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A RELIABILITY AND VALIDITY STUDY OF THE FINE VISUAL MOTOR SCREENING INVENTORY AND THE MOTOR PERCEPTUAL DIAGNOSTIC INVENTORY.

The University of Oklahoma, Ph.D., 1976
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THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

A RELIABILITY AND VALIDITY STUDY OF THE FINE VISUAL MOTOR SCREENING INVENTORY AND THE MOTOR PERCEPTUAL DIAGNOSTIC INVENTORY

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

DOCTOR OF PHILOSOPHY

BY

HAROLD HERBERT BLAKELOCK

Norman, Oklahoma

1976

A RELIABILITY AND VALIDITY STUDY OF THE FINE VISUAL MOTOR SCREENING INVENTORY AND THE MOTOR PERCEPTUAL DIAGNOSTIC INVENTORY

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ACKNOWLEDGEMENTS

I wish to acknowledge Professors Charlyce King, Robert Ragland, and Charles Butler, who were members of the Advisory Committee, and who contributed to the completion of this study. Special appreciation is extended to Professor Omer John Rupiper, Chairman of the Committee, who directed this study and provided the writer with guidance and encouragement throughout his graduate program.

Appreciation is extended to Dr. Bob Lance and Donna Robinson for their part in scoring the inventories. I also wish to thank Dr. Eugene Medvedeff and Dr. Beverly Dearth for their time and encouragement throughout this endeavor. Special thanks is also extended to the subjects who volunteered to participate in this study and to Mr. Kenneth Sweeney, Executive Director of the SCBMR, for his patience and support.

Special gratitude is extended to my wife, Karen, and daughter, Jennifer. They refused to let my studies take preference over my responsibilities as husband and father and, in doing so, made each role that much more rewarding.

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CHAPTER I

INTRODUCTION

As a result of litigation and legislation, an increasing number of individuals with IQ's below 50 are being served in organized habilitation and day care programs. The inclusion of vocational opportunities in these programs is consistent with popular treatment philosophies and professional acceptance of and guidance toward a philosophy of normalization. If normalization has relevance for the trainable mentally retarded (TMR), not only should day programs be available, but they should also include the opportunity for productive renumerative work as a reflection of, and a means toward, normative activity programs.

At one time productive work and work evaluations were considered unfeasible for mentally retarded adults with IQ's below 50. This was due, in part, to the inability of evaluation units to adequately assess the work potential of the TMR and to the lack of appropriate tasks within sheltered work settings. Lacking sophisticated evaluation systems, sheltered workshops relied upon an arbitrary system of natural selection, staff impression, work evaluation, and psychometric data to place clients within their respective settings. As a result, sheltered workshops emphasized productivity rather than habilitation. If a client performed a certain job, he was placed there. If he could not perform, little or no effort was expended in training.

A review of available current literature indicated that there were no truly validated methods of assessing aptitude for work, vocational interests, or specifically prerequisite motor development as a function of work (Timmerman & Doctor, Note 1). This did not indicate a lack of research or available data dealing with work evaluation of the retarded. The thrust of this research was, however, oriented towards quantitative descriptions and classifications of the mentally retarded as workers (Gellman, 1968), and had more applicability to general populations of retarded than to TMR groups (Tobias and Gorelick, 1960).

New strategies toward evaluating the work potential of the TMR are necessary if vocational habilitation is to become a reality. The procedures evaluators should employ depend upon the goals that instigate examination. The goal, being habilitation and training rather than productivity, dictates the use of diagnostic procedures based on the following assumptions: it is possible to identify and to measure characteristic processes subsequent to learning situations; the processes through which individuals learn are modifiable; the initial goal of evaluation is not to establish the client's relative standing on a performance task or work sample but to establish the qualitative strengths and weaknesses that dictates the client's progress on that task or work sample. The ultimate goal, then, of work evaluation is the prescription of intervention procedures designed specifically to modify functional processes in order to enhance the client's learning and work potentials. In pursuit of this ultimate goal, measurement of the products of prior learning play an important initial role that must be complemented with a comprehensive picture of the strengths and weaknesses of the individual's learning strategies and processes across a wide variety of modalities and situations.

In order to truly achieve a dynamic approach to the process of work evaluation, it became necessary not only to analyze what was to be learned in the way of production-oriented tasks, but it also became necessary to analyze the adult as the information processor. By way of example, a careful study of the physiological requirements for successful work productivity necessitated an analysis of how work tasks and physiological factors were related. Areas such as gross and fine motor performances, ocular motility, and perception needed to be examined in order to determine their contribution to the variance in productive work.

Primary behaviors required for the performance of work tasks such as gross motor, fine motor, and visual motor performance were generally not measured directly, but inferred from test scores (Destegano, Ellis and Sloan, 1958; Tobias and Gorelick, 1960). Although information derived from performance tests provided a contemporary pool of performance levels, the professional received very little information from such tests concerning primary levels of performance.

With the availability of assessment procedures that would identify the gross and fine motor variables essential to success in work-oriented tasks, professionals would be in an advantageous position to maximize their effectiveness in training the TMR. In designing learning experiences for the TMR adult, the educator must consider not only the content of such a program, but also the competencies the adult takes to the task. The rationale for considering gross and fine motor development in the content of work-related tasks appeared sound in that the developmental areas were sequentially related and essential for work-related tasks. An assessment program which focused on the sequential improvement of certain gross and fine motor performance skills of the TMR adult should provide a developmentally sound basis on which to build the skills necessary for successful performance of workshop activities.

The need for more knowledge in the area of screening and assessment programs for adults was evident. Hobbs (1975) pointed out the need for more research directed towards the development of screening instruments and he proposed the following research questions:

1. "How reliable and valid are the tests used in screening programs and how may they be improved?"

2. "Do currently available screening procedures reliably identify a significant number of children whose difficulties were not already known?"

There was an attempt to produce a screening battery that would assess functional motor processes and provide professionals with much needed information regarding motor efficiency of clients (Medvedeff and Dearth, 1974). The researcher found that two of the instruments developed by Medvedeff and Dearth, the Motor Perceptual Diagnostic Inventory (MPDI) and the Fine Visual Motor Screening Inventory (FVMSI) were easy to administer, simple to score, and short enough in duration so as to be practically useful in the functional assessment of TMR adults.

This investigation was undertaken to examine the reliability and validity of both the FVMSI and the MPDI. Specifically, this study attempted to answer the following questions:

1. What is the coefficient of stability (test-retest reliability) of the FVMSI and the MPDI with adult TMRs?

2. What is the inter-rater reliability of the FVMSI product scores for adult TMRs?

3. What are the inter-rater reliabilities of the MPDI for adult TMRs by subtest?

The validity of both FVMSI and the MPDI was analyzed in several ways. Since both the FVMSI and MPDI were designed to measure sequential developmental traits, a correlational analysis of the relationship between these tests should provide data for determining concurrent validity. Specifically:

4. What is the concurrent validity coefficient of the FVMSI and the MPDI?

The Bender-Motor Gestalt Test (B-G) was reported to have validity as a measure of perceptual motor functioning (Kitay, 1972). A concurrent validity coefficient was computed between the FVMSI and the B-G. Specifically:

5. What is the validity coefficient of the FVMSI and the B-G test?

This investigator observed that TMRs who exhibited the least amount of confounding motor involvement (e.g., differential performance of the two hands, poor ocular motility, balancing problems, etc.) were the most consistent workers. Since all of the subjects in this study worked on the same jobs and were paid on a piece-rate basis, TMRs who exhibited the least amount of motor and/or motor perceptual problems should have completed more tasks and earned more money. Therefore, criterion validity was analyzed by correlating each inventory in turn with each subject's adjusted yearly income. Specifically:

6. What are the criterion validity coefficients of the FVMSI and adjusted annual income?

7. What are the criterion validity coefficients of the MPDI subtests and adjusted annual income?

Similarly, subjects designated as "high performers" should have earned significantly higher scores on all inventory items than subjects designated as "low performers" if the FVMSI and the MPDI provided a valid measure of work-related functional abilities. In order to determine the construct validity of both the FVMSI and the MPDI, the following hypotheses were generated:

$H_{1.0}$ High performing TMR workshop clients will perform at higher levels on the performance portion of the FVMSI when compared to low performing TMR workshop clients.

