THE EFFECTS OF A SCHOOL-BASED PHYSICAL EDUCATION CURRICULUM ON WORK PRODUCTIVITY AND PHYSICAL FITNESS PARAMETERS OF HIGH SCHOOL PARTICIPANTS WITH MENTAL RETARDATION

by

FRANK EDWARD SEAGRAVES III

(Under the direction of MICHAEL A. HORVAT)

ABSTRACT

The purpose of this study was to investigate the effectiveness of a school-based physical education progressive resistance-training program on muscular strength, endurance, and work productivity of high school participants with mental retardation. Fourteen high-school participants matched according to age, gender, height, and weight were randomly placed into treatment and control groups. Treatment groups participated in a progressive resistance-training program and the control group participated in group and individual games. Both programs were 10 weeks in duration at a frequency of twice per week. Vocational and strength assessments were collected at three intervals five weeks apart plus a retention assessment. Peak isometric strength was assessed bilaterally using a hand-held dynamometer at the following sites: elbow flexion, elbow extension, shoulder abduction, knee flexion and knee extension, which were summed to create composite scores for the upper and lower body. Vocational assessments were representative of typical job skills for this population and consisted of a dolly push (timed distance), pail carry (timed distance), box stacking (timed repetitions), and chair stacking (timed repetitions). After termination of the treatment intervention at 10 weeks a retention assessment was administered 5 weeks after cessation of training. Based on a randomized complete block with repeated measures research design, a significant difference was found for all vocational tasks (chair stacking, $F_{1,6}=9.79$, $p=.010$; pail carry, $F_{1,6}=4.65$, $p=.037$; dolly push $F_{1,6}=4.89$, $p=.018$; & box stacking $F_{1,6}=4.85$, $p=.035$) with resistance training participants displaying higher mean scores than participants in control groups. In addition, percentage change data for isometric strength composites with treatment groups increased an average of 38.35% while the control group increased 4.08%. Based on the retention data mean percentage change for all participants in the training group decreased towards initial levels of functioning with isometric strength composites decreasing 11.42% and vocational tasks decreasing 12.64%. Based on the data analysis it was concluded that the school-based physical education training program was effective in increasing physical functioning and work-related skills, which can facilitate the school to work transition process.

INDEX WORDS: Mental retardation, Strength, Work-related skills, Transition, Progressive resistance training

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FRANK EDWARD SEAGRAVES III

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FRANK EDWARD SEAGRAVES III

Approved:

Major Professor: Michael Horvat

Committee: Chris Franklin
David Hayes
Karen Jones
Bryan McCullick
Michael Tarrant

Electronic Version Approved:

Gordhan L. Patel
Dean of the Graduate School
The University of Georgia
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CHAPTER 1

INTRODUCTION

The ability to work for economic independence is a route to social identification, and a source for personal networking for most adults in society (Kiernan, 2000). Work supports our lifestyles, develops our friendships, and often defines our person. Trends in education reform have attempted to highlight and strengthen the ties between school and work for those individuals not moving into post-secondary education in an effort to relieve reoccurring problems with school to work transitions. This movement of identifying successful transition practices has been a focus of special education reform for the past decade (Fabian, Lent, & Willis, 1998), because of historically poor postsecondary outcomes of individuals with disabilities. Despite research that has linked the positive benefits of work for individuals with mental retardation research indicates that just three out ten are employed (Gilmore, Schuster, Timmons, & Butterworth, 2000; Mank, 1994). Wagner and Blackorby (1996) indicated that a national survey of over 8,000 participants revealed that only 27% of participants with disabilities enrolled in post-secondary education compared to 68% of the general population. Furthermore, only 57% of individuals with disabilities find employment 3-5 years after high school compared to 69% in the general population.

In addition, over 30% of individuals with disabilities drop out of or never enter high school. Although Wagner and Blackorby does not delineate by disability, Hasazi, Gordon, Roe, Hull, Finck, & Salembier (1985) reported similar findings that only 47% of mildly mentally retarded participants find employment within one year of exiting school.

Individuals with mental retardation are one of the largest sub-populations in vocational rehabilitation who have difficulty gaining and maintaining employment (Rubin & Roessler, 1987), due to concerns of physical competence, social integration, reliability, and productivity, (Greenwood and Johnson, 1987). McGaughey et al. (1994) reported that unemployment for individuals with mental retardation hovers around 70% further emphasizing the difficulty in attaining employment and the importance of the school in the transitional process for this population.

The Individuals with Disabilities Education Act Amendments of 1997(IDEA) defines transition as a coordinated set of activities for a student, designed within an out-come oriented process, which promotes movement from school to post-school activities, including postsecondary education, vocational training, integrated employment, continuing and adult education, adult services, independent living, or community participation (IDEA, 1997). With the support of IDEA, employment strategies for individuals with mental retardation are moving away from the sheltered workshop model that is basically custodial to supported employment models that train and place individuals in actual job sites. Programs that have shown success in training and employment for individuals with disabilities suggest internship-type programs that begin while the participants are still enrolled in high school to be superior to sheltered workshop type programs (Fabian, Lent, & Willis, 1998). This is also supported by an analysis of trends over the last decade (1985-1995) of individuals with disabilities receiving services from state vocational rehabilitation agencies (Gilmore, Schuster, Timmons, & Butterworth, 2000). Statistics from a national database containing information from over 600,000 cases per year report no significant change in the number of closures from vocational rehabilitation services annually, but the number of closures into sheltered workshops declined (24.8%-14.9%) while the number closures into competitive employment increased (69.3-82.8%). Successful closure according to the Rehabilitation Services Administration is a case where the individual receiving services obtains and maintains employment for a period of 90 days. This data supports the 1992 amendments to the Americans with Disabilities Act that dictates changes in service delivery. Outcomes of greater community involvement, higher earnings and job satisfaction are also reported by research showing supported employment as a superior strategy to sheltered workshops (Wehman & Kregel, 1995).

A study of Arkansas Rehabilitation Services rolls by Bolton, Bellini, and Brookings (2000) revealed that individuals with mental retardation had more functional limitations in adaptive behavior, lower vocational qualifications, and lower physical capacity and motor function compared to other groups with disabilities based on a survey of 4,603 individuals representing five major disabilities categories. Functional limitations were based on a behaviorally anchored, vocational counselor-rated diagnostic battery that addresses 30 items including learning ability, upper extremity function, endurance, and memory. This battery is used to predict employment outcomes and which variables make to most important contributions to the prediction of employment outcomes. Results indicate that the above factors account for 33% of the variability in competitive employment and 12% variance in salary. In addition, findings indicated that functional limitations and training had considerable predictive value of salary and employability at closure.

Individuals with mental retardation were comparable or superior to individuals without mental retardation according to a study by Adams-Shollenberger and Mitchell (1996) that investigated retention and absenteeism in a competitive work environment. In a comparison of 417 janitorial workers (288 individuals without mentally retardation, 50 individuals with mental retardation) those without mental retardation had an 81% voluntary termination rate compared to 70% of individuals with mental retardation, while involuntary termination rates were 19% and 24% over a 12-month period respectively. In addition, the two groups showed no differences in overall absence rates for the first year; however, the individuals with mental retardation did have a higher rate of excuses for absences that fell into the poor weather category. The authors suggest that this trend may be due to their reliance on family members or public transportation for access to the work site. While this study reported promising results, unfortunately, it did not report age or level of impairment for subjects, which has a considerable impact on physical functioning.

Additional authors have supported these findings with job separation rates of 72% reported by Botuck et al. (1998) for 109 individuals with disabilities in post-placement jobs that were tracked over a 24-month period. Reasons for separation included poor attendance, poor attitude, criminal behavior, tardiness, employer financial problems, task production (low quality, slow rate, prompting required), and social-vocational.

Many of the jobs obtained by individuals with mental retardation are entry-level (Parmenter, 1993) and require physical labor including manual materials handling of a specific weight, or repetition of an action with a certain frequency, over a given range, with containers of various sizes (Genaidy, Bafna, Sarmidy, & Sana, 1990). These types of jobs come with a pre-requisite requirement of a certain amount of physical functioning, which Croce and Horvat (1992) have stated is a major detriment in securing and retaining employment for this population.

Physical functioning relates to specific barriers to success on the job including non-completion of work tasks at appropriate rates (Horvat & Croce, 1995; Wehman & Kregel, 1988), and unsatisfactory quality and production required by employers (Nisbet, 1988). Subsequently, unsatisfactory vocational skills make it more difficult to place participants with mental retardation in competitive jobs. Therefore, physical functioning often inhibits many individuals with disabilities from reaching their full potential. It is then, imperative for the programs and services to address the issues limiting this population from functioning at their full potential.

