and third hypotheses requires the assumption that the Columbia Mental Maturity Scale measures abilities similar to those measured by the WISC Performance Scale and others which are similarly measured by the WISC Verbal Scale. Previous studies have attempted to determine the essential elements of "intelligence" used by subjects taking the Columbia. Berko (1) attempted to explain his findings by saying the Columbia Mental Maturity Scale relied heavily on visual perception, categorization and abstraction. Estes, Kodman, and Akel (2) merely called the essential element "general intelligence." Mill and Turner (3) reported the Scale to be heavily weighted with reasoning and understanding of ideas. They also reported suggestions of spatial perception and ability to perceive and organize small details into meaningful configurations or wholes. It would seem that all of these attempts to describe the "intelligence" measured by the CMMS would be acceptable. It may be pointed out that none emphasize motor functions.

The statistical results of this study, and subsequent acceptance of the first hypothesis, lend substance to the aforementioned studies. In addition, the relationship of the Columbia I.Q. and the Picture Arrangement sub-test of the WISC (P less than .01) strongly suggests the presence of visual perception of relationships and the ability to synthesize non-verbal material, both of which have been presented previously as possible common elements measured by both the

Columbia Mental Maturity Scale and the Wechsler Intelligence Scale for Children. Wechsler (6) states that Picture Arrangement is the type of test which effectively measures a subject's ability to comprehend and size up a total situation. That is, the testee must understand the whole, to get the "idea" before effectively dealing with any given situation.

The fact that the CMMS does not require extensive motor manipulation or verbal expression, has been emphasized by investigators previously, Warren and Collier (5) being the most recent. They felt that the necessity for verbalizations and motor dexterity was a handicap to mentally retarded children as well as children with motor impairment. Shontz (4) praised the Columbia specifically, "as it does not require the use of expressive language or manual skills" (4, p. 268).

It would seem, therefore, that in light of past investigations, the Columbia Mental Maturity Scale would be more of a non-verbal test than an academic one. This, in fact, was one basic change in the CMMS in 1959, i.e., eliminating the academic items and replacing them with non-verbal material. In addition, no time limit or time cut-off was advised by the authors. This would suggest that, in moving from academic to non-verbal type items, the child would not be unnecessarily penalized. In having no time limit, the child would become involved in what he relies on to communicate, in consideration of his verbal inabilities. This was

suggested in the high and significant correlations between the CMMS and WISC Performance I.Q.'s. It is certainly conceivable and within the realm of common sense and observation that a child may have a relatively high degree of intelligence but be unable to show it in his behavior due to neurological or emotional barriers. The expectations of the CMMS are minimal, only gross motor movement indicating a response item. In fact, some situations dictate that the discretionary powers of the clinician be used in determining response choices by the subject's eye movements and fixations. Therefore, the Columbia Mental Maturity Scale provides an outlet which can be used to reflect the mental ability of mentally retarded children with a minimum penalty for physical dysfunctions and handicaps.

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CHAPTER VIII

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

Individuals concerned primarily with the facilities and programs for mentally retarded children have long been aware of the growing need for brief but reliable testing instruments. This increasing need has been spurred and nurtured by staff shortages and growing populations within our institutions. Within the past decade, this situation has become critical.

The present investigation studied the Columbia Mental Maturity Scale in comparison with the Wechsler Intelligence Scale for Children to determine whether or not the Columbia could be used in place of or supportively with the WISC. The amount of time needed to test or screen the necessary subjects would be reduced, thereby giving the institutions and clinicians more time to test a greater number of subjects and to become involved in other necessary activities. This would greatly aid understaffed and overpopulated institutions.

The following hypotheses were advanced:

I. The Columbia Mental Maturity Scale will correlate positively with the Wechsler Intelligence Scale for Children Full Scale I.Q., Performance I.Q., and Verbal I.Q. in a male,

mentally retarded population, and reach a level of significance of .05.

II. The correlation between the Columbia Mental Maturity Scale and the Performance I.Q. of the Wechsler Intelligence Scale for Children will be positive and significantly higher than the correlation between the Columbia and the Verbal I.Q. of the WISC.

III. The mean Columbia Mental Maturity Scale I.Q. score will be significantly lower than that of the Wechsler Intelligence Scale for Children Full Scale I.Q. mean, and reach a level of significance of at least .05.

The subjects, thirty institutionalized, mentally retarded males, with a mean chronological age of twelve years, eight months and a mean mental age of five years, six months, were obtained on a pre-test availability status from the Denton State School for the Mentally Retarded. During the study, no student became unavailable for testing.

Subjects were randomly divided into two groups, A and B. Group A received the Columbia Mental Maturity Scale first, followed by the Wechsler Intelligence Scale for Children one week laster. Group B received the WISC and the CMMS one week later. Group B underwent testing first.

The mean I.Q.'s and standard deviations for each group were computed. The Pearson Product Moment Coefficient was used and the t test was utilized to determine the level of significance of the differences obtained between the appropriate groups.

The first and third hypotheses were confirmed. The Columbia Mental Maturity Scale positively correlated with the WISC Full Scale, Performance, and Verbal I.Q.'s, each at a level of significance of at least .05. It was further found that the mean Columbia I.Q. was lower than the mean WISC Full Scale I.Q. at a level of significance of less than .05.

The second hypothesis, however, was rejected. Although a positive correlation was obtained, it was not significant at the .05 level. Factors which may have led to these results have been discussed.

Conclusions and Recommendations

The overall results of this investigation, in view of the present and past studies, warrant the conclusion that the collected data are reliable estimates of the comparison between the CMMS and the WISC. From this data, it seems pertinent to state that there is a very favorable comparability between the two tests and that the Columbia Mental Maturity Scale can be used supportively or in place of the Wechsler Intelligence Scale for Children in working with mentally retarded children, due to a high correlation with the WISC I.Q.'s. The CMMS does seem to reflect the same, or similar aspects of "intelligence" which are purportedly measured by the WISC.

There are, however, several aspects of the Columbia that need further investigation and revision. Item difficulty levels were generally consistent, but items fifty-four, fifty-five, and fifty-six were missed many more times than other items at higher levels of supposed difficulty. It would seem that further investigation and adjustment is in order in reference to the difficulty levels for the Scale's items.

Another aspect of the Scale which needs improvement is one which on first inspection seems to be of minor importance. This not-so-minor problem is the cards themselves, or rather the surface of the cards. Some mentally retarded children find it impossible to keep their fingers out of their mouths, and this behavior, during a testing session, creates the problem of saliva being deposited on the CMMS cards wherever touched. This repeated deposit of moisture soon soaks into the cards (regardless of the care of the tester) and stains them. Future subjects may curiously rub the soiled spot and obtain a "miss" when actually they were merely being curious. It is not permitted to question a child about a particular response, so, therefore, any designation toward the card is counted as a "response" and scored appropriately. Some less absorbent material or more washable coating would be advantageous to both the examiner and child.

With further investigation and revision, it would seem that the Columbia Mental Maturity Scale promises to become a

useful and valuable psychometric tool, supplying some relief for understaffed, overpopulated institutions. It would appear that it has sufficient reliability to be used as a screening device or follow-up test, and under necessitating circumstances, the main diagnostic measure for determining mental ability. This, of course, would usually become the case when staff or population factors dictate.

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