$H_{2.0}$ High performing TMR workshop clients will perform at higher levels on the product portion of the FVMSI when compared to low performing TMR workshop clients.

$H_{3.0}$ High performing TMR workshop clients will perform at higher levels on the Gross-Motor section of the MPDI when compared to low performing TMR workshop clients.

$H_{4.0}$ High performing TMR workshop clients will perform at higher levels on the Balance and Coordination (eyes open) section of the MPDI when compared to low performing TMR workshop clients.

$H_{4.1}$ High performing TMR workshop clients will perform at higher levels on the Balance and Coordination (eyes closed) section of the MPDI when compared to low performing TMR workshop clients.

$H_{5.0}$ High performing TMR workshop clients will perform at higher levels on the Coordination and Neural Maturity (eyes open) section of the MPDI when compared to low performing TMR workshop clients.

$H_{5.1}$ High performing TMR workshop clients will perform at higher levels on the Coordination and Neural Maturity (eyes closed) section of the MPDI when compared to low performing TMR workshop clients.

$H_{6.0}$ High performing TMR workshop clients will perform at higher levels on the Ocular Motility section of the MPDI when compared to low performing TMR workshop clients.

CHAPTER II

REVIEW OF LITERATURE

The traditional method by which psychometrists and work evaluators estimated the work potential of retarded individuals was to measure intelligence, dexterity, perception, etc. relative to age norms. Individuals were, in essence, compared with respect to their relative mastery of the products of prior learning. This approach assumed that the individuals being compared had an equal opportunity to develop these skills. Haywood (1970), however, found that differential opportunity to learn was clearly associated with race, parental intelligence, and access to educational opportunity.

Poor performance on product-oriented tests did not necessarily indicate the lack of an aptitute for productive work, but could have indicated that opportunities to learn the associations or motor movements demanded by the tests were not present. Another explanation could be that the tests did not measure the functional strategies required for productive work. There were, however, sufficient commonalities between the tasks demanded on these predictive instruments and subsequent work production that enabled the tests predictive use to become a succession of self-fulfilling prophecies.

In 1967, Lorne Elkin attempted to develop a battery of tests which would assess the performance of TMRs on sheltered workshop tasks. The battery was comprised of 19 items including standard tests, personal information, and a rating scale. Other than indicating that there was a "general ability" factor encompassing intellectual and psychomotor skills which was related to performance on certain types of job tasks, the study contributed little. No attempt was made to operationally define the construct of "general ability" which would have permitted behavior to be objectively measured instead of inferred.

Wagner and Hawver (1965) conducted a similar study at the Summit County Board of Mental Retardation. The results of the test battery were compared with rankings compiled by the chief instructor of the workshop. The battery again was found to be predictive of workshop performance. However, the sample of subjects and their tasks were limited in size and scope respectively. The authors indicated the presence of an ability factor which they referred to as an "inactive" factor but once again they failed to functionally define it for programming purposes.

One study which used a single test for predictive purposes was conducted by Tobias and Gorelick (1960). They predicted performance on workshop tasks from performance scores on the Purdue Pegboard. However, it was questionable whether the results of this study could be generalized to other tasks where fine visual-motor performance was nonessential.

A second method by which the abilities of the retarded to perform work tasks were assessed emphasized the use of work samples. Gold (1973) reported that although a number of researchers felt work samples were superior to standardized tests, especially with retarded populations, others (Sakata & Sinick, Note 2) felt standard tests revealed as much if not more than work samples.

The following arguments were presented by Gold in favor of work samples: (1) They were concerned with the same criterion task obtained from competitive industry. (2) Because they more closely approximated "real work" job samples would not be subject to some of the motivational problems evident on standard tests. (3) Many of the intrusive factors which potentially affected test scores were less likely to influence work task performance. Included in these factors were such variables as recency of schooling, educational deprivation, excessive anxiety, speech and hearing impairment, etc. (4) One report noted that prospective employers had been found generally more amenable to reports of work sample performance than to test scores or profiles. (5) Finally, work samples were somewhat better able to reveal not only skills required, but various aspects of the client's personality, interest, motivation, and attitudes toward work.

The arguments presented against a heavy reliance upon work samples were: (1) The resemblance of work tasks to actual jobs was no assurance that performance on one would predict performance on the other. Jobs differed in many respects that could not be duplicated in work samples. (2) The resemblance of work samples to actual jobs may have caused clients to believe they were truly being trained for such jobs. This could have raised false hopes on one side and also have caused clients to resist certain job samples because they resembled jobs they thought they disliked. (3) The behaviors and attitudes noted throughout the job sample were subject to the same subjective observation and interpretations by raters as were other types of rating scales. (4) Generally speaking, there was almost a complete lack of standardization of work samples. Most facilities which used work samples had devised their own based on jobs in their workshop or surrounding community and had not properly validated them.

Comprehensive Test Batteries

There have been at least two attempts to produce comprehensive batteries of tests for the vocational assessment of the TMR. The first of these, the Vocational Capacity Scale (VCS) (MacDonald Training Center) was developed on a handicapped population within the educable rather than trainable range. It was subsequently validated, however, (Dayan, 1968, Note 3) on an institutional, TMR, population. This battery was used to predict the eventual vocational level which would be attained by the clients tested.

The other battery which included research with a TMR population was the McCarron-Dial Work Evaluation System (Note 4), which was still in the process of release through Indiana State University (Terre Haute, Indiana). This battery attempted to evaluate five predictive factors: Verbal-Cognitive, Sensory, Motor, Emotional, Integration and Coping. This evaluation was accomplished through a combination of standard tests, specially designed tasks, and rating scales. Sufficient information was not yet available to allow a true evaluation of the McCarron-Dial Work Evaluation System or the VCS.

Functional Assessment

Some areas, apparently, remain completely unexplored. No studies, for instance, were found that emphasized a functional assessment procedure to predict performance. However, one pilot study was conducted which attempted to determine the effects of prescriptive individualized programming on achievement variables for a group of moderately to severely retarded adults in a sheltered workshop program (Dearth and Rizor, 1973, Note 5). To prepare the prescriptive programming, each subject was assessed on functional motor performance, functional visual skills including ocular motility and convergence/divergence, fine visual motor performance, and perceptual organization. Their results indicated that the prescribed programs based on functional assessment significantly effected learning and achievement and thus implied that functional assessment of the TMR adult provided a good basis for determining areas of deficiency and, unique to the literature, consequent prescriptive practices. This assessment approach differed from all others reviewed in that it concentrated on how the adult performed and not how much work he completed.

Summary

A review of the literature regarding vocational assessment of the TMR adult indicated that consistently reliable and valid instruments that would provide data on which to base prescriptive programming did not exist. Insofar as individual, standardized tests of aptitude, perception, dexterity, and intelligence were concerned, they served little function except to provide a classification system to categorize subjects.

