

AN ABSTRACT OF THE THESIS OF

Nicolette E. Laurie for the degree of Master of Science in Movement Studies in Disability presented on 25 August 1997. Title: Reliability of a One Mile Rockport Fitness Walking Test

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Douglas H. Collier

A modified version of the Rockport Fitness Walking Test (RFWT) has been determined to be reliable for persons with mental retardation. Previous investigations have used one pacer for each participant. While this protocol may be reliable, it is not likely feasible in most school or community-based settings. Therefore, the purpose of this study is twofold: first to evaluate the reliability of a modified version of the RFWT using one pacer per five participants; second, to determine the agreement among the one to one protocol and the proposed five to one protocol. This study compared the end completion times and mean peak heart rates of three different one-mile walking sessions of 35 participants with mild mental retardation. Eighteen females (21.1 ± 2.7 yr.) and 17 males (19.7 ± 2.8 yr.) participated in each testing session. Each participant randomly completed two sessions of walking with one pacer per five participants and one session of one pacer per participant on an indoor surface 1/9th of a mile long. Results from ANOVA indicated end completion times and mean peak heart rates did not differ based on gender ($p=0.798$), sessions ($p=0.053$), and gender \times sessions ($p=0.855$). To determine agreement, intraclass correlation coefficients (ICC) were

calculated for end completion times for the first five to one and the one to one ($R=0.83$) and the second five to one and the one to one ($R=0.85$). ICC's were calculated for mean peak heart rates for the first five to one and the one to one ($R=0.95$) and for the second five to one and the one to one ($R=0.93$). The results support that the five to one modified walking protocol produces results similar to the results using the one to one testing.

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Reliability of a One-Mile Rockport Fitness Walking Test

by

Nicolette E. Laurie

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APPROVED:

Redacted for privacy

Major Professor, representing Movement Studies in Disability

Redacted for privacy

Chair of the Department of Exercise and Sport Science

Redacted for privacy

Dean of the Graduate School

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Nicolette E. Laurie, Author

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DEDICATION

This thesis is dedicated to my parents (Mom and Dad) who gave me the greatest gift of all, life. And to Monty, Claudette, Danny and Bernadette for making that life so interesting.

Reliability of a One-Mile Rockport Fitness Walking Test

Chapter 1 Introduction

According to the Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM) as many as 75% of Americans do not participate in enough physical activity to experience health benefits (Pate et al., 1995). Physical activity recommendations from the CDC, the ACSM, and the World Health Organization (WHO) focus on decreasing the sedentary lifestyle patterns of millions of Americans. According to recent figures only 22% of adults meet the current ACSM and CDC guidelines that recommend at least 30 minutes of moderate intensity physical activity each day (Pate et al., 1995). Although participation in physical activity has increased since the 1960's, it has plateaued in recent years (Nieman, 1991).

Before 1995, the focus was on the type, mode, intensity, and duration of exercise. These guidelines were stringent and inactive individuals had difficulty in reaching the ACSM standards. This resulted in a smaller percentage of Americans participating in any type of physical activity. The recent ACSM guidelines are less stringent and are aimed at increasing the activity levels of sedentary individuals. The new recommendations from the Surgeon General, the CDC and ACSM suggest that intermittent activity or continuous moderately intense physical activity totaling 30 minutes per day are sufficient for obtaining health benefits (Pate et al., 1995, Surgeon General, 1996). By increasing activity levels there will be a reduction in the nation's health costs and

increased prevention and control of disease, injury, and disability (Surgeon General's Report, 1996).

Reduction in coronary heart disease morbidity, mortality, hypertension, non-insulin-dependent diabetes mellitus, and blood lipid profile risk factors are potential health benefits associated with regular physical activity (Grundy, 1990; Morris, 1993; Paffenbarger et al., 1986; Pate, 1995). Specifically, the latest report from the Surgeon General (1996) has served notice that the majority of Americans need to improve their cardiovascular fitness levels through moderate physical activity in order to enjoy a higher quality of life.

Cardiovascular fitness serves multiple purposes through the stages of life (Shephard, 1995). The stages have been described as childhood, adolescence, adult life and old age. Shephard (1995) outlined the importance of fitness for the young child as being the formation of a lifetime habit, information gathering, and the learning of positive attitudes. The second stage of cardiovascular fitness, adolescence focuses on the early prevention of cardiovascular disease through continuous bouts of exercise. During adult life, the reasons for physical activity shift towards preventing premature death, decreasing absenteeism at work, reducing obesity, and increasing the chance of preferable blood lipid profiles. During old age physical activity serves to enhance bodily functions and improve the overall quality of life. The benefits of physical activity span all stages of life by enhancing the quality of life and decreasing the occurrence of premature death.

The importance of physical activity is heightened for individuals with mental retardation because of an increased incidence of obesity and sedentary lifestyles (Pitetti, Rimmer & Fernhall, 1993; Rimmer, Braddock, & Fujiura, 1993).

A lack of physical activity for this population is strongly related to increased mortality rates, coronary heart disease, hypertension, non-insulin-dependent diabetes mellitus, osteoporosis, and colon cancer (Pate et al., 1995). Recent studies indicate that low cardiovascular fitness levels for individuals with mental retardation is due to their predominantly sedentary lifestyles (Fernhall, Pitetti, Rimmer et al., 1996; Fernhall et al., 1989; Kittredge, Rimmer & Looney, 1994; Pitetti, Fernandez, Pizarro & Stubbs, 1988; Rintala, Dunn, McCubbin, & Quinn, 1992; and Teo-Koh, 1995). Standard VO_2 max levels for individuals without MR are 35-43 $ml.kg^{-1}.min^{-1}$ for females and 44-51 $ml.kg^{-1}.min^{-1}$ for males (Nieman, 1990) while levels for male and female individuals with mild mental retardation including individuals with Down syndrome ranged from 27 $ml.kg^{-1}.min^{-1}$ (Millar, 1984) to 34.3 $ml.kg^{-1}.min^{-1}$ (Pitetti et al., 1988). Later studies by Rintala et al., (1992) and Teo-Koh (1995) reported average peak VO_2 values of 40.01 $ml.kg^{-1}.min^{-1}$ and 41.3 $ml.kg^{-1}.min^{-1}$ for males with mental retardation with mean ages of 26 and 14.3 years, respectively. Moon and Renzaglia (1982), reported that individuals with mild mental retardation have decreased VO_2 efficiency due to lower levels of max VO_2 .

Individuals with mild mental retardation often need to increase physical activity levels to ensure adequate cardiorespiratory fitness (Pommering et al., 1994). These low physical activity levels may be attributed to poor lifestyle choices, the lack of opportunities to participate, decreased motivation and safety concerns based on medical conditions. With decreased physical activity levels for individuals with mental retardation it can be expected that cardiorespiratory fitness levels will be sub-average in comparison to those individuals who are physically active.

Adequate cardiorespiratory fitness levels allow for the completion of everyday, leisure, recreational and job-related pursuits for individuals with mild mental retardation. Further research by Fernhall and Tymeson (1988) suggests that the successful participation in vocational activities and in the work force were directly related to one's ability to sustain moderate levels of physical activity. Second, increased levels of fitness improve the chances of independent living for individuals with mild mental retardation due to the increased ability to care for oneself and hold a job (Fernhall et al., 1996). Adequate fitness levels allow individuals with mild mental retardation the ability to enjoy lifetime leisure pursuits and increase their ability to complete work related tasks without undue fatigue (Fernhall, Tymeson, Millar, & Burkett, 1989).

The assessment of cardiorespiratory fitness levels is important to any population because it provides knowledge of current levels of activity. Assessment of cardiorespiratory fitness levels for individuals with mental retardation is particularly important because the information provides baseline fitness levels that can be used by physical education teachers, recreation specialists, parents, guardians and coaches to establish and monitor appropriate physical activity programs.

Before the 1990's, tests which assessed cardiorespiratory fitness were developed for the typically developing individuals and generalized to populations with mental retardation. As easy-to-use field tests were not generally available in the early 1990's, Rintala et al., (1992 & 1997) and Kittredge et al., (1994) examined the validity and reliability of the one mile Rockport Fitness Walking Test for individuals with mild mental retardation. Both Rintala et al., (1992 & 1997) and Kittredge (1994) determined that the RFWT

was reliable for individuals with MR with a ratio of one subject to one pacer. In group-home and school environments, a ratio of one pacer per participant is impractical in assessing the cardiorespiratory fitness levels of individuals with mild mental retardation (Pitetti, Rimmer, & Fernhall, 1993).

According to Teo-Koh (1995) and Pitetti, Rimmer and Fernhall (1993) the effect of pacers, (individuals who walk slightly ahead of participants and provide external motivation in the form of verbal reinforcement and skill feedback) needs to be evaluated to determine their relationship to optimal walk performance. As noted, the one-to-one ratio is not practical because of the large number of students, the lack of trained staff and budgetary constraints. While the Rockport Fitness Walking Test is valid and reliable the testing protocol requires one pacer per participant. This study will modify the previous protocol by changing the pacer to tester ratio from one pacer to one participant to one pacer for five participants. In modifying the Rockport Fitness Walking there is a need to assess its reliability. Second, the study will determine whether there is a significant difference in mean peak heart rates and end completion times between the one to one walking sessions and both five to one sessions.

Purpose of the Study

The purposes of this study are twofold. The first is to evaluate the reliability of a modified one mile Rockport Fitness Walking Test for cardiorespiratory fitness using a ratio of five participants to one pacer for males and females aged 16 to 25 years with mild mental retardation. The second purpose is to determine whether the modified protocol of one pacer per five

participant produces the same results as the original protocol of one pacer per participant. Specifically, the testing protocol (one pacer to one participant) previously used by Rintala et al., (1992 & 1997) and Kittredge et al., (1994) was modified by using a single pacer for five participants. Reliability was determined by two different measures: (a) repeatability of test completion time, and (b) heart rate consistency at the end of testing sessions. Similarity between the different testing protocols was determined by comparing the (a) repeatability of test completion time, and (b) heart rate consistency at the end of testing sessions for the one to one session and both five to one sessions.

Significance of the Study

Cardiorespiratory fitness assessments are necessary in school and group home living environments for individuals with mild mental retardation. Assessments allow teachers, recreational therapists, and parents to determine baseline fitness levels which provide vital information in setting up exercise programs that decrease instances of sedentary lifestyles among individuals with mental retardation. Furthermore, through proper assessment of individuals with mental retardation, the chances of completing everyday tasks without undue fatigue and enjoying recreational activities is increased if individuals have a high level of cardiorespiratory fitness. As part of an exercise program these tests may be used to predict and improve physical performance for individuals with mild mental retardation, as well as to design and monitor the effectiveness of the exercise programs (Croce and Horvat, 1992).

Currently, five cardiovascular fitness tests are reported to be valid and

reliable when assessing individuals with mental retardation. Fernhall and Tymeson (1988) provided evidence for the validity and reliability of a 1.5 mile walking test using 15 adult males with mental retardation. Rintala et al., (1992 & 1997) validated and cross-validated a one mile walking test referred to as the Rockport Fitness Walking Test (RFWT), using 19 males with moderate mental retardation. Further research by Kittredge et al., (1994), validated the one mile RFWT using 12 adult males and 13 females. Kittredge and colleagues (1994) extended previous research by including 13 females in the validation process. The Rockport Fitness Walking Test has been validated and proven reliable for males and females with mild retardation using a one pacer to one participant protocol (Rintala et al., 1992; Kittredge et al., 1994). Both studies reported correlation values (R) greater than .90. Though the RFWT has been validated and found reliable, the one to one ratio is impractical in most settings as financial constraints, the lack of adequate staffing, and the de-institutionalization movement has decreased fitness and activity opportunities for individuals with mental retardation. Community based alternatives are needed to provide guidance to vocational and recreational leaders working with people with mental retardation. Currently, individuals with mild mental retardation lack a knowledge base, financial support, and worthwhile opportunities to increase their levels of fitness. One way to increase fitness opportunities for this population may be to establish simple and appropriate protocols which parents, support staff and group-home workers can use to measure baseline and post exercise program cardiorespiratory fitness levels. This measure will provide valuable information regarding the direction exercise programs should follow as well as giving clear evidence regarding the effectiveness of the fitness

program. This study will examine fundamental changes in the RFWT protocol. Specifically the test protocol will be changed from a ratio of one pacer to one participant to a ratio of one pacer to five participants. Testing procedures will be examined that are feasible in a variety of settings, economically viable, and practical. A reliable and accurate assessment tool is an important component of effective and practical exercise programs for people with mental retardation.

Research Hypotheses

The following research hypotheses were tested:

- #1 There will be no difference between the mean peak heart rates and mean completion times for participants in both five to one sessions.
- #2 There will be no difference in mean peak heart rates for participants between the one to one session or the five to one sessions.
- #3 There will be no difference in end completion times between the five to one sessions and the one to one session.

Limitations

The study was limited by the following factors. The small number of participants limits generalization of the modified RFWT to other groups. Subjects were not randomly selected from therefore generalizability to other populations is limited.

Delimitations

This study was de-limited to males and females living in group homes of family settings in Western Oregon between the ages of 16 and 25 with mild mental retardation. Only participants (and their parents or guardians if subject was not 18 years old) who completed a consent form regarding participation were included. Participants had no physical disabilities that may have limited their ability to complete the RFWT.

Definition of Terms

The following were definitions used throughout the study:

Cardiovascular Fitness

“It enhances oxygen and substrate delivery to active skeletal and the heart and seeds the removal of CO₂ and metabolites” (Brooks, Fahey and White, 1996, p.282). It is frequently measured by the Fick Equation (see below) which shows the relationship between cardiac output, oxygen consumption and a-VO₂ difference (McArdle, Katch and Katch, 1991).

cardiac output (ml.min⁻¹)= O₂ consumption (ml.min⁻¹)

a-VO₂ difference (ml per 100ml blood) x 100

Mental Retardation

The current definition is divided into four categories (Luckasson et al., 1992). Mental retardation includes the following criteria: limitations in certain personal capabilities, manifested as significantly sub-average intellectual functioning, exists with related disabilities in two or more of the following adaptive skill areas: communications, home living, community use, self-care,

social skills, self-direction, health and safety, work, functional academics and leisure.

The degree of mental retardation is now classified by two levels, mild and severe. The functional capacity of each individual within adaptive skill levels typifies the new classification system.