Muscular strength and endurance have been related to functional skills (Croce & Horvat, 1992; Zetts, Horvat, & Langone, 1995), and research has shown that individuals with mental retardation function at a lower level physically than their peers (Reid et al, 1985; Chaiwanichsiri, Sanguanrungsirikul, & Suwannakul, 2000; & Graham & Reid, 2000). However, other studies show this population responds to training similarly as peers without disabilities (Montgomery, Reid, & Seidl, 1988;

Pitetti & Tan, 1991, Sayers, Cowden, Newton, Warren, & Eason, 1996; Croce & Horvat, 1992; Rimmer, & Kelly, 1991; & Brown, 1977). Therefore, if a limiting factor to employment is physical functioning and this domain has shown to improve with training, a logical conclusion is that improving the physical functioning of individuals with mental retardation may enhance their vocational skills thus employability.

Support of that conclusion can be found in a few investigations that have studied the effects of strength on work productivity in community-based settings (Croce & Horvat, 1992; Zetts, 1993; & Zetts, Horvat, & Langone, 1995). They reported significant improvements in work productivity and physical functioning. But no studies were found that employed a school-based physical education program for training coupled with work productivity assessment.

In summary, legislation has provided the bridge for the transitional process from the secondary to post-secondary or vocational environment for individuals with mental retardation. To ensure that individuals with mental retardation are prepared to take advantage of these opportunities, a school-based physical education curriculum must strengthen the limitations of these individuals thus developing the skills of this population in the vocational field. It is the hypothesis of this investigation that a school-based physical education training program will improve muscular strength and endurance and work productivity to facilitate the transition from the school to post-school opportunities in high school participants with mental retardation.

Statement of the Problem

Based on the lack of overall physical functioning of individuals with mental retardation and limited information on the effectiveness of school-based programs, this study was undertaken to assess the effectiveness of training on muscular strength/endurance and work productivity in a school-based physical education setting. It was hypothesized that there woould be a significant difference in physical functioning and work productivity of individuals with mental retardation from participation in a school-based physical education program.

Purpose of the Study

The purpose of this study was to determine the effectiveness of a school-based progressive resistance-training program in improving the muscular strength/endurance and work performance of high school participants with moderate/severe mental retardation. This is relevant as individuals with mental retardation routinely score lower on fitness assessments as compared to peers without mental retardation. In addition, a lack of physical functioning is a major detriment to the placement in the work related setting.

Justification for the Study

Implementation of federal legislation has placed the responsibility of preparing participants to be productive citizens and providing transitional services to nourish their migration into the work setting on the public school system. A minimal amount of information is available to describe the improvement of physical function and work performance (Croce & Horvat, 1992), and none have been conducted in a school-based setting with the equipment and facilities that are typical of most public school settings. Therefore, this study is designed to investigate the existence of a relationship between a school-based progressive resistance-training program and work productivity in individuals with mental retardation.

Significance of the Study

This study will be the first to use a school-based setting that is representative of the facilities and equipment available in the traditional high school physical education program. This study will also determine if a school-based program is sufficient for the transition process as mandated by federal legislation. In addition this study will investigate the effects of non-exercise after treatment by collecting retention data.

Hypothesis

The following hypotheses between the response and explanatory variables for this study were:

1. There will be a significant change in work productivity after participation in a school-based progressive resistance-training program by high school male and female participants with moderate/severe mental retardation.
2. There will be a significant change in the muscular strength after participation in a school-based progressive resistance-training program in high school male and female participants with moderate/severe mental retardation.

Delimitations

The participants for this study were recruited from a high school in Northeast Georgia. The findings of the study may not be generalized to other participants and other settings and environments. This study was delimited to populations of high school age males and females with moderate/severe mental retardation, and to programs that utilize equipment available in the school-based physical education setting.

Limitations

The limitations of this study were:

1. The findings of this study will only be comparable to other studies utilizing high school participants with moderate/severe mental retardation.
2. The findings of this study will only be comparable to studies involving the designated work skills used in this study.

The findings of this study will only be comparable to other studies utilizing the specific training equipment in this investigation.

Definition of Terms

Mental Retardation- Mental retardation as defined by the American Association on Mental Retardation (AAMR) refers to substantial limitations in certain personal capabilities. It is manifested as significantly sub-average intellectual functioning, existing concurrently with related disabilities in two or more of the following applicable adaptive skill areas: communication, self care, home living, social skills, community use, self-direction, health and safety, functional academics, leisure, and work. Mental retardation begins before the age of 18 (IDEA, 1997). Intellectual functioning is most commonly assessed using intelligence quotients (IQ). The AAMR's diagnostic system creates only two categories of mental retardation-mild and severe. This system is divided into six categories of intellectual functioning, psychological and emotional considerations, health and physical considerations, etiological considerations, environmental considerations, and appropriate support. Public schools however adhere to the definition that is found in the Rules for Implementing IDEA. This definition describes mental retardation as significantly sub-average general intellectual functioning existing with deficits in adaptive behavior and manifested during the developmental period that adversely affects a child's educational performance. Categories under this definition are built around IQ scores as follows: mild 50 or 55 to approximately 70, moderate 35 or 40 to 50 or 55, severe 20 or 25 to 35 or 40, and profound below 20 or 25.

Muscular strength- Muscular strength is commonly defined as the ability to exert maximal force by the muscles of the body that control movement. But this definition has been criticized for its simplicity because muscles may exert force through isometric, concentric, and eccentric actions. In addition, concentric and eccentric actions may be performed at a wide range of velocities. Therefore strength is not a result of an assessment performed under a single set of conditions, but rather strength of a muscle or muscle group must be defined as the maximal force generated at a determined velocity (Knuttgen & Kramer, 1987).

Muscular endurance- Endurance is the time limit of a person's ability to maintain an isometric force or a power level of dynamic exercise (Komi, 1992). In the domain of strength training the concept of muscular endurance is commonly associated with the use of lighter resistance and higher repetitions, usually in excess of twelve. This form of training produces lower gains in overall strength but allows the muscles involved to adapt to repetitive type movements without becoming overly fatigued (Horvat & Kalakian, 1995)

Progressive resistance training program-Exercises that are designed to facilitate the improvement or maintenance of fitness parameters including muscular strength and endurance, flexibility, cardiovascular functioning, and body composition. A properly designed program will meet the needs of each individual (Kraemer & Fleck, 1993). The participants in this study will use dumbbells, thera-bands, and gravity-assisted exercises.

Work performance-Work performance is defined as the amount of a specific work task completed in a specific time period (Croce & Horvat, 1992).

CHAPTER 2

REVIEW OF LITERATURE

Employment and Individuals with Mental Retardation

Employment opportunities for individuals with mental retardation have traditional been limited to sheltered workshop type environments. Recent legislation has broadened the spectrum of placements to include competitive employment; subsequently research has begun to focus on the performance and success of mandated programs and services. The following is a review of the present level of performance of individuals with mental retardation in employment environments and related transitional services.

Bolton, Bellini, & Brookings (2000) investigated employment in individuals with mental retardation in a review study by sampling 4,603 individuals receiving state funded vocational rehabilitation services from the Arkansas Rehabilitation Services Agency. These services include three phases: (1) referral, (b) diagnostic evaluation and rehabilitation, and (3) service provision or vocational outcome referred to as case closure. The study attempted to construct a prediction model of factors that relate to employment outcomes controlling for the type of disability. The factors investigated included personal history, functional limitations, and rehabilitation services. Disability groups consisted of orthopedic (impairments of the limbs or spinal column), chronic medical (cardiac, respiratory, circulatory, metabolic, endocrine, and digestive disorders, psychiatric (diagnosis of psychosis, neurosis, or personality disorders), mental retardation (mild moderate, and severe), and specific learning disability. Evaluation by disability groups revealed that individuals with mental retardation had more functional limitations in adaptive behavior, lower vocational qualifications, and lower physical capacity and motor function compared to the other groups. Results indicate that the above factors account for 33% of the variability in competitive employment and 12% variance in salary. This highlights the fact that functional limitations of individuals with mental retardation do have a modest effect of the predictability of vocational rehabilitation services or job placement.

