43367

National Library of Canada | Bibliothèque nationale du Canada

CANADIAN THESES ON MICROFICHE | THÈSES CANADIENNES SUR MICROFICHE

NAME OF AUTHOR/*NOM DE L'AUTEUR* CHERYL R. CASTLE

TITLE OF THESIS/*TITRE DE LA THÈSE* THE PERFORMANCE OF EDUCABLE MENTALLY HANDICAPPED GIRLS ON THE CANADA FITNESS AWARD/ CAHPER FITNESS PERFORMANCE TEST

UNIVERSITY/*UNIVERSITÉ* UNIVERSITY OF ALBERTA

DEGREE FOR WHICH THESIS WAS PRESENTED/ *GRADE POUR LEQUEL CETTE THÈSE FUT PRÉSENTÉE* M.A.

YEAR THIS DEGREE CONFERRED/*ANNÉE D'OBTENTION DE CE GRADE* 1978

NAME OF SUPERVISOR/*NOM DU DIRECTEUR DE THÈSE* DR. A.E. "TED" WALL

Permission is hereby granted to the NATIONAL LIBRARY OF CANADA to microfilm this thesis and to lend or sell copies of the film.

The author reserves other publication rights, and neither the thesis nor extensive extracts from it may be printed or otherwise reproduced without the author's written permission.

L'autorisation est, par la présente, accordée à la BIBLIOTHÈQUE NATIONALE DU CANADA de microfilmer cette thèse et de prêter ou de vendre des exemplaires du film.

L'auteur se réserve les autres droits de publication; ni la thèse ni de longs extraits de celle-ci ne doivent être imprimés ou autrement reproduits sans l'autorisation écrite de l'auteur.

DATED/*DATÉ* OCT 20, 1978 SIGNED/*SIGNÉ* Cheryl R Castle

PERMANENT ADDRESS/*RÉSIDENCE FIXE* 50 WILSON CRES
SHERWOOD PARK, ALTA
T8A 3L2

NOTICE

The quality of this microfiche is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us a poor photocopy.

Previously copyrighted materials (journal articles, published tests, etc.) are not filmed.

Reproduction in full or in part of this film is governed by the Canadian Copyright Act, R.S.C. 1970, c. C-30. Please read the authorization forms which accompany this thesis.

THIS DISSERTATION
HAS BEEN MICROFILMED
EXACTLY AS RECEIVED

AVIS

La qualité de cette microfiche dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de mauvaise qualité.

Les documents qui font déjà l'objet d'un droit d'auteur (articles de revue, examens publiés, etc.) ne sont pas microfilmés.

La reproduction, même partielle, de ce microfilm est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30. Veuillez prendre connaissance des formules d'autorisation qui accompagnent cette thèse.

LA THÈSE A ÉTÉ
MICROFILMÉE TELLE QUE
NOUS L'AVONS REÇUE

THE UNIVERSITY OF ALBERTA

THE PERFORMANCE OF EDUCABLE MENTALLY HANDICAPPED GIRLS ON THE CANADA FITNESS AWARD/CAHPER FITNESS-PERFORMANCE TEST

by

© CHERYL R. CASTLE

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

DEPARTMENT OF PHYSICAL EDUCATION

EDMONTON, ALBERTA

FALL, 1978

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled The Performance of Educable Mentally Handicapped Girls on the Canada Fitness Award/ CAHPER Fitness-Performance Test submitted by Cheryl R. Castle in partial fulfilment of the requirements for the degree of Master of Arts.

.....
Supervisor

.....

.....

Date October 1978

ABSTRACT

The purpose of this study was to investigate the effects of an audio-visual presentation, continuous verbal encouragement, and the combined audio-visual presentation, followed by verbal encouragement on the scores of educable mentally handicapped girls performing the Canada Fitness Award/CAHPER Fitness-Performance Test. Subsidiary problems investigated the suitability of the test for use with educable mentally handicapped girls and compared the distribution of the subjects' scores with national norms.

The subjects were 48 educable mentally handicapped girls 159 to 183 months of age. Two intelligence levels were established within the educable mentally handicapped range. The differential effects of the three treatment conditions on the performance of the girls at the two intelligence levels were assessed. Analyses of variance were completed on the scores of the six items of the test battery. The .05 level of significance was used.

Verbal encouragement and the combined audio-visual presentation followed by the verbal encouragement did not have a significant effect on the scores of the girls at either intelligence levels. The audio-visual presentation did elicit an improvement in scores for the standing broad jump, however, the improvement was evident at the lower intelligence level only.

Overall, the distribution of scores for the high intelligence group did not differ from the national norms for the CAHPER Fitness-Performance Test except in situp scores where results favoured the performance of the educable mentally handicapped girls. The distribution of scores for the low intelligence group differed from the national norms on three test items, situps where results favoured the performance of the educable mentally handicapped girls, and the standing broad jump and shuttle run where results favoured normative data. The distribution of scores for 14 year old subjects differed from the norms on two items, situps where results favoured the performance of the educable mentally handicapped girls and the shuttle run where results favoured the normative data.

The following conclusions were stated: the Canada Fitness Award/CAHPER Fitness-Performance Test was judged suitable for use with these educable mentally handicapped girls; the audio-visual presentation was judged unnecessary but instruction in the standing broad jump was indicated; the verbal encouragement was ineffective but in the light of past findings further research in this area was recommended; the dual presentation of treatment conditions were contraindicated; and, as this study was unable to come to terms with the deficit performances in the shuttle run, further research in this area was recommended.

ACKNOWLEDGEMENTS

I would like to express my sincere thanks to Dr. A.E. Wall for his time, effort, and invaluable assistance in the preparation of this study.

I would also like to express my appreciation to Dr. R. Mulcahy and Dr. E.J. Watkinson for agreeing to act as members of my committee.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Few would argue the importance of motor proficiency in the daily lives of mentally retarded persons, not only in terms of leisure pursuits but, more notably, in terms of vocational pursuits (Bruininks, 1974). Recognition of this importance has drawn considerable attention to the physical training and performance of mentally retarded persons and its assessment.

Research has indicated a low positive relationship between intelligence and the performance of gross motor skills of mentally retarded persons which has not been apparent in their non-retarded peers (Distefano, Ellis & Sloan, 1958; Malpass, 1960; Sloan, 1951; Turnquist & Marsolf, 1954). Comparisons of the gross motor performance of mentally retarded subjects to that of their non-retarded peers have consistently indicated differences in physical performance in favour of the non-retarded subjects (Francis & Rarick, 1959; Geiger, 1975; Howe, 1959; McClure, 1970; Rarick & Dobbins, 1972; Rarick, Widdop and Broadhead, 1970). Although it has been shown that the mentally retarded follow a similar developmental pattern to their non-retarded peers and that there is a structural similarity of the motor domain of the two groups, marked differences seem to exist in the average levels of performance, with mean scores for the mentally retarded

subjects lagging two to four years behind normative data (Dobbins & Rarick, 1975; Francis & Rarick, 1959).

Unfortunately, several authors have reported problems in the assessment of gross motor performance tasks in dealing with mentally handicapped subjects. Peries (1976) reported difficulties in fitness testing and performance evaluation procedures owing to the mentally handicapped child's lack of cognitive appreciation of the stipulated task, his lack of experience with a variety of motor skills, and the presence of various degrees of lethargy and hyperactivity. Rarick and Dobbins (1972) reiterated the lack of necessary skill acquisition prior to testing. They noted that mentally retarded youngsters have displayed a reluctance to endure the physical discomfort of maximum effort, a lack of motivation in testing situations, and were easily distracted during testing procedures.

The main purpose of this study was to investigate two of these problem areas in dealing with mentally handicapped girls: the mentally handicapped child's possible lack of understanding of the stipulated task and his lack of motivation in physical fitness testing situations. Ultimately, it was hoped that the study would demonstrate effective means of minimizing these difficulties in physical fitness testing, thus permitting a truer measure of performance.

Several tests of physical fitness have been designed specifically for use with educable and/or trainable

mentally retarded subjects (AAHPER, 1968; Fait, 1967; Hayden, 1964; Johnson & Londeree, 1976). However, it has been demonstrated (Carter, 1966 cited in AAHPER, 1975a; Stein, 1965) that when educable mentally retarded subjects have participated in a regular systematic physical education program, as have the subjects chosen for this study, their performance is comparable to normative data in the AAHPER Youth Fitness Test (AAHPER, 1965), the American counterpart of the Canada Fitness Award (Health and Welfare Canada, 1973).

The subjects chosen for the study were educable mentally handicapped girls who were enrolled in a special vocational school administered by the Edmonton Public School Board. All girls had participated in a structured physical education program for at least one school year prior to this study, receiving at least three thirty-five minute periods of instruction per week.

Although most of the students had been exposed to the test, the Canada Fitness Award, formerly the CAHPER Fitness-Performance Test (CAHPER, 1966), was chosen to assess the physical fitness of the educable mentally handicapped girls. The Canada Fitness Award/CAHPER Fitness-Performance Test purports to measure the physical fitness of Canadian children seven to seventeen years of age. It is readily available from Health and Welfare Canada and is used in schools across the country. The test battery is comprised of six items; speed situps, the standing broad jump, the shuttle run, the flexed arm hang, the 50 yard dash, and the 300 yard run, each of

which purports to measure strength and endurance of abdominal muscles, explosive muscle power of the leg extensors, speed and agility, arm and shoulder girdle strength, explosive leg power and speed, and cardio-vascular efficiency respectively (CAHPER, 1966). Reliabilities reported on the items in this test when used with junior secondary school boys ranged from .725 to .859 (Crawford & Mason, 1974). It was reported that higher motivation might produce more consistent levels of performance, thereby, increasing the reliability of the test items.

To deal with the problems of cognitive understanding and motivation in using this test with educable mentally handicapped youngsters, three treatment conditions were established to investigate their effects on fitness test performance.