The use of work samples to predict performance of TMR adults was somewhat better. Generally speaking, there was a complete lack of standardization for work samples resulting in inconsistent and poorly validated results.

Efforts had been made in the field of work evaluation of the retarded to produce batteries of tests which would assess performance on a variety of tests and scales and then these results were combined into a single predictive profile. However, the majority of work in this area had utilized EMR or mildly retarded populations. The two studies where evidence was presented to validate these methods with TMR populations did not provide sufficient data to allow a true evaluation of the validity and usefulness of the instruments.

Those existing tools which appeared most promising to this researcher were the functional assessment tools developed by Medvedeff and used by Dearth and Rizor (1973). The fact that the instruments measured functions which were subject to developmental and adaptive changes enhanced the development of adequate prescriptive programs and ongoing evaluations. Functional assessment, then, had potential, not only as a predictive and prescriptive tool, but the procedure insured the TMR client against the terminal evaluation and placement procedures that have made institutions and sheltered workshops dead-end programs.

CHAPTER III

METHOD

The Subjects

At the onset of this study, there were 115 adult clients within the TMR range of mental deficiency that participated in the Summit County Board of Mental Retardation's workshop program. The entire population was included in the study except for individuals who exhibited major deficits other than mental retardation such as blindness or paralysis who could not handle some of the tasks required in the test. Complete medical records kept on all clients were utilized to screen subjects for inclusion in the study. Fifteen subjects were not included for the following reasons: three clients were blind, two clients were deaf, two clients were physically handicapped, three clients were ill during testing sessions, one client was uncooperative during testing, two clients chose not to participate, and two clients left the program.

The total sample of 100 TMR clients fell within two categories which designated their performance as either high or low. These classifications were Sheltered Workshop

(SW), which designated high performance, and Adjustment (A), which designated low performance. Out of the sample of 100 clients, 77 fell in the SW group and 23 fell in the A group. Placement of a client into either the SW or A group was based on a thorough evaluation which lasted between two to four weeks. The evaluations were conducted by two masters-level staff members whose sole function was to evaluate incoming clients. Clients were tested on a number of locally devised tests and work samples of contract work. The clients were also evaluated by the staff speech pathologist, audiologist, and psychologist. Final placement was determined at bi-weekly staffings. Provision for movement between groups, as a result of development after placement, was established. However, client records revealed few placement changes.

A sub-sample of 41 clients was selected from the total sample of 100 clients for inclusion into the inter-rater portion of the study. All 41 subjects in the sub-sample had B-G test scores in their records. However, after the sub-sample was established, this investigator decided to readminister the B-G test to each subject to control for consistency in the scoring system.

Procedures

Both the FVMSI and the MPDI were administered to all 100 clients selected for inclusion in the study. The presentation of tests was counterbalanced to eliminate any effects of fatigue. Retesting was conducted approximately one month after initial testing occurred. The tests were administered in a room that was approximately twelve feet square, which was well lighted and furnished with a round table, three chairs, and a metal cabinet. Both tests were administered individually to each client. Either the client's instructor or the second rater were present during test administration to assure that the conditions for administration of the tests remained consistent.

Both the FVMSI and the MPDI were administered as per the instructions in the accompanying manuals. If clients did not respond to the instructions appropriately, further instructions in the way of gestures and modeling were demonstrated.

An initial attempt was made to video tape each session to record test behavior to further objectify scoring. However, space limitations and the intrusion of the video tape equipment negated its use.

Inter-rater scoring of the FVMSI was conducted by a Ph.D.-level clinical psychologist employed and trained by the developers of the test. Inter-rater scoring was limited to the product section of the test due to the inability of the second rater to attend test sessions. Protocols of those clients selected for this phase of the study were forwarded to the second rater who scored them blindly.

Inter-rater scoring of client performance on the MPDI was conducted by a SCBMR employee who had attended training sessions at Blick Clinic (Tallmadge, Ohio) in administration of the instrument. Prior to the onset of the study, both the investigator and the proposed second rater scored the client's video-taped performances on the MPDI to establish consistency.

The B-G test (Bender, 1946) was administered by the researcher to each of the 41 subjects in the inter-rater phase of the study. The tests were scored by using the Developmental Bender Scoring System (Koppitz, 1963), which consisted of 30 mutually exclusive scoring items which were scored as either present or absent. Total scores were converted into Developmental Age scores and reported in months.

Instrumentation

The MPDI was designed to measure gross motor control, gross motor coordination, ocular motility, fine motor control, and neural maturity factors including static balance, dynamic sequence, dynamic posture and finger agnosia. Individual items were scored on a four-point scale: (1) Will not or cannot perform. (2) Performance not acceptable. (3) Performance acceptable - room for improvement. (4) Performance at norm.

Performance items on the MPDI consisted of chronologically aged, normed activities ranging from three to seven-year levels. A Pearson product moment correlation coefficient of .44 was reported between MPDI performance items and medical norms for achievement at given ages (Medvedeff, 1974). MPDI reliability was reported as being

.92 on kindergarten children (Medvedeff, 1969).

The FVMSI consisted of six plates of drawings which the subject reproduced on a blank sheet of paper. The test was designed to assess fine motor control, left-to-right orientation, counter-clockwise orientation, space organization, attention to visual detail, closure, size discrimination, body midline crossing, head and eye orientation, and ability to follow instructions.

The reproductions were scored plus (+) or minus (-) on two factors: (1) Performance, which assessed directionality in terms of left-to-right, counter-clockwise, and top-to-bottom orientation. (2) Product, or the configuration of the reproduced shape. A measurement of artistic ability was not intended. Test-retest reliability was reported as .94 and interjudge reliability reported as .95. Permission to reproduce the inventories was granted by Westinghouse Learning Corporation, see Appendix B.

Limitation of the Study

This study was delimited in terms of several variables. No effort was made to categorize or separate out the socio-economic status of the subjects. Summit County was comprised of urban, suburban, and rural districts. Workshop clients came from throughout the country. Since the SCMBR had a "no reject" policy, it was assumed that the majority of TMRs were being served. No effort was made to control for the cause of mental retardation of the subjects.

The sample did not exhibit a preponderance of any racial minority and was evenly balanced as to sex. The ages of the subjects were not controlled. The ages of the subjects ranged from C.A. 19-4 to C.A. 43-7 with a mean C.A. of 27-8.

The split-half method and alternate form method of determining test score reliability were not appropriate for testing the reliability of the FVMSI and the MPDI scoring systems. This left the test-retest method of testing for reliability which presented some difficulties. Immediate retesting with both the FVMSI and the MPDI would show the result of practice, while a long-term interval between test administration might reflect both maturation and aging. It was hoped that the practice effect and the effects of maturation and aging were kept to a minimum by retesting at one-month intervals.

Definition of Terms

1. Gross Motor Performance: The measured ability to use large muscle groups of the body in a coordinated and efficient manner.

2. Ocular Motility: The measured performance of binocular pursuit skills in horizontal, vertical, diagonal, and rotary planes.