Pacers

Pacers were individuals who walked ahead of or along side participants, providing positive specific skill feedback, reinforcement, and prompts designed to elicit optimal performance during the modified and standard versions of the one-mile RFWT.

Rockport Fitness Walking Test

A one-mile walking cardiovascular test designed to assess fitness levels of individuals with and without mental retardation.

Heart-Rate Monitor

A short range telemetry microcomputer system consisting of two separate mechanisms a transmitter belt and receiver used in recording individual heart rates for each subject.

Prompting

“The cue or stimulus that makes a behavior occur. It can be physical, verbal, visual, or some combination of sensory stimuli (Sherrill, 1993, p.219)

Positive Skill Feedback

“Verbal reactions to correct, well-executed aspects of the movement skill attempt” (Darst, Zakrajsek and Mancini, 1989, p.180)

Specific Skill Feedback

“Verbal reactions conveying positive, corrective, or negative appraisal of movement skill attempts including either precise targeting of the aspect of performance that triggered the comment or exact prescription for improving subsequent performance” (Darst, Zakrajsek and Mancini, 1989, p.180)

Assumptions

1. Participants will provide a maximal effort.
2. Participants will understand the instructions as provided by the tester.

Chapter 2 Review of Literature

Recently, there has been a trend within the United States towards a health promotion paradigm as opposed to treating and/or reducing morbidity and mortality. Health promotion is defined as the promotion of healthy lifestyles which include favorable changes in activity levels and diet modification. As part of the health promotion movement, the Surgeon General has released three reports. Healthy People (1979) and Healthy People 2000 (1991) and the Surgeon General's Report on Physical Activity (1996) to address the physical activity needs of this country. The initial report was aimed at reducing the number of infectious diseases, while the second report attempted to reduce the prevalence of chronic diseases or lifestyle related diseases. This document stressed that, by the year 2000 adults need to assume responsibility for their own well being by being physically active as much as possible. Furthermore changes in lifestyle that increased activity levels would decrease the leading causes of mortality (Public Health Service, 1991).

Fitness: the American Breakthrough

A fitness awakening has occurred in the United States since the end of World War II. In 1943, nearly 3 million Americans were rejected from participating in armed forces active duty due to physical and mental deficiencies (Pangrazi & Darst, 1995). The chief of Athletics and Recreation for the Army, recommended a more rugged school physical education program in order to increase the physical fitness of American youth, especially potential young

soldiers. After the war, both heart disease and obesity levels rose with the majority of exercising Americans focusing on muscular strength and muscle size (Public Health Service, 1985). In 1953, the results of the Kraus-Weber tests of minimum muscular fitness indicated negative results for American youth. This test consisted of six simple movements of vital muscle groups. A stunning 59% of American children tested failed to meet the minimum requirements of the test while only 8.7% of the Europeans missed the cut-off score (Pangrazi & Darst, 1995). As a direct result of these negative findings, President Eisenhower formed two task forces, the President's Council on Youth Fitness and the President's Citizens Advisory Committee on the Fitness of American Youth. These task forces were formed to assess and positively change fitness levels in America. From the Eisenhower years to the present, physical activity levels have increased with the help of physical education and fitness centers but current activity levels indicate that there is room for improvement in cardiovascular fitness (Surgeon General's Report, 1996).

The next two fitness awakenings focused on jogging and aerobics. In the late 1960's University of Oregon track coach Bill Bowerman encouraged a new wave of American joggers with his book, *Jogging*. In 1968, Dr. Kenneth Cooper published *Aerobics* and followed up 2 years later with *The New Aerobics*. Both books challenged the American public to change their lifestyles in order to counter the effects heart disease, obesity levels and to reduce the cost of medical care. Cooper focused on running, swimming, cycling, walking, stationary running and other aerobic activities that stimulated the heart, lungs and blood vessels.

In 1995, the American College of Sports Medicine (ACSM) and the Centers for Disease Control (CDC) adopted new guidelines to promote participation in physical activity for both health promotion and disease awareness (Pate et al., 1995). The new guidelines suggest “30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week” (p. 402). Exercise, whether intermittent or continuous, provides the same benefits. Engaging in 30 minutes of moderate-intensity physical activity can reduce the risk of chronic diseases, hypertension, non-insulin dependent diabetes, osteoporosis, colon cancer, anxiety and depression (Pate et al., 1995). With the benefits of physical activity becoming clear the number of Americans participating in exercise regimens has increased.

Current Activity Levels

A recent survey from the U.S. National Health Interview Survey (NHIS, 1988) indicated that overall fitness levels are low. In this survey only 7% of females and 8% of males exercised at an intensity and duration of 20 minutes or more, 3 days per week. Basically, this information indicates that 6 out of every 10 Americans exercise at less than desirable levels. Comparison data from a Canadian survey, The Campbell Survey on Well Being (1988), noted that 52% of individuals in Canada do not exercise enough to receive adequate benefits.

The following is a summary of the NHIS survey: a) Males have a greater tendency to exercise than females at any age, b) There is equal participation in aerobic and/or conditioning activities, c) as age increases so does activity participation, d) individuals having upper socioeconomic status (income,

education and job) tend to be more physically active, e) on average whites (42%) tend to exercise more than blacks (37%), and f) the most popular activity was walking, and individuals on the west coast exercise the most with people from the northeast and south exercising the least.

Increases in the number of individuals exercising has been attributed to awareness of and the positives associated with a healthy lifestyle. The number of sedentary individuals has decreased since the 1970's. Although these statistics are encouraging a greater percentage of Americans need to start participating in physical activity to reap health and wellness benefits.

Fitness Evaluations

With the increase in participation in physical activity, fitness evaluations have become popular assessment tools. These evaluations are used to individualize exercise and/or workout programs. Fitness evaluations serve two purposes. Initial or beginning levels are determined and second results are used for comparison with subsequent evaluations after engaging in a training regimen. Fitness evaluations usually consist of four components including: flexibility, muscular strength and endurance, body composition, and cardiovascular fitness (Nieman, 1991). Cardiovascular fitness is defined as the "ability to continue in strenuous tasks involving large muscle groups for extended periods of time" (Nieman, 1991, p.25). This component of health related fitness has been determined to have the greatest effect on decreasing the risk factors associated with coronary heart disease.

Measuring VO₂ max is considered the "gold standard" in determining the

cardiovascular fitness levels of individuals with and without MR. Current research focuses on graded maximal exercise tests which examine heart rate, respiratory exchange ratio's, anaerobic threshold, onset of blood lactate, ventilatory threshold and oxygen consumption to assess cardiovascular capacities of individuals with and without mental retardation.

A one-mile walking field test measure conducted by Kline and her colleagues (1989), was used to estimate maximal oxygen consumption for 300 healthy adults (males =165 and females =178) between the ages of 30 and 69 years. The maximal oxygen uptake (VO_2 max) protocol utilized a self-selected treadmill test with 2.5% increase in grade every 2 minutes. The field test consisted of at least two, one-mile walks within 30 seconds for data analysis. A multiple regression analysis was used to estimate VO_2 , track walk time, fourth quarter heart rate, age, weight and sex. Comparison between observed and estimated VO_2 max levels through cross validation yielded an R-value of .92. Results of this study included the derivation of 6 equations for VO_2 max (SEE .355 l/min) and the following guidelines:

- a) the use of a large sample size,
- b) validation and cross-validation groups were homogeneous for all independent measures,
- c) no statistical difference between observed and estimated VO_2 max,
- d) accuracy of estimation (reflected by SEE) was comparable to similar sub-maximal protocols,
- e) the field test is simple and easy (requires minimal equipment and time), and
- f) test requires fast walking, which makes it useful with sedentary population.

This study laid the foundation for the use of the Rockport Fitness Walking Test in the assessment of cardiorespiratory fitness levels of individuals with and without mental retardation.

Fitness and Mental Retardation

Fitness is especially important for individuals with mild mental retardation because of vocational needs and independence needed to live their lives (Moon & Renzaglia, 1982). Success in the work place is directly related to cardiovascular fitness and one's ability to maintain physical activity for extended amounts of time. Adequate levels of physical fitness allow individuals with mild and severe mental retardation the ability to enjoy lifetime leisure pursuits and complete work related tasks. (Fernhall, Tymeson, & Webster, 1988). Research has established that the fitness levels of individuals with mild mental retardation is inferior to individuals without MR. (Fernhall, Tymeson, Millar, & Burkett, 1989; Millar, 1984; Pitetti et al., 1988). Studies have shown that lower levels of cardiovascular fitness are apparent for individuals with MR. (Campbell, 1973; Fernhall, 1992; Fernhall et al., 1996; Fernhall, Tymeson, Millar & Burkett, 1989; Fernhall, Tymeson & Webster, 1988 & Pitetti, Fernandez, Pizarro & Stubbs, 1988). Cardiovascular fitness serves multiple purposes through the stages of life. These include habit formation, reducing the risk of premature death and work absenteeism. One component of physical fitness is cardiorespiratory fitness. This measure is indicative of one's potential ability to complete daily tasks without undue exhaustion. Individuals with mild and severe mental retardation rely heavily on this type of fitness to work in society. Moon and

Renzaglia (1982) indicated a high level of CV fitness was highly correlated to work productivity. In order to better promote a self help and healthy lifestyle, individuals with mild and severe mental retardation need to learn and use activities that increase their cardiorespiratory fitness levels. This increase will serve two purposes. First the completion of everyday tasks without lethargy and second to allow positive and successful participation in leisure and recreational activities. As the severity of mental retardation increases, the level of fitness decreases (Jansma, Ersing & McCubbin, 1986).

Cardiovascular Fitness and MR

Numerous studies have investigated the various components of cardiovascular fitness of individuals with mental retardation. It has been demonstrated that as a group individuals with mental retardation have decreased fitness levels (Fernhall, Tymeson & Webster, 1988; Pitetti & Campbell, 1991). With the evidence indicating predominantly poor cardiovascular fitness levels, early studies failed to establish the validity and reliability of dependent measures. Current investigations need to focus on cadence adherence, learning and motivation to perform optimally during the assessment of cardiovascular fitness levels.

Andrew, Reid, Beck, and McDonald (1979) and Bar-Or, Skinner, Bergsteinova et al., (1971) were pioneers in testing individuals with MR on treadmills. Bar-or et al., (1971) tested 105 educably handicapped children on three different treading walking protocols. The difference between the protocols was the length of the stages, which ranged from to 2 to 4 minutes with

a constant speed of 5.6 kilometers per hour. The study failed to report the criteria which determined VO_2 . Results indicated that the boys with MR had lower VO_2 levels than their peers without MR but it failed to show significant differences between the two classifications of girls on the same test (MR and non-MR). These findings were limited because the VO_2 data were gathered from only 32 of the 105 subjects in the study. As well there was no explanation on test termination and reporting of peak vs. maximal VO_2 levels. Bar-or et al., (1971) used subjects with higher IQ's for the treadmill protocol. Limitations are apparent because subjects with lower IQ's were not included, maybe the warm-up period of four minutes was not adequate to alleviate the pressure of the test for individuals with severe or profound MR.

Fernhall et al. (1996) determined the cardiorespiratory capacity of individuals with mental retardation including individuals with Down syndrome. 111 subjects from six testing centers in the United States participated in the study. All testing centers followed similar familiarization and testing protocols. Metabolic data was collected using open circuit spirometry with a walking treadmill protocol. Results indicated that peak VO_2 and peak HR were not significantly different. Both peak oxygen uptake and peak minute ventilation were greater for males than females. Non-DS subjects had greater peak heart rates and peak respiratory exchange ratios. In conclusion subjects with mental retardation had low levels of peak VO_2 ($27.85 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ for all subjects) which is consistent with low levels of cardiorespiratory fitness. Subjects with DS, had on average the lowest levels of peak VO_2 ($25.1 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ for DS and 30.6 for non-DS) and peak heart rates (165 bpm for DS and 179 for non-DS). In conclusion individuals with DS had the lowest levels of cardiorespiratory fitness.

The authors attributed this to genetic and environmental factors.

Data reported by Andrew et al., (1979) dealt with physical fitness training of males with MR. A twelve week training program was followed by a maximal treadmill test to determine training effects for a control and exercising group. Significance was not reported between the pre and post training numbers (38.0 ml.kg⁻¹min⁻¹ and 40.9 ml.kg⁻¹min⁻¹ for the exercising males) for both groups. A 12% increase in VO₂ reported for the exercising males which may be due to the characteristics of the training group. The control group reported a 9% drop in peak VO₂ after twelve weeks of testing. Similar to the Bar-Or (1971) study, important details were missing. These included the IQ's of the subjects, test termination endpoints, using VO₂ max instead of peak VO₂ and the lack of a familiarization session to rid fears of the testing procedure. Early VO₂ testing sessions using individuals with MR provided basic results but failed to provide standardized testing procedures because of vague testing techniques.

Fernhall and Tymeson (1988) evaluated the feasibility of a graded exercise test for individuals with mild MR. Twenty-one subjects participated in a 3 step process that included familiarization, training and testing using a treadmill protocol. The work capacity was estimated using VO₂ max. Average levels were 26.30 ± 8.0 ml.kg⁻¹min⁻¹, heart max was 171 ± 14 beats per minute and Ve(BTPS) was recorded at 62.8 ± 21.8 l/min. Individuals with mild mental retardation have lower levels of cardiorespiratory fitness than their same-aged peers.

Pitetti et al., (1988) measured the cardiovascular fitness of 33 subjects with mild and severe mental retardation ranging. Subjects ranged in age from 12 to 49 years. A sub-maximal exercise test was used to estimate VO₂ max.

Results indicate that 81% of the participants were successful in reaching their predicted maximum heart rate (220-age for females; 205-age/2 for males). This supports the premise that individuals with mild and severe mental retardation are capable of reaching the same fitness levels as individuals without MR.