There is no doubt that these mentally handicapped students differ from their chronological age peers in terms of mental development and that, in testing motor performance, the lack of cognitive competence could contaminate performance results (Ellis & Craig, 1969). For example, consider the standing broad jump. With non-retarded subjects, the measurement of the jump would likely reflect the physical characteristics the test purports to measure, the power of the leg extensors. On the other hand, with the mentally retarded subjects, the measurement could reflect the ability of the subject to perform a novel skill, the standing broad jump. To help minimize this contamination, the first treatment

condition was an audio-visual presentation of a performance of each of the six test items. This presentation was designed to offer instruction in each of the items, to present a visual picture of the task, thus aiding the students in "getting the idea of the movement" (Wall, 1976), and to give appropriate verbal cues chosen to facilitate skill acquisition (Gold & Barclay, 1973). Although the audio-visual presentation was expected to enhance performance on all six test items, it was expected to have a significant effect on the results of the standing broad jump and the shuttle run, both considered more complex skill items (Jackson, 1975; Smith, 1972).

The second treatment condition was continuous verbal encouragement. It was included to motivate the subjects and to promote maximum effort during the performance of the fitness test. Motivational stimuli have been proven effective in enhancing the physical performance of educable mentally handicapped students (Levy, 1974; Stein, 1968). Continuous verbal encouragement was chosen because of its reported success in eliciting an improved response in physical performance tasks (Ellis & Distefano, 1959; Solomon, 1968 cited in AAHPER, 1975a) and because of its easy application to the classroom situation. Although verbal encouragement was expected to enhance performances on all six test items, it was expected to have a significant effect on the results of the endurance items, the speed situps, the flexed arm hang, and the 300 yard run where a maximum effort was required over

an extended period of time.

The third treatment condition was the combined use of the audio-visual presentation with the continuous verbal encouragement. The positive effects of each of the treatment conditions were expected to be in evidence, causing a compounded effect on the improvement of scores.

Finally, another independent variable was the level of intelligence of the girls. Each of the three treatment conditions was administered over two levels of intelligence within the educable mentally handicapped range.

Thus, the purpose of this study was to obtain information on the following questions:

1. Does an audio-visual presentation of a performance of each of the six test items of the Canada Fitness Award have an effect on the performance of educable mentally handicapped girls completing the test?
2. Does continuous verbal encouragement have an effect on the performance of educable mentally handicapped girls on the Canada Fitness Award?
3. Does the combined use of an audio-visual presentation of a performance of each of the six test items of the Canada Fitness Award, followed by continuous verbal encouragement during the test, have an effect on the performance of educable mentally handicapped girls completing the test?

4. Do any of the three treatment conditions described differentially affect the performance of the educable mentally handicapped girls on the Canada Fitness Award at the two intelligence levels?

5. Does the Canada Fitness Award/CAHPER Fitness-Performance Test prove to be an appropriate instrument for fitness testing with educable mentally handicapped girls when their performance scores are compared with the normative data provided for the test?

METHOD

SUBJECTS

The subjects included 54 cultural-familial educable mentally handicapped female students enrolled in the Year 1 and Year 2 programs at a special vocational school administered by the Edmonton Public School Board. The Wechsler Intelligence Scale for Children full scale scores, or the Stanford-Binet Intelligence Quotient where the WISC scores were not available, were used to classify the mentally retarded girls. The study excluded students diagnosed by school officials as having brain damage, physical disabilities, or behavioural difficulties.

EXPERIMENTAL DESIGN

This study was designed to examine the effects of three treatment conditions chosen to facilitate the fitness performance of educable mentally handicapped girls on the Canada Fitness Award program. To examine the possible differential effects that these treatment conditions might have on the performance of girls of different intelligence levels, high and low intelligence groups within the educable mentally handicapped range were established.

Initially, the sample was divided into two equal groups: a high intelligence group with IQ scores of 73 or higher and a low intelligence group with IQ scores of 72 or

less. The subjects within each intelligence level were then randomly assigned to the three treatment conditions resulting in six experimental groups each with nine subjects. Six students failed to complete the test and were eliminated, leaving twenty-four students at each intelligence level. A two-way analysis of variance resulted in significant differences between the high and the low intelligence groups; however, there were no significant differences among the three treatment groups at each intelligence level (Appendix E). Personal data on the six experimental groups is presented in Table 1.

Table 1

CA and IQ Data on Six Experimental Groups

Treatment		Audio-visual	Encouragement	Combination
Low IQ	n	7	8	9
	Mean IQ	66.2	62.1	61.6
	S.D.	3.2	3.4	6.5
	Mean CA (mos.)	168.14	167.50	169.22
	S.D.	4.91	8.12	5.09
High IQ	n	7	9	8
	Mean IQ	76.7	74.4	77.5
	S.D.	6.5	3.7	3.2
	Mean CA (mos.)	174.71	168.67	174.13
	S.D.	6.85	6.95	7.79

The resulting experimental design consisted of two levels on the intelligence factor, three levels within the

treatment factor, and pre-test and post-test scores on a repeated measures factor. The general format for the experimental design and statistical analysis is presented in Table 2.

Two independent variables were employed in this study. The first was the intelligence factor, the high and low intelligence groups for each treatment condition afforded the measurement of the differential effects of the treatments over the two intelligence levels.

The second independent variable included three treatment conditions. The first of these was an audio-visual presentation. A videotape was produced on a Sony AV3600 video recorder using a Sony CVC-2100A video camera. A female student enrolled in the school, not a subject in this study, performed each of the test items according to the instructions provided in the test manual (CAHPER, 1966) in the physical environment in which the subjects of the study would be tested. The audio portion providing explicit instructions as to how the subjects were to perform each of the test items was then recorded at appropriate moments during the tape. A complete description of the presentation is included in Appendix C.

The second treatment condition selected was continuous verbal encouragement. Appropriate verbal cues for each test item were chosen and provided at specified times during the performance of each subject. See Appendix D.

Table 2

General Format for the Analysis of Variance - Main Effects*

Source of Variation	k	df	df or error term	Results describe effect of
Intelligence (A)	2	1	42	Intelligence differences
Treatment (B)	3	2	42	Treatment differences
Pre-Post-Test (C)	2	1	42	Pre-Post-Test differences
Subjects	7-9			

*All factors are fixed, except subjects.

The third treatment condition was the combined use of the audio-visual presentation followed by continuous verbal encouragement during the performance of each test item.

The six dependent variables used in this study were the scores of the educable mentally handicapped girls on the six test items of the Canada Fitness Award/CAHPER Fitness-Performance Test: scores for speed situps, the standing broad jump, the shuttle run, the flexed arm Hang, the 50 yard dash and the 300 yard run.

PROCEDURE

Each of the three groups at each intelligence level was randomly assigned to one of the treatment conditions. Testing order within groups was randomly assigned.

The pre-test was administered to intact groups according to the instructions in the manual (CAHPER, 1966). The same instructions were given to all groups (Appendix B). All testing was done indoors: the 50 and 300 yard runs in the hallway, the shuttle run in the gymnasium and the speed situps, the flexed arm hang and the standing broad jump in an auxillary gymnasium.

The testing of the subjects was completed over a two week period. The actual test was conducted in two days. The first day included, in testing order, the 50 yard dash, speed situps, the flexed arm hang, the standing broad jump, and the shuttle run. The 300 yard run was completed on a

second day. Five students who were absent for their scheduled pre-test were tested at an alternate time during the same week.

The post-test was conducted the following week in the same manner, on the same days, and, as near as possible, at the same time as the pre-test. Intact groups and testing order were maintained. Those absentees pre-tested at the alternate time were incorporated into their treatment groups following the original testing order. Each of the three treatment conditions was presented to the appropriate group at each intelligence level.

The audio-visual presentation was displayed on a portable Sony Solid State Video Monitor CVM 920U. The entire group was seated in the test area and viewed the videotape together prior to performing each test item. The verbal encouragement groups received the identical instructions used in the pre-test prior to performing each test item and were then provided with the schedule of verbal encouragement during their performance. The combined audio-visual and verbal encouragement groups received both treatment conditions as outlined above.

Two subjects from the high intelligence combined treatment group, one subject from the low intelligence audio-visual presentation group, and one subject from the low intelligence verbal encouragement group were absent from the scheduled post-test session and were tested individually later in the week at the same time of day under the

appropriate treatment condition. Absenteeism also resulted in subject loss from the experimental groups. The numbers of students completing both stages of the test under the assigned treatment condition are included in Table 1. One exception to be noted occurred in the low intelligence combined treatment group where two subjects failed to complete the 300 yard run post-test and, for this item only, were eliminated from the statistical analysis.

STATISTICAL TREATMENT OF DATA

A two-way analysis of variance was completed on the intelligence scores to determine if a significant difference in intelligence actually existed between the two intelligence groups. The data was processed at the University of Alberta Computing Services, using DERS: ANOV 25.

A three-way analysis of variance, fixed effect model with repeated measures on one factor was used to compare the pre-test and post-test results under the three treatment conditions at the two intelligence levels. The data was processed at the University of Alberta Computing Services, using the Statistical Package for the Social Sciences program.

The chi square test for goodness of fit was used on both the pre-test and the post-test scores to compare the performance results of the educable mentally handicapped girls with national norms.

RESULTS

Summary tables of the three-way analyses of variance for the six dependent variables are included in Appendix F. The .05 level of significance was used for this study. The results, as related to each of the dependent variables, will be presented in six appropriate subsections. Comparisons of the pre-test scores, the post-test scores, and the post-test scores for the 14 year old girls with the published norms for the CAHPER Fitness-Performance Test are also included.

STANDING BROAD JUMP

As indicated in Table 3, the significant three-way

Table 3

Simple Effects Tests for Standing Broad Jump Means Within the Significant Interaction of Intelligence Level, Treatment Conditions and Pre-Post Testing

Source	S.S.	d.f.	M.S.	F
IQ x T x P-P	71.277	2	35.638	4.64*
T x P-P at IQ_1	125.571	1	125.71	16.368*
T x P-P at IQ_2	37.07	1	37.07	4.82

*p ≤ .05

interaction of intelligence groups, treatment conditions and pre-post testing was analyzed on the basis of intelligence

levels. The simple effects tests indicated that there was a significant interaction only at the lowest intelligence level.