Another study by Botuck, Levy, and Rimmerman (1998) investigated the post-placement success of 109 individuals with mental retardation, severe specific learning disabilities, and psychiatric disorders. The participants were tracked for a 24-month period of time in which separation rates, wages, benefits, and hours worked were examined. All of the individuals were enrolled in a training program and placed in competitive jobs lasting at least 30 days. Jobs were in the areas of maintenance, retail, clerical, messenger, and food service. Of the entire sample 72% of the individuals changed jobs at least one time during the 24-month period. The 28% retention rate for individuals with mental retardation during a 12-24 month was supported by a similar study reporting only 30% retention rates (Shafer, 1991). But interestingly, the factors associated with job retention were situational, employer related, and job market driven as opposed to employee related (age, gender, diagnostic category, race/ethnicity, family economic status, months before competitive employment, previous paid employment, experience, and training site location). The authors did not however discuss the factors relating to physical functioning. In addition, wages, hours and medical benefits of individuals with mental retardation were not commensurate with individuals without disabilities but exceeded those expected from sheltered workshop settings.

Conversely, Fabian, Lent, and Willis (1998) reported that participation in a highly structured community-based internship program was significantly predictive of post-school outcomes in 2,258 special education high school participants. Specifically, individual, behavioral, and program factors were examined in relation to work transition outcomes. Bridges…from School to Work is a program developed and funded by the Marriot Foundation for People with Disabilities that serves special education participants in their last year before school exit in a one semester (12 weeks), highly structured program. The program consists of three phases: (1) prevocational orientation, (2) prevocational preparation, and (3) internship placement. Participants are placed at job sites as apprentices with the support of school personnel trained under the program's guidelines. Of the 2,258 original participants 76% completed the program and 71% of them accepted job offers at completion. Six month follow-up assessments (N=1042) found that 84% of the program participants were either gainfully employed or enrolled in a post-secondary program. Average wages earned at the follow-up assessment were $5.44 up from $5.17 at time of internship and number of hours worked were 39 up from 23 during internship. In addition the number of days absent during the internship was 2.5 and days tardy was 1.3. Hours worked was the single greatest predictor of internship completion and internship completion was the highest predictor of job acceptance. Conclusions by the authors were that internships created opportunities for successful work transition by opening doors that may not have been accessible to participants otherwise.

Adams-Shollenberger & Mitchell (1996) investigated the retention and absenteeism of individuals with and without mental retardation and found that individuals with mental retardation were comparable or superior to individuals without mental retardation. Their sample included 99 individuals with mental retardation and 318 non-disabled peers studied over a two-year period. They were all employed through janitorial contracts from federal and state funding programs, which require a ratio of 75% non-disabled and 25% disabled man-hours on all contracted sites. All participants were responsible for the cleaning of entire buildings at the locations they were assigned. Of individuals with disabilities who left the job during the first year 70% did so voluntarily, 24% involuntarily versus 81% and 19% of individuals without disabilities respectively. Based on the results individuals with disabilities had lower dismissal rates during the first year, but higher dismissal rates during the second year. The researchers suggested that individuals with disabilities are at a competitive disadvantage (fewer jobs available at their skill level) and are more likely to remain on the job and no seek advancements because a lack of alternatives. They also cited that more individuals with disabilities were involuntarily terminated because they lacked alternatives and were unable to react to impending termination in a similar fashion as non-disabled peers. Total absences did differ significantly with both groups increasing from first to second year (mentally retarded 7.0-13.3 & non-disabled 4.1-8.0). However, reasons for absences were surprisingly different. Individuals with disabilities displayed a lower rate of absences for family reasons but a higher rate for inclement weather with transportation difficulties being the hypothesized reason for the higher rate. One bias reported by the authors is this study used a sample population drawn from federally contracted employers. Employers in this case may have been more accommodating and less eager to terminate employees who were important to maintaining lucrative contracts.

Millington, Szymanski, and Hanley-Maxwell (1994) stated that discrimination in employee selection and termination is significantly influenced by employer attitudes towards individuals with mental retardation. The effects of the label of mental retardation on employer concerns and attitudes was investigated through the use of surveys mailed to personnel in a variety of manufacturing industries and financial institutions whose responsibilities included the hiring of new employees. A total of 296 surveys were returned (29.6% response rate). The survey consisted of The Employment Selection Concerns Questionnaire, which contains items related to qualities used in employee selection and rejection such as fundamental skills, job knowledge, skills and abilities, personal liability, personal assets, dependability, advanced skills, and organizational demands. Surveys were placed in control (label of mental retardation absent) and experimental (label present) groups randomly. Results suggest that the label of mental retardation influences employer perceptions of criteria for entry-level employee selection. Many of the traits identified as contributing to rejection such as dependability, social behavior, competence, and productivity have been previously cited as traits often associated with individuals with mental retardation. This study supported previous research that cited preference by employers of individuals with physical limitations over those with mental retardation, and that employers were most concerned about worker productivity, accident rates, and worker compensation rates (Fuqua, Rathbun, & Gade, 1983). A common thread in the discussion of employment with individuals with disabilities is productivity rates. Since most jobs are entry level and require physical ability (strength and endurance) it would seem important that individuals with mental retardation to be on par with their peers to be competitive.

Muscular Strength and Endurance in Individuals with Mental Retardation

The most comprehensive and precise studies completed to date concerning muscular strength and endurance in individuals with mental retardation involves the use of isokinetic dynamometry. This type of equipment is manufactured by several companies but is considered the standard for the measurement of muscle parameters. Over the last decade researchers have begun to use this type of assessment tool to improve the knowledge concerning the muscular functioning of individuals with mental retardation.

Pitetti (1990) initiated the use of these devices with individuals with mental retardation in a study that established feasibility and reliability. Nineteen adults (12 male, 7 female aged = 26$\pm$3) were evaluated on elbow and knee flexion and extension using a Cybex 340 dynamometer. A 10-minute warm-up period was followed by 10 practice repetitions, two moderate and two maximal, and finally two sets of three maximal efforts. The angle speed for elbow and knee movements was set at 60^0 per second. Although test/retest regression coefficients were significant indicating that this type of device could be used with this population, the authors point out that data should be gathered on two separate days to ensure that the subject's best effort is captured.

Following this study isokinetic arm and leg strength of adults with and without Down syndrome was compared by Pitetti, Climstein, Mays, & Barret (1992) and supported by later findings that individuals with mental retardation perform at lower levels than peers without mental retardation. The investigation consisted of three groups of adults (Down syndrome=18, mentally retarded=18, and sedentary adults) assessed, using a Cybex 340 dynamometer, for knee and arm extension and flexion strength. Data was collected on peak torque; peak torque percent body weight, average power, and average power percent body weight at a speed of 60 degrees per second. After warm-up and sub-maximal efforts the participants performed two sets of three maximal efforts with a 30 second rest between sets. Statistical analysis was performed through the use of a repeated-measures one-way analysis of variance with a Turkey multiple comparisons to detect specific differences between means. Significance was set at $p>.01$. Results indicate that individuals without mental retardation were stronger than individuals in both comparison groups across all measures and movements. In addition individuals with mental retardation without Down syndrome were stronger as measured in this study than individuals with Down syndrome. Pitetti et al. (1992) point out that this information is critical if this sample is representative of the population with mental retardation because previous research has demonstrated that strength is related to vocational opportunities, recreation, and activities of daily life.

Horvat, Pitetti, and Croce (1997) expanded the previous study with an investigation of isokinetic torque, average power, and flexion/extension ratios of adults with and without mental retardation. Three groups were used and consisted of adults with mental retardation (N=13), adults with Down syndrome (N=9), and adults without mental retardation (N=13). The mean age of each group was 24.1, 25.9, and 24.2 respectively. Elbow flexors and extensors were tested for peak torque, and average power at velocities of 60 and 90 degrees per second on a Cybex 340 dynamometer. Each test consisted of six trials (highest score being recorded) repeated 48-96 hours later in an attempt to overcome difficulties with motivation and consistency reported (Pitetti et al., 1990) with this population. Testing protocol for adults without mental retardation the was performed once. Participants were given instructions and practice trials. Test trials were split into two sets of three. Analysis was performed on peak torque and average power through the use of a 3 (subject group) X 2 (muscle group) X 2(angular velocity) analysis of variance (ANOVA). Peak torque and average power flexion/extension ratios were analyzed using a 3(subject group) X 2 (angular velocity) ANOVA. Both analysis used the Greenhouse-Geyser correction factor. Results indicate that individuals without mental retardation had significantly higher values that other subject groups with respect to peak torque and average power. Conclusions from the authors state that coupled with previous research this study strengthens the case for inclusion of this population in resistance training programs to improve physical functioning facilitating the improvement of skills related to work and activities of daily living. With consistent data on the strength deficits existing within this population the next step by researchers was to attempt to relate muscular strength to functional ability.