The relationship between VO_2 max and the 1/2 mile run-walk was assessed for children with mild or moderate mental retardation (Fernhall, Pitetti, Stubbs, & Stadler, 1996). Twenty-three subjects completed a VO_2 max test utilizing the procedures validated by Fernhall and Tymeson (1987) and Pitetti et al., (1989). Similar to the Kline et al., study (1987) subjects walked at a self-chosen speed for comfort and ability. Reliability of the testing protocol was completed through test-retest measures, conducted 2 to 7 days apart. The 1/2 mile walk was completed on an outdoor 440-yard track. Subjects were instructed on pacing techniques and walking prior to the testing session. Pacers walked an average of 2 to 3 feet ahead of the subject and provided verbal encouragement. Peak VO_2 ($R=.90$) and 1/2 mile completion times ($R=.96$) were highly reliable with a $p<.05$. The correlation between VO_2 max testing and the 1/2 mile was $R=.60$. The study established the concept of individuals with mental retardation and reduced aerobic fitness levels. Previous studies reported VO_2 levels 70% higher than $28.2 \text{ ml.kg}^{-1}\text{min}^{-1}$ respectively. This study indicated validity and reliability of a 1/2 mile run-walk test as an indicator of aerobic fitness in children with mental retardation.

Rockport Fitness Walking Test and Mental Retardation

The one-mile protocol utilized in the RFWT is a simple and familiar activity that requires minimal training. This is especially useful when testing individuals with mental retardation due to quick testing and minimal testing anxiety. Depauw et al., (1990) assessed the cardiorespiratory fitness levels of nine subjects with the Rockport Fitness Walking Test and resulted indicated higher results than the 12 minute walk-run test (Depauw, 1990).

Rintala, Dunn, McCubbin, and Quinn (1992) completed a study that validated a field test of cardiorespiratory fitness for men with mental retardation. Nineteen subjects with a mean age of 26 years, completed a maximal treadmill test and a one mile walking test, twice. Average numbers for peak VO_2 were $40.01 \text{ ml.kg}^{-1}.\text{min}^{-1}$ or 2.59 l.min and peak heart rate was 182 beats per minute. Results indicate substantially higher results than previous studies for individuals with mild and severe mental retardation but were below average in comparison to same aged non-mentally retarded men. 79% of the subjects achieved greater than normal fitness levels during the 1 mile walking test in comparison to the norms in the RFWT manual. These increased levels of fitness can be attributed to the fact that sixteen of the subjects participated in aerobic activities three days per week. The Rockport Fitness Walking Test was both a reliable and a valid indicator of cardiorespiratory fitness for individuals with mild mental retardation due to significant R values.

Teo-Koh (1995) completed a study that assessed the cardiovascular fitness levels of forty male and female subjects (12-17 years), with mental retardation. This added to the Rintala et al. (1992) study because females were

utilized. Using the Rockport Fitness Walking Test, subjects completed a three phase familiarization and practice phase before the actual testing. Subjects completed two trials of the one-mile walking test and 24 subjects completed a maximal graded treadmill exercise test. Average peak VO_2 was $41.28 \text{ ml.kg}^{-1}.\text{min}^{-1}$ with a test-retest reliability of .90. Results supported previous studies by Rintala et al., (1992) which demonstrated that the RFWT is a reliable field test for individuals with mental retardation.

Studies before 1990 reported similar findings in reporting VO_2 max levels. These lower numbers may be due to sedentary lifestyles, severity of mental retardation and the lack of continuous physical activity. Rintala et al., (1992) and Kittredge et al., (1994) determined that VO_2 levels were higher than previous studies by Beasley (1982); Coleman, Ayoub and Friedrich (1976); Pitetti et al., (1988), and Pitetti and Tan (1990). The higher reported findings in the latter studies can be attributed to familiarization protocols used in and motivational techniques.

Motivational Techniques

It has been reported that the use of active supervision patterns, verbal feedback and prompts in the physical education setting increases the rate of on task performances for students without MR (Van der mars, 1989; Van der mars, Darst, Vogler & Cusimano, 1994). According to Van der mars and colleagues (1994) teachers who had active supervision patterns reduced off-task behaviors in a physical education setting. These teachers also provided verbal feedback at a rate of 3.2 responses per minute. Positive behavior feedback correlated positively with students on-task behavior. The use of feedback helps create a

positive learning environment for the student (Ormond, 1993; Manross & Templeton, 1997). The use of prompt furthers the learning environment due to the fact that it shapes student responses during an activity.

When dealing with students with disabilities, the use of prompts and feedback plays an important part in obtaining a maximal effort from the participants. According to Reynolds et al., (1992) secondary school students with disabilities preferred activity reinforcers rather than edible or tangible reinforcers. The RFWT utilizes a pacer as the participant completes the one mile walk. It has been shown in the physical education setting that the use of prompts and feedback increases the on-task participation time of individuals with disabilities. Students with mild mental retardation have continually increased their performances with the use of specific and individualized feedback and prompts (Pommering et al., 1994). In order to elicit maximal results Kittredge and colleagues (1994), Rintala et al., (1992 & 1997), and Teo-Koh, (1995) effectively used pacers in a one on one walking situation.

Summary

The importance of cardiovascular fitness for all Americans has been well documented in the literature (Paffenbarger et al., 1986; Morris, 1993; Powell & Blair, 1993; Wood, 1993; Public Health Service, 1991). High levels of cardiorespiratory fitness are associated with decreased risks in coronary heart disease, obesity, blood lipid risk factor profiles, mortality, anxiety and depression (Paffenbarger et al., 1986; Grundy, 1990; Casperson, Powell & Christenson, 1985). One subset of the population with a greater need for

cardiorespiratory fitness are individuals with mental retardation. Beasley (1982) and Moon and Renzaglia (1982) determined that high levels of cardiorespiratory fitness are associated with the ability to complete work related tasks. High levels are indicative of independence and the ability to engage, enjoy and complete day-to-day tasks.

Cardiovascular fitness is often determined through field tests for individuals with and without mental retardation. The validity and reliability of field tests for individuals in the general population has received a far greater amount of attention from researchers. Tests used indiscriminately with individuals with mental retardation remain vague on testing issues which include mental ability and capacity, movement proficiency, cadence adherence, and prior learning experiences (Seidl, Reid, & Montgomery, 1987). Studies before 1990 focused on criterion measures (VO₂ max testing) and refrained from familiarization techniques (Lavay et al., 1990) which produced sub-average VO₂ levels. Field tests were unreliable and only validated for individuals in the general population. Since 1990, field tests have begun to focus on individuals with mental retardation and validating tests that are simple to administer and complete. One field test, the Rockport Fitness Walking Test has been validated with a variety of subjects in a numerous demographic settings (Depauw et al., 1990; Fernhall et al., 1996; Kittredge et al., 1994; & Rintala et al., 1992).

Chapter 3 Methodology

The purpose of this study is twofold. First, it is to examine the differences between a walking session of one pacer to one subject and two sessions of one pacer per five participants. Second, it is to evaluate the reliability of the modified one-mile Rockport Fitness Walking Test for cardiorespiratory fitness for individuals with mild mental retardation. The modified version of the RFWT increases the pacer to subject ratio to one to five. End completion times and peak heart rate were the dependent measures. This chapter is divided into the following sections: selection and recruitment of subjects, reinforcement, testing procedures, pilot study, testing apparatus, experimental design, effect and sample size estimation, and statistical analysis.

Selection and Recruitment of Participants

Participants were seventeen males and eighteen females with mild mental retardation, between the ages of 16 to 25 years. This age range was chosen in order to make comparisons to previous studies with similar populations. Twenty-two of the subjects were contacted through, and attended, the Albany, Corvallis and Lebanon School Districts. Four subjects were contacted through the Emerald Valley Division of the Oregon Special Olympics. The remaining nine were contacted through the Developmental Disabilities Office of Benton County. Of these 35 participants, 16 lived in independent living

apartments, five lived in a group home setting and 14 lived at home with their parents. While 13 of the participants worked in the community, the remaining 23 subjects were students in high school. Only those individuals without physical, orthopedic, and cardiac impairments participated in the study.

In order to establish phone contact with the family, the State of Oregon Mental Health Division was notified regarding the study. Permission requested to contact local authorities for personal information regarding each subject, Family history regarding the subject was obtained through records from the school district, group home coordinator, guardians, parents, and the county Developmental Disability Office. Prior to the start of the recruitment sessions, the Institutional Review Board of Oregon State approved the use of human subjects for this project (Appendix A). Informed consent documents were mailed to teachers, parents, subjects and group home coordinators. The participant was asked to read the document or if reading was not possible, the document was read aloud. Comprehension of the informed consent document was verified by having each participant verbally communicate what the walking test consisted of, where it would be performed, what they would do during each session, and the number of times required to complete the study. Prior to the start of testing, the informed consent was obtained (Appendix B) from each participating subject. The informed consent required only the signature of the participant if the subject was 18 years or older. If under the age of 18 both the subject and parent/guardian signature was required.

Reinforcers

Enclosed with the informed consent document was a questionnaire asking for preferred reinforcers for each participant (Appendix C). Identifying effective reinforcers was important because maximal effort was necessary during all three sessions. Teachers, guardians, parents, and group home workers who worked with the participants filled out questionnaires which asked for four phrases, words and/or questions that motivated the individual participants. Each questionnaire was shared with the pacers prior to each session so that their feedback could be individualized and meaningful. During each session name tags were worn by each participant. This allowed the pacer to remember each participant's name and provide meaningful reinforcement.

Further reinforcement was provided to the subjects in the form of a pizza party. A pizza party followed all three testing sessions and was used because it was motivating and provided an opportunity for all participants to engage in a social activity outside of the school or group home environment. Participants were notified of the pizza party during the initial recruitment meeting where the study was explained and when volunteers were asked to participate.

Testing Procedures

A modified version of the one-mile Rockport Fitness Walking Test was conducted three times with approximately one week between testing sessions. Two separate walking sessions of one pacer per five participants were used to determine the reliability of the modified version of the RFWT. The one to one

session was compared to both Rintala et al., (1992 & 1997) studies to determine if the mean peak heart rates and end completion times were consistent with the work of previous researchers. To keep conditions constant, each session was completed on a 1/9 mile indoor astro-turf surface in the McAlexander Fieldhouse on the Oregon State University Campus. Boundaries were marked using pylon cones and tape. To minimize differences between tests due to diurnal and seasonal variations the time of the testing session, the season and the day of the week were held constant.

Prior to the first session, each subject completed a two step familiarization process. The familiarization process acquainted the participant with the activities required during testing, decreased pre-test anxiety, and this increased the likelihood of optimal performance. The first step of the familiarization process was done in the subject's school, group home complex, family home or Special Olympic practice. It included an introduction to the main tester, an explanation of the walking sessions, the number of visits required to finish the test, and a question and answer period. The second step of the familiarization process took place in the testing environment. This included trying on the individual heart rate monitor chest bands and watches with the surgical gel and receiving instructions from the primary tester on how to walk on the turf and cement at McAlexander fieldhouse. Participants were encouraged to swing their arms and lift their knees with each step. The final part of the process included meeting with the individual pacers.

Pacers were undergraduate and graduate students from the Exercise and Sport Science Department at Oregon State University. Pacers used verbal positive feedback to motivate participants and ensure that they completed the

mile as quickly as possible. Pacers completed a two step training process that included: a) how to provide positive specific skill feedback, and b) appropriate walking techniques.

The first part of the training process included a brief meeting with the pacer in order to review the set reinforcement statements and instruction sheet. The instruction sheet included the walking instructions which were given to the subjects during the warm-up lap (see Appendix D). Second, it outlined the goal for each subject to finish in the quickest time possible. It was explained that each pacer was to provide individualized reinforcement to each participant during the walking sessions. Along with the individualized reinforcers, pre-set motivational statements were utilized by each pacer (see Appendix E). These included: a) "Great job, I like the way you are swinging your arms", b) "Good job, keep picking your knees up high", c) Pizza is waiting at the end of the third session, d) First names, e) "I like your quick feet" f) "Only _ laps until the end", 7) "The quicker you walk the quicker you finish", g) "I like what I am seeing", and h) "Wonderful" or "Fantastic". Subjects were reminded to remain positive throughout all nine laps.

The second part of the training process included a brief synopsis on 'quick walking' techniques. Each pacer was advised to have the subject use a full stride, to pick up their knees and swing their arms. They were also advised to have the subjects pass their peers for both motivational reasons and in order to walk faster. The pacers provided the directions to the participants during both the warm-up phase and during the actual data collection.

Prior to the start of the first testing session the subject's height was recorded in centimeters using a cloth tape measure and weight was recorded in

kilograms using a Sunbeam portable scale. Each subject wore a heart rate monitor with a chest band and receiver watch to allow for data collection during the trials. Before the start of each warm-up session, resting heart rate measurements were recorded on the RFWT data sheets. In order to warm the entire body and prepare the participant for physical activity, a three to four minutes moderately walking session was completed.

During each warm up session each subject was advised to walk as quickly as possible around the outside of the cones, for nine laps. They were told to pass other subjects as needed and to walk as close to the outside of the cones as possible. They were told that the purpose of the test was to finish the nine laps as quickly as possible without running. They were told that if they walked on the inside of the cones the data would be unacceptable. Each subject was advised to hold their left hand out to allow their heart rate monitor watch to be read as they completed each lap. They were reminded not to slow down as the data was being collected. Prior to the start of the initial lap the following statement was read aloud: "Walk nine laps around the marked course as fast as you can, as if you were in a hurry to go somewhere" (Rintala et al., 1992).

Pilot Study

One week prior to the start of the data collection a pilot study was conducted in order to determine the following: a) boundary lines, b) starting area, c) placement of the pacer during the five to one sessions, d) design of

data collection sheets, e) pacers for the five to one sessions (only two were chosen to minimize tester variations), and f) data collection points.

The subjects for the pilot study included three males and two females from a transition group within the Corvallis School District. The subjects ranged in age from 17 to 21 and had varying degrees of mental retardation and attention deficit hyperactivity disorder. From the pilot study, it was decided that the pacer used during the five to one sessions would start with the pack of five subjects. As the participants spread out on the course, the pacer would provide feedback by crossing back and forth in the infield. To elicit a maximal effort it was decided that the pacer would provide the greatest amount of encouragement during the final lap.

Testing Apparatus

Polar Sport heart-rate monitors (model 1901201-polar beat) were used to record heart rate readings throughout each testing session. The Polar Sport heart-rate monitor (model 1901201-polar beat) is a short-range telemetry microcomputer system that consists of a transmitter and receiver. The receiver needs to be within a one-meter range of the transmitter for accurate readings. The transmitter (3 electrodes) is attached to a belt and worn on the left side of the body between the mid-axillary line and the xiphoid process and below the fourth intercostal. The receiver is a watch that can be worn on the wrist or attached to an article of clothing (Polar Sport Corporation, 1995). Sportline stop watches (model econosport 240) were used to record lap times and total walk time.