As illustrated in Figure 1 and presented in Table 4, further simple effects tests confirmed that a significant pre-post-test difference in standing broad jump performance was found only under the audio-visual presentation treatment condition. Furthermore, the post-test mean for the audio-visual presentation treatment group was significantly greater than the standing broad jump means obtained by the groups under the other two treatment conditions; however, no significant differences were found among the three treatment condition means during the pre-testing.

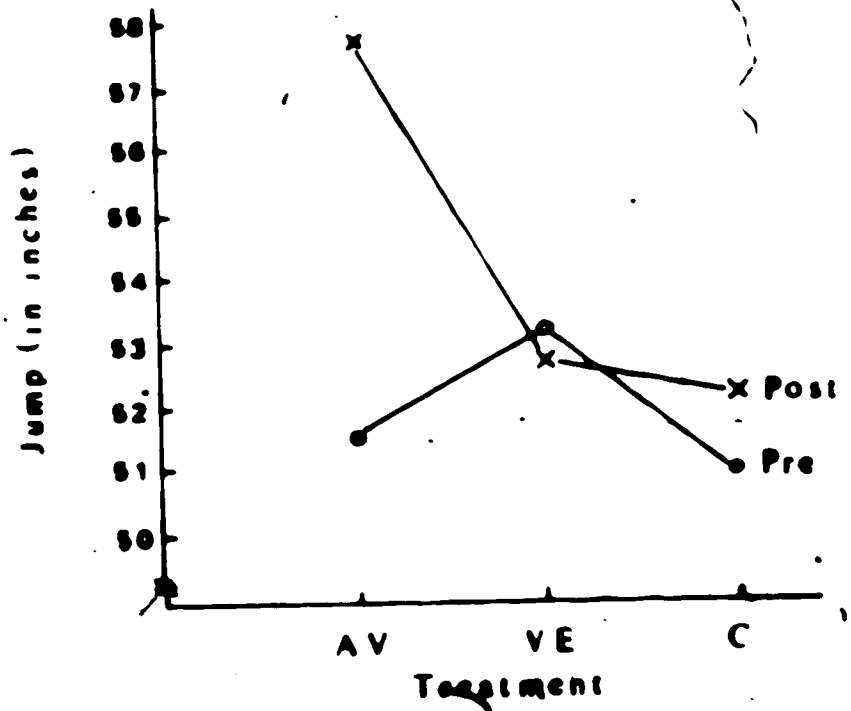

Figure 1. Standing Broad Jump: Low Intelligence: Treatment x Pre-post Testing Interaction

Table 4

Tests on Pre-test and Post-test Means of Standing Broad Jump Scores Under Three Treatment Conditions for the Low Intelligence Group

Pre-test/Post-test	Means (Inches)
Pre-test	
Audio-visual Presentation (AV_1)	51.571
Verbal Encouragement (VE_1)	53.125
Combined (C_1)	51.000
Post-test	
Audio-visual Presentation (AV_2)	57.714
Verbal Encouragement (VE_2)	52.750
Combined (C_2)	52.333
	F(1,42;1,42)
H1: $AV_2 > AV_1$	5.43*
H2: $VE_2 = VE_1$	.33
H3: $C_1 = C_2$	1.179
H4: $AV_1 = VE_1$	1.37
H5: $AV_1 = C_1$	.505
H6: $VE_1 = C_1$	1.880
H7: $AV_2 > VE_2$	4.39*
H8: $AV_2 > C_2$	4.762*
H9: $VE_2 > C_2$	.369

*$p \leq .05$

The analysis of variance of the scores on the standing broad jump also resulted in a significant treatment x pre-post testing interaction (Appendix F.1). The results of the simple effects test on the above interaction are presented in Table 5; they indicate that a significant pre-post-test difference was found only for the audio-visual presentation treatment condition. Furthermore, the mean of this treatment condition was significantly greater than the means of the other two treatment conditions.

This finding is congruent with the above intelligence x treatment x pre-post testing interaction as this higher-order interaction was traced to significant pre-post-test differences under the audio-visual presentation condition only for the lowest intelligence group. Therefore, the treatment x pre-post testing interaction must be interpreted in the light of the above results.

The main effect for intelligence level was significant, indicating that the girls in the low intelligence group jumped approximately five inches less than the higher intelligence group under all treatment conditions, however, this main effect is qualified by the results obtained on the above higher order interactions.

SHUTTLE RUN

As in the standing broad jump, the results of the analysis of variance for the shuttle run scores indicated that the girls in the higher intelligence group ran faster

Table 5

Tests on Pre-test and Post-test Means of Standing Broad Jump Scores under Three Treatment Conditions

Pre-test/Post-test	Means (Inches)
Pre-test	
Audio-visual Presentation (AV_1)	55.357
Verbal Encouragement (VE_1)	53.294
Combined (C_1)	55.529
Post-test	
Audio-visual Presentation (AV_2)	59.000
Verbal Encouragement (VE_2)	54.588
Combined (C_2)	55.471
	$F(1,42;1,42)$
H1: $AV_2 > AV_1$	20.736*
H2: $VE_2 = VE_1$	2.60
H3: $C_2 = C_1$	.005
H4: $AV_1 = VE_1$	2.578
H5: $C_1 = AV_1$	.215
H6: $C_1 = VE_1$	2.793
H7: $AV_2 > VE_2$	5.52*
H8: $AV_2 > C_2$	4.11*
H9: $C_2 = VE_2$	1.10

*$p \leq .05$

than their less intelligent counterparts (Appendix F.2). Furthermore, a significant improvement in shuttle run performance was found between the pre-test and post-test scores. Table 6 shows the mean pre-test and post-test scores for the girls under each treatment condition. The average pre-post-test improvement over the three treatment conditions was .29 seconds; however, much of this improvement can be attributed to the girls in the audio-visual group.

Table 6

Pre-Post-Test Means (in Seconds) for the Shuttle Run under Three Treatment Conditions

Treatment	Pre-test	Post-test	Difference
Audio-visual	13.51	12.91	.60
Encouragement	13.26	13.12	.14
Combined	13.51	13.32	.19
Overall	13.42	13.13	.29

SPEED SITUPS

Results of the analysis of variance on the speed situp scores indicated that the girls significantly improved their scores between the pre-test and post-test, irrespective of treatment condition (Appendix F.3). Table 7 shows the mean pre-test and post-test scores for speed situps under the three treatment conditions. The overall difference in performance, 1.56 situps, represents less than two situps during the minute

performance period. Much of the improvement can be attributed to the girls who performed under the encouragement condition; furthermore, the girls in the audio-visual presentation group performed fewer situps in the post-test than in the pre-test.

Table 7

Pre-Post-Test Means for the Number of Situps under Three Treatment Conditions

Treatment	Pre-test	Post-test	Difference
Audio-visual	32.64	32.36	-.28
Encouragement	29.12	31.94	2.82
Combined	29.53	31.35	1.82
Overall	30.29	31.85	1.56

FLEXED ARM HANG

The analysis of variance on the flexed arm scores resulted in no significant differences for all three treatment conditions (Appendix F.4).

300 YARD RUN

The results of the analysis of variance on the 300 yard run scores indicated that the girls significantly improved their performance between the pre-test and the post-test. Table 8 presents the pre-test and the post-test mean times for the girls as well as the group means under the three treatment conditions. The improvement in performance time for the girls was 1.66 seconds.

Table 8

Pre-Post-Test Means (in seconds) for the 300 Yard Run under Three Treatment Conditions

Treatment	Pre-test	Post-test	Difference
Audio-visual	74.57	73.79	.78
Encouragement	74.59	72.82	1.77
Combined	75.33	73.00	2.33
Overall	74.83	73.17	1.66

50 YARD DASH

The analysis of variance on the 50 yard dash scores resulted in no significant differences for all three treatment conditions (Appendix F.6).

COMPARISONS TO PUBLISHED NORMS

Chi square results are presented in Tables 9, 10, and 11. The .05 level of significance was used for these comparisons.

Pre-test results, presented in Table 9, indicated that the distribution of scores for the low intelligence group did not compare favourably with the norms on three test items: the standing broad jump, the shuttle run, and the 300 yard run. On the other hand, their scores were compatible with the normed distribution in the flexed arm hang and the 50 yard dash and actually exceeded the norms in speed situps. Comparisons with the high intelligence group indicated no difference in the distribution of scores except

Table 9

Number of Scores in Each Quartile of National Age Percentile Scales for the Pre-test Results

Quartile	Situps	Jump	Shuttle	Hang	50	300
Low Intelligence						
4	14	0	0	6	12	2
3	7	4	4	3	6	3
2	2	10	8	10	8	6
1	1	10	12	5	8	11
Chi Square+	17.68*	12.01*	13.34*	4.34	4.01	8.92*
High Intelligence						
4	17	4	7	4	11	4
3	4	5	4	10	2	8
2	2	10	3	8	6	6
1	1	5	10	2	5	6
Chi Square	27.68*	5.68	5.01	6.68	7.01	1.34
Combined Intelligence Groups						
4	31	4	7	10	13	6
3	11	9	8	13	8	11
2	4	20	11	18	14	12
1	2	15	22	7	13	17
Chi Square	43.82*	12.16*	11.82*	5.49	1.82	5.16

+Chi square compared the actual distribution of scores in each quartile with an expected distribution in which 25% of the scores fell into each quartile.

*$\chi^2.95 = 7.82$ with 3 degrees of freedom.

in the case of speed situps where, again, results favoured the mentally retarded subjects. Combining both intelligence levels resulted in comparisons favouring the norms in the standing broad jump and the shuttle run, favouring the mentally retarded subjects in the situps, and indicating no differences in the flexed arm hang, the 50 yard dash and the 300 yard run.