3. Fine Motor Control: The measured ability to use small muscle groups in a coordinated and efficient manner.

4. MPDI: Abbreviation for the Motor Perceptual Diagnostic Inventory (Medvedeff, 1965).

5. FVMSI: Abbreviation for the Fine Visual Motor Screening Inventory (Medvedeff, 1966).

6. Trainable Mentally Retarded: In attempting to define this term for purposes of this study, no hard and fast boundaries were drawn. It was operationally defined in terms of IQ basically because this was the descriptive criterion used to legally classify the population. The group being researched fell 3.01 to 4.00 standard deviation units below the mean of the general population according to the AAMD Manual on Terminology and Classification in Mental Retardation (2nd ed.), 1961. According to the same source this corresponded to an IQ range of 51-36 on the Revised Stanford-Binet Tests of Intelligence and 54-40 on the Wechsler-Bellevue Intelligence Scale, Children and Adult forms. The terms "Trainable Mentally Retarded," as used in this study, were roughly equated with a full-scale IQ of 35-55.

CHAPTER IV

RESULTS

This study was conducted to investigate the reliability and validity of both the FVMSI and the MPDI when used to evaluate TMRs in a sheltered workshop. The 100 subjects were participants in a sheltered workshop program. The data were obtained from tests administered by this investigator to each subject individually. The data were analyzed using the STATKSU computer package on a Burroughs computer. Results gave sufficient evidence of the reliability and validity of both the FVMSI and MPDI. To organize the results in a readable fashion, each test will be dealt with individually.

FVMSI

Reliability

The FVMSI manual reported a reliability coefficient of .94. The Pearson Product-Moment Correlation Coefficient revealed a coefficient of stability of .7956 for the performance of the inventory and .8654 for the product section (see Table 13 in Appendix).

The inter-rater reliability coefficient for the product section of the FVMSI was found to be .8625 (see Table 14 in Appendix). This coefficient of stability was consistent with the obtained test-retest correlation for a single scorer.

Validity

Concurrent validity coefficients of the FVMSI and the MPDI are reported in Table 3 of Appendix. The coefficients ranged from -.4434 between the FVMSI Performance section and the MPDI Gross Motor section to -.6267 between the FVMSI Product section and the MPDI Ocular Motility section.

In using the B-G test as a measure of perceptual-motor functioning, a concurrent validity coefficient was obtained by correlating the FVMSI with the B-G test. The resultant coefficient was -.3864 (see Table 1).

Criterion validity of the FVMSI was assessed by correlating both the Performance and Product sections of the inventory with each client's adjusted annual income. The validity coefficient for the Performance section of the FVMSI with earnings was reported as -.2472. The validity coefficient for the Product section with earnings was reported as -.1876. Since the direction of the scores for the FVMSI was reversed, high scores indicated poor performance, the negative correlations were expected.

Construct validity of the FVMSI was investigated by utilizing the t-test to evaluate the differences between the

TABLE 1

Mean and Standard Deviations for the Product Scores on the FVMSI and Developmental Age Scores on the Bender-Gestalt Test for the Sub-Sample of 41 TMR Adults

Variables	$\overline{X}$	SD	r
FVMSI Product	7.63	2.47	-.3864**
B-G	35.32	4.46	

**$p < .02$

scores of the A and SW groups. The tests for homegeneity revealed that no significant differences were present. As predicted, the SW group earned significantly higher scores on both the Performance section, $\underline{t}$ (98) = -3.592, $\underline{p} < .01$, and the Product section, $\underline{t}$ (98) = -3.440, $\underline{p} < .01$, than the A group (see Table 2).

MPDI

Reliability

The test-retest data obtained on the MPDI revealed correlations ranging from .9423 to .9856 (see Table 13 in Appendix). Inter-rater reliability coefficients for the sub-sections of the MPDI ranged from .7721 on the Ocular Motility section to .9864 on the Balance and Coordination (eyes closed) section (see Table 14 in Appendix).

Validity

Criterion validity of the MPDI sub-scales was assessed by correlating each sub-scale with each client's adjusted annual income. The income of clients was adjusted to account for differential attendance. All subjects worked a minimum of 40 weeks, the maximum was 48 weeks. Average weekly incomes were tabulated using computerized pay records. Incomes were then adjusted until all clients totaled 48 pay weeks. Mean adjusted earnings for the total sample of 100 TMRs was presented in Table 17 in the Appendix. The correlations obtained ranged from .3539 on the Gross Motor subscale to .4261 on the Coordination and Neural Maturity (eyes open) sub-test which indicated significant positive

TABLE 2

T-Test of Difference Between Means of the Adjustment and Sheltered Workshop Groups

Variables		Adjustment Group (n = 23)		Sheltered Workshop Group (n = 77)			
		X	SD	X	SD	df	t
FVMSI	Performance	7.57	1.99	5.55	2.46	98	-3.592**
	Product	9.00	2.22	6.90	2.67	98	-3.440**
MPDI	Gross Motor	18.65	4.90	26.00	6.93	98	4.739**
	Balance & Coordination (Eyes Closed)	23.35	7.15	37.56	10.66	98	5.992**
	Coordination & Neural Maturity (Eyes Open)	32.44	8.40	47.44	11.01	98	6.027**
	Ocular Motility	29.65	10.77	44.43	12.11	98	5.260**

**p < .01

relationships between money earned and functional motor abilities.

Construct validity of the MPDI sub-scales was investigated by utilizing the t test to evaluate the differences between the means of the A and the SW groups on each of the MPDI sub-scales, respectively. The F tests revealed that variances among the variables of Gross Motor, Balance and Coordination (eyes closed), Coordination and Neural Maturity (eyes open), and Ocular Motility were homogeneous. The variances were heterogeneous between the two groups on the variables of Balance and Coordination (eyes open) and Coordination and Neural Maturity (eyes closed) which necessitated the use of Sutherthwaite's formula (Weiner, 1964) for adjusting the degrees of freedom. On the basis of these data, hypotheses 3.0, 4.0, 4.1, 5.0, 5.1, and 6.0 were accepted (see Tables 3 and 4).

As predicted in hypothesis 3.0, the SW group performed at a higher level on the Gross Motor section of the MPDI when compared to the A group, $\underline{t}$ (98) = 4.739, $\underline{p} < .01$. Hypothesis 4.0 proposed that the SW group would perform at a higher level than the A group on the Balance and Coordination (eyes closed) sub-scale of the MPDI. As predicted, the SW group did earn higher scores on this sub-scale than the A group, $\underline{t}$ (57) = 8.189, $\underline{p} < .01$. Hypothesis 4.1 proposed that high performing TMRs would perform at higher levels on the Balance and Coordination (eyes open) sub-scale of the MPDI than low performing TMRs. The hypothesis was

TABLE 3

T Test of Difference Between

Means of the Adjustment and

Sheltered Workshop Groups

Variables	Adjustment Group (n = 23) $\bar{X}$	SD	Sheltered Workshop Group (n = 77) $\bar{X}$	SD	Adjusted df	t
Balance & Coordination (Eyes Open)	28.09	6.45	42.60	10.11	57	8.189**
Coordination & Neural Maturity (Eyes Closed)	25.74	7.03	40.12	11.18	58	7.400**

Note: Degrees of freedom adjusted to account for lack of homogeneity.

**p < .01

accepted, t (98) = 5.992, $p < .01$. Hypothesis 5.0 proposed that the SW group would perform at a higher level than the A group on the Coordination and Neural Maturity (eyes open) sub-section of the MPDI. The hypothesis was accepted, t (98) = 6.027, $p < .01$. Hypothesis 5.1 proposed that the SW group would function at a higher level on the Coordination and Neural Maturity (eyes closed) sub-section of the MPDI than the A group. The hypothesis was accepted, t (58) = 7.400, $p < .01$. Hypothesis 6.0 stated that high performing TMRs would perform at higher levels on the Ocular Motility sub-section of the MPDI when compared to lower functioning TMRs. Hypothesis 6.0 was accepted, t (98) = 5.260, $p < .01$.