Experimental Design

Each participant walked a one-mile course on three separate days. Two sessions of one pacer to five subjects and one session of one pacer per subject was completed by each participant. Testing sessions were randomly assigned. Random assignments of the three sessions were based on each school districts' availability.

Data Analysis

To establish reliability, the intraclass reliability coefficient (R) for end heart rate and completion time was calculated for all three walking sessions using a repeated measures ANOVA. An alpha level of .05 was used to indicate statistical significance. Assessment of agreement between the means of the completion times and heart rates were determined using the Bland and Altman (1983) assessment of agreement technique. Independent t-tests were used to determine the differences between males and females for end completion times and peak heart rates. Statistical analyses of the data collected were performed using SPSS (version 6.1) and Microsoft EXCEL (version 6.1).

Chapter 4 Results

The purpose of the present study was to evaluate the reliability of a modified version of the Rockport Fitness Walking Test for individuals with mild mental retardation and to determine if there was agreement among the original and modified protocols. This chapter is divided into the following sections: Subject Profiles, Completion Times and Heart Rates, Intraclass Correlations, Completion Times and Peak Heart Rates across Sessions and between Males and Females, and Assessment of Agreement.

Subject Profiles

The test sample consisted of 17 male and 18 female participants with mild mental retardation, including two with Down syndrome (Ds). Of these 35 participants, 16 lived in independent living apartments, five lived in a group home setting and 14 lived at home with their parents. While 13 of the participants worked in the community, the remaining 23 subjects were students in high school. Participants ranged in age from 16 to 25 years (mean \pm SD=20.6 \pm 2.8 yrs.) The Intellectual Quotient (IQ) for each participant was available from previous records and was measured by either the Weschler Intellectual Scale- 3rd Edition Revised (WISC-3rd) or the Stanford Binet intelligence test (see appendix E for individual IQ's). Table 1 presents the descriptive characteristics of the study participants.

Table 4.1.

Descriptive Characteristics of Study Participants*

	<u>females</u>	<u>males</u>
age (years)	21.1 ± 2.7	19.7 ± 2.8
height (cm)	156.5 ± 9.4	177.2 ± 10.2
weight (kg)	60.4 ± 16.4	81.1 ± 24.0

* Tabled data are mean ± SD

Completion Times and Heart Rates

All subjects completed the individual mile walk on three different occasions. Time was recorded in minutes and seconds (minutes:seconds) upon completion of each lap. On average the females completed the one to one session in 17:13 ± 3:50 (minutes:seconds), the first five to one session in 17:25 ± 3:36, and second five to one session was completed in 17:36 ± 4:35. The males completed the one to one session in 16:01 ± 3:24 (minutes:seconds), the first five to one session in 16:02 ± 3:27, and second five to one session was completed in 16:17 ± 3:55. Throughout the study males and females were separated for comparative purposes. See Figure 4.1 for a histogram of means and standard deviation of the mean completion times and Appendix F for individual walk times.

Independent t-tests were used to determine the difference in the group means between the males and females for end completion times. A t-test

revealed a non-significant difference ($p = 0.33$) for end completion times between males and females. A t-test for the first five to one session between the females and males revealed a p-value of 0.25 and the second five to one session resulted in a p-value of 0.37 which can be interpreted as a non-significant difference between the means (see Appendix G for t-tests).

The individual heart rates for each lap are located in Appendix F. The mean peak heart rates for the females was 164 ± 15 beats per minute (bpm) for the one to one session, 170 ± 24 bpm for the first five to one session and 166 ± 22 for the second five to one session. The males mean peak heart rates were 154 ± 25 , 155 ± 29 , and 158 ± 28 bpm for the three individual miles. See Figure 2 for a histogram of means and standard deviation of the mean peak heart rates. T-tests between the mean peak heart rates for males and females revealed non significant differences for all three sessions (see Appendix H for t-tests). The p-value for the one to one condition was 0.14. The first five to one condition had a p-value of 0.10, while the second five to one condition's value was 0.40.

Both the females and males tended to have peak heart rates during the ninth lap of the mile. During the one to one session 94% of the males and 83% of the females peaked during the ninth lap. During the first one to one session 83% of the males and 83% of the females peaked in the ninth lap. Similarly, 88% and 89% of the males and females peaked during the ninth lap for the second five to one session. T-tests revealed non-significant differences for both the females and males for the lap in which the mean peak heart rate occurred.

Intraclass Correlations

In order to establish the relationship between the male and female combined mean completion times across each of the sessions, an intraclass coefficient (R) or coefficient of consistency was calculated (Baumgartner, 1989). See Table 4.2 for the correlation coefficients for end completion times and mean peak heart rates. All three coefficients indicate a strong relationship between the combined end completion times for both males and females. The intraclass correlation coefficient (R) was calculated as follows for both the five to one sessions, the first five to one and the one to one session and the second five to one session and the one to one session (Thomas & Nelson, 1990, p. 351):

$$R = \frac{MS(\text{subject}) - MS(\text{within})}{MS(\text{subject}) - (k/k' - 1)MS(\text{within})}$$

$$MS(\text{subject}) - (k/k' - 1)MS(\text{within})$$

The coefficients of determination (r^2) were calculated for the combined mean completion times. A value of 0.83 or greater was reported which indicates that the variances in the end completion times and mean peak heart rates for the RFWT are strongly related. Furthermore, an R value of 0.83 indicates that 69% of the total variance in the first five to one mile is associated with variance in the one to one mile.

Table 4.2.

Intraclass Correlations (R) and Coefficient of Determination (r²)for the one-mile RFWT for males and females

	<u>Peak</u> <u>HR</u>	<u>R</u> <u>End Time</u>	<u>Peak</u> <u>HR</u>	<u>r²</u> <u>End Time</u>
T1 & T2	0.83	0.95	0.69	0.90
T1 & T3	0.85	0.93	0.72	0.86
T2 & T3	0.86	0.94	0.74	0.85

T1 = one to one session

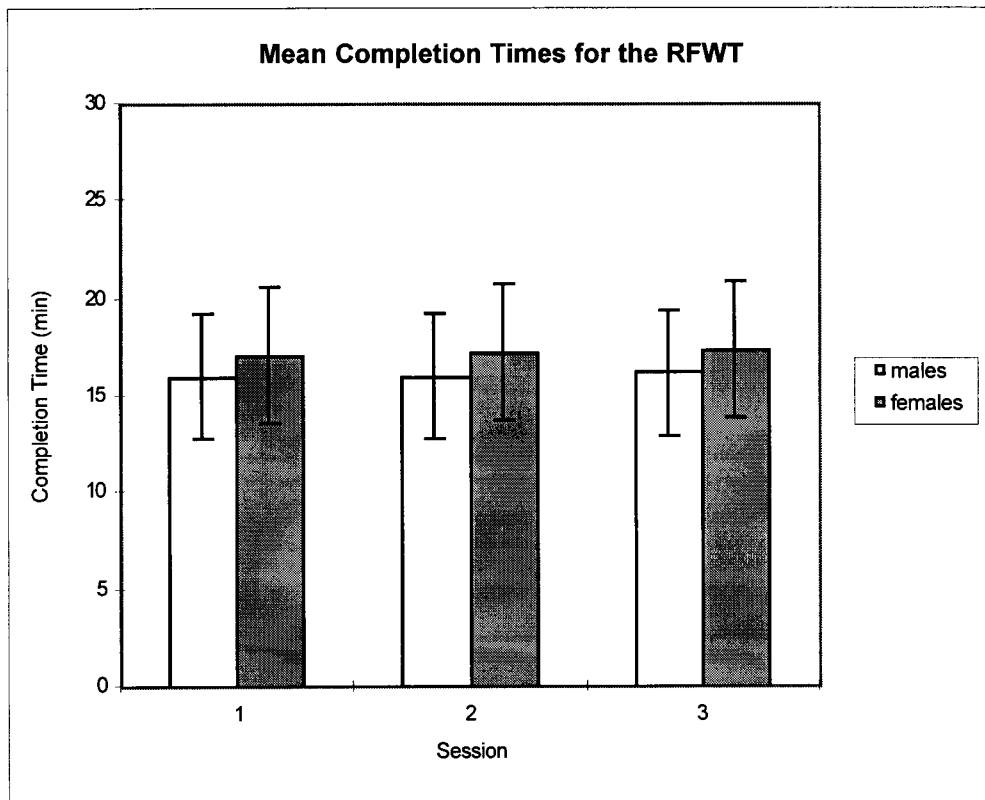
T2 = first five to one session

T3 = second five to one session

Completion Times and Peak Heart Rates Across Sessions and Between Males and Females

Two separate 2x3 analysis of variance (ANOVA) models were used to determine whether completion times and peak heart rates differed by test sessions, gender, and the interaction between test sessions and gender. The p-values for the end completion times were 0.937 for sessions and 0.085 for the gender effects. The two way interactions of sessions x gender were determined to be non-significant for end completion times. The resulting p-value was 0.995 for the end completion time. Overall both end completion times and peak heart rates did not differ by the main effects of test sessions and gender or the two way interactions between gender and walking session for peak heart rate and completion times (see Appendix H for the ANOVA table of completion times and heart rates).

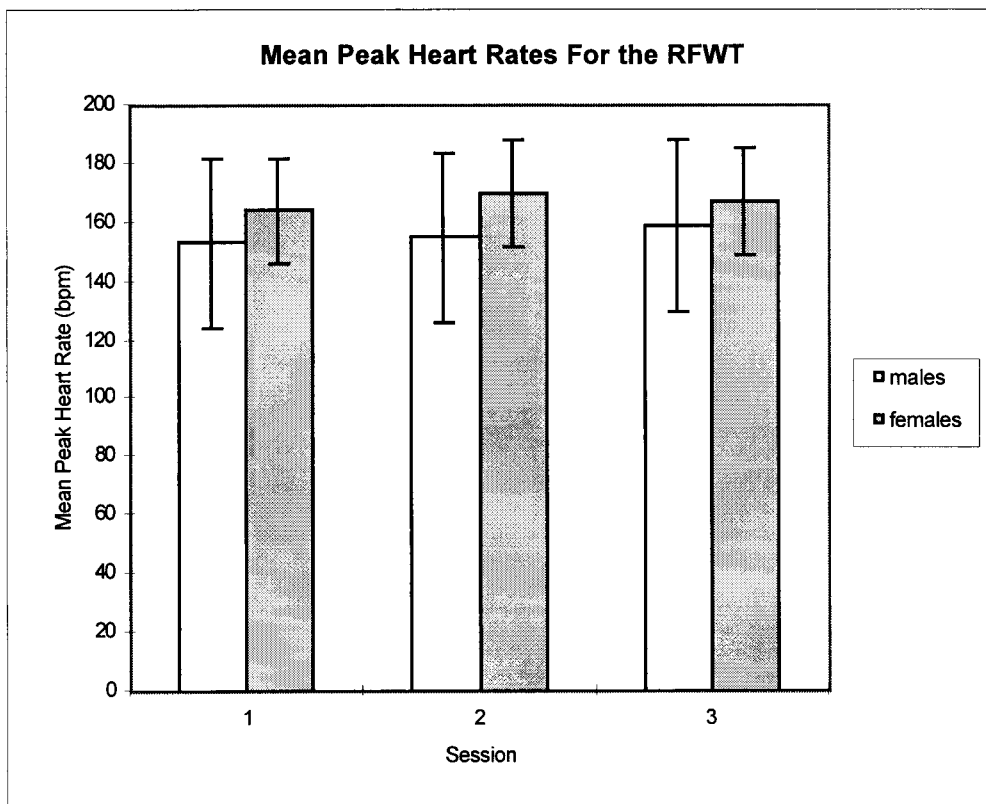
Figure 4.1.

Histogram of Mean Completion Times for the RFWT

1= one to one; 2= first five to one; 3= second five to one

Figure 4.1. Histogram of mean completion times for males and females. An ANOVA indicated non-significant differences among mean completion time by test session and gender and by the interaction between session and gender.

Figure 4.2.

Histogram of Mean Peak Heart Rates for the RFWT

1= one to one; 2= first five to one; 3= second five to one

Figure 2. Histogram of peak heart rates for males and females. An ANOVA indicated non-significant differences among peak heart rates by test session and gender and by the interaction between session and gender

Assessment of Agreement

The Bland and Altman (1983) technique was used to assess the agreement between completion times across the testing sessions. Although correlation coefficients measure the strength of a relationship between two variables, the Bland and Altman (1983) technique quantifies the amount of agreement. A plot of the difference between the completion times against their

mean demonstrates between method differences (Bland & Altman, 1983). If the distribution of scores is normal, 95% of the scores will lie between two standard deviations (SD's) of the mean difference.

The first Bland and Altman plot (Figure 4.3) demonstrates a strong agreement between the means and differences for both five to one sessions. There is a nonsystematic difference between the means and differences and a lack of outliers beyond two or more standard deviations. The results indicate that the mean difference between the two five to one sessions was 13 seconds. The range of values for individual mean differences for the two five to one sessions was 0:01 (minutes:seconds) to 3:47.

There is strong agreement between the means and differences of the first five to one session and the one to one session. Figure 4.4 indicates that there is a nonsystematic difference or a significant pattern between the mean and the difference for the first five to one session and the one to one session. The mean values of the two sessions differed by six seconds. The lack of outliers beyond two or more standard deviations above or below the mean indicates the strong agreement between the individual completion times for the first five to one session and the one to one session. The range of the individual mean scores for the first five to one and the one to one was 0:06 to 3:08.

Figure 4.5. demonstrates the difference in the second five to one session and the one to one session plotted against the mean completion time for the same scores. A mean difference of twenty-two seconds was reported between the sessions. The range of scores for the individual mean times were 0:04 seconds to 2:29. The random distribution of the scores indicates that the times do not vary systematically.

Figure 4.3.

Bland and Altman (1983) Plot of Agreement between the First and Second Five to One Sessions for Completion Times.