Post-test results, presented in Table 10, indicated that the distribution of scores of the low intelligence group did not compare favourably with the norms in the standing broad jump and the shuttle run, were compatible in the flexed arm hang, the 50 yard dash, and the 300 yard run, and, again, actually exceeded the norms in speed situps. The high intelligence group distribution of scores exceeded the norms for situps and were compatible with comparisons made on all test items except the flexed arm hang. Combining both intelligence levels resulted in comparisons favouring the norms in the flexed arm hang, favouring the mentally retarded subjects in situps, and indicating no differences in the standing broad jump, the shuttle run, the 50 yard dash and the 300 yard run.

Chronological age grouping provided 9, 25, and 14 subjects at 13, 14 and 15 years of age respectively. [illegible] 14 year old age group provided sufficient subjects f[illegible] chi square test and results presented in Table 11 [illegible] no differences between the norms and the subjects' [illegible] except in the shuttle run where the norms were favour[illegible]

Table 10

Number of Scores in Each Quartile of National Age Percentile Scales for the Post-test Results

Quartile	Situps	Jump	Shuttle	Hang	50	300
Low Intelligence						
4	17	3	0	6	3	3
3	5	2	6	6	7	4
2	1	10	7	9	5	6
1	1	9	11	3	9	9
Chi Square+	28.68*	8.34*	10.34*	3.00	3.34	3.83
High Intelligence						
4	20	6	7	5	10	7
3	3	5	5	7	5	8
2	1	8	4	11	4	4
1	0	5	8	1	5	5
Chi Square	44.34*	1.01	1.68	8.68*	3.68	1.68
Combined Intelligence Groups						
4	37	9	7	11	13	10
3	8	7	11	13	12	12
2	2	18	11	20	9	10
1	1	14	19	4	14	14
Chi Square	71.82*	6.16	6.32	10.82*	1.16	1.14

+Chi square compared the actual distribution of scores in each quartile with an expected distribution in which 25% of the scores fell into each quartile.

*$\chi^2.95 = 7.82$ with 3 degrees of freedom.

Table 11

Number of Scores in Each Quartile of National Age Percentile Scales Post-test Results - 14 Year Olds

Quartile	Situps	Jump	Shuttle	Hang	50	300
4	18	4	2	5	7	7
3	5	3	5	7	6	6
2	1	10	6	11	3	2
1	1	8	12	2	9	8
Chi Square+	31.16*	5.24	8.44*	6.84	3.00	3.48

+Chi square compared the actual distribution of scores in each quartile with an expected distribution in which 25% of the scores fell into each quartile.

*$\chi^2.95 = 7.82$ with 3 degrees of freedom.

in the situps where the performance of the mentally retarded subjects was favoured.

DISCUSSION

The results will be discussed in terms of the six dependent variables, the comparisons to the published norms, and the intelligence factor. The standing broad jump and the shuttle run, which were expected to be improved by the audio-visual presentation, will be considered first. The speed situps, the flexed arm hang, and the 300 yard run, hypothesized for improvement through verbal encouragement, will then be discussed, followed by the 50 yard dash.

STANDING BROAD JUMP

It was expected that the standing broad jump scores would be significantly improved by the audio-visual presentation and, furthermore, the combined verbal encouragement plus audio-visual presentation might result in even greater improvements in performance. The verbal encouragement was expected to have minimal effect on the standing broad jump performance. As reported in Figure 1 and Tables 4 and 5, the audio-visual presentation did in fact, improve the standing broad jump performance of the girls in the lower intelligence group. It should be noted that the standing broad jump has been considered a complex perceptual-motor skill rather than simply a measurement of the explosive power of the leg extensors (Smith, 1972). The significantly depressed scores of the lower intelligence

group tends to confirm this analysis.

The significant improvement of the girls in the lower intelligence group, after viewing the audio-visual presentation, must be considered a rather clear effect as it improved their scores more than 20 percentile points on the norms for 14 year old girls published in the CAHPER Fitness-Performance Test Manual (1966). The lack of a significant improvement in the performance of the high intelligence group might suggest that these subjects had an adequate understanding of the task prior to the testing.

SHUTTLE RUN

It was expected that the shuttle run scores like the standing broad jump scores, would be significantly improved by the audio-visual presentation, possibly more so by the combined verbal encouragement plus audio-visual presentation. The verbal encouragement alone was expected to have a minimal effect. Results, however, indicated that none of the three treatments had a significant effect on the performance of the girls. The shuttle run has been criticized as an indicator of fitness (Smith, 1972), since it involves so many variables, e.g. body control, agility, co-ordination, hand-eye co-ordination, etc. It is possible that the audio-visual presentation did not, in fact, could not present the salient features of this task sufficiently to elicit the significantly improved response hypothesized.

Results did indicate a significant pre-post test difference not attributable to any particular treatment,

however, though significant, the average improvement of .29 seconds must be termed minimal as it represents less than 5 percentile points in this score range on the norms for 14 year old girls as published in the CAHPER Fitness-Performance Test Manual (1966).

The analysis of variance also indicated a significant difference between the performance of the two intelligence groups, a finding compatible with what research would suggest (Fait & Kupferer, 1956) owing to the complexity of the task.

SPEED SITUPS

It was expected that the speed situp scores of the girls would be significantly improved by the verbal encouragement, possibly more so by the combined verbal encouragement plus audio-visual presentation. The audio-visual presentation alone was expected to have little or no effect. Results indicated that none of the three treatment conditions had a differential effect on the improvement of situp performance. It is possible that verbal encouragement did not offer a strong enough motivation to overcome the recollection of the discomfort endured during the maximum effort which was exerted on the pre-test held the previous week; however, the verbal encouragement group did improve the most in terms of absolute performance. Comparisons to the norms also indicated that both the pre-test and the post-test scores for speed situps for these girls were

skewed toward the upper percentile ranks, indicating a high level of performance throughout.

There was a significant pre-post test improvement overall. However, though significant, the improvement represented less than two situps per minute, approximately 5 percentile points or less on the norms for 14 year old girls (CAHPER, 1966).

FLEXED ARM HANG

It was expected that the verbal encouragement would have a significant effect on the flexed arm hang scores, that the combined verbal encouragement and audio-visual presentation might have a greater effect on performance but that the audio-visual presentation alone would have a minimal effect. Results indicated no significant differences in performances under any of the treatment conditions. However, the high variability in scores reported and the high intra-individual variability evident in this event might account for this lack of significance. These findings are in agreement with the high variability of scores reported in the norms for the flexed arm hang for 14 year old girls published in the CAHPER Fitness-Performance Test Manual (1966). Such high variability would also make standardizing motivational cues very difficult and, thus, might explain the lack of response to the verbal encouragement treatment condition.

300 YARD RUN

As with situps and the flexed arm hang, it was expected that verbal encouragement would have a significant effect on the improvement of scores for the 300 yard run, perhaps even more so when combined with the audio-visual presentation. The audio-visual presentation alone was expected to have little effect. As was the case with the other two mentioned subtests, results indicated no significant difference in performance under any one treatment condition. Perhaps the physical separation from the source of verbal encouragement decreased its effectiveness or the length of time over which the encouragement was given caused a diminishing of the motivational effect.

There was an overall significant pre-post test difference not attributable to any particular treatment The difference was, however, only 1.66 seconds, representing approximately 5 percentile points on the norms for 14 year old girls' performance in the CAHPER Fitness-Performance test Manual (1966).

50 YARD DASH

It was thought that it would be difficult for any of the three treatment conditions used in this study to have a marked effect on the 50 yard dash scores for the girls and, therefore, no significant differences were expected. Such was the case. The number of variables of

performance involved in this event, the short period of time over which the test occurs, the importance of reaction time (Bolonchuk, 1971) in the score, and the physical separation of the subject from the source of verbal encouragement might have diminished the effectiveness of any of the three treatment conditions.

COMPARISONS TO PUBLISHED NORMS

The performance of the educable mentally handicapped girls, on the whole, compared favourably with the published national norms. Generally, the distribution of their scores did not differ from the expected distribution in the results for the flexed arm hang, the 50 yard dash, and the 300 yard run with the exception of two instances where high intra-individual variability of scores is thought to have had an influence on scores. Comparisons for situps consistently favoured the performance of the mentally retarded girls. In fact, only in the case of the standing broad jump and the shuttle run with the low intelligence group were there consistent discrepancies in the comparisons. As previously mentioned, these items are considered more complex and, therefore, this finding is congruent with expectations.

Since the high intelligence group compared favourably on all items except the post-test flexed arm hang, this study seems to indicate that these youngsters are suitable subjects for the Canada Fitness Award program as

it is presently structured. In terms of the program, owing to the fact that qualification in but four of the six events is required for an award, success would certainly seem to be within the reach of a very reasonable number of all subjects who participated in this study.

INTELLIGENCE

Analysis of variance results of the six test items indicated significant differences in performance between the two intelligence levels on two items: the standing broad jump and the shuttle run. As the physical performance of mentally retarded subjects is thought to be related to the complexity of the task (Fait & Kupferer, 1956) and the standing broad jump and shuttle run are considered more complex tasks (Smith, 1972), these results are in keeping with the hypotheses of this study. A deficit in understanding these complex tasks was indicated in the low intelligence group and, therefore, as was clearly the case with the standing broad jump, the need for instruction is evident. Comparisons with the published norms also indicated differences in performance between the two intelligence levels, the higher intelligence level more closely approximating the performance indicated by the norms than the lower intelligence level.

Recent definitions of mental retardation (Kauffman & Hallahan, 1974) have been based on descriptions of adaptive behaviour and not simply intelligence assessment scores. A diagnostic-prescriptive process has been used to identify

behavioural excesses and deficits and it has been on this basis that students have been assigned to special education programs. This trend has resulted in the inclusion in this study of students whose intelligence scores approach and, in some cases, exceed the previously defined IQ limits for the educable mentally handicapped but whose adaptive behaviour has resulted in their placement within this category. This could account in part for the favourable comparisons between the scores of the high intelligence group and the normative data.