Pitetti and Fernall (1997) also investigated the relationship of leg strength to aerobic capacity. Twenty-nine participants (17 male, 12 female) with a mean age of 14.2 participated in this study using treadmill and isokinetic dynamometry. Peak torque, average torque and average force were measured by a Kin-Com Isokinetic device at a speed of 60 degrees per second. Each subject performed twelve repetitions from which the strength data was chosen. The treadmill test (VO_2 max) was performed following the procedures previously outlined in a study by Pitetti, Rimmer, and Fernall (1993). The participants walked at an initial speed of 3.0 mph at 0% grade, which was increased by 4% every two minutes until 12% was achieved. After two minutes at 12% the speed was increased 0.5 to 1.0 mph every two minutes. The test was terminated at volitional exhaustion. Two tests were performed 2-7 days apart with the average of the two highest values of the best test recorded for each subject. The data was analyzed using t-test for independent samples to detect gender differences and Pearson product-moment correlations used to evaluate relationships between strength, anthropometric, and VO_2 variables. Results indicated that peak torque, peak force, and average force were significantly related to VO_2 max during both flexion and extension. Pitetti and Fernall cited other studies that indicated no relationship between leg strength and VO_2 max in non-disabled populations and speculate that there may be a threshold of strength where VO_2 capabilities are affected. Coupled with other studies with individuals with mental retardation that indicated lower levels of strength, including knee flexion/extension, this finding could be significant because it may highlight deficits in endurance that could affect vocational performance.

In a further attempt to not only examine the evidence of muscular deficits but also begin to uncover the factors related to these deficits Cioni, Cocilova, Di Pasquale, Rillo Araujo, Rodrigues Siqueira, & Bianco, (1994) investigated the strength deficits of the knee extensor muscles of individuals with Down syndrome from childhood to adolescence. Unlike other studies they used isokinetic speeds of 30 degrees per second, but similar to other studies two sets of three repetitions were used to collect test data. The participants (experimental N=25 and control N=40) included in the sample were chosen in part to investigate if there is a difference in the maturation process with respect to strength between groups. Data was analyzed using paired Student t-test for intra-subject limb comparison and unpaired Student t-tests to make comparisons between groups. A chi-squared distribution test analyzed frequency distributions of muscle strength dominance in individuals with Down syndrome and the control participants. Single and multiple regression methods were also used with torque as the dependent variable and age, weight, and height as the independent variable. Results indicate that individuals with Down syndrome were once again significantly weaker than both other groups and individuals without mental retardation were the strongest as measured by a Cybex II isokinetic dynamometer. Further individuals with Down syndrome failed to show the physiological strength gain normally associated with maturation during these age periods. Interestingly the authors concluded that the data suggest a dysfunction of the neuromuscular system at the level of the pyramidal system and/or the neuromuscular junction possibly caused by premature aging. Their conclusions were in part due to the anthropometric data collected that showed that the Down syndrome group was overweight in absolute terms but lower in both height and weight when compared to control groups. In addition all participants were tested for testosterone levels and sexual development and found to be within normal range, leading to support the conclusion that dysfunction in strength is due to neuromuscular factors rather than maturational.

Horvat, Croce, Pitetti, and Fernall (1999) used isokinetic testing to compare peak force and work in individuals with and without mental retardation, as well as time to peak torque. Seventeen males and thirteen females with mental retardation with a mean age of 14.7 and 13.6 respectively and fifteen males and females non-disabled youth with a mean age of 12.7 and 13.4 respectively participated in this study. All participants' height, weight, and body mass indexes were calculated and no participants had any pathology or medications that would interfere with the protocol of this study. The participants' peak force, time to peak torque, angle of peak torque, total work, and peak torque hamstrings/quadriceps ratio were assessed using a Kin-Com Isokinetic dynamometer. Peak torque was also corrected by weight and body mass index. All values were gathered at sixty degrees per second (flexion and extension) over one set of six continuous, maximal repetitions. Mean and standard deviations were performed for all variables. The effect of group and gender in relation to muscular performance (knee flexion/extension) was assessed using a 2x2x2 (Group x gender x muscle) repeated measures multivariate analysis of variance for absolute peak torque, peak torque relative to body weight, peak torque relative to body mass index, time to peak torque, angle of peak torque, and total work. In addition, univariate analyses of variances were used as follow-up procedures. Separate 2 x 2 (group x gender) ANOVA were used on the hamstring to quadriceps ratios and body mass index. The authors performed separate ANOVA procedures because they felt no *a priori* assumption that the above two variables would be correlated. Finally they used the conservative Greenhouse-Giesser correction factor to evaluate within-group F-ratios, and a Tukey test was used in *post-hoc* comparisons. Results indicate significance differences in peak torque values and total work (both absolute and corrected) between groups. All data were higher in non-disabled participants. An interesting finding of this study was that the time to peak torque and the angle of peak torque (during flexion) was similar between groups. The authors suggested that this is indicative of similar kinematics between groups. As is the case with other studies the finding that individuals with mental retardation perform below their peers in tests of muscular strength was supported.

Therefore literature supports the conclusion that individuals with mental retardation have lower strength parameters and this deficit has an impact on physical functioning. The next step is towards remediation. In rehabilitation, health, athletic performance, and fitness the use of progressive resistance training is often used and prescribed. Regardless of the environment progressive resistance training is a proven method of increasing muscular strength and endurance in non-disabled populations. What is the impact of progressive resistance training on individuals with mental retardation?

Progressive Resistance Training with Individuals with Mental Retardation

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Strength or progressive resistance training involves a systematically applied program to improve physical functioning especially parameters of muscular strength and endurance. These programs have been traditionally used with athletes to improve performance; however, their utility has been found to benefit diverse populations.

One of the earlier studies involving progressive resistance training with individuals with mental retardation was conducted by Brown (1977) and involved forty males (mean age 12) classified as trainable mentally retarded. This term was later revised to moderately mentally retarded and is characterized by intellectual quotients in the range of 30-50. The six-week training program was applied to one group while the other group served as the control. Pre and post treatment assessment of strength was accomplished using a spring-scale technique. Each subject participated in a daily routine of twelve isometric exercises (ten second contraction) for duration of six weeks. Data was analyzed using a 2 x 2 (group x test) analysis of variance. Results indicate that although there were no significant differences pre treatment, significant differences did exist post treatment on all strength variables with the treatment group producing higher values than the control group.

Rimmer and Kelly (1991) used yet another method of training with once again significant increases in strength measures. Participants participated in a nine-week training program using isokinetic equipment. Twenty-four adults (13 male, 11 female) with mental retardation participated in a nine-week training session consisting of biweekly workouts. Testing procedures including finding 1-RM maximums for all participants on the following exercises pre and post treatment: leg extension, leg flexion, pull over, pectoral deck, and shoulder abduction. Participants performed three sets of each exercise (leg extension, leg flexion, shoulder abduction. pull over, pec deck, pull-ups, and bicep curl) at 30, 60, and 70% of 1-RM for 8-10 repetitions. Resistance was added when a subject could complete 12 repetitions on the third set. The group data was analyzed using a multivariate analysis of covariance. Additional univariate analysis of variance was performed to determine which if any of the dependent measures proved to be significant. Based on the data analysis there was a significant difference between groups on all measures with the exception of pull-ups and leg flexion. The authors concluded that it is possible to dramatically increase muscular strength and endurance in adults with mental retardation in as little as nine weeks of training. Additionally this is of importance because physical fitness is related to vocational rehabilitation.

Suomi, Surburg, & Lecius (1995) also investigated the use of a hydraulic resistance training program on isokinetic strength measures of peak torque and total work with this population and is in support of the results from other research that this population responds similarly to the use of resistance training in population without mental retardation. Their sample consisted of 22 total men with mild to moderate mental retardation separated into two equal groups-experimental and control. They were employed at a vocational training facility while all of the resistance training took place at a local YMCA. The men trained for a duration of 12 weeks at a frequency of three sessions per week. The exercise sessions started with one set on each exercise progressing to five sets per machine by the end of week twelve. Repetitions were set at ten, and resistance was increased when the participants were able to meet time criteria for completion of repetitions. The goal was to add resistance at two-week intervals for the duration of the program. Exercises included a unilateral quadriceps/ hamstring, hip flexion/extension, and hip adduction/abduction machines. The participants were tested isokinetically prior to and following the resistance-training program. Data collected included total work and peak torque for knee flexion/extension and hip abduction at 60 and 30 degrees per second respectively. Isokinetic assessment began with a five-minute warm-up period on a stationary bike followed by four maximal repetitions with a one-minute rest and finally three additional sets of four maximal repetitions with a one-minute rest period in between sets. Analysis consisted of a 2x2 (group x test) analysis of variance was used to detect differences between groups across tests with the Bonferoni method used to reduce alpha level inflation and risk of Type I error. Probability level for all tests was set at .01. Results indicated that the strength trained participants performed significantly higher on isokinetic tests for peak torque and total work for both knee extension and hip abduction bilaterally leading researchers to conclude that high intensity hydraulic strength training was able to produce significant strength gains over a twelve-week period in men with mental retardation.