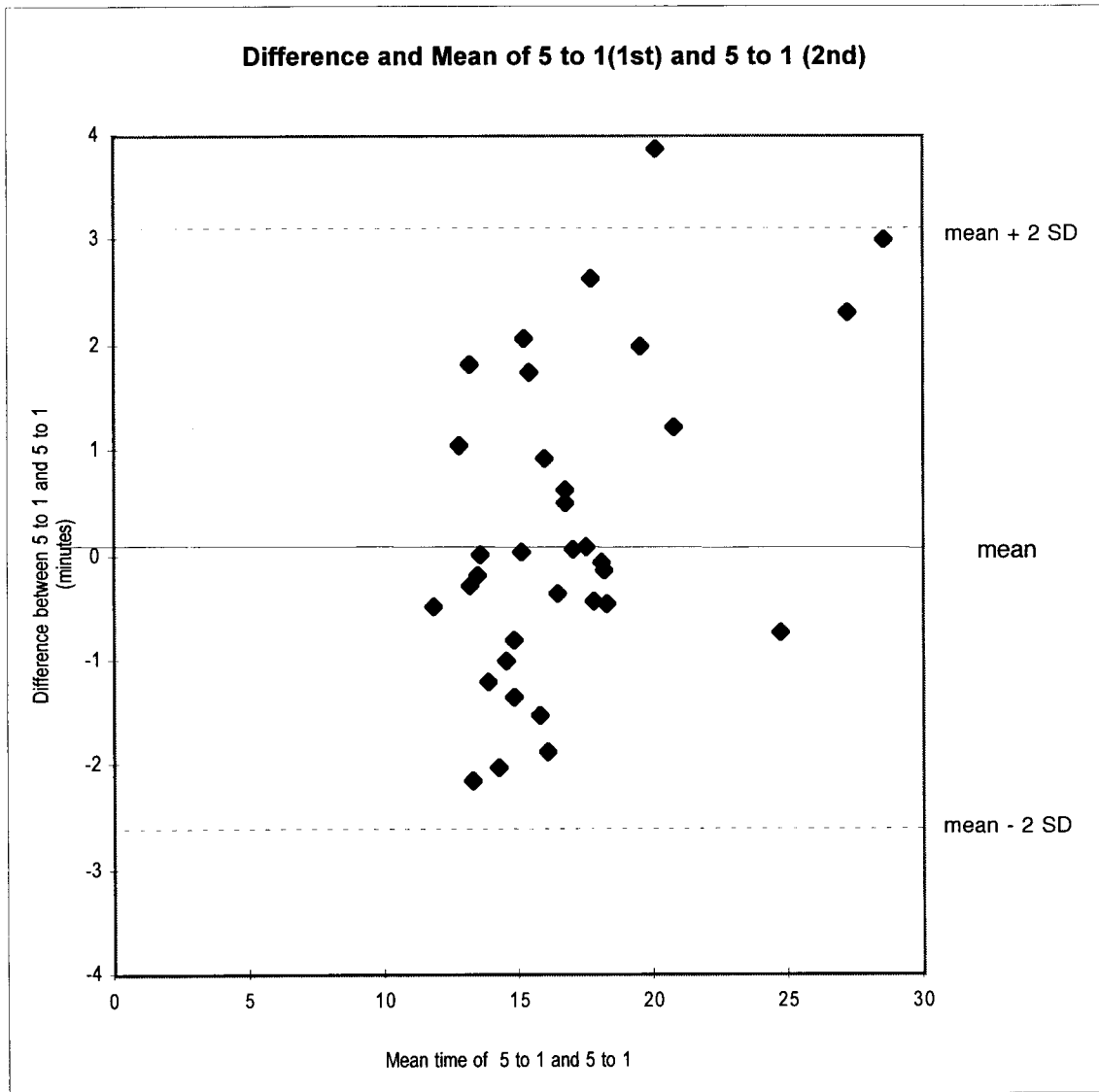


Figure 4.4.

Bland and Altman (1983) Plot of Agreement between the First Five to One Session and the One to One Session for Completion Times.

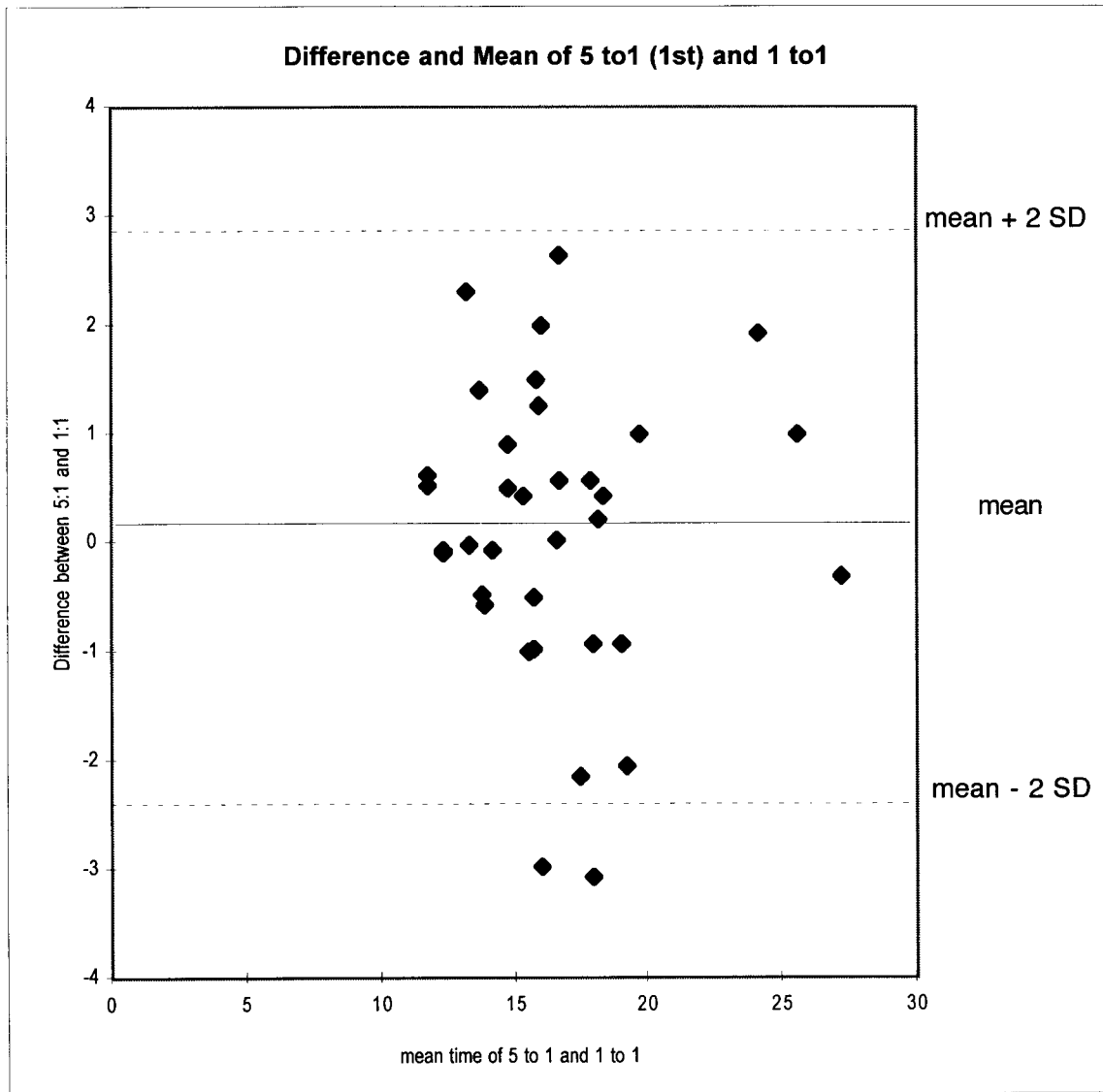
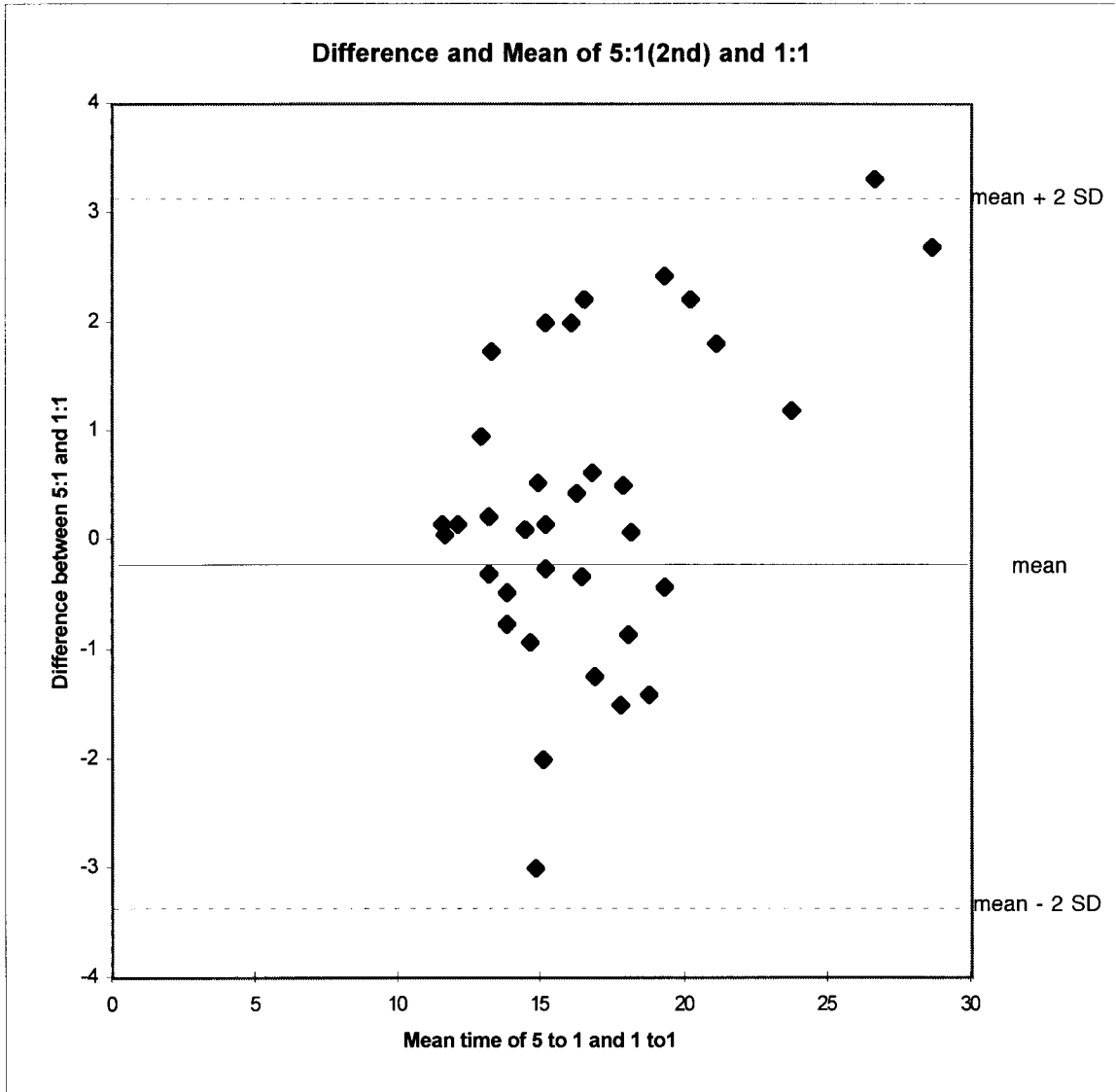


Figure 4.5.

Bland and Altman (1983) Plot of Agreement between the Second Five to One Session and the One to One Session for Completion Times.



Chapter 5 Discussion

The purpose of this study was to assess the reliability of a modified version of the Rockport Fitness Walking Test and to examine if the results of the modified version were different from those obtained with the original protocol with respect to completion time and peak heart rates. The original protocol for persons with mental retardation consisted of testing one participant per pacer (Rintala et al., 1992 & 1997). The modified protocol increased the ratio to five participants per pacer. The primary reason for modifying the current protocol was to improve the practicality of the test. It is impractical to assess a single person at a time due to both financial and personnel constraints. The recent movement toward group home and/or independent living for individuals with mental retardation forces caregivers to complete a larger number of tasks in a shorter amount of time.

General Findings

The modified version of the RFWT (one pacer per five participants) was found to be reliable for individuals with mild mental retardation based on end completion times and mean peak heart rates. During three separate one mile walking sessions there were no significant differences in mean completion times and mean peak heart rates for 35 male and females between the ages of 16 and 25 with mild mental retardation. This indicated that the five to one testing protocol produces the same results as the one to one testing protocol. The non-significant differences in the mean completion times and mean peak

heart rates for the all three walking sessions suggests that the five to one protocol is effective in determining the cardiovascular fitness levels of individuals with mental retardation. This finding allows physical education teachers, group home workers and coaches to accurately test five individuals at a time when completing the one-mile Rockport Fitness Walking Test. Although the males finished the walking sessions more quickly and the females had higher mean peak heart rates, the 2x3 ANOVA and independent t-tests revealed the differences to be non-significant.

It's hypothesized that the consistent performances by the participants in the five to one sessions and the one to one session were dependent on consistent feedback provided by the pacers, individualized reinforcement, the use of a familiarization process for the participant, consistent set-up of the testing area, testers with proper training, a party used as a long term reinforcer and minimal distractions during testing time. In particular, the use of consistent and individualized feedback motivated the participants and led to optimal finishing times. Individualized feedback appeared to be critical throughout all nine laps. Rintala, McCubbin and Dunn (1995) recommended a familiarization process to ensure that the participants were comfortable with the testing procedure, the testing environment and the pacers. This, as well, led to reliability and optimal finishing times for all three sessions. High reliability was also achieved through the consistency of the pacers. All pacers were extensively trained prior to the initial testing session. Furthermore, the same two pacers were used for the five to one sessions. This allowed the investigator to carefully train two highly motivated people who were capable of providing appropriate and individualized feedback to all participants.