CONCLUSIONS

This study has indicated that an audio-visual presentation was not a worthwhile endeavour with the Canada Fitness Award/CAHPER Fitness-Performance Test. However, a need for instruction in skill items such as the standing broad jump was indicated, especially with students in the lower end of the intelligence range. Although verbal encouragement during the performance of the test was not successful in this study, in view of past findings, further investigation in this area is recommended. The dual presentation of treatment conditions is contrainindicated.

The subjects' success with the Canada Fitness Award/ CAHPER Fitness-Performance Test would support its suitability as a testing vehicle for educable mentally handicapped girls thirteen to fifteen years of age who have had similar opportunities to participate in a regular structured physical education program. As mentioned, since

the Award program requires qualifying performance in but four of the six test items, according to this data, the Canada Fitness Awards are attainable by these students and provide them a rare opportunity of success when being compared with normal students.

BIBLIOGRAPHY

American Alliance for Health, Physical Education and Recreation. Annotated research bibliography in physical education, recreation, and psychomotor function of mentally retarded persons. Washington, D.C.: AAHPER, 1975. (a)

American Alliance for Health, Physical Education and Recreation. Testing for impaired, disabled and handicapped individuals. Washington, D.C.: AAHPER, 1975. (b)

American Alliance for Health, Physical Education and Recreation. Youth fitness test manual (3rd ed.). Washington, D.C.: AAHPER, 1975. (c)

American Association for Health, Physical Education and Recreation. Special fitness test manual for the mentally retarded. Washington, D.C.: AAHPER, 1968.

American Association for Health, Physical Education and Recreation. Youth fitness test manual. (Rev. ed.). Washington, D.C.: AAHPER, 1965.

Bolonchuk, W.W. A critical analysis of the AAHPER youth fitness test. A summer research project sponsored by the Louis W. and Maud Hill Family Foundation, St. Paul, Minn., 1971. (ERIC Document Reproduction Service No. ED 103 414).

Brace, D.K. Motor fitness of MR boys relative to national age norms. Paper presented to the Research Section AAHPER National Convention, Atlantic City, N.J., 1961. (ERIC Document Reproduction Service No. ED 084 758).

Brown, B.J. Mental age and physical performance of trainable mentally retarded. Training School Bulletin, 1973, 70, 131-134.

Bruininks, Robert H. Physical and motor development of retarded persons. International Review of Research in Mental Retardation, 1974, 7, 209-261.

Canadian Association for Health, Physical Education and Recreation. The CAHPER fitness-performance test manual. Ottawa: CAHPER, 1966.

Crawford, G.L., and Mason, G.P. Reliability of the CAHPER fitness-performance test with junior secondary school boys. CAHPER Journal, 1974, 40, 12-17.

Distefano, M.K., Ellis, N.R., and Sloan, W. Motor proficiency in mental defectives. Perceptual and Motor Skills, 1958, 8, 231-234.

Dobbins, D.A., and Rarick, G.L. Structural similarity of the motor domain of normal and educable retarded boys. Research Quarterly, 1975, 46, 447-456.

Dobbins, D.A., and Rarick, G.L. Separation potential of educable retarded and intellectually normal boys as a function of motor performance. Research Quarterly, 1976, 47, 346-356.

Docherty, D., and Collis, M.L. The CAHPER fitness-performance test revisited. CAHPER Journal, 1976, 42, 35-38.

Ellis, M.J., and Craig, T.T. A note on the inferiority of retardates' motor performance. Journal of Motor Behavior, 1969, 1, 341-346.

Ellis, N.R., and Distefano, M.K. Effects of verbal urging and praise upon rotary pursuit performance in mental defectives. American Journal of Mental Deficiency, 1959, 64, 486-490.

Fait, Hollis F. Physical fitness test battery for mentally retarded children (trainable and educable). Storrs, Conn.: Connecticut University, 1967. (ERIC Document Reproduction Service No. ED 039 671).

Fait, H.F., and Kupferer, H.J. A study of two motor achievement tests and its implications in planning physical education activities for the mentally retarded. American Journal of Mental Deficiency, 1956, 60, 729-732.

Francis, R.J., and Rarick, G.L. Motor characteristics of the mentally retarded. American Journal of Mental Deficiency, 1959, 63, 792-811.

Geiger, W.L. The perceptual- and gross-motor ability of mentally retarded children. Paper presented at the Midwest AHPER Convention, Grand Rapids, Michigan, 1975. (ERIC Document Reproduction Service No. ED 115 062).

Gold, M.W., and Barclay, C.R. The effects of verbal labels on the acquisition and retention of a complex assembly task. Training School Bulletin, 1973, 70, 38-42.

Hayden, F.J. Physical Fitness for the mentally retarded: A manual for teachers and parents. Toronto: Metropolitan Toronto Association for Retarded Children, 1964.

Hayden, Frank J., and Yuhasz, Michael S. The fitness-performance of Canadian children and youth. Research proposal for Recreation Canada, 1975. (Mimeographed).

Health and Welfare Canada. Canada fitness award manual. Ottawa: Recreation Canada, 1973.

Heber, R.F. Motor task performance of high grade mentally retarded males as a function of the magnitude of incentive. American Journal of Mental Deficiency, 1959, 63, 667-677.

Howe, C.E. A comparison of motor skills of mentally retarded and normal children. Exceptional Children, 1959, 23, 352-354.

Jackson, A.S. An evaluation of the AAHPER youth fitness test. Paper presented at the evaluation section of the annual meeting of AAHPER, Atlantic City, N.J., 1975. (ERIC Document Reproduction Service No. ED 103 411).

Johnson, L., and Londeree, Ben. Motor fitness testing manual for the moderately mentally retarded. Washington, D.C.: AAHPER, 1976.

Kauffman, J.M. and Hallahan, D.P. The medical model and the science of special education. Exceptional Children, 1974, 41, 97-102.

Kral, P.A. Motor characteristics and development of retarded children: Success experience. Education and Training of the Mentally Retarded, 1972, 7, 14-21.

Levy, J. Social reinforcement and knowledge of results as determinants of motor performance among EMR children. American Journal of Mental Deficiency, 1974, 78, 752-758.

Malpass, L.F. Motor proficiency in institutionalized and non-institutionalized retarded children and normal children. American Journal of Mental Deficiency, 1960, 64, 1012-1015.

McClure, K.L. A comparison of the performance of EMR girls and intellectually normal girls on the AAHPER youth fitness test battery. (Doctoral dissertation, University of Georgia, 1970). Dissertation Abstracts International, 1970, 30, 3306A. (University Microfilms, 1970, No. 70-1180).

Peries, Dr. V.P. Fitness testing and evaluation procedures for mentally retarded children. Journal for Special Educators of the Mentally Retarded, 1976, 12, 192-195.

Rabin, H.M. The relationship of age, intelligence and sex to motor proficiency in mental defectives. American Journal of Mental Deficiency, 1957, 62, 507-516.

Rarick, G.L. The factor structure of motor abilities of educable mentally retarded children. In G.A. Jervis (Ed.), Expanding concepts in mental retardation: A symposium. Springfield, Ill.: Charles C. Thomas, 1968.

Rarick, G.L., and Dobbins, D.A. Basic components in the motor performance of educable mentally retarded children: Implications for curriculum development. (Grant No. OEG-0-70-2368-610), Washington, D.C.: U.S. Office of Education, 1972.

Rarick, G.L., Widdop, J.H., and Broadhead, G.D. Physical fitness and motor performance of educable mentally retarded children. Exceptional Children, 1970, 36, 509-519.

Sengstock, W.L. Physical fitness of mentally retarded boys. Research Quarterly, 1966, 37, 113-120.

Sloan, W. Motor proficiency and intelligence. American Journal of Mental Deficiency, 1951, 55, 394-406.

Smith, C.D. Fitness testing: Questions about how, why and with what. Journal of Health, Physical Education and Recreation, 1972, 43, 37-8.

Solomon, A.H., and Pangle, R. Demonstrating physical fitness improvement in the EMR. Exceptional Children, 1967, 34, 177-181.

Speakman, Hadden G.B. A critique of the special fitness test. Paper presented at the 89th Annual Convention of AAHPER, Anaheim, California, 1974. (ERIC Document Reproduction Service No. ED 103 347).

Stein, J.V. Physical fitness of mentally retarded boys relative to national age norms. Rehabilitation Literature, 1965, 26, 205-208.

Stein, J.V. Current status of research on physical activity for the retarded. In G.A. Jervis (Ed.), Expanding concepts in mental retardation: A symposium. Springfield, Ill.: Charles C. Thomas, 1968.

Turnquist, D.A., and Marzolf, S.S. Motor abilities of mentally retarded youth. Journal of Health, Physical Education, and Recreation, 1954, 25, 43-44.

Wall, A.E. The motor performance of the mentally retarded. McGill Journal of Education, 1976, XI, 74-82.

APPENDIX A

APPENDIX A

REVIEW OF LITERATURE

Motor proficiency and physical work capacity are of primary importance to the health, leisure pursuits, and, in fact, the very livelihood of mentally handicapped persons. Kennedy Foundation grants, concern of government agencies, and the widespread support for the "Special Olympic" program have all served to focus attention on physical education for the mentally retarded and have provided funds for much needed research. An extensive review of the literature indicated little work had been completed in the area with the Canada Fitness Award Test but studies involving the similar AAHPER Youth Fitness Test, the Special Fitness Test, and other physical performance measures are abundant.

AAHPER (1975a) has published an extensive annotated bibliography dealing with physical education, recreation, and psychomotor functions of mentally retarded persons. Bruininks (1974) has presented an informative review article dealing with the physical and motor development of retarded persons. Similarly, Kral (1972) has summarized studies involving retardate-normal comparisons on a variety of motor performance and fitness tests.