CHAPTER V

DISCUSSION

FVMSI

Reliability

In attempting to determine the reliability of the FVMSI, it was determined that repeated measures of both the Performance and Product sections of the inventory provided the most appropriate set of operations for estimating reliability coefficients. The fact that the scoring system accounted only for directionality and the final Gestalt, and not for any intra-individual behaviors that would lend themselves to subjective assessment, supported the use of this technique.

The correlation between scores on the Performance section of the inventory was high, .7956. The simplicity of the scoring system, a plus (+) for a correct performance and a minus (-) for an incorrect performance, accounted for the lack of bias in grading performance that accompanies the B-G test. The correlation between scores on the Product section of the FVMSI was also high, .8654, and reflected the same lack of grading bias. The inter-individual dispersion of expressed abilities was very satisfactory (see Tables 4 and 5). However, intra-individual performance, affected by the TMRs limited motor repertoire, did not appear to vary and had a positive effect on the correlation. Post-test scores (see Table 16 in Appendix) were higher on both the Performance and Product sections of the inventory. The investigator felt that the increase in scores was facilitated by the interaction of the personalities of subjects with that of the investigator. In general, post-testing was more efficient than pre-testing and the subjects had become familiar with the setting, the examiner, and the tasks.

Scorer Reliability

In encountering the problem of establishing the reliability of a new instrument with a specific population, it became necessary to investigate the reliability of the scoring system. The Product section protocols of each of the 41 subjects included in this phase of the study were first scored by the investigator. All identifying marks were then removed and the same protocols scored by the second rater. A reliability coefficient of .8625 was obtained with a mean raw score of 7.63 for the investigator and 8.44 for the second rater (see Table 6). It was felt that this correlation reflected the simplicity and conciseness of the scoring standards.

TABLE 4

Earned Scores, Frequencies, Cumulative Frequencies and Percentile Ranks for the Total Sample of 100 TMR Adults on the Product Variable of the FVMSI

Score	f	cf	PR
0	2	2	1.00
1	2	4	3.00
2	4	8	6.00
3	4	12	10.00
4	3	15	13.50
5	7	22	18.50
6	10	32	27.00
7	9	41	36.50
8	16	57	49.00
9	12	69	63.00
10	31	100	84.50

TABLE 5

Earned Scores, Frequencies, Cumulative Frequencies and Percentile Ranks for the Sample of 100 TMR Adults on the Performance Variable of the FVMSI

Score	f	cf	PR
0	1	1	0.50
1	2	3	2.00
2	6	9	6.00
3	11	20	14.50
4	10	30	25.00
5	12	42	36.00
6	10	52	47.00
7	15	67	59.50
8	16	83	75.00
9	9	92	87.50
10	8	100	96.00

TABLE 6

Means and Standard Deviations on the FVMSI and MPDI for the Sub-Sample of 41 TMR Adults by Pre-Test and Inter-Rater Performance

Variables		Pre-Test		Inter-Rater	
		$\bar{X}$	SD	$\bar{X}$	SD
FVMSI	Product	7.63	2.47	8.44	2.46
MPDI	Gross Motor	23.46	6.53	25.66	6.49
	Balance & Coordination (Eyes Open)	37.68	10.74	39.34	10.88
	Balance & Coordination (Eyes Closed)	32.32	11.41	33.90	11.46
	Coordination & Neural Maturity (Eyes Open)	42.71	12.01	45.39	11.31
	Coordination & Neural Maturity (Eyes Closed)	35.46	11.87	37.90	11.81
	Ocular Motility	41.56	13.74	42.20	14.35

Validity

In general, all subjects regardless of placement had difficulty copying the FVMSI designs. Many processes were involved in the performance of these tasks: fine finger dexterity, reciprocal coordination of the two hands, visual-motor integration, fixation, etc. When a subject failed to copy a design, was it because of incompetence in all these areas? That was possible, but realistically, a deficit in just one of these processes was enough to cause failure. In comparing the qualitative performance of the subjects in the SW and the A groups, subjects in group A exhibited significant interference in more processes than did the subjects in the SW group.

Concurrent validity coefficients of the FVMSI with the MPDI were reported in Table 3 in the Appendix. The reliability coefficients ranged from -.4434 to -.6267. The correlations were negative because high scores on the FVMSI were indicative of poor performance while high scores on the MPDI were indicative of good performance. These correlations were all significant at the .01 level and supported the assumption that since both the FVMSI and the MPDI were designed to measure sequential developmental traits, a positive relationship should exist between the inventories.

In a strictly empirical sense, a common procedure for validating a new instrument was to set as a criterion some well-established test which was accepted as a valid measure of the trait in question. Appraisal of the validity of the new instrument was then based on the degree to which it correlated with the established test. This study used the B-G test as the concurrent criterion for perceptual-motor performance. The resultant coefficient between the sum of minus scores on the FVMSI and earned developmental age scores on the B-G test was -.3864, $p < .02$.

Criterion validity of the FVMSI was assessed by correlating both the Performance and Product sections of the FVMSI with each subject's annual adjusted income. Annual income was considered a highly reliable criteria of job success and appropriate to the situation because income of all subjects was based on piece-rate production. The investigator hypothesized that individuals with the most flexible and sophisticated perceptual-motor behaviors would be more efficient and capable workers and, therefore, earn more money. The validity coefficient between the Performance section of the FVMSI and annual income was -.2472, $p < .02$. The validity coefficient between the Product section of the FVMSI and annual income was -.1876, $p < .10$. The results indicated that the FVMSI had the potential to assess perceptual-motor abilities that directly influenced job productivity.

The FVMSI was designed to provide the professional with measures of process variables of perceptual-motor performance (e.g., directionality, fine motor control, attention to visual detail, etc.) as well as the product of these skills. Successful completion of work tasks demanded that the TMR carry these skills to the task. Therefore, subjects who have the best command over the perceptual-motor domain should have been the most productive workers and they should have earned significantly higher scores on both the Performance and Product sections of the FVMSI. The construct validity of the FVMSI was investigated by using the t test to evaluate the differences between the scores of high performers and the scores of low performers. As predicted, the SW group (high performers) earned significantly higher scores on both the Performance sub-scale, $\underline{t}$ (98) = -3.592, p < .01, and the Product sub-scale, $\underline{t}$ (98) = -.3440, $\underline{p}$ < .01, than the A group (poor performers). The results indicated the strength of the FVMSI as a screening instrument in the assessment of those perceptual-motor abilities that were necessary for successful completion of work tasks at the subject's workshop.

MPDI

Reliability

Pre-test/post-test correlations between scores on the sub-scales of the MPDI yielded coefficients between .9423 on the Coordination and Neural Maturity (eyes closed) sub-scale and .9856 on the Balance and Coordination (eyes closed) sub-scale.

It appeared that the MPDI format controlled for a large part of possible unreliability in grading bias because the sub-scales measured observable behaviors and not subjective items such as psychological or hypothetical constructs. Normative data (see Tables 7 thru 12) showed a full range of test behaviors on all sub-scales and indicated the heterogeneous nature of the subjects which positively affected the reliability coefficients. Many of the skills specific to the MPDI (walking, hopping, ocular motility, etc.) were taken to the test by the subjects. However, the execution of these tasks were generally clumsy and awkward, and very little intra-individual variability was evident. Where a restriction in inter-individual variability would have negatively affected the reliability coefficients, it appeared that the limited behavioral repertoire was a definite factor in obtaining stable coefficients.