Muscular strength and endurance has also been related to functional development skills such as walking. In a 1996 study, Sayers, Cowden, Newton, Warren, and Eason investigated the effect of pediatric strength intervention on the developmental stepping movements of infants with Down syndrome. Five participants aged 18 to 38 months participated in an eight-week pediatric strength intervention program based on the principles of progressive interactive facilitation. Progressive interactive facilitation is designed to promote independent upright posture in infants and toddlers with multi-system delays. Pre and post treatment data was collected on motor development, strength, and gait analysis using the Hawaii Early Learning Profile Strands, Battelle Developmental inventory, and specialized gait analysis. Data was analyzed by comparing pre and posttest scores and analytical case study strategies. The results indicated that the rates of motor development exceeded their lifetime development prior to intervention and subject increased in rate and distance. Two participants acquired independent upright locomotion, and one subject established an independent sitting movement and a creeping pattern while one subject was unable to complete the study. Strength was measured through the use of ankle weights during specific motor movements designed to increase balance and muscular strength and endurance. Sets and repetitions were set according to the individual's progression by increasing to heavier ankle weights and progressing to more difficult exercises resulting in progressive resistance training. The authors concluded that although infants with Down syndrome move through levels of motor development individually and this progression is influenced by many congenital factors including previous medical complications, hypotonicity is one of the rate-limiting factors that can be remediated.

Because of the limitations of intellectual functioning in individuals with mental retardation, employment opportunities are often confined to areas that require certain levels of physical functioning including muscular strength and endurance. As shown previously individuals with mental retardation have specific deficits in these areas, but the ability to remediate is apparent. Attempts to translate the benefits of progressive resistance training to work productivity in jobs that require physical skills has become increasingly popular for reasons of corporate image, selective recruitment, turnover reduction, absenteeism reduction, medical cost reduction, job-site injury reduction, and productivity (Shephard, 1992). The following section presents research related to exercise programs and their affect on work productivity in populations without mental retardation.

Work Productivity and Exercise Programs

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Productivity and safety of employees is a concern of most employers. The goal of increasing these factors through the implementation of worksite-based exercise programs has been examined by several authors. The following section includes research studies on this subject and their results.

Genaidy, Bafna, Sarmidy, & Sana, (1990) investigated the effects of an intensive and short physical training program on the endurance limits of new employees in lifting tasks. For the purposes of protecting workers in jobs that require manual material handling, ergonomic job design has been implemented as a process to develop and maintain job requirements within the capabilities of the work force. From these design studies job stress indexes have been developed and are defined as the ratio of job demands to work capacity. Another method to protect workers is the implementation of physical training on site to increase the workers tolerance for physical stress. Twenty-seven college males were involved in this study and were placed into three groups of symmetrical lifting (n=12, age=21.2), asymmetrical lifting (n=10, age=23.8), and control (n=5, age=22.6). Each subject within the treatment group participated in 16 total training sessions occurring approximately every other day. The task required the lifting of a 10kg box in a prescribed pattern as fast as the subject could for as long as they could hold the pace. Cycles per minute and endurance times were recorded for each session. In addition Ratings of Perceived Exertion were recorded after termination of each session. Data was examined using an analysis of variance technique. Results indicate a significant training effect for endurance times of the manual handling tasks for both asymmetrical and symmetrical groups. In fact the groups showed increases of 248% and 46% respectively. The authors concluded that physical limits of new workers can be increased through the use of training programs.

A similar study was conducted by Genaidy, Gupta, and Alshedi (1990) but used the principle of progressive overload in the training protocol. Fifteen participants with a mean age of 24.9, and no prior experience in manual materials handling were used for this study. Participants were placed into three groups of five consisting of two treatment and one control group. The treatment groups participated in sixteen (over a six-week period) training sessions that followed the principles of progressive overload. Training sessions utilized a 6RM and 10RM protocol designed to enhance muscular strength, which was adopted from previous research. Both treatment groups trained using a thirteen step manual materials handling task that was divided into three sets performed with 5-minute rest periods between sets. Training set loads and repetitions were designed as follows: (1) 50% RM at 6 and 10 repetitions, (2) 75% RM at 6 and 10 repetitions, and (3) 100% RM at 6 and 10 repetitions. Set load was increased 4kg when the participants were able complete the third set at 100%

RM two repetitions above standard (8 &12). Each set was performed at a rate of 5 times per minute. Endurance time, heart rate, ratings of perceived exertion (RPE), static strength, and dynamic strength (shoulder, arm back, leg, and composite) were response variables. Strength measurements were collected using a load cell and heart rate was monitored using a physiological recorder with chest electrodes. Assessment data was collected pre and post treatment in all three experimental groups. Means and standard deviations were calculated for all variables. In addition to detect differences between groups an analysis of variance (ANOVA) technique was used. Overall the 10 RM group produced better results, however both the 6RM and the 10RM training groups showed significance for the training effect in most of the tested muscle groups. The heart rate dropped significantly for both groups indicating that the training induced cardiovascular responses even thought the training program was only 6 weeks in length. The authors noted that some of the improvement of the program should be attributable to improvement in manual handling technique and neuromuscular coordination, but such a program was successful in improving muscular strength and endurance, and heart rate.

In a follow-up study Genaidy (1991) once again investigated the effect of a physical training program on the muscular strength and endurance required for manual materials handling tasks. This study involved twenty participants (mean age=25.4) randomly separated into four groups comprised of two experimental groups and two control groups, each containing five individuals. Similar to previous research participants participated in a six-week training program with 16 total sessions performing a manual materials handling task that required lifting, lowering, pushing, pulling, and carrying. Static and dynamic strength, heart rate, RPE, and endurance time were measured pre and post treatment for all participants. The training program was altered in such a way that participants in experiment one trained with loads that exceeded 50% of their initial dynamic strength, where experiment two trained with loads below 50% of their initial dynamic strength. An additional difference was the muscle groups that were tested were slightly different for each group. Analysis included means, standard deviations and analysis of variance (ANOVA) for all variables. Results supported the previous study in that significant differences were found with respect to muscular and cardiovascular endurance as a result of the training program. Moreover it was also found that static and dynamic strength could be increased but only when the training load exceeded 50% of the individuals' initial dynamic strength values. This would support literature that is related to the design of muscular strength programs involving weights that also prescribe the use of weights that exceed a percentage of the individual's strength level to produce a training effect.

Genaidy, Davis, Delgado, Garcia, and Al-Herzalla (1994) examined the effect of a job-simulated exercise program on the dynamic and static muscular strength, muscular endurance, and trunk flexibility of workers from three different job sites. Twenty-eight employees from manufacturing plants volunteered for this study. All participants' job required manual materials handling. They were randomly assigned to experimental and control groups at each site. Two protocols were implanted, one which involved strength training only and the second that involved strength training combined with trunk flexibility. Both programs were conducted four times weekly for four weeks (total time was six weeks with weeks 1 and 6 used for evaluation). The strength training programs were based on a 10 RM protocol outlined in previous research (Genaidy et al., 1990). The flexibility programs were performed in sets of six with four sets performed before progressive resistance training and two following. Each set of flexibility exercises consisted of flexion and extensions, lateral bending, trunk twisting, and sit and reach. Each flexibility exercise in the first week was performed slowly and held for ten seconds. Exercise sets were increased by three and the hold count by two each week until the last week which included fifteen repetitions and hold counts of fourteen. Dependent variables for this study were static strength and dynamic strength (shoulder, arm, back, and composite), bilateral handgrip, low back flexibility, endurance time, total number of cycles, frequency of handling, and RPE. The participants were tested pre and post training on two separate days. Means, standard deviations, and ANOVAs were conducted on all variables. Results indicated that both training protocols were able to increase dynamic and static strength at a significant level. However the training protocol that combined progressive training with flexibility produced greater gains than progressive resistance training alone. Compared to the college-aged participants in previous research, the current study resulted in smaller improvement values, implying according to the authors gains that can be attributed to the novice factor.