Comparison to Previous Research

A comparison to the Rintala study (1992) revealed slower completion times for both the modified protocol of five participants per pacer and the original protocol of one pacer per participant. The participants in the Rintala et al., study (1992) were active males between the ages of 18 to 25 years while the present study focused on males and females with mental retardation with differing activity levels. The mean completion time for the Rintala et al., (1992) study was 14:39 (minutes:seconds). This time was almost a minute and twenty seconds quicker than the mean completion time for males in the current study, regardless of the testing protocol. Examination of the Kittredge et al., study (1994) revealed similar findings. The participants in that study had mean completion times of 14:45 for each of two walking sessions. If the completion times differed by more than 0:40, a third session was completed. The protocol, used in the Kittredge et al., (1994) investigation did not allow for a comparison with the present study with respect to completion times. This appears largely due to differences in participants. The current study included both males and females with differing levels of physical activity and a broader range of functional abilities. As well, the Rintala et al., (1992 & 1997) studies relied on a pacer to participant ratio of one to one whereas the modified protocol increased the ratio to five to one.

The completion times and peak heart rates for the one to one session in the present study resulted in the quickest end completion times and the greatest mean peak heart rate values. The differences for mean completion times across sessions ranged from one second to sixteen seconds for the

males. Differences for females ranged from twelve to twenty-three seconds. Regardless of the testing protocol, the participants tended to finish each mile in roughly the same amount of time.

With respect to the mean peak heart rates, there were no significant differences between either five to one session or the one to one session. The magnitude of difference between the modified protocol and previous research for mean peak heart rates was almost non-existent as well. Kittredge et al., (1994) reported mean peak heart rates for all 25 participants (males = 12, females =13) as 156.2 ± 17.9 beats per minute (bpm). Rintala et al., (1992) reported mean peak heart rates for the RFWT as 182 ± 10.3 bpm for 19 healthy males. The current study reported mean peak heart rates as 161.2 ± 23.3 bpm. As noted, the mean peak heart rates found in the current investigation are more consistent with the Kittredge et al., (1994) study as opposed to the Rintala et al., (1992) study. This is likely due to the inclusion of both males and females in the testing sample. The differences in the mean peak heart rates between the Rintala et al., (1992) study and the current study can be attributed to the primarily sedentary population used in this study. Furthermore, individuals with mental retardation who do not regularly participate in vigorous exercise or activity that substantially increases their heart rate will not be able to sustain the high intensity bout of exercise needed to complete a one-mile walking test.

Individual Responses and Gender Differences

Although the 2x3 ANOVA revealed no significant differences for the end completion times for all three sessions, the actual time difference between the

individual completion times for the one to one session and five to one sessions may pose a problem in the real world. The magnitude of the bias (estimation of the mean difference or the lack of agreement between sessions), or the difference between the mean completion times is similar across all three walking sessions. This reported bias between the one to one session and either five to one sessions was almost the same as the reported bias for the five to one sessions. It would be expected that the bias between both five to one sessions would be smaller than the bias between either five to one and the one to one session due to the same protocol being utilized.

There were inter-individual differences for end completion times and mean peak heart rate. The males in the present study completed all three one mile sessions in a mean time of 16:06 with the differences in individual completion times ranging from 0:09 to 2:30. The females mean completion times across all three sessions was 17:12. The range of individual differences was as great as 3:32 and as small as 0:04. While an examination of the mean peak heart rates values revealed a difference of five beats per minute (bpm) for both the males and females across all three sessions, individuals differed by as much as twenty three bpm for males and thirty-four bpm for females across walking sessions. In contrast the strength of agreement between sessions is strong, on average, because the mean difference scores are close to zero. Further examination of the individual completion times and peak heart rates indicate, in general, a greater difference between the reported values within the one to one session, the first five to one session and the second five to one session. From a statistical stand point the five to one walking sessions are

reliable and produce similar results to the one to one walking session although individual responses may vary by as much as three minutes.

For 82% of the 35 subjects, the difference between the individual end completion times for the one to one session and the first five to one session was less than or equal to two minutes. Furthermore, 86% of the participants differed by less than two minutes with respect to differences in individual end completion times for the one to one session and the second five to one session as well as both five to one sessions. The differences in the individual times are due to a number of factors. Factors may include the functional level of the participants, motivational characteristics, and the somewhat competitive atmosphere during the five to one sessions. In general, participants with lower functional abilities and IQ's completed the walking sessions in the longest amount of time. Furthermore, those with lower IQ's had the largest differences in end completion time between the one to one session and the five to one sessions likely because of the decreased individual attention and motivation. The differences in completion times may also be related to the motivational characteristics of the individuals. Self-motivated individuals appeared to complete the individual miles more quickly. Furthermore the slower walkers relied on the pacers for extrinsic motivation. A self-motivated walker tended to ask about their turn, have interest in their results and show great interest in finishing as quickly as they could. Another reason most participants gave an optimal effort during the five to one sessions may relate to companionship or competitiveness factors. Throughout the study classmates motivated each other to walk even more quickly. This appeared to be more effective with the higher functioning subjects.

Significance of the Findings

Due to budgetary constraints and the de-institutionalization movement, individuals with disabilities frequently live in community based group homes. The greater percentage of individuals with mental retardation living in mainstream society requires caregivers, employers, and researchers to address both these individuals current fitness levels and fitness needs. These are related to work productivity, leisure activities and the ability engage in daily activities (Zetts, Horvat & Langone, 1995; Pommering et al., 1994). The five to one testing protocol is feasible in a real world situation by allowing testers to test a greater number of people in a smaller amount of time. The five to one walking session is reliable and produces results comparable to previous data with this population. Therefore, it appears logical to administer the one mile walking RFWT with a ratio of five participants per pacer instead of the one to one ratio.

Future Directions

By establishing the usefulness and reliability of the modified version of the RFWT group home attendants and physical education teachers can assess more than one person at a time. Although end times and mean peak heart rates for the one to one session and the five to one sessions did not differ significantly a few questions remain. The individual completion times may vary by as much as 3:47. Another study needs to look at why individual differences between completion times is so large. Second, the magnitude of the bias between the one to one session and the five to one sessions is similar to the

bias between both five to one sessions. It would seem logical that the magnitude of bias between the two five to one sessions would be smaller because the same protocol was used. Future studies need to examine why the bias is the same for the comparison of the one to one session and five to one session against both five to one sessions. Third, identification and quantification of specific reinforcers and the motivational characteristics of participants needs to be addressed. Individual reinforcers were established before the start of study but the extent to which they effected the outcome needs to be established. Studies exist that encourage the use of individualized, varied, and specific reinforcers, but what is necessary to ensure a maximal effort? Fourth, a study should investigate the division of participants based on the level of mental retardation. Even though all subjects were classified as having mild mental retardation, those with higher IQ levels and functional ability tended to finish the sessions more quickly. A study needs to investigate the different ability levels in the mild mental retardation classification due to the fact that the category included 95% of all individuals with mild mental retardation. Fifth, investigating the effect of walking one more session a one pacer for five participants on the end completion times and mean peak hearts. Although the results in the present study were non-significant, it was apparent that about one-third of the participants did significantly better on the second five to one session regarding completion times. This may be due to understanding of the protocol and comfort with pacers. Sixth, validating the five to one walking sessions with maximal VO_2 testing is imperative.

Conclusions

The findings of this study provide strong evidence of the reliability and usefulness of a modified version of the Rockport Fitness Walking Test for individuals with mental retardation. The reliability of the modified version was dependent upon the high motivation and effort of the participants and the effort put forth by the pacers. Regardless of the test protocol (one to one vs. five to one), the participants completed the mile as quickly as possible without significant differences in end completion times and peak heart rate across sessions. By essentially reducing the cost and time of testing, the five to one session is a logical and productive way to test the cardiorespiratory fitness levels of individuals with mental retardation.

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Appendices

Appendix A
IRB Proposal

1. SIGNIFICANCE OF THE STUDY

Typically, individuals with mental retardation demonstrate low fitness levels (Pitteti, Rimmer & Fernhall, 1993). The chances of completing everyday tasks without undue fatigue and enjoying recreational activities is increased if individuals have a reasonable level of cardiorespiratory fitness. Cardiorespiratory fitness assessments, if used as part of an exercise program, may be used to predict and improve physical performance for individuals with mild mental retardation (Horvat and Croce, 1992). A field test measuring cardiovascular fitness in men and women with mental retardation found to be valid and reliable is the Rockport Fitness Walking Test (Kittredge et al., 1994). Rintala et al., (1992) validated a 1 mile walking test, the Rockport Fitness Walking Test (RFWT), using 19 males with moderate mental retardation. Further research by Kittredge et al., (1994), validated the one mile RFWT using 12 adult males and 13 females. The RFWT has been validated and proven reliable for males and females with mild retardation using a one tester to one subject protocol (Rintala et al., 1992; Kittredge et al., 1994). Though the RFWT has been validated and found reliable, the 1:1 ratio, is impractical in most settings as financial constraints and the de-institutionalization movement have increased the number of individuals with mental retardation currently working and/or living independently in the community. A way to increase fitness for this population may be the establishment of simple and appropriate protocols which parents, support staff and group-home workers can use to measure baseline and post exercise program cardiorespiratory fitness levels. This measure will provide valuable information regarding the direction exercise programs should follow as well as giving clear evidence regarding the effectiveness of the fitness program. This study will examine the reliability of the RFWT when the protocol is modified from a one tester to one subject ratio to a five subjects to one tester ratio.

2. METHODS AND PROCEDURES

A one mile walking protocol (Rockport Fitness Walking Test) will be conducted on the indoor 1/9 mile track, at McAlexander Fieldhouse on three separate occasions for each subject. Each session will be at least 5 days apart. There will be two familiarization procedures in this study (see appendix A). The first will take place in the subject's home one week prior to the initial one mile walk while the second will take place immediately before the initial testing session. The first familiarization session at the home will include an introduction to the procedures and purpose of the test and a question and answer session. The familiarization procedure at the first testing session will include an introduction to the building, walking techniques and the use of a heart rate monitor. Subjects will participate in a brief ten minute warm-up period, that will include stretching and light walking.

Using a fully crossed randomized design each subject will complete one walking test paired with a trained pacer. The remaining two sessions will group five subjects with a trained pacer. During each walking session the pacer will walk slightly ahead of the subject and encourage the subject positively (using

individualized reinforcement) to walk as quickly as they can. During the second and third sessions the pacer will walk with the five subjects and provide both group and individual positive reinforcement to the walkers.

3. RISKS AND BENEFITS

Risks: The potential risks in a one-mile walking test are minimal. Fast-paced walking may result in shortness of breath and muscle soreness 24 to 48 hours following completion of each. Although the pacer and researcher will encourage the subjects to walk as quickly as they can, both a stretching session and aerobic warm-up will take place immediately before the one-mile walk and should reduce the onset of muscle soreness.

Benefits: The benefits include gaining knowledge about the health-related benefits of walking. These include increased energy levels, reduction in sedentary lifestyles, and probable interest in a walking regimen. Age appropriate positive reinforcement will be used to help motivate and encourage participation.

4. DESCRIPTION OF SUBJECT POPULATION

Subjects will be at least thirty (30), physically healthy, males and females from Oregon between the ages of **16 and 25**. All subjects will have the classification of mild mental retardation as based on the American Association on Mental Retardation classification system (Luckasson et al., 1992). As the classification system for individuals with mental retardation changed in 1992, individuals at the lower end of the mild category will be chosen. Thus, subjects participating in this study will have similar characteristics to those in the Rintala et al. (1992) study. All of the subjects and their legal guardians will be given an informed consent which details the study. Subjects will be contacted and recruited through local social service agencies including the Association of Retarded Citizens, Special Olympics and group home supervisors.

5. THE INFORMED CONSENT

See attached copy. (Appendix B)

6. METHODS TO OBTAIN INFORMED CONSENT

In the presence of a known supervisor (such as a group home worker or Special Olympics coach), parent or guardian each subject will have the purpose and methodology of the study explained to them by the principal investigator. **If a participant is younger than 18 years both a participant and parent or legal guardian signature will be obtained.** The informed consent will be written in a language familiar to the subjects. Subjects will read (or have read) and understand the informed consent prior to signing.

7. CONFIDENTIALITY OF SUBJECT

Anonymity and confidentiality will be preserved at all times by assigning a code number to each subject. All paperwork will be filed using the subjects code number. Only the researcher(s) will have access to the data from the testing sessions.

8. N/A

9. N/A

10. N/A

Familiarization Sessions

1. Familiarization sessions at homes
 - A. Participants met with the tester for explanation of the purpose and procedures for the study.
 - B. Questions from participants and guardians or parents are answered.
 - C. Participants are introduced to the heart rate watches and transmitters including trying on and demonstrating how the monitors work.
2. Prior to first testing session at McAlexander Fieldhouse participants participated in the following methods.
 - A. Participants met the individual testers.
 - B. Walked in McAlexander Fieldhouse.
 - C. Wore heart rate monitors.
 - D. Listened to identification of boundaries and walking area.
 - E. Four minutes of warm-up and stretching exercises.

Appendix B
Informed Consent

Informed Consent

The purpose of this test is to show whether I can walk a mile on three different days and finish the test in the same amount of time each time I take the test.

1. Procedures

I will be dropped off by my parents, guardian or group home coordinator at the Oregon State University McAlexander Fieldhouse in Corvallis, Oregon and participate in a one-mile walking test. All sessions will be conducted inside. I will be tested by walking one-mile (nine times around the inside of the fieldhouse) as fast as I can with a testing helper on three separate days (5 to 7 days apart). For safety, I will wear a special belt around my chest and a watch to measure my heart rate while I walk.

2. Possible Risks and Benefits

I may have some shortness of breath during the walking test and muscle soreness after the test.

I will learn about how fit I am based on how fast I complete each test.

3. Questions

If I have any questions, I can contact the primary investigator, Dr. Douglas Collier or Nicolette Laurie. The phone numbers and address will be included in a small information packet passed out to my supervisor during the familiarization part of the study.

4. Withdrawing and Liability

If for any reason I want to stop being in the study, I can do so without penalty. I know I am free to leave the study at any time.

Oregon State University will not assume responsibility for any problems that may arise during of the study and will not pay for any medical costs if I am injured during the study.

5. Confidentiality

Results of the experiment will only be used by the researchers to help other teachers through professional papers and conferences. My name will not be used in any of the results of the study. Instead a number will be assigned to me to protect my confidentiality.

I have read, or had read to me the entire form and understand the informed consent document and will be a willing subject in the study.

Subject Signature _____

Date_____

I consent to having my son or daughter participate in this study. Guardian or Parent Signature (only required if subject is under the age of 18)

Date_____

Appendix C
Reinforcers

Subject # _____

Date __/__/__

Name _____

Dear Colleague:

As you know I have relied on your assistance with the completion of my project, "The Reliability of a One Mile Walking Test" and was hoping to gain some more information on the participants. As part of the study I am providing reinforcers to each individual participant as they complete each mile.