This study is concerned with the physical fitness testing of educable mentally handicapped girls and attempts

to investigate some of the cognitive and motivational aspects of such testing. Among the difficulties mentioned in evaluating the performance of educable handicapped youngsters have been their lack of understanding of the cognitive aspects of the tests (Peries, 1976) and their seeming unwillingness to approach and/or endure marked physical discomfort under test conditions (Rarick & Dobbins, 1972). This review of the literature deals with the physical fitness and motor performance of educable mentally handicapped youngsters, motivational considerations, cognitive considerations, and comments on the AAHPER Youth Fitness Test, the latter since it more closely approximates the Canada Fitness Awards Test than other tests discussed in the literature.

MOTOR PERFORMANCE, FITNESS, AND IQ

Earlier research indicated a low positive relationship between intelligence and the motor performance of mentally handicapped persons which was not apparent in non-retarded subjects (Brace, 1961; Distefano, Ellis & Sloan, 1958; Malpass, 1960; Sloan, 1951; Turnquist & Marzolf, 1954). Rabin (1957) cited similar correlations but his results failed to show significance, an occurrence he explained by an uncontrolled Examiner-Institution variable which, when taken into consideration, suggested the results would have been significantly positive. More current research (Fait, 1967; Geiger, 1975; Rarick, Widdop, & Broadhead; 1970) has

supported this finding but has stressed the need for further research, carefully considering the nature of the comparisons made, age and task specificity, and other possible factors. Brown (1973), working with 60 trainable mentally handicapped boys performing the standing broad jump, the stork stand with open eyes, 30 second situps and the 25 yard dash, did not find any such positive correlation. Fait and Kupferer (1956) found little or no relationship between IQ and the performance of educable mentally handicapped boys on a vertical jump test but found some relationship between IQ and the more complicated squat thrust, drawing attention to the necessity of considering specific aspects of the task and its complexity.

Another [redacted] to the intelligence-motor performance issue is the investigation of significant differences between the performance of educable mentally handicapped subjects and their non-retarded peers. Studies previously mentioned indicated that the motor performance of children in the educable range was inferior to that of peers of normal intelligence. The AAHPER Motor Fitness Testing Manual for the Moderately Retarded (Johnson & Londeree, 1976) reported that mentally retarded persons would appear to perform two to six years behind their chronological age peers in fitness and motor performance assessments, depending on their level of intelligence. Howe (1959), comparing the performance of 43 educable mentally retarded to 43 non-retarded students matched on age, sex, and socio-economic

status on 11 motor tasks, found that normal children were consistently superior to the mentally retarded. Francis and Rarick (1959) tested 284 mildly retarded students from special classes on 11 motor proficiency test items. Their finding, when compared to normative data, indicated that, although the performance of the mentally retarded followed the same developmental trend, their mean scores were 2 to 4 years behind normative data. Results also indicated that the difference in performance increased with age.

Sengstock (1966), comparing 30 educable mentally retarded boys to 30 chronological age matched non-retarded boys and 30 mental age matched non-retarded boys on the AAHPER Youth Fitness Test, concluded that the performance of the educable mentally retarded boys was about midway between the mental and the chronological age matched groups, i.e. a 2 to 4 year lag. He also found their fitness scores inferior to the chronological age peers, even when percentile scores were used to equate height and weight. McClure (1970), using a similar design with female subjects, reported similar results, the retardate group's scores being significantly inferior to the matched chronological age group on all tests of the battery.

Rarick, Widdop, and Broadhead (1970) tested 4,235 mildly retarded boys and girls in 21 different states to develop norms for the modified AAHPER Youth Fitness Test (AAHPER, 1968). The mean performance of male and female retardates were significantly less than those of the non-

retardates at all age levels. The authors did report similar developmental patterns to normal children with developmental lags of 2 or more years.

Rarick and Dobbins (1972), using an extensive test battery of 47 items, compared 261 educable mentally retarded children with 145 non-retarded peers to obtain chronological age - mental age and sex comparison data. The results concurred with previous studies which indicated a 2 to 4 year lag in performance. In addition, they concluded that the factor structure of motor abilities of retarded children is similar to that of normal children, agreeing with a previous study by Rarick (1968). Moreover, they reported that the components of motor performance for retarded children were not as well defined, were more diffuse, and less specific than the factor structure of the non-retarded.

However, Dobbins and Rarick (1976) cautioned against generalizing depressed motor performance to all educable retardates in their study comparing 15 motor performance traits of 71 educable mental retardates with 71 normal chronological age peers indicated a 32%, i.e. one in three overlap in performance in the two groups. They had also reported (Dobbins & Rarick, 1975) that the basic components of the motor domain of these two grouping are tangibly coincidental, i.e. the basic components of the motor domain of the educable mentally retarded boys reflect those described for the normal subjects.

Geiger (1975), in a study examining the etiological

classifications of Down's Syndrome, cultural-familial and other mentally retarded subjects on perceptual and gross-motor tasks, concluded that there was considerable variability among the subjects, that a pattern of motor ability was not characteristic of a specific etiological group, and that all retarded subjects performed more poorly than the non-retarded subjects. He noted that the cultural-familial grouping was closer to the non-retardates in performance scores than were other etiological groups.

Of special note here are the recent findings of several authors indicating that educable mentally retarded subjects receiving systematic physical education instruction approach normal levels of physical performance. Stein (1965), using the AAHPER Youth Fitness Test with 24 educable mentally retarded boys enrolled in a daily physical education program, found that the retarded subjects did not differ significantly from the non-retarded boys when individual test items had been normed.

Carter (1966 cited in AAHPER, 1975a) found that educable mentally retarded students participating in a regular physical education program had percentile scores essentially the same as national norms and that the organized program encouraged near average fitness scores for these subjects. Carter (1970 cited in AAHPER, 1975a) in investigating opportunity as a factor in explaining the fitness scores of educable mentally retarded persons, again concluded that such scores could be improved by participation

in a physical education program.

Solomon and Pangle (1967) found that educable mentally retarded students involved in a systematic physical education program demonstrated physical fitness levels that compared favourably with non-retarded youngsters. Six weeks following the fitness tests, the comparison tests indicated the significant gains were still evident; however, it has been suggested that the improvements were due to the Hawthorne effect.

Of special interest to this study involving educable mentally handicapped girls is a study involving similar subjects conducted by Ehrenburg (1963 cited in AAHPER, 1975a). The author concluded that regular physical education classes did not seem either to motivate the subjects or to provide them with sufficient instruction to bring their motor performance results within the non-retarded range.

MOTIVATIONAL CONSIDERATIONS

Stein (1968) cited motivation as an important, if not indispensible, factor in the successful performance of retarded children. The widespread use of programs involving conditioning, behaviour modification, token economies, contingency contracting, etc. attest to the importance and the effectiveness of motivational techniques used in educating and assessing the performance of retarded children.

Heber (1959) examined motor task performance of educable mentally retarded subjects related to incentive

magnitude. Using 36 subjects, he established rank orders for motivational objects which he was then able to classify as low or high incentive for individual subjects. Motor task performance on the Minnesota Spatial Relations Test Board was best under high incentive conditions. Subjects were able to respond differentially to incentive variations and Heber noted that incentive affected the performance rather than the learning.

Ellis and Distefano (1959) assessed the effects of verbal urging on rotary pursuit performances of a sample of 28 retardates. The motivational condition experimental group performed significantly better than the control group.

Wagner (1967 cited in AAHPER, 1975a) tested educable mentally retarded subjects, matched non-retarded mental age and matched non-retarded chronological age peers and then evaluated them under three incentive conditions: standard instruction, active encouragement, and candy on the performance of four tasks. In all three groups, active encouragement elicited better performances than standard instruction and candy elicited better performances than active encouragement. Educable mentally retarded subjects achieved their best performances with the candy incentive which elicited the performances closest to their chronological age matches. An order effect was noted in that performance was most improved when motivation proceeded from the lowest to the highest level. Educable mentally retarded subjects also tended to reach maximum performance

levels later than the non-retarded subjects.

Solomon (1968 cited in AAHPER, 1975a) examined the effects of basic motivation, continuous verbal encouragement, and continuous verbal encouragement plus money on public school and institutionalized retardates and non-retarded youths in five of the AAHPER Youth Fitness Test items. He concluded that the continuous verbal encouragement and the continuous verbal encouragement plus money had a greater effect than basic motivation. In normal subjects, encouragement and encouragement plus money had similar effects but for the educable mentally retarded subjects, the money provided added incentive. Public school and institutionalized subjects reacted similarly on all but the encouragement plus money condition under which institutionalized subjects responded more favourably.

Levy (1974) investigated the effects of social reinforcement and knowledge of results on the motor performance of educable mentally retarded youngsters. Levy found that the effectiveness of these factors varied with the initial skill level, i.e. social reinforcement increased performance on well learned tasks while knowledge of results was most effective for novel tasks. Four treatment conditions: tangible candy reward, praise, reproof, and control, were administered both in the presence of and the absence of knowledge of results on a rotary pursuit task. Motor performance increased in all social reinforcement conditions and to a greater degree with knowledge of

results. Knowledge of results lessened between group differences and tangible reinforcement was more stimulating than the praise-reproof situations. Levy concluded, as did the other authors, that the educable mentally retarded youngster requires a high reward situation to elicit the best performance.

COGNITIVE CONSIDERATIONS

Fait (1967) developed a test battery for both educable and trainable mentally retarded children. His chief concern was that physical fitness scores of retardates are adversely affected by the subject's inability to understand what is expected of him on tests designed for children of normal intelligence. Fait's test battery included physical performance items that elicited high motor performance as they were not highly related to cognitive level. Simplicity of administration and scoring were prime factors in the test choices. His test battery included a 25 yard run with a false finish, a bent arm hang, a 20 second leg lift, static balance, burpees, and a 300 yard run/walk.