Increasing Work Performance and Physical Fitness Parameters in Individuals with Mental Retardation

Although much of the research conducted with individuals with mental retardation and work productivity has focused on social and cognitive factors involved with employment the benefits of using physical training programs to improve work productivity in populations without mental retardation has also been applied to populations with mental retardation. Although studies have produced similar favorable results when compared to training studies in populations without mental retardation they are limited in scope. Research in populations without mental retardation has used training programs that closely mimics the skills used on the job. In contrast the following studies utilize a more general progressive resistance-training program in an attempt to obtain the same results.

Croce and Horvat (1992) investigated the effects of a resistance training and aerobic conditioning program on the work productivity and physical fitness of three men with mental retardation. All three participants were receiving services in a sheltered workshop. The study was designed to determine the effectiveness of an exercise program specifically in men with below average fitness levels, but who were able to follow directions and had no physical or motor impediments that would preclude them from participation in this study. All three men were classified as obese according to standard height and weight charts and had an IQ range of 48-56. The researchers used a multiple-baseline-across-participants design in an effort to alleviate problems of inconsistent performance and individual differences often associate with this population. Dependent variables were body weight, percent body fat, oxygen consumption, composite isometric strength, and work productivity. After the establishment of baseline, the participants participated in a hour long exercise session three times per week and one forty minute exercise session (length change due to omission of resistance training during one session per week). Each exercise session included a ten-minute warm-up, twenty minutes of isotonic resistance training, twenty minutes of aerobic conditioning, and a ten-minute cool-down. The resistance-training program utilized surgical tubing as resistance, and the aerobic conditioning program consisted of running/walking and stationary cycling. Strength measurements were collected using hand-held dynamometry, cardiovascular conditioning was assessed through the use of the Astrand Bicycle Ergometry Test that predicts oxygen consumption, body composition was collected using skinfold testing, and work performance was assessed as the number of jar lids that could be screwed onto jars and placed into a box and the boxes stacked in a normal 6-hour work day. In addition the researchers used behavior reinforcement consisting of social and token reinforcement systems. The data was analyzed by calculating trend lines that were extended through the treatment and retention phases. These trend lines also know as celeration lines could then be used to determine statistical significance of the data. Results indicate that in general participants displayed substantial improvements on most dependent measures. Because of the variable length of treatment phases not all measures reached a level of significance. The authors also noted that because of the participants initial low levels of fitness the physiological data should be interpreted accordingly. In addition work performance measures improved supporting previous studies in the use of training programs in enhancing performance in this and non-disabled populations.

Serr, Lavay, Young, and Greene (1994) investigated the correlation between bench assembly tasks and manual dexterity in adults with mild mental retardation. Thirty participants ranging in age from 20 to 47 years were assessed using the Vocational Transit Test System, which was developed to measure U.S Department of Labor aptitudes. National normative data is available on this test with this specific population and the test includes items that assess motor coordination, manual dexterity, and finger dexterity with and without assembly. Scores are given in individual test components and as a composite score. Work output percentages were determined from completed work over the last work quarter of the year of the study. Output was determined from jobs that included tasks such as collating, labeling, sorting, and mechanical assembly. Percentages were calculated from an industrial standard that is a measure of performance of individuals without disabilities considered representative of populations in this type of job. Data was analyzed using Pearson-product moment correlation and multiple regression analysis was used to determine the most effective predictors of work output. Results indicated that participants had a wide range of scores indicative of the variance of performance expected with this population. Correlations ranged from .631 to .716 indicating a moderate to moderately high relationship between variables in this study. Finger dexterity was determined to be the best predictor of work output. The authors concluded that the use of dexterity aptitudes was useful in predicting work output in this population and that more studies needed to be conducted to further investigate the relationship of motor skills and physical fitness to employment opportunities for individuals with mental retardation.

Zetts, Horvat, and Langone (1995) investigated the effect of a community-based resistance-training program on the work productivity of high school aged participants. Six participants with moderate mental retardation were included in the sample and participated in fourteen exercise sessions at a community gym. Strength measures were calculated using a hand-held dynamometer in addition to the gains measured on each exercise (bench press, shoulder press, leg press, and dumbbell exercises). The resistance program was split into three levels that were based on sets, repetitions, and weight. When the subject was able to complete the prescribed sets lifting the targeted weight the correct number of repetitions they could progress to the next level. Work productivity was measured using simulated work tasks such as box stacking, hand truck pushing, and pail carry, which were measured in boxes per minute and feet per minute. The data was analyzed using single subject multiple probe design. Results were measured by visual analysis of the plotted data to detect changes. For the work performance measures with only one exception the participants displayed a consistent pre-intervention baseline with an upward trend after intervention. The muscular strength data showed dramatic strength gains with some participants exhibiting 100% gains over the course of the program. The authors concluded that the intervention of a resistance-training program was effective in increasing work productivity. However the authors suggest that only after systematic replication of this study will the results be generalizable across a larger group of people with mental retardation. A retention measure to determine the length of sustained gains was not used.

In summary research has indicated that individuals with mental retardation are employed at rates that are below their peers. One of the obstacles to gaining and maintaining employment in this population are deficits related to physical functioning, which can be improved with training. Investigations into the relationship of work productivity and exercise programs have indicated that the addition of exercise programs increases work productivity in disabled and non-disabled individuals. Research has not investigated this relationship in the school-based setting.

Chapter 3

METHODS AND PROCEDURES

This chapter examines the methods and procedures used during the implementation of this study. Specifically, this chapter will detail the participants, selection of participants, setting, instrumentation, variables, equipment, data collection, experimental design, and data analysis.

Participants

This study included a total of 14 participants matched by age, gender, height, and weight into seven groups. Participants were randomly placed into training and control groups. All participants were enrolled in high school and were classified in the moderate to severe intellectually disabled category as defined by the United States Department of Education guidelines (IDEA, 1997). Participants chosen for the study have consistent attendance records; do not exhibit behavior problems, or orthopedic disorders. The participants engaged in this study toward partial fulfillment of their school physical education credit and were selected based on their placement in a self-contained adapted physical education program. Therefore, random selection was not employed but a convenience sample was selected that was characteristically representative of self-contained participants.

Data Collection

Data collected for this study was performed within the physical education classroom setting. Each classroom from which the participants were drawn had a para-professional to aid the certified teacher in the daily classroom routines. Para-professionals attended each physical education class and assisted the participants and the physical education teacher in the delivery of instruction. Para-professionals as required by the state must complete professional development courses to remain employed and are evaluated yearly by the teacher and their immediate supervisor. Orientation sessions prior to the start of the progressive resistance and work performance training were conducted to acquaint each para-professional in the purpose of the study and the procedures implemented. During this training session each para-professional was given instructions concerning proper exercise techniques and spotting procedures. To ensure standardization of training technique, a trial run with volunteers not involved in the study, was conducted. The simulated training session was lead by the investigator, and included the correct positions for each exercise and how to appropriately spot each exercise.

Muscular strength (independent variable) was measured using a MicroFet2 hand-held dynamometer (1991). This device records data in pounds and has been found to be a valid and reliable method of measuring isometric strength in individuals with mental retardation (Horvat, Croce, & Roswall, 1993,1994). Based on previous research by Horvat, Croce, Roswall, & Seagraves (1995), recorded scores were the mean of three trials. Data was collected on the following sites dominant and non-dominant sides: arm flexion and extension, leg flexion and extension, and shoulder abduction. Data was recorded prior to treatment (0 weeks), mid-treatment (5 weeks), post treatment (10 weeks), and retention (15 weeks). The retention phase (weeks 10-15) coincided with the school's vacation schedule therefore participants were not engaged in any physical activity.

Data on the dependent variable (work productivity performance) was measured using a stopwatch, tape measure, and observation. Equipment used for the dependent variables were weighted boxes, a weighted two-wheeled hand truck, two five-gallon weighted buckets, and common stackable, plastic lunchroom chairs. Tasks were simulated in the classroom environment (box stacking, pail carry, hand truck, and five gallon bucket) while chair stacking was performed on the actual work site. The task involving the weighted boxes requires the participant to stack as many boxes from one table, approximately 36 inches from the ground, to an identical table approximately three feet from the first in a time limit of one minute. The boxes were stacked in groups of four. The boxes interlock allowing for safety and easing the stacking process. The pail carry required the subject to carry two five-gallon buckets weighted with twenty pounds each around an oblong course of cones in a timed fashion. The participants were given the instructions "Ready-Go" and the stopwatch was started at the participant's first movement and stopped at 30 seconds. The score for this task was recorded as distance (measured in inches) covered. Running was not allowed for safety reasons. The weighted cart push required participants to maneuver a cart around two cones positioned 33 feet apart in an oval fashion. Once again each participant had 30 seconds to move as far as possible. Scores were recorded as the amount of distance covered (in inches). The chair-stacking task required participants to stack plastic cafeteria chairs on top of a table. Participants were given one minute to stack as many chairs from the floor to the top of the table. Scores represented the number of chairs successfully stacked. Any chair that was not completely locked into the previous chair was not scored. Spotters were present to maintain safety.