Reinforcers are statements or cues that motivate the subject to complete the mile as quickly as possible. Unfortunately I am not able to know each participant on a personal level. Therefore, I am asking you to provide me with any cues, statements or ideas that will encourage the participant to finish quickly. Please feel free to call if you have any questions (737-2709). Thank you for your continued assistance. Please return the form to me at the following address:

Nicolette Laurie
OSU-WB 107E
Corvallis, OR 97331

1. _____

2. _____

3. _____

Appendix D
Testing Directions

Here are the directions. Please read them to each subject during the warm-up lap. At the end of the lap please make sure the heart rate monitor is working and ask them if they have any questions.

1. Walk 9 times around the cones “as if you were in a hurry to go somewhere”.
2. Stay on the outside of the cones. (point to the correct side)
3. Walk as quickly as you can.
4. Remember to put your left arm out as you pass over the yellow line. (Make sure the heart rate watch is on the left hand facing you.)
5. Nikki will let you know when you are on the last lap.
6. Remember it is okay to pass.
7. No running.
8. I want to see you finish as quickly as possible.

Thanks. Please make sure I am ready before you start. If you have to wait it will be a brief break. Please be patient.

Thanks again,

Nikki

Appendix E
Individual Subject Data

RFWT	age	sex	DOB	height	weight	IQ	scale
1	21	M	7.24.76	73	196		66 WISC-3rd
2	21	M	1.13.78	66.25	111	FS 67	WAIS-R
3	21	M	11.22.76	64.75	120		60 TONI
4	20	F	3.8.77	64.75	114		
5	20	M	12.02.76	71.5	161		63
6	16	M	2.28.82	64.5	211		50 WISC-3rd
7	18	F	11.15.78	61.5	160		48 WISC-3rd
8	18	M	10.31.78	68.75	200		S. Binet
9	16	F	6.9.82	62.2	134		47 WISC-3rd
10	16	M	6.20.81	70	136	34 IQ	Leiter
11	16	M	9.29.81	64.5	213		50 WISC-3rd
13	21	F	5.14.75	59.5	126		
14	23	F	10.09.73	61.25	116		63 WISC-3rd
15	25	F	11.25.71	57	142		63 WISC-3rd
16	23	M	07.17.73	67	196		42 WIPPS-1
17	21	F	10.29.75	66	198		63 WISC-3rd
18	18	M	6.6.78	62.5	158	41+5	
19	20	M	6.6.76	73.25	296		43
20	19	M	7.14.77	73.5	290		unable to test
21	23	F	12.13.74	61	125	CA 9-4, MA 5.5	Leiter
22	22	M	04.14.74	66	163		68 WISC-3rd
23	24	M	11.26.72	67.5	153	41.7-48.3	Leiter
24	23	F	7.14.73	66.5	114		
25	22	F	07.28.74	54.25	102		59 WISC-3rd
26	25	M	02.06.72	73.75	158	49-67	Stanford
27	25	F	8.15.71	60.5	139		
28	24	F	10.11.72	59.5	104		68 WAIS-R
29	25	F	08.28.71	64	144		
30	18	F	7.25.79	54.5	120		58 WIPPS-1
31	21	M	6.13.76	62.5	112		50 Stanford
32	20	F	02.03.77	54	148		43 Stanford
33	20	F	01.19.77	59.5	230	36-40	Stanford
34	21	F	12.11.76	59	87		56 WISC-3rd
35	18	M	9.30.78	72.25	142		66 WISC-3rd
36	18	F	10.13.78	58.75	88		68 WISC-3rd
	20.63			64.15	154.49		
	2.76			5.60	50.45		

Appendix F

Individual End Completion Times and Heart Rates

RFWT	Gender=m, f=0	Date	Time	Test # (1,2or3)	Ratio(S or 1)	Time Lap1	Time Lap2	Time Lap3	Time Lap4	Time Lap5	Time Lap6	Time Lap7
1	1	1.31.97	10.00am	1	51	1:42	3:07	4:52	6:38	8:25	10:12	12:02
1	1	2.7.97	10.00am	2	52	1:38	3:14	4:55	6:38	8:29	10:05	12:05
1	1	2.21.97	10.00 am	3	1	1:44	3:03	5:13	6:53	8:37	10:19	12:02
2	1	1.31.97	10.00am	1	51	1:14	2:37	4:01	6:46	7:47	9:35	11:18
2	1	2.7.97	10.00am	2	52	1:19	2:04	4:02	5:21	6:43	8:01	9:26
2	1	2.21.97	10.00am	3	1	1:17	2:38	3:57	5:18	6:39	8:00	9:02
3	1	1.31.97	10.00am	1	51	1:37	3:02	4:35	6:09	7:48	9:16	10:42
3	1	2.7.97	10.00am	2	52	1:35	3:01	4:21	5:55	7:26	8:59	10:35
3	1	2.21.97	10.00am	3	1	1:52	3:05	5:44	7:39	9:33	11:21	13:09
4	0	1.31.97	10.00am	1	51	1:31	3:01	4:52	6:17	7:53	9:47	11:27
4	0	2.7.97	10.00am	2	52	1:29	2:58	4:04	6:22	8:01	9:47	11:35
4	0	2.26.97	8.00pm	3	1	1:34	3:15	4:45	6:17	7:52	9:45	11:18
5	1	1.31.97	10.00am	1	51	1:12	2:33	3:56	5:24	6:41	7:57	9:29
5	1	2.7.97	10.00am	2	52	1:17	2:04	4:01	5:23	6:44	8:00	9:23
5	1	2.21.97	10.00am	3	1	1:16	2:32	3:52	5:11	6:32	7:05	9:01
6	1	2.11.97	10.30am	1	51	2:01	4:13	5:59	8:01	8:32	9:45	11:33
6	1	2.18.97	11am	2	1	1:38	3:32	5:31	7:33	9:34	11:12	13:03
6	1	2.25.97	10.30am	3	52	1:03	3:22	5:01	7:03	8:48	10:25	12:28
7	0	2.18.97	11.00am	2	51	1:58	3:42	5:03	7:15	9:07	10:49	12:03
7	0	2.25.97	10.30am	3	52	1:43	3:35	5:28	7:03	9:17	11:12	13:02
7	0	2.26.97	12.00pm	1	1	1:32	3:01	5:01	6:47	8:39	10:24	12:13
8	1	2.11.97	11.30am	1	1	1:05	3:54	6:01	8:07	10:16	12:29	14:35
8	1	2.18.97	10.30am	2	51	1:47	3:37	5:28	7:19	9:05	10:57	12:55
8	1	2.25.97	10.30am	3	52	1:05	3:49	5:05	7:47	9:43	11:47	13:04
9	0	2.11.97	11.00am	1	51	1:56	3:39	5:29	7:15	9:01	11	13:19
9	0	2.18.97	11.00am	2	1	2:07	3:59	6:26	8:42	11:07	13:08	15:07
9	0	2.25.97	11.00am	3	52	2:15	4:09	5:48	7:38	9:48	12:02	14:45
10	1	2.11.97	11.30am	1	1	1:02	2:43	4	5:22	6:53	8:25	9:52
10	1	2.18.97	11am	2	51	1:27	2:46	4:11	5:35	6:56	8:17	9:39
10	1	2.25.97	10.30am	3	52	1:03	3:02	4:46	6:12	7:42	9:08	10:32
11	1	2.11.97	11.00am	1	51	1:45	3:45	5:46	7:55	10:12	12:02	14:37
11	1	2.18.97	11.00am	2	1	1:47	3:48	5:54	7:59	9:59	12:08	14:04
11	1	2.25.97	11am	3	52	1:51	3:53	5:27	7:19	9:12	11:15	13:21
13	0	1.29.97	8.30am	1	1	1:43	3:08	5:15	7:01	9:05	11	13:05
13	0	2.11.97	10.30am	2	51	1:52	3:03	5:14	7:02	8:58	10:49	12:44
13	0	2.18.97	10.30am	3	52	1:42	3:26	5:14	7:02	8:58	10:49	12:44
14	0	2.25.97	11.30am	1	51	1:21	2:58	4:03	6:08	7:04	9:06	10:03
14	0	3.4.97	11.30am	2	52	1:24	3:01	4:45	6:35	8:28	11:18	13
14	0	3.11.97	11.30am	3	1	1:16	3:03	4:47	6:34	8:01	9:05	11:39
15	0	2.26.97	8.00pm	1	51	2:03	3:57	6	8:14	10:22	12:32	14:37
15	0	3.5.97	8.00pm	2	1	2:01	4:15	6:26	8:39	10:55	13:11	15:23
15	0	3.12.97	8.00pm	3	52	2:04	3:55	5:58	8:08	10:18	12:03	14:32
16	1	3.5.97	8.00pm	1	1	2	3:54	5:47	7:42	9:38	11:24	13:11
16	1	3.21.97	8.00pm	2	51	2	3:23	5:17	7:08	9:01	11:07	13:15
16	1	3.26.97	8.00pm	3	52	1:47	3:38	5:04	7:35	9:33	11:27	13:02
17	0	2.18.97	11.30am	1	1	2:05	4:01	6:09	7:55	9:04	11:29	13:14
17	0	2.26.97	8.00pm	2	51	1:35	3:12	4:47	6:28	8:14	10	11:45
17	0	3.12.97	8.00pm	3	52	1:36	3:15	4:55	6:31	8:12	9:55	11:32
18	1	2.18.97	11.00am	1	1	1:55	3:57	6:13	8:03	10:48	12:59	15:01
18	1	2.25.97	11.00am	2	51	1:57	4:08	6:23	8:42	11:02	13:22	15:42
18	1	2.26.97	12.00pm	3	52	2:18	4:35	7:05	9:46	12:23	14:59	17:32
19	1	2.11.97	10.30am	1	51	1:58	3:05	5:59	8:17	10:05	13:17	15:38
19	1	2.18.97	11.30am	2	1	1:24	3:38	5:59	8:32	10:57	13:03	15:48
19	1	2.25.97	11.00am	3	52	1:51	4:05	6:43	9:22	11:53	14:03	17:07
20	1	2.11.97	11.00am	1	51	2:45	5:25	8:03	10:56	14:01	16:54	19:49
20	1	2.18.97	11.00am	2	1	2:35	5:08	7:41	10:01	12:39	15:25	18:02
20	1	2.25.97	11.00am	3	52	2:31	4:05	7:22	9:58	12:41	15:34	18:32
21	0	2.25.97	11.30am	1	51	1:04	3:31	5:22	7:22	9:19	11:16	13:16
21	0	3.4.97	11.30am	2	52	2:02	4:05	6	7:57	9:42	11:36	13:25
21	0	3.12.97	11.30am	3	1	1:46	3:22	5:05	6:43	8:25	10:02	11:45
22	1	2.26.97	8.00pm	1	51	1:35	3:12	4:34	6:01	7:44	9:19	10:52
22	1	3.12.97	8.00pm	2	1	1:22	2:58	4:32	6:02	7:04	9:13	10:54
22	1	3.26.97	8.00pm	3	52	1:34	3:08	4:38	6:01	7:41	9:01	10:04
23	1	2.25.97	11.30am	1	51	1:26	2:46	4:15	5:28	6:51	8:19	9:42
23	1	3.4.97	11.30am	2	52	1:24	3:03	4:33	6:14	7:05	9:25	11:12
23	1	3.11.97	11.30am	3	1	1:36	3:16	5	6:31	7:48	9:07	10:27
24	0	2.26.97	8.00pm	1	1	1:05	3:31	5:08	6:46	8:28	9:57	11:32
24	0	3.12.97	8.00pm	2	51	1:14	3:33	5:12	6:53	8:39	10:24	12:03
24	0	3.26.97	8.00pm	3	52	1:35	3:11	4:05	6:33	8:19	10	11:31
25	0	2.25.97	11.30am	1	51	1:05	3:55	5:51	7:57	9:55	12:11	14:02
25	0	3.4.97	11.30am	2	52	2:08	3:52	5:46	7:53	9:52	12	14:06
25	0	3.11.97	11.30am	3	1	2:01	4:05	6:01	7:59	10:09	11:57	14:06
26	1	2.25.97	11.30am	1	51	1:03	2:52	4:31	6:01	7:45	9:09	10:33
26	1	3.4.97	11.30am	2	52	1:24	2:58	4:25	5:45	7:02	8:47	10:18
26	1	3.11.97	11.30am	3	1	1:13	2:49	4:23	6:02	7:44	9:07	10:42
27	0	3.12.97	8.00pm	1	1	1:56	3:56	6:01	8:04	10:05	12:02	14:27
27	0	3.21.97	8.00pm	2	51	1:47	3:47	5:21	7:21	9:35	11:42	13:59
27	0	3.26.97	8.00pm	3	52	1:56	4	5:49	7:45	9:49	11:58	13:59
28	0	2.26.97	8.00pm	1	51	1:35	3:01	4:32	6:08	7:44	9:18	10:47
28	0	2.12.97	8.00pm	2	1	1:22	2:58	4:29	6:07	7:49	9:03	11:11
28	0	3.26.97	8.00pm	3	52	1:29	2:57	4:19	6:02	7:47	9:23	11:05
29	0	2.26.97	8.00pm	1	51	1:47	3:31	5:24	7:12	9:07	11	13:05
29	0	3.12.97	8.00pm	2	1	1:38	3:16	4:56	6:45	8:35	10:12	11:58
29	0	3.26.97	8.00pm	3	52	1:05	3:04	5:14	6:53	8:03	10:15	12:05
30	0	2.26.97	8.00pm	1	51	1:47	3:46	5:31	7:34	9:04	11:51	14:03
30	0	3.12.97	8.00pm	2	52	1:46	3:42	5:21	7:19	8:52	11:49	13:35
30	0	3.26.97	8.00pm	3	1	1:54	4	6:18	8:04	10:06	12:03	14:54
31	1	2.13.97	12.00pm	1	1	1:47	3:49	5:05	7:45	9:45	11:54	14:02
31	1	2.26.97	12.00pm	2	51	2	3:59	6:11	8:02	10:01	12:35	14:43
31	1	2.28.97	12.00pm	3	52	2:08	4:21	6:47	9:01	11:29	14:03	16:13
32	0	3.4.97	12.30pm	1	1	3:25	6:16	9:42	13:42	17:12	19:49	22:19
32	0	2.26.97	12.00pm	2	51	2:02	4:01	8	12:01	13:33	16:56	19:56
32	0	2.26.97	12.00pm	3	52	2:55	7:34	11:49	15:42	18:07	20:39	23:05
33	0	2.13.97	12.00pm	1	1	1:43	3:28	5:12	6:51	8:36	10:12	11:52
33	0	2.26.97	12.00pm	2	51	2:18	4	5:34	7:29	9:02	10:58	12:43
33	0	2.26.97	12.00pm	3	52	1:15	2:47	4:21	5:55	7:42	9:35	11:15
34	0	2.26.97	12.00pm	1	51	3:18	6:03	8:45	12:07	14:25	17:36	20:26
34	0	2.26.97	12.00pm	2	52	3:25	7:15	10:42	14:42	17:12	19:29	22:09
34	0	3.4.97	11.30am	3	1	3:12	5:59	8:05	11:59	13:58	16:43	19:58
35	1	2.11.97	10.30am	1	51	1:38	3:22	5:01	6:41	8:35	10:29	12:19
35	1	2.18.97	10.30am	2	52	1:25	2:46	4:09	5:32	6:53	8:12	9:37
35	1	2.26.97	12.00pm	3	1	1:29	2:48	4:08	5:34	6:05	8:09	9:34
36	0	2.11.97	11.00am	1	51	1:35	3:18	4:58	6:04	8:25	10:01	11:04
36	0	2.18.97	10.30 am	2	52	1:22	2:47	4:14	5:04	7:11</		