Ellis and Craig (1969) expressed concern about the cognitive contamination involved in motor performance testing with retardates, believing a test itself could be disadvantageous because of the level of cognitive functioning demanded by the test and its administration. Normal and retardate discrepancies could be the result of

environmental and experiential factors, especially if the subjects are institutionalized. To offer control in this area, Ellis and Craig used matched chronological and mental age subjects performing a task novel to all participants. They provided knowledge of results with appropriate informative comments. Results showed no significant differences between the learning or performance of the educable mentally retarded and the non-retarded subjects. Thus, educables were successful and able to learn and perform in the same way as normals when cognitive elements were equalized for all subjects.

Other authors have expressed concern for the cognitive aspects of mentally retarded persons in physical performance situations. As previously mentioned, Peries (1976) listed the lack of cognitive appreciation of the task as the first difficulty of retardates in performing stipulated tasks. Wall (1976) pointed out a possible deficit in the "getting the idea of the movement" phase of learning or performance described by Gentille. Care must be taken to ensure students understand and have a clear picture in their minds of the task.

Other authors have been concerned with aids to learning. Of special interest to the preparation of an audio-visual presentation, aside from the visual demonstration to present the task, is the audio instruction portion. Gold and Barclay (1973), testing 16 moderately and severely retarded individuals, found that verbal cues for

visual discriminations resulted in a superior performance over a "no verbal cue" group in a physical assembly task. This finding would suggest that cue phrases for instruction might aid in optimizing task performance and increasing the effectiveness of the taped presentation.

THE CANADA FITNESS AWARD AND THE AAHPER YOUTH FITNESS TEST

> Physical fitness is a state in which an individual possesses qualities of strength, power, agility, flexibility, endurance, balance, speed and general co-ordination to the extent that he is able to meet his everyday needs and meet energy situations adequately. This implies that functioning of the cardio-vascular system is attuned to meet these same everyday needs and emergency situations. (AAHPER, 1975b, p. 19).

To assess physical fitness, both CAHPER and AAHPER have established test batteries for use with school age children. The CAHPER Fitness-Performance Test (CAHPER, 1966), presently the Canada Fitness Award (Health and Welfare Canada, 1973), consists of six test items: speed bent-knee situps to measure strength and endurance of abdominal muscles, the standing broad jump to measure the explosive muscle power of the leg extensors, the shuttle run to measure speed and agility, the flexed arm hang to measure arm and shoulder girdle strength, the 50 yard dash to measure explosive leg power and speed, and the 300 yard run to measure cardio-vascular efficiency. Though the test is presently under review (Hayden and Yuhasz, 1977), little work has been published regarding the use of this test.

In a study by Docherty and Collis (1976) an

intercorrelational matrix using the six test items, plus a Physical Work Capacity$_{170}$ revealed that the CAHPER Fitness-Performance Test did not contain an adequate measure of aerobic power. There was also a high intercorrelation among the standing broad jump, the 300 yard run, the 50 yard dash and the shuttle run, all essentially leg power items and the authors recommended that, based on their data for test-retest reliability, only the standing broad jump be retained as a test item.

Reliability of the test was investigated by Crawford and Mason (1974) in a two part study. Initially the following reliability coefficients were obtained: situps .863, the standing broad jump .832, the shuttle run .706, the flexed arm hang .751, the 50 yard dash .678, and the 300 yard run .419. Only speed situps and the standing broad jump reflected acceptable reliability. Following innovations in administration of the test to raise motivational levels, the following reliability coefficients were obtained: situps .725, the standing broad jump .843, the shuttle run .777, the flexed arm hang .859, the 50 yard run .756, and the 300 yard run .821. In this situation, only the standing broad jump, the flexed arm hang and the 300 yard run appeared sufficiently reliable. The authors suggested that raising motivational levels might, however, produce more consistent levels of performance.

Much of the research with educable mentally handicapped children in the United States has been done

either with the AAHPER Special Fitness Test (AAHPER, 1968) or with the AAHPER Youth Fitness Test (AAHPER, 1965). Speakman (1974) offered a critique of the Special Fitness Test with improvement suggestions, however, as the AAHPER Youth Fitness Test more closely approximates the CAHPER Fitness-Performance Test, it will be considered in more detail.

The AAHPER Youth Fitness Test (AAHPER, 1965) consists of seven items: pullups (flexed arm hang for female subjects) to measure arm and shoulder girdle strength, the standing broad jump to measure leg power, the shuttle run for speed and change of direction, the 50 yard dash to measure leg power and running speed, straight leg situps to measure abdominal and hip flexor strength, the softball throw to measure gross motor co-ordination, and the 600 yard walk/run to measure cardio-vascular efficiency. This test has since been streamlined (AAHPER, 1975c) by dropping the softball throw, by replacing the straight leg situps with flexed leg situps done in one minute, and by providing flexibility for cardio-vascular endurance through the use of alternatives to the 600 yard walk/run. However, the research dealt with in this review concerns the earlier test.

Smith (1972) reviewed fitness testing and questioned whether the Youth Fitness Test was a fitness test or a combined fitness-motor skill test. For example, if the subject does not know how to jump, does the standing broad jump measure leg power? Smith considered the jump a

specific skill requiring a degree of total body co-ordination and kinesthetic awareness. The inclusion of the 600 yard walk/run was questioned as an indicator of cardio-vascular fitness. Smith stated that the 50 yard dash did little but measure the ability to run fast and that the shuttle run involved too many variables, e.g. body control, agility, co-ordination, hand-eye co-ordination, and speed be classified as an indicator of fitness.

Jackson (1975) evaluated the Youth Fitness Test and questioned its validity. He suggested the test does not measure only fitness components. In addition, he suggested that the 600 yard walk/run was too short to measure aerobic capacity.

Likewise, Bolonchuk (1971) criticized the Youth Fitness Test and questioned its validity. He concluded that the flexed arm hang, an alternative to pullups for female subjects, did not account for body weight differences, that pullups were a measure of strength rather than endurance, and that the 50 yard dash included reaction time which was not a reflection of leg strength. As did Jackson, Bolonchuk considered the 600 yard walk/run a test of muscular work, anaerobic work as opposed to aerobic and, therefore, not a valid indicator of cardio-vascular efficiency.

Despite these criticisms of the tests, however, the CAHPER Fitness Performance Test/Canada Fitness Award has been judged a useful instrument for school assessments of

physical fitness. These limitations in reliability and validity must be considered when interpreting the results of this study.

The use of this test is justified based on the convenience of its practical implementation, the extensive normative data available, the acceptance of the program in schools, and the government funding of an associated awards program.

APPENDIX B

APPENDIX B

INSTRUCTIONS FOR PRE-TEST

50 YARD DASH

Each person runs the race in her proper order. The red line is the start line. You may step on but not over the line. You may use a sprint start or a standing start. I will stand by the finish line and say, "On your mark. Get set. Go." On the "Go" signal, run as fast as you can past the marker showing the finish line through the doors past the black pole.

SPEED SITUPS

Lie down on your back. Bend your knees up. Interlace your fingers and keep your hands behind your head. As you sit up, touch your elbows to your knees. When I say "Go", do as many as you can in one minute. Your partner will straddle your feet and hold you, her hands on the back of your legs just below your knees. She will count every time your elbows touch your knees.

FLEXED ARM HANG

Hold the bar with your palms toward your face and keep your eyes looking level into the bar. I will help you into this position. When I say "GO", hang on as long as you can.

SHUTTLE RUN

This is the start line and there are two blocks. You will start here lying down, your forehead down on the start line and your hands here beside your chest. I will say "On your mark. Get set. Go." When I say "Go" you run down, pick up one block, run back, and place it behind this start line. Do not throw the block, place it down. Then run back and get the other block and race over this line still holding it. We will do the same thing again.

STANDING BROAD JUMP

Stand with your feet slightly apart behind this start line.

Bending your knees and swinging your arms, jump as far forward as possible. You may have two practices and then I will measure two jumps.

300 YARD RUN

This is the start line. You [redacted]tand on but not over the line. The marker down the h[redacted] 50 yards away. You will start here. I will say, "On [redacted] mark. Get set. Go." On "Go" you run down to that marker, around it and back to this marker, around here and back down the hall to that marker, around it and back here again, around this marker and, finally, again down to that marker, around it and back here. That is three times around the course. The last time run straight through past me. You may use your sprint or standing start. I will let you know what lap you are running. . . . This is your second, one more to go. . . . Last one.

APPENDIX C

APPENDIX C

AUDIO-VISUAL PRESENTATION

INTRODUCTION

We are going to see a short film clip on each test item to see if you can pick up any tips on what you should be doing on each test to help you do your best. Listen and watch carefully to see if you do all the things as they are suggested here.

50 YARD DASH

Video: The film shows the start line and then the post and marker indicating the finish line. A sprint start and then a standing start is shown. Then the dash as performed for the test was filmed from the finish line.

Audio: This red line is the start line. Your foot can be on the line but not over it. You are to run down the hall to the finish line by the black post. Run straight through the doorway past that post. You may use your crouch or standing start. Here is the standing start. "On your mark" - foot in position. "Get set" - tense, ready. "Go." Now the actual run. Here the runner uses a standing start. I will say, "On your mark. Get set. Go." and drop my arm. On "Go" run as fast as you can all the way past the pole. Do not slow down near the finish. Let's watch again. "On your mark. Get set. Go." Think - run past the post at the finish line.

SPEED SITUPS

Video: The film shows the subject lying down, pulling up her knees, interlacing her fingers and then, placing her hands behind her head. A partner comes in, straddles the subject's feet and holds her legs. The subject performs the situp test for one minute.

Audio: Lie on your back. Bend your knees up. Interlace your fingers and put your hands behind your head. You must keep them there. Your partner will straddle your feet and hold the back of your legs. Remember, a situp is every time your elbows touch

your knees and back to the lying position. On "Go" start doing situps and your partner will count every time your elbows touch your knees with your hands behind your head. It is normal for you to become tired and for your stomach to hurt. Just think - elbows to knees, elbows to knees.

FLEXED ARM HANG

Video: The film shows the subject standing on a chair facing the bar. The tape shows the hand position and then a close-up of the eyes at bar level. On "Go" the chair is removed, the subject steadied and filmed performing the hang for about 60 seconds.