The work productivity performance tasks were designed to simulate actual tasks that might be performed on a typical job site. These tasks were selected from observation of the participants at their actual job placements. They were designed to require muscular strength and endurance to complete. Collection intervals were pre-treatment (0 weeks), mid-treatment (5 weeks), post treatment (10 weeks), and retention (15 weeks). During the retention phase (weeks 10-15) participants were not in school and received no formal strength training.

Resistance Training Intervention Program

The instruments used for training included Quick-Fit© exercise tubing and dumbbells. Tubing resistance is achieved through varying its diameter, and is easily identified by material color (blue-most resistant, red-light heavy, green-medium, and yellow-light). Tubing was used for the following exercises: triceps extension, bicep curl, shoulder abduction, and upright row. The dumbbells ranged in weight from 2-

10 pounds and were used for the shoulder press exercise. Leg strength training was accomplished using SISSY SQUAT™ equipment, as well as stationary bikes and Healthriders©. SISSY SQUAT equipment utilizes the body weight of the individual as resistance and assistance for this exercise was user initiated until adequate strength was built up to perform independently as determined by the examiner. All equipment was chosen for versatility and accessibility and is consistent with most school-based physical education programs.

Progressive resistance training program guidelines prescribed by Kraemer and Fleck (1993) were adhered to during the training phases of this study. Before the implementation of the training an orientation was performed to introduce the participants to the proper techniques used with each exercise. Movements initially used the lightest dumbbells and bands to ensure proper technique. Progressive resistance training sessions were conducted in a circuit fashion, which involves multiple stations with each station containing a different exercise. Participants move as a group from one station to the next with approximately 1 minute between exercises. Participants were placed into groups of two with each group performing 3-4 sets of each exercise with 8-12 repetitions per set. The training was modeled after the Zetts, Horvat, and Langone (1995) protocol thus divided into three levels of intensity, each level decreased repetitions and increased resistance starting at 12 repetitions at 3 sets with light resistance, 10 repetitions at 3 sets with moderate resistance, and ending with 8 repetitions at 4 sets with heavy resistance. Participants did not move to the next level until they were able to meet the prescribed criteria, which was the completion of the number of sets and repetitions at the prescribed resistance level for that phase. The prescribed level of resistance was determined by the initial strength testing. The training program was performed at a frequency of two times per week for a duration of ten weeks, for a total of twenty training sessions. Training sessions lasted approximately 30-40 minutes. Each student was evaluated weekly for advancement to the next level of intensity.

Experimental Design

This study used a randomized complete block design with repeated measurements for the analysis of the data. Dehlert (2000) described block designs as a method of variance reduction to control experimental error (which increases confidence interval length and decreases test power). The blocks (7) in this study consisted of two participants (N=14) matched by the attributes of age, gender, height, and weight. As outlined by Huck and Cromier (1996), none of the matching attributes were dependent variables used to compare samples. Participants were assigned to the two treatment groups (strength training and no strength training) by a random draw.

Data Analysis

Means and standard deviations were calculated for all variables. To determine if there were significant differences between variables, separate analyses of variance (ANOVA) were performed for each block (Dehlert, 2000). Sphericity tests were performed on all ANOVAs to ensure the validity of the split-plot method of analysis. Significance level was set at $<.05$ to reduce the chance of a Type I error. In the field of education the use of public funds should be done prudently, therefore reducing the chance of finding significance where none exists takes priority.

CHAPTER 4

RESULTS

Overview

A randomized complete block design with repeated measures was used to test the hypothesis that a progressive resistance-training program would improve muscular strength and vocational productivity. Analysis results are presented in three sections including descriptive statistics, percentage of change over data collection periods, and differences between groups. Each section will examine the results of vocational tasks and isometric strength composites. Individual movements assessed for each region of the body (upper and lower) were summed to arrive at composite scores. Upper body isometric strength composites consist of measurements taken for the movements of elbow extension, elbow flexion, and shoulder abduction. Lower body composites consist of knee flexion and knee extension. Data was compared from pre-training, mid-point of training, end of training, and after a five-week retention period.

Descriptive Statistics

Information used to pair groups (N=7) is presented in Table 4.1 for all fourteen individuals. Means and standard deviations were calculated and are included in Tables 4.2-4.3, and graphic representation in Figures 4.1-4.6

Change Across Data Collection Periods

Mean percent change data (tables 4.5-4.7) were calculated for each variable to track differences across assessment intervals. For the following discussion assessment intervals will be referred to as 1 (weeks 0-5), 2 (5-10), and 3(10-15). Table 4.4 represents values at week 0 (interval 0).

For mean isometric strength composite data (Table 4.5), the treatment group demonstrated a 19.04% and 10.98% increase for the upper left composite and an 8.11% and 51.34% increase for the lower left composite at intervals 1 and 2 while at interval 3 the upper left decreased 10.30% and lower left decreased 8.68%. The right side of the body showed similar results with a 14.99% and 16.98% increase at intervals 1 and 2 (upper) and 14.72% and 16.41% increase (lower) for the same assessment intervals, while interval 3 showed a 12.24% and 13.98% decrease. Although the control group did increase 6.80% for interval 1 (left upper), intervals 2 and 3 showed a 3.67% and .51% decrease. The lower composite (left) however, showed decreases of 3.10% and .17% at intervals 1 and 2, with a .57% increase at interval 3. The right side of the body (upper) produced 3.55% and 1.91% increases for intervals 1 and 2, with a 3.21% decrease at interval 3. Finally the lower right produced a 3.99% and 1.26% increase at intervals 1 and 2, with a .03% decrease at interval 3. This data is important, although not significant, because we see concurrent percent increases in work productivity (function).

Vocational task data (Table 4.6) for the chair stack showed a 22.75% and 27.74% increase for the treatment group at intervals 1 and 2 respectively, and a 18.11 decrease at interval 3. Control group data showed a 3.5%, 6.68% and 2.01% increase for the same assessment intervals. The box-stacking task for the treatment group showed a 14.54% and 17.31% increase at intervals 1 and 2, while interval 3 decreased 11.93%. The control group increased 2.57% at intervals 1 and 2 and decreased 1.65% at interval 3. A 12.79% and 11.80% increase for the pail carry was found for the treatment group at intervals 1 and 2 with a 9.24% decrease at interval 3. The control group increased 9.69%, .44%, and 2.79% at intervals 1,2, and 3 respectively. The treatment group showed a 30.25% and 14.24% increase at intervals 1 and 2 for the dolly push with a 14.03% decrease at interval 3. The control group decreased .28% at interval 1, increased 3.42% at interval 2, and decreased .64% at interval 3.

Group Comparisons

Analysis of variance (ANOVA) procedures were preformed to determine group differences in isometric strength composites and vocational tasks across the four data collection periods. ANOVA summary information is presented in table 4.8-4.9. Comparisons between groups for all vocational tasks (chair, $F_{1,6}$=9.79, p= .0102; pail, F=$_{4.65}$, p= .0372; dolly, $F_{1,6}$=4.89, p= .0187; and box, $F_{1,6}$=4.85, p= .0350) indicated significant differences. Isometric strength composites were significant by sides of the body (upper left, $F_{1,6}$=27.42, p= <.0001; upper right, $F_{1,6}$=31.12, p= <.0001; lower left, $F_{1,6}$=44.57, p=<.0001 & lower right, $F_{1,6}$=69.30, p=<.0001).

Table 4.1

Matching Characteristics for Groups

	Gender	Age (years)	Height	Weight (lbs.)
Group 1	F	17	5’4”	210
	F	15	5’9”	185
Group 2	F	17	5’8”	187
	F	18	5’9”	220
Group 3	M	16	5’2”	149
	M	15	5’1”	139
Group 4	F	14	5’5”	126
	F	14	5’3”	124
Group 5	F	18	5’8”	175
	F	16	5’3”	163
Group 6	M	19	5’6”	190
	M	17	5’4”	182
Group 7	M	16	5’4”	139
	M	14	5’6”	141

Table 4.2

Means and Standard Deviations for Upper and Lower Body Strength Composites

Week		Treatment Left		Treatment Right		Control Left		Control Right	
0		Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
	M	18.59	30.09	19.61	31.72	19.11	30.72	19.18	28.32
	SD	3.19	4.98	4.04	5.20	4.37	9.54	3.85	11.14
5									
	M	22.13	32.53	22.55	36.39	20.41	29.77	19.86	29.45
	SD	1.79	3.87	2.46	4.56	4.37	10.11	4.08	11.92
10									
	M	24.56	40.23	26.38	42.36	19.66	29.72	20.24	29.82
	SD	1.12	6.49	2.32	6.75	3.57	9.08	2.64	11.21
15									
	M	22.03	36.74	23.15	36.44	19.56	29.89	19.59	29.81
	SD	0.08	5.78	2.34	7.18	4.10	9.01	3.57	10.09

Note. Values represent pounds of peak isometric strength as measured by a Micro-Fet hand-held dynamometer.