Time	Laps	Time	Laps	HR	rest	lap1	lap2	lap3	lap4	lap5	lap6	lap7	lap8	lap9	Peak Hr	Lap	Peak Hr	Paac
15:52	17:03	75	139	142	143	157	162	158	158	154	157				5		162	Jenn
13:42	15:17	95	142	145	150	146	143	149	151	151	159				9		159	Jenn
13:39	15:02	78	123	125	138	141	149	154	145	155	162				9		162	Jenn
10:58	12:07	64	154			152	151	153	154	162	176				9		176	Jenn
10:49	11:59	71	148	136	136	147	143	149	164	161	168				9		168	Jenn
12:04	11:55	65	127	127	153	138	148	146	153	153	187				9		187	Jill
12:05	15:27	71	141	143	110	110	121	131	136	89	129				2		143	Jenn
14:52	13:28	100	133	158	143	140	142	144	145	148	153				2		158	Jenn
14:52	16:25	88	106	105	109	111	111	108	114	119	130				9		130	Chris
13:28	15:05	72	129	136	132	133	139	173	94	139	147				6		173	Jenn
13:21	15:08	91	164	134	147	146	149	152	140	136	134				1		164	Jenn
13:09	14:56	96	128	162	168	156	168	168	167	172	178				9		178	Katie
10:45	12:05	70	155	163	165	166	167	169	166	174	179				9		174	Jenn
10:46	11:57	82	144	152	135	152	158	162	159	164	171				9		171	Jenn
10:03	11:43	63	135	154	156	160	163	166	170	172	180				9		180	Jenn
12:54	14:51	81	136	137	151	148	150	156	158	170	156				8		170	Chris
15:39	17:48	87	140	140	137	140	141	146	138	138	147				9		147	Jenn
14:33	16:25	78	145	134	134	134	134	179	162	172	189				9		189	Jenn
14:14	15:49	78	134	151	171	165	169	182	186	175	193				9		193	Mike
14:55	16:42	82	153	153	156	159	169	155	162	159	179				9		179	Jenn
14:02	16	100	128	136	142	172	174	176	179	175	157				7		179	Nikki
16:55	18:53	100	132	132	133	140	134	140	135	135	137				6		140	Chris
14:05	16:39	88	106	111	112	117	116	117	110	116	123				9		123	Jenn
15:38	17:03	100	117	120	117	121	117	115	123	122	127				9		127	Jenn
14:55	16:41	85	156	169	173	173	170	171	157	181	190				9		190	Chris
17:22	19:49	89	142	169	123		115	127	162	159	155				7		162	Mike
16:54	19:05	88	140	152	171	174	174	153	147	154	159				4.5		174	Chris
11:11	12:35	80	151	162	160	177	177	167	173	176	176				4.5		177	Jenn
11:07	12:26	87	131	147	177	154	153	154	152	154	157				3		177	Jenn
12:03	13:31	82	143	151	154	160	162	160	171	158	178				9		178	Jenn
16:37	18:15	72	134	129	132	135	121	135	127	132	169				9		169	Chris
16:05	17:57	76	134	134	123	123	132	116	134	128	149				9		149	Michelle
16:07	18:08	88	130	137	138	135	142	140	132	135	146				9		146	Chris
15:02	16:55	64	64	129	135	147	148	148	140	154	154				8.5		154	Chris
15:01	16:59	65	144	147	148	153	147	143	144	144	146				4		153	Jenn
14:32	16:22	66	148	149	151	147	144	142	147	149	157				9		147	Jenn
12:46	14:12	78	155	147	158	145	149	163	173	142	175				9		173	Jenn
14:44	16:18	86	133	136	129	121	118	111	130	123	127				3		136	Jenn
13:01	14:18	78	107	127	130	127	132	135	133	138	148				9		148	Katie
16:44	18:51	86	169	174	174	175	173	173	172	176	181				9		181	Nikki
17:35	19:45	118	141	150		157	157	157	154	160	162	188			9		168	Katie
18:45	18:05	94	153	164	160	158	162	158	152	161	172				9		172	Jenn
14:59	16:44	78	124	134	141	138	138	151	152	157	164				9		164	Michelle
15:13	17:01	88	155	158	159	153	158	145	142	140	173				9		173	Jenn
15:19	17:07	78	145	153	141	148	149	153	149	149	162				9		162	Chris
15:01	16:04	88	131	123	130	150	150	155	164	161	176				9		176	Mike
13:28	15:05	86	175	183	183	179	180	179	181	180	194				9		194	Nikki
13:01	14:05	109	172	178	178	178	178	178	178	178	188				9		188	Jenn
17:12	19:14	58	58	70	67	66	67	69	70	76	79				9		79	Katie
18:03	20:14	58	60	59	60	61	59	59	61	61	64				9		64	Jenn
19:15	21:36	48	59	67	85	82	85	68	68	73	75				9		75	Chris
16:59	18:17	100	144	145	142	144	144	144	149	148	148				7		149	Jenn
18:16	20:22	88	137	147	148	146	149	150	113	155	159				9		159	Jenn
19:42	22:04	102	134	130	127	129	135	133	133	134	150				9		150	Chris
22:03	25:05:00	72	117	125	123	126	132	134	123	126	142				9		142	Chris
20:04	23:12	72	134	134	136	137	139	138	138	138	149				9		149	Jenn
21:55	24:32:00	86	136	142	149	134	128	127	130	132	146				3		149	Chris
15:15	16:52	78	138	134	135	132	131	131	128	129	163				9		163	Jenn
15:06	17:03	100	108	119	119	122	136	131	135	137	167				9		167	Jenn
13:03	15:03	76	146	157	156	170	167	172	166	168	188				9		188	Chris
12:16	13:56	76	127	145	145	150	155	154	156	159	172				9		172	Nikki
12:36	14:14	76	145	145	140	148	148	154	154	154	164				9		164	Michelle
12:12	13:37	78	134	138	148	146	151	154	155	162	175				9		175	Chris
11:08	12:27	76	152	159	159	162	168	150	156	157	176				9		176	Jenn
12:48	14:08	102	140	149	148	135	157	155	162	162	184				9		184	Jenn
11:45	12:35	106	123	123		120	135	151	158	151	171				9		171	Jenn
13:05	14:35	78	121	131	137	145	147	158	160	163	161				8		163	Jenn
13:39	15:25	76	114	123	127	125	128	127	130	138	155				9		155	Jenn
13:06	14:44	102	132	145	136	141	158	138	158	158	173				9		173	Chris
16:34	18:26	129	168	180	160	152	131	134	135	193	191				8		213	Jenn
16:18	18:13	86	151	158	165	164	168	168	168	169	189				9		189	Jenn
16:01	18:05	78	132	148	152	157	160	167	168	170					9		170	Jenn
11:59	13:29	68	108	116	123	106	117	127	129	138	154				9		154	Jenn
11:46	13:01	72	127	146	143	162	145	145	138	161	188				9		188	Jenn
12:05	13:32	82	143	128	139	127	135	142	148	145	163				9		163	Mike
16:35	18:42	102	109	106	111	111	109	114	107	108	140				9		140	Jenn
15:59	17:49	102	109	111	113	121	121	124	111	125	135				9		135	Jenn
15:57	17:57	84	98	103	110	115	102	96	98	97	127				9		127	Chris
12:18	13:56	84	158	151	155	163	159	144	160	172	173				9		173	Nikki
12:49	14:04	88	158	145	145	147	149	151			162	166			9		166	Jill
12:26	13:57	102	143	143	127	147	149	152	161	167	169				9		169	Jenn
15:42	16:56	86	147	150	150	144	142	141	138	135	170				9		170	Nikki
13:45	15:29	78	135	151	139	135	151	155	146	152	159				9		158	Chris
13:53	15:03	92	115	127	144	161	152	136	153	136	171				9		171	Chris
16:03	18:02	96	176	180	175	169	162	158	160	174	185				9		185	Jenn
15:42	17:59	88	175	168	167	166	158	159	160	162	182				9		182	Jenn
16:54	15:38	88	159	159	159	148	144	157	152	169	175				9		175	Howard
16:08																		

Appendix G

t-tests between Males and Females for Mean Completion Times,

Mean Peak Heart and Peak Lap

females									
	Time_Lap9	Time_Lap9	Time_Lap9	Peak Hr-La	Peak Hr-La	Peak Hr-La	Peak Hr	Peak Hr	Peak Hr
4	14:56	15:05	15:08	9	6	1	178	173	164
7	16:00	15:49	16:42	7	9	9	179	193	179
9	19:49	16:41	19:05	7	9	4.5	162	190	174
13	16:55	16:59	16:22	8.5	4	9	154	153	147
14	14:18	14:12	16:18	9	9	3	148	173	136
15	19:45	18:51	18:05	9	9	9	168	181	172
17	16:04	15:05	14:05	9	9	9	176	194	188
21	15:03	16:52	17:03	9	9	9	186	163	167
24	14:35	15:25	14:44	8	9	9	163	155	173
25	18:05	18:26	18:13	9	8	9	170	193	189
27	18:42	17:49	17:57	9	9	9	140	135	127
28	14:04	13:56	13:57	9	9	9	166	173	169
29	15:29	16:56	15:03	9	9	9	158	170	171
30	15:38	18:02	17:59	9	9	9	175	185	182
32	27:34:00	27:02:00	30:03:00	9	6.5	9	152	149	143
33	15:08	15:51	14:15	9	9	9	163	176	187
34	25:02:00	26:02:00	28:34:00	9	9	9	129	110	122
36	13:00	14:41	13:22	9	9	9	185	180	187
	17:13	17:25	17:36	8.69	8.36	7.97	164.00	169.22	165.39
Stdev-Fem	3:50	3:36	4:35	0.67	1.41	2.44	15.36	22.18	21.35
T-test	0.332648	0.252877	0.37062	0.742661	0.403398	0.394924	0.145956	0.118003	0.428001
Ave-Males	16:01	16:02	16:17	8.59	7.82	8.59	153.65	155.29	158.65
Stdev-Male	3:24	3:26	3:55	1.18	2.27	1.70	24.92	28.90	28.08
Males									
Subject No	Time_Lap9	Time_Lap9	Time_Lap9	Peak Hr-La	Peak Hr-La	Peak Hr-La	Peak Hr	Peak Hr	Peak Hr
1	15:02	17:03	15:17	9	5	9	162	162	159
2	11:55	12:07	11:59	9	9	9	167	176	168
3	16:25	15:27	13:26	9	2	2	130	143	158
5	11:43	12:05	11:57	9	9	9	180	174	171
6	17:48	14:51	16:25	9	8	9	147	170	189
8	18:53	16:39	17:03	6	9	9	140	123	127
10	12:35	12:26	13:31	5	3	9	177	177	178
11	17:57	18:15	18:08	9	9	9	149	169	146
16	16:44	17:01	17:07	9	9	9	164	173	162
18	19:14	20:14	21:36	9	9	9	79	64	75
19	20:22	18:17	22:04	9	7	9	159	149	150
20	23:12	25:02:00	24:32:00	9	9	9	149	142	149
22	14:14	13:56	13:37	9	9	9	164	172	175
23	12:35	12:27	14:08	9	9	9	171	176	184
26	13:32	13:29	13:01	9	9	9	163	154	188
31	18:07	18:49	20:49	9	9	9	129	137	137
35	12:02	14:32	12:17	9	9	9	182	179	181

Appendix H

2X3 ANOVA of Main Effects and Two Way Interactions for End Completion

Times and Mean Peak Heart Rates

Table A.1

Analysis of Variance for End Completion Times for the RFWT for Individuals with Mental Retardation.

Source	SS*	DF*	MS*	F	Sig F*
Main Effects	46.514	3	15.505	1.055	0.372
-Sessions	1.924	2	0.962	0.065	0.937
-Gender	44.590	1	44.590	3.034	0.085
2-way Interactions	0.140	2	0.070	0.005	0.995
Explained	46.654	5	9.331	0.635	0.674
Residual	1455.028	99	14.697		
Total	1501.681	104	14.439		

*SS=Sum of Squares; DF=Degrees of Freedom; MS=Mean Square; Significance of F

Table A.2

Analysis of Variance for Mean Peak Heart Rates for the RFWT for Individuals with Mental Retardation.

Source	SS*	DF*	MS*	F	Sig F*
Main Effects	2450.259	3	816.75	1.426	0.240
-Sessions	258.362	2	129.181	0.226	0.798
-Gender	2191.897	1	2191.897	3.828	0.053
2-way Interactions	180.041	2	90.021	0.157	0.855
Explained	2630.300	5	526.060	0.919	0.472
Residual	56691.261	99	572.639		
Total	59321.562	104	570.400		

*SS=Sum of Squares; DF=Degrees of Freedom; MS=Mean Square; Significance of F