As on the FVMSI, post-test scores were higher on all sub-scales of the MPDI (see Table 16 in Appendix). Again, it was felt that subject performance on the post-test was facilitated by the interaction of the personalities of subjects with that of the investigator. The effect of this interaction was a more relaxed approach to the post-testing on the part of both the investigator and the subjects.

TABLE 7

Earned Scores, Frequencies, Cumulative Frequencies and Percentile Ranks for the Total Sample of 100 TMR Adults on the MPDI Gross Motor Performance Variable

Score	f	cf	PR
12	1	1	0.50
14	4	5	3.00
15	4	9	7.00
16	8	17	13.00
17	7	24	20.50
18	5	29	26.50
19	2	31	30.50
20	2	33	32.00
21	6	39	36.00
22	4	43	41.00
23	4	47	45.00
24	7	54	50.50
25	5	59	56.50
26	5	64	61.50
27	5	75	72.50
28	5	75	72.50
29	2	77	76.00
31	3	80	78.50
32	2	82	81.00
33	4	86	84.00
34	6	92	89.00
36	3	95	93.50
37	1	96	95.50
38	1	97	96.50
39	1	98	97.50
41	1	99	98.50
43	1	100	99.50

TABLE 8

Earned Scores, Frequencies, Cumulative Frequencies and Percentile Ranks for the Total Sample of 100 TMR Adults on the MPDI Balance & Coordination (Eyes Open) Variable

Score	f	cf	PR
19	1	1	0.50
20	2	3	2.00
21	1	4	3.50
22	1	5	4.50
24	4	9	7.00
25	2	11	10.00
26	2	13	12.00
27	4	17	15.00
28	3	20	18.50
29	3	23	21.50
30	4	27	25.00
31	2	29	28.00
32	2	31	30.00
33	3	34	32.50
34	4	38	36.00
35	4	42	40.00
36	4	46	44.00
37	5	51	48.50
38	3	54	52.50
39	2	56	55.00
40	1	57	56.50
41	3	60	58.50
42	2	62	61.00
43	2	64	63.00
44	3	67	65.50
45	1	68	67.50
46	3	71	69.50
47	3	74	72.50
49	1	75	74.50
50	4	79	77.00
51	2	81	80.00
52	2	83	82.00
53	2	85	84.00
54	1	86	85.50
55	4	90	88.00
56	2	92	91.00
57	2	94	93.00
58	3	97	95.50
59	1	98	97.50
60	1	99	98.50
62	1	100	99.50

TABLE 9

Earned Scores, Frequencies, Cumulative Frequencies and Percentile Ranks for the Total Sample of 100 TMR Adults on the MPDI Balance & Coordination (Eyes Closed) Variable

Score	f	cf	PR
16	4	4	2.00
17	3	7	5.50
18	1	8	7.50
19	3	11	9.50
20	2	13	12.00
21	2	15	14.00
22	2	17	16.00
23	1	18	17.50
24	5	23	20.50
25	3	26	24.50
26	5	31	28.50
27	3	34	32.50
28	4	38	36.00
29	2	40	39.00
30	1	41	40.50
31	4	45	43.00
32	5	50	47.50
33	5	55	52.50
34	3	58	56.50
36	1	59	58.50
37	2	61	60.00
38	2	63	62.00
39	3	66	64.50
40	1	67	66.50
41	2	69	68.00
42	3	72	70.50
43	2	74	73.00
44	4	78	76.00
45	1	79	78.50
46	5	84	81.50
48	1	85	84.50
49	1	86	85.50
50	3	89	87.50
51	1	90	89.50
53	1	91	90.50
54	4	95	93.00
55	2	97	96.00
56	3	100	98.50

TABLE 10

Earned Scores, Frequencies, Cumulative Frequencies and Percentile Ranks for the Total Sample of 100 TMR Adults on the MPDI Coordination and Neural Maturity (Eyes Open) Variable

Score	f	cf	PR
22	2	2	1.00
25	2	4	3.00
26	2	6	5.00
27	1	7	6.50
28	1	8	7.50
29	3	11	9.50
30	2	13	12.00
31	1	14	13.50
32	3	17	15.50
33	5	22	19.50
34	2	24	23.00
35	3	27	25.50
36	4	31	29.00
37	4	35	33.00
38	4	39	37.00
39	3	42	40.50
40	3	45	43.50
41	7	52	48.50
42	3	55	53.50
43	4	59	57.00
45	3	62	60.50
46	1	63	62.50
47	2	65	64.00
48	1	66	65.50
50	2	68	67.00
51	2	70	69.00
52	1	71	70.50
53	2	73	72.00
54	3	76	74.50
57	2	78	77.00
58	3	81	79.50
59	4	85	83.00
60	3	88	86.50
61	1	89	88.50
62	4	93	91.00
63	2	95	94.00
64	1	96	95.50
66	1	97	96.50
67	1	98	97.50
69	1	99	98.50
70	1	100	99.50

TABLE 11

Earned Scores, Frequencies, Cumulative Frequencies and Percentile Ranks for the Total Sample of 100 TMR Adults on the MPDI Coordination and Neural Maturity (Eyes Closed) Variable

Scores	f	cf	PR
18	5	5	2.50
19	1	6	5.50
20	2	8	7.00
21	1	9	8.50
23	1	10	9.50
24	3	13	11.50
25	6	19	16.00
27	3	27	25.50
28	4	31	29.00
29	5	36	33.50
30	1	37	36.50
31	3	40	38.50
32	3	43	41.50
33	5	48	45.50
34	1	49	48.50
35	5	54	51.50
36	2	56	55.00
37	5	61	58.50
38	1	62	61.50
40	1	63	62.50
42	2	65	64.00
43	2	67	66.00
44	2	69	68.00
45	1	70	69.50
46	2	72	71.00
47	3	75	73.50
48	2	77	76.00
49	3	80	78.50
50	1	81	80.50
51	5	86	83.50
52	3	89	87.50
53	4	93	91.00
57	4	97	95.00
63	2	99	98.00
64	1	100	99.50

TABLE 12

Earned Scores, Frequencies, Cumulative Frequencies and Percentile Ranks for the Total Sample of 100 TMR Adults on the MPDI Ocular Motility Variable

Score	t	cf	PR
18	7	7	3.50
19	1	8	7.50
21	1	9	8.50
24	2	11	10.00
27	1	12	11.50
28	3	15	13.50
29	4	19	17.00
30	2	21	20.00
31	4	25	23.00
32	5	30	27.50
33	3	33	31.50
34	4	37	35.00
35	3	40	38.50
36	5	45	42.50
37	2	47	46.00
38	3	50	48.50
39	2	52	51.00
40	1	53	52.50
41	2	55	54.00
42	2	57	56.00
43	2	59	58.00
44	2	61	60.00
45	2	63	62.00
46	1	64	63.50
47	1	65	64.50
48	2	67	66.00
49	1	68	67.50
50	2	70	69.00
51	3	73	71.50
52	1	74	73.50
53	3	77	75.50
54	4	81	79.00
55	3	84	82.50
56	4	88	86.00
58	1	89	88.50
59	3	92	90.50
61	1	93	92.50
62	1	94	93.50
63	1	95	94.50
66	3	98	96.50
67	1	99	98.50
69	1	100	99.50

Scorer Reliability

In encountering the problem of establishing the reliability of a new instrument with a specific population, it became necessary, as with the FVMSI, to investigate the reliability of the scoring system. The performance of the 41 subjects included in this phase of the study, on each of the sub-scales, was scored by the investigator and the second rater concurrently during the performance of the task. Investigator inter-rater correlations between scores on the sub-scales of the MPDI yielded coefficients between .7721 on the Ocular Motility sub-scale and .9864 on the Balance and Coordination (eyes closed) sub-scale (see Table 14 in Appendix). These coefficients reflected the simplicity of the scoring system with a range from one (cannot or will not perform) to four (performs adequately) which left little chance for variability. The concise nature of the scoring instructions also added to the reliability of the inventory.