Audio: The idea in this event is to hold yourself up on the bar for as long as you can. Your hands take hold of the bar with your palms toward your face. Make sure you hold the bar where it's comfortable with your hands at least opposite your shoulders. Keep your eyes level with the bar, look into it. When I say "Go" tense up. I'll take away the chair, steady you if you are swinging, and you hang as long as you can. Your arms will hurt. They may shake. This is natural. It means your muscles are working to hang on. Think - eyes at the bar, eyes at the bar.

SHUTTLE RUN

Video: The film shows the start line with a red target box. The two blocks are shown and the starting position is demonstrated. The run is demonstrated once, then at a slower pace while instructions are given and then repeated at a realistic speed.

Audio: The front of the narrow red square is your start line and there are the two blocks you will pick up. You will start lying down, with your forehead touching the front edge of the red square. Your hands are on the floor at chest level, ready to push you up and off. I will say, "On your mark. Get set. Go." When I say "Go" you run down, pick up one block, bring it back and set it in the red square. Do not throw the block, place it. Quickly, run back, get the other block, and then run as fast as you can over the line, carrying the block. Now watch again more slowly. You come to the blocks. You are already bending, looking at the block, turning, picking it up, and running, coming to the red box, lowering your arm, turning. Later again, turning,

then all out run. Now again as fast as you will do it. Think - block, box, block, run; block, box, block, run.

STANDING BROAD JUMP

Video: The film shows the start line and then the subject stepping up to the start line. From the side, the positioning of the feet is shown, the deep knee bend and the arm swing. Three jumps are demonstrated.

Audio: This is the start line. You jump up the mat. Stand with your feet comfortably apart, your toes on the line but not over it. You want to really bend your knees, lean forward, swing your arms, and then really push off with your legs while you are swinging forward. Again, really bend, lean, push, swing, and reach forward with those feet. Remember, fall forward, not back, hands in front. Again, deep bend, push, stretch forward. Think - bend, reach.

300 YARD RUN

Video: The film shows the start line and then a view down the course to the 50 yard marker. The subject demonstrates a standing start and then the test is completed, the run being filmed from the start/finish line.

Audio: This is the red start line. Your foot may be on but not over the line. Beside the line is one marker and there is another down the hall behind the black pole. You will go down the hall, around the outside of that marker, back to the start and around this marker three times. Use your standing start. I will say, "On your mark. Get set. Go." On "Go" you start running. You go down the hall around the outside of the marker, back to the start, around this marker and down again. I will tell you which number lap you are running. Notice you start off running quickly, not your fastest, but an even, quick pace. Count 1, 2, 1, 2 and keep that pace. Then, on your last lap, the third lap, when you are coming past me for the last time, you go all out, running as fast as you can. Think - 1, 2, 1, 2, and then, at the end, sprint.

APPENDIX D

APPENDIX D

VERBAL ENCOURAGEMENT

50 YARD DASH

Each person runs the race in her proper order. The red line is the start line. You may step on but not over the line. You may use a sprint start or a standing start. I will stand by the finish line and say, "On your mark. Get set. Go." On the "Go" signal run as fast as you can past the marker showing the finish line through the doors past the black pole.

Encouragement: At 3 seconds - "Faster."
At every 2 seconds after - "Faster."

SPEED SITUPS

Lie down on your back. Bend your knees up. Interlace your fingers and keep your hands behind your head. As you sit up, touch your elbows to your knees. When I say "Go" do as many as you can in one minute. Your partner will straddle your feet and hold you, her hands on the back of your legs just below your knees. She will count every time your elbows touch your knees.

Encouragement: At 15 seconds - "Keep going."
At 30 seconds - "Half way - keep going."
At 40 seconds - "Keep going."
At 45 seconds - "Every one counts."
At 50, 53 and 56 seconds - "Keep going."

FLEXED ARM HANG

Hold the bar with your palms toward your face and keep your eyes looking level into the bar. I will help you into this position. When I say "Go" hang on as long as you can.

Encouragement: At 1, 3, 6, and 9 seconds - "Hang on."
At 15 seconds - "Hang on."
At 20 seconds - "Good. Hang on."
Every 5 seconds after - "Good. Hang on."

SHUTTLE RUN

This is the start line and there are two blocks. You will

start here lying down, your forehead down on the start line and your hands here beside your chest. I will say, "On your mark. Get set. Go." When I say "Go" you run down, pick up one block, run back, and place it behind this start line. Do not throw the block, place it down. Then run back and get the other block and race over this line, still holding it. We will do the same thing again.

Encouragement: First pass - "Go. Go. Keep going."
Return - "Hurry. Hurry."
Second pass - "Quickly. Quickly."
Return - "Really run. Really run."

STANDING BROAD JUMP

Stand with your feet slightly apart behind this start line. Bending your knees and swinging your arms, jump as far forward as possible. You may have two practices and then I will measure two jumps.

Encouragement: First jump - "Try hard. Good."
Second jump - "Another good one. Really try. Good."

300 YARD RUN

This is the start line. You may stand on but not over the line. The marker down the hall is 50 yards away. You will start here. I will say, "On your mark. Get set. Go." On "Go" you run down to that marker, around it and back to this marker, around here and back down the hall to that marker, around it and back here again, around this marker and finally, again down to that marker, around it and back here. That is three times around the course. The last time run straight through past me. You may use your sprint or standing start. I will let you know what lap you are running.

Encouragement: First lap back, beginning at the turn - "Keep going. Keep going. Come on. Good."
Second round. "That's it. Keep it up."
Second lap back, beginning at the turn - "That's it. Keep coming. Keep coming. One more. Way you go."
Final lap back, beginning at the turn - "Good. Good. Come on. Keep going. Keep going. Good. All the way. Hurry. Hurry."

APPENDIX E

APPENDIX E

Two-Way Analysis of Variance - Intelligence Scores of Experimental Groups

Source	Sum of Squares	D.F.	Mean Squares	F Ratio	Probability
SA (Intelligence)	0.237017E+04	1.	0.237017E+04	51.166779	0.000001*
SB (Treatment)	0.336888E+02	2.	0.168444E+02	0.363634	0.697215
SE	0.203819E+04	44.	0.463224E+02		

*p ≤ .05

APPENDIX F

APPENDIX F.1

Three-way Analysis of Variance - Standing Broad Jump Scores

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probability
A (Intelligence)	602.716	1.	602.716	5.266	0.027*
B (Treatment)	172.611	2.	86.305	0.754	0.477
AB	154.614	2.	77.307	0.675	0.514
S-within	4807.000	42.	114.452		
C (Pre-Post-Test)	58.258	1.	58.258	7.586	0.009*
AC	15.214	1.	15.214	1.981	0.167
BC	58.382	2.	29.191	3.801	0.030*
ABC	71.277	2.	35.638	4.640	0.015*
CS-within	322.563	42.	7.680		

*$p \leq .05$

APPENDIX F.2

Three-way Analysis of Variance - Shuttle Run Scores

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probability
A (Intelligence)	1764.330	1.	1764.330	5.151	0.028*
B (Treatment)	72.730	2.	36.365	0.106	0.900
AB	327.534	2.	163.767	0.478	0.623
S-within	14386.000	42.	342.524		
C (Pre-Post-Test)	213.738	1.	213.738	8.390	0.006*
AC	3.463	1.	3.463	0.136	0.714
BC	103.406	2.	51.703	2.029	0.144
ABC	67.288	2.	33.644	1.321	0.278
CS-within	1070.000	42.	25.476		

* $p \leq .05$

APPENDIX F.3

Three-way Analysis of Variance - Speed Situp Scores

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probability
A (Intelligence)	335.017	1.	335.017	2.536	0.119
B (Treatment)	81.605	2.	40.803	0.309	0.736
AB	112.373	2.	56.187	0.425	0.656
S-within	5549.125	42.	132.122		
C (Pre-Post-Test)	53.249	1.	53.249	4.653	0.037*
AC	1.299	1.	1.299	0.113	0.738
BC	40.787	2.	20.394	1.782	0.181
ABC	52.259	2.	26.130	2.283	0.114
CS-within	480.625	42.	11.443		

*p ≤ .05

APPENDIX F.4

Three-way Analysis of Variance - Flexed Arm Hang

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probability
A (Intelligence)	16.505	1.	16.505	0.070	0.793
B (Treatment)	195.094	2.	97.547	0.414	0.664
AB	479.044	2.	239.522	1.016	0.371
S-within	9904.840	42.	235.830		
C (Pre-Post-Test)	66.942	1.	66.942	3.524	0.067
AC	3.345	1.	3.345	0.176	0.677
BC	33.118	2.	16.559	0.872	0.426
ABC	37.873	2.	18.936	0.997	0.378
BC-within	797.945	42.	18.999		

APPENDIX F.5

Three-way Analysis of Variance - 300 Yard Run

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probability
A (Intelligence)	300.595	1.	300.595	2.760	0.104
B (Treatment)	6.648	2.	3.324	0.031.	0.970
AB	117.769	2.	58.884	0.541	0.587
S-within	4355.750	40.	108.894		
C (Pre-Post-Test)	61.259	1.	61.259	6.791	0.013*
AC	0.950	1.	0.950	0.105	0.747
BC	9.972	2.	4.986	0.553	0.580
ABC	5.698	2.	2.849	0.316	0.731
CS-within	360.813	40.	9.020		

*p ≤ .05

APPENDIX F.6

Three-way Analysis of Variance - 50 Yard Dash

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probability
A (Intelligence)	617.466	1.	617.466	3.394	0.073
B (Treatment)	14.843	2.	7.421	0.041	0.960
AB	460.625	2.	230.313	1.266	0.293
S-within	7641.563	42.	181.942		
C (Pre-Post-Test)	14.348	1.	14.348	1.409	0.242
AC	-0.495	1.	-0.495	-0.049	0.999
BC	34.139	2.	17.069	1.677	0.199
ABC	34.633	2.	17.317	1.701	0.195
CS-within	427.563	42.	10.180		