Table 4.3

Means and Standard Deviations for Vocational Tasks by Assessment Period

Week		Chair*		Box**		Pail***		Dolly***	
0		Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
	M	12.57	12.14	18.71	16.71	1350.00	1225.71	1204.71	1209.71
	SD	2.87	3.14	3.01	4.23	256.63	285.09	196.76	170.87
5									
	M	15.43	12.57	21.43	17.14	1522.71	1344.43	1569.14	1206.29
	SD	3.66	2.77	4.44	4.12	229.1	229.83	374.54	222.06
10									
	M	19.71	13.41	25.14	17.58	1702.43	1350.29	1792.57	1247.57
	SD	3.99	2.10	5.03	2.97	202.56	217.65	380.03	232.14
15									
	M	16.14	13.14	22.14	17.29	1545.14	1388	1541.14	1239.57
	SD	3.40	1.73	4.49	3.45	180.39	186.47	312.39	203.21

Note. *Number of chairs stacked in 1 minute; **Number of boxes stacked in 1 minute;

***Total inches covered in 30 seconds

Table 4.4

Values at Week 0 for Isometric Strength Composites and Vocational Tasks

Group	Upper Composite		Lower Composite		Chair	Box	Pail	Dolly
	Left	Right	Left	Right				
Treatment	18.59	19.61	30.09	31.72	12.57	18.71	1350	1204.71
Control	19.11	19.18	30.72	28.32	12.14	16.71	1225.71	1209.71

Table 4.5

Percent Change of Isometric Strength Composites at Weeks 5, 10, &15

	Treatment left		Treatment right		Control left		Control right	
Assessment interval	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
(1) 0-5 weeks	19.04	8.11	14.99	14.72	6.80	-3.10	3.55	3.99
(2) 5-10 weeks	10.98	51.34	16.98	16.41	-3.67	-0.17	1.91	1.26
(3) 10-15 weeks	-10.30	-8.66	-12.24	-13.98	-0.51	0.57	-3.21	-0.03

Table 4.6

Percent Change of Vocational Tasks at Week 5,10, & 15

	Chair		Box		Pail		Dolly	
Assessment interval	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
(1) 0-5 weeks	22.75	3.5	14.54	2.57	12.79	9.69	30.25	0.28
(2) 5-10 weeks	27.74	6.68	17.31	2.57	11.80	0.44	14.24	3.42
(3) 10-15 weeks	-18.11	2.01	-11.93	-1.65	-9.24	2.79	-14.03	-0.64

Table 4.7

Analysis of Variance for Vocational Tasks

Source	df	F	Pr>F
Group	6	71.72	<.0001*
Box	1	281.84	<.0001*
Week	3	28.88	<.0001*
Error	18	(1.04)	
Group	6	37.44	<.0001*
Chair	1	88.15	<.0001*
Week	18	24.17	<.0001*
Error	6	(1.28)	
Group	6	48.51	<.0001*
Pail	1	91.04	<.0001*
Week	18	22.71	<.0001*
Error	6	(79.59)	
Group	6	47.13	<.0001*
Dolly	1	122.26	<.0001*
Week	18	22.29	<.0001*
Error	6	(101.89)	

Note. Values within parentheses represent root mean squared error or standard deviations.

*Denotes significance at .05

Table 4.8

Analysis of Variance for Isometric Strength Composites

Source	df	F	Pr>F
Group	6	26.79	<.0001*
Lower right	1	69.30	<.0001
Week	3	7.83	.0015*
Error	18	(3.32)	
Group	6	23.70	<.0001*
Lower left	1	44.57	<.0001*
Week	3	8.14	.0012*
Error	18	(2.73)	
Group	6	6.84	.0007*
Upper right	1	31.12	<.0001*
Week	3	7.63	.0017*
Error	18	(2.16)	
Group	6	17.47	<.0001*
Upper left	1	27.42	<.0001*
Week	3	11.80	<.0002*
Error	18	(1.51)	

Note. Values within parentheses represent root mean squared error or standard deviations.

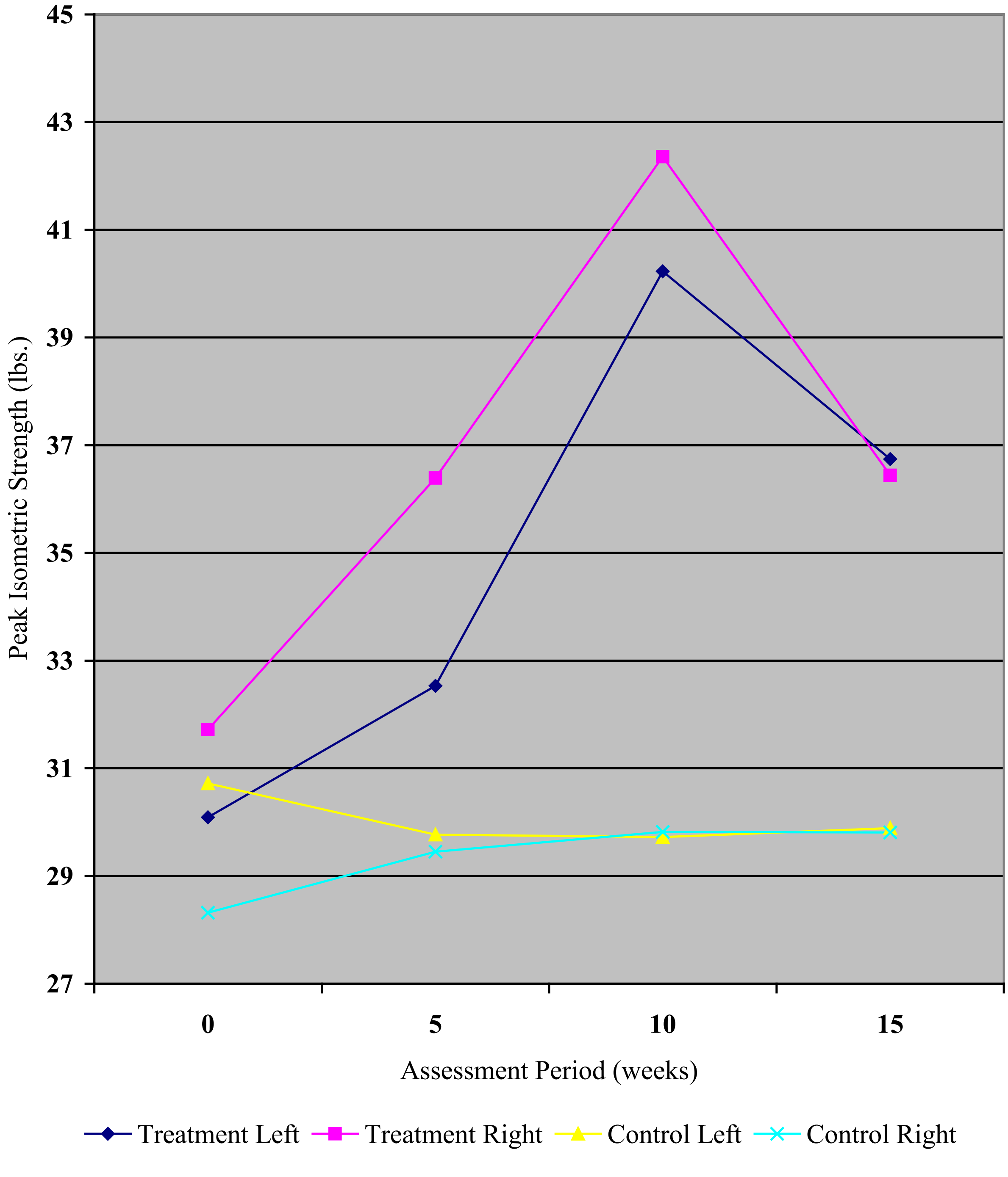

Figure 4.1 Means For Lower Body Strength Composites by Assessment Period