Validity

Similar to the FVMSI, the criterion validity of the MPDI sub-scales was assessed by correlating each MPDI sub-scale in turn with each subject's annual adjusted income. It was hypothesized that the subjects who exhibited the most flexible and sophisticated motor-perceptual skills would be more efficient and capable workers and, as a result, earn larger incomes than the less coordinated subjects.

The correlation between scores on the Gross Motor sub-scale and annual adjusted incomes yielded a coefficient of .3539. This correlation revealed a positive relationship between gross motor performance and work productivty. The correlation between scores on the Balance and Coordination sections (eyes open and closed) yielded coefficients of $\underline{r}$ = .3811 and $\underline{4}$ = .3951, respectively, and also revealed a positive relationship between the motor-perceptual skills tested and the skills required for productive work. Similar findings and conclusions were drawn from the correlations between annual adjusted incomes and scores earned on the Balance and Coordination sections (eyes open and closed), $\underline{r}$ = .4261 and $\underline{r}$ = .4192, respectively, and between scores on the Ocular Motility sub-scale with annual adjusted incomes, $\underline{r}$ = .3727.

Analysis of intra-sub-scale correlations revealed significant intercorrelations at the .01 level between all sub-scales (see Table 15 in Appendix). This indicated that the sub-scales were all influenced by a general coordination factor. Since the test items required gross motor (walking), fine motor (fingers to thumb), balancing (standing on one foot), and visual skills (ocular motility), it was the investigator's belief that the MPDI sub-scales were measuring different aspects of the coordination criterion.

A t statistic was used to assess the difference between means for the SW and the A groups on gross motor scores earned by TMR subjects on the MPDI sub-scale.

The mean score of the high performing SW group ($\underline{n}$ = 77) was 26.00 with a standard deviation of 6.93. The mean performance for the low performing A group ($\underline{n}$ = 23) was 18.65 with a standard deviation of 4.90. When the difference between these means was treated statistically, the hypothesis ($H_{3.0}$) that high performing TMRs would perform at higher levels on the Gross Motor section of the MPDI than low performing TMRs was accepted, $\underline{t}$ (98) = 4.739, $\underline{p} < .01$. The results indicated that the Gross Motor subscale appeared to have validity in the assessment of those gross motor skills (walking, walking on toes, walking on heels, etc.) that affected successful work productivity.

In comparing balance and coordination skills with eyes opened between the SW and the A groups, a t[1] statistic was used (Winer, 1971). The mean performance of the SW group on the Balance and Coordination (eyes open) subscale ($\underline{n}$ = 77) was 42.60 with a standard deviation of 10.11. The mean performance for the A group ($\underline{n}$ = 23) on the same sub-scale was 28.09 with a standard deviation of 6.45. When the difference between these two means was treated statistically, hypothesis 4.0, which stated that high performing TMRs would perform at higher levels on the Balance and Coordination (eyes closed) sub-scale of the MPDI when compared with low performing TMRs, was accepted, $\underline{t}$ (57) = 8.189, $\underline{p} < .01$. Hypothesis 4.1, which stated that high performing TMRs would perform at higher levels on the Balance

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[1]Sutherwaite's approximation for the t distribution.

and Coordination (eyes closed) sub-scale of the MPDI was tested using the t statistic to assess the difference between the mean performances of the SW and A groups. The mean performance of the SW group (n = 77) on this sub-scale was 37.56 with a standard deviation of 10.66. The mean performance of the A group (n = 23) on the same sub-scale was 23.35 with a standard deviation of 7.15. Hypothesis 4.1 was accepted, t (98) = 5.992, p < .01. Both Balance and Coordination sub-scales combined with the Gross Motor sub-scale appeared to be valid measures of these gross motor skills which were required by the demands of work tasks. Skills such as walking, bending, and breaking with gravity, etc., though little problem to a normal population, were seriously delayed in the TMR population. Identification of these problem areas was facilitated by the use of the MPDI. Qualitative differences between the two groups were marked. Subjects who were high performers exhibited wider ranges of movement on specific tasks than the low performers. For example, though most low performers exhibited a limited ability to bend their knees or walk backwards, the subjects designated as high performers had a wider range of these behaviors and performed them more efficiently.

A t statistic was used to assess the difference between means for the SW and A groups on performance scores of the Coordination and Neural maturity (eyes open) sub-scale of the MPDI. The mean performance score for the SW group (n = 77) was 47.44 with a standard deviation of 11.01. The mean performance score for the A group (n = 23) was 32.44 with a standard deviation of 8.40. In testing the difference between these means, the obtained t value, t (98) = 6.027, p < .01, supported the hypothesis ($H_{5.0}$) that high performing TMR workshop clients would perform at higher levels on the Coordination and Neural Maturity (eyes open) sub-scale of the MPDI, when compared to low performing TMR workshop clients.

A t statistic was used to assess the difference between means for the SW and A groups on performance scores of the Coordination and Neural Maturity (eyes closed) sub-scale of the MPDI. The mean performance score for the SW group (n = 77) was 40.12 with a standard deviation of 11.18. The mean performance score for the A group (n = 23) was 25.74 with a standard deviation of 7.03. In testing the difference between these means, the obtained t value, t (58) = 7.400, p < .01, supported the hypothesis ($H_{5.1}$) that high performing TMR workshop clients would perform at higher levels on the Coordination and Neural Maturity (eyes closed) sub-scale of the MPDI than low performing TMR clients. Responses of the A group on this sub-scale indicated that the poor performers had a more difficult time maintaining their relationship to objects and positions in space than the high performers. Motor responses of the individuals in the A group were characteristically disorganized, lacking patterns, while the motor performance of the SW group appeared more consistent and flexible. It appeared that both of the Coordination and Neural Maturity sub-scales were valid measures of those fine motor and perceptual motor tasks necessarily present for efficient and capable completion of work tasks.

In comparing ocular motility performance between the SW and the A groups, a t statistic was used to assess the difference between means on the Ocular Motility sub-scale of the MPDI. The mean performance score for the SW group (n = 77) was 44.43 with a standard deviation of 12.11. The mean performance score for the A group was 29.65 with a standard deviation of 10.77. When the differences between these two means were statistically tested, the results, t (98) = 5.260, p < .01, supported the hypothesis ($H_{6.0}$) that high performing TMR workshop clients would perform at higher levels than low performing workshop clients. Since most work tasks presented to TMRs required vision as the primary avenue of perceptual input, ocular motility was considered an essential skill to evaluate. Both groups of subjects experienced difficulty with this task. Individuals in the SW group typically exhibited adequate ocular motility control but within restricted ranges from their midlines. The subjects from the A group had more difficulty moving their eyes independent from their head movement and many had not progressed beyond the level of fixation. All subjects, regardless of their placement level, exhibited difficulty in performing coordinated binocular convergent and divergent eye movements.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This investigation was conducted to determine if the FVMSI and the MPDI were reliable and valid measures of those fine visual-motor and motor-perceptual abilities that affected the performance of TMR adults on workshop tasks. The sample consisted of 100 TMR adults enrolled in a sheltered workshop program. Subjects were classified as either high performers or low performers on the basis of a thorough work evaluation and actual past performance.

Reliability coefficients for both the FVMSI and MPDI sub-scales were determined by correlating repeated measures of each sub-scale. Inter-rater reliability was assessed with a sub-sample of 41 TMR adults. Obtained coefficients gave sufficient evidence of the reliability of both inventories.

Concurrent validity coefficients of the FVMSI with the MPDI were all significant at the .01 level. The results supported the assumption that since both the FVMSI and MPDI were designed to measure sequential developmental traits, a positive relationship should exist between the inventories.

Criterion validity of both inventories was assessed by correlating each sub-scale in turn with each subject's annual adjusted income. Results indicated that both inventories had the potential to measure those perceptual-motor and motor-perceptual abilities that directly influenced job productivity.

Validity of the FVMSI as a measure of perceptual motor functioning was determined by correlating the FVMSI sub-scales with performance on the B-G test. Results indicated the comparability of the two instruments.

Construct validity of the FVMSI and MPDI sub-scales was investigated by using the t test to evaluate the differences between earned scores of the SW and A groups on both inventories. The results indicated the strength of both inventories as screening instruments in the assessment of those perceptual-motor and motor-perceptual abilities necessary for successful completion of work tasks.

Conclusions

A review of research that was directly concerned with work evaluation of the retarded yielded little more than quantitative descriptions and classifications of the mentally retarded as workers. Most studies reviewed had more applicability to general populations of retarded than to the TMR. Traditionally, evaluator's estimations of the work potential of the retarded was based on performance tests that measured the products of prior learning. The principal goals of these performance tests were their use as prediction and selection of criteria but the results of performance testing were used basically for classification.

Prediction referred to a relatively narrow band of events, such as the prediction of relative success on a standard work sample. Prediction, in a broader sense, referred to prediction of vocational adjustment or success. Obviously, the narrower the band of predicted outcomes the greater the strength of the predictive instrument. Performance tests were also used for selection of those individuals who might have performed certain tasks more efficiently than others and to choose who should have or should not have participated in training programs. If the goal of work evaluation was to conduct such criterion activities in the most efficient manner possible, then performance tests as predictors and selectors were reasonably appropriate. If, however, the goal of work evaluation was to emphasize habilitation rather than productivity, with the emphasis upon the individual's strengths and weaknesses, performance tests were not effective.

Retarded individuals have scored poorly on performance tests, not necessarily because they lacked the aptitude for these tasks, but frequently because the opportunities for them to learn the associations and skills demanded by the tasks were not uniformly present, and because the tasks failed to measure adequately the functional skills required for completion of those tasks. However, sufficient commonality between performance tests and productivity enabled the tests predictive use to become a succession of self-fulfilling prophecies.

A new philosophy regarding work evaluation of TMRs is suggested. Essentially, the goal of work evaluation should not be to establish an individual's relative standing on some inferred performance level, but to determine what the individual's needs are in the way of programming.

The initial goal of work evaluation must be the prescription of intervention procedures designed specifically to modify those functional abilities that relate to efficient production. This study indicated the relative strengths of the FVMSI and the MPDI as instruments that could provide the experienced work evaluator with an assessment of those abilities.

The primary problem does not lie in administering the FVMSI or the MPDI, since both are relatively simple to administer and score, but rather in coming up with a valid interpretation of the results. Differing levels of training are required depending upon the purpose of the interpretation. If the purpose of the screening is the identification of performance problems to make referrals, then little expertise is needed. However, to interpret the results into functional programming knowledge of performance levels coupled with an understanding of the progression and complexity of motor and perceptual development for the population being served is a necessity.

Recommendations

The results of this study indicated the feasibility of identifying potential performance problems in adult TMRs. The validity of the instruments as either descriptive or decision-making tools will be directly related to the skills of those who interpret them. More research, then, is indicated to determine what qualifications are necessary for personnel who administer and interpret the results of the inventories.

Investigations as to the efficiency of the FVMSI and MPDI are a priority. Classification as to their effectiveness and accuracy in identifying performance problems not previously recognized is a necessity. What damages could result from falsely identifying an individual as having a specific motor problem? How effective will follow-up from the test results be? How valid will program outcomes be?

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APPENDIX A

INTERPRETIVE DATA

TABLE 13

Correlation Coefficients of the FVMSI and MPDI between Pre-Test and Post-Test Scores for 100 TMR Adults

Variable	r
FVMSI	
Performance	.7956
Product	.8654
MPDI	
Gross Motor	.9724
Balance & Coordination (Eyes Open)	.9820
Balance & Coordination (Eyes Closed)	.9856
Coordination & Neural Maturity (Eyes Open)	.9709
Coordination & Neural Maturity (Eyes Closed)	.9423
Ocular Motility	.9489

TABLE 14

Correlation Coefficients Between Pre-Test Scores and Inter-Rater Scores on the FVMSI and MPDI for the Sub-Sample of 41 TMR Adults

Variable	r
<u>FVMSI</u>	
Product	.8625***
Gross Motor	.9406***
Balance & Coordination (Eyes Open)	.9484***
<u>MPDI</u>	
Balance & Coordination (Eyes Closed)	.9864***
Coordination & Neural Maturity (Eyes Open)	.1757***
Coordination & Neural Maturity (Eyes Closed)	.9589***
Ocular Motility	.7721***

***$p < .01$

TABLE 15

Intercorrelations of the FVMSI and MPDI Sub-Scales for the Sample of 100 TMR Adults

	Sub-Scales	Product	Gross Motor	Balance & Coord. (Eyes Open)	Balance & Coord. (Eyes Closed)	Coord. & Neural Maturity (Eyes Open)	Coord. & Neural Maturity (Eyes Closed)	Ocular Motility
FVMSI	Performance	.69	-.44	-.49	-.51	-.51	-.48	-.56
	Product		-.51	-.47	-.47	-.54	-.49	-.63
MPDI	Gross Motor			.88	.86	.85	.82	.70
	Balance & Coordination (Eyes Open)				.95	.88	.86	.69
	Balance & Coordination (Eyes Closed)					.90	.89	.69
	Coordination & Neural Maturity (Eyes Open)						.44	.77
	Coordination & Neural Maturity (Eyes Closed)							.72

TABLE 16

Means and Standard Deviations on the FVMSI and MPDI for 100 TMR Adults by Pre and Post-Test Performance

		Pre-Test n = 100		Post-Test n = 100	
Variables		$\overline{X}$	SD	$\overline{X}$	SD
FVMSI	Performance	6.01	2.49	6.26	2.64
	Product	7.38	2.70	7.47	2.61
MPDI	Gross Motor	24.31	7.16	26.59	7.80
	Balance & Coordination (Eyes Open)	34.26	11.19	42.24	11.77
	Balance & Coordination (Eyes Closed)	34.29	11.55	36.41	12.44
	Coordination & Neural Maturity (Eyes Open)	43.99	12.15	47.90	12.24
	Coordination & Neural Maturity (Eyes Closed)	36.81	11.99	39.73	13.08
	Ocular Motility	41.03	13.25	43.52	13.93

TABLE 17

Mean Adjusted Earnings for the Total Sample of 100 Mentally Retarded Adults

Group	$\bar{X}$
Adjustment n = 23	147.78
Sheltered Workshop n = 77	497.92
Total n = 100	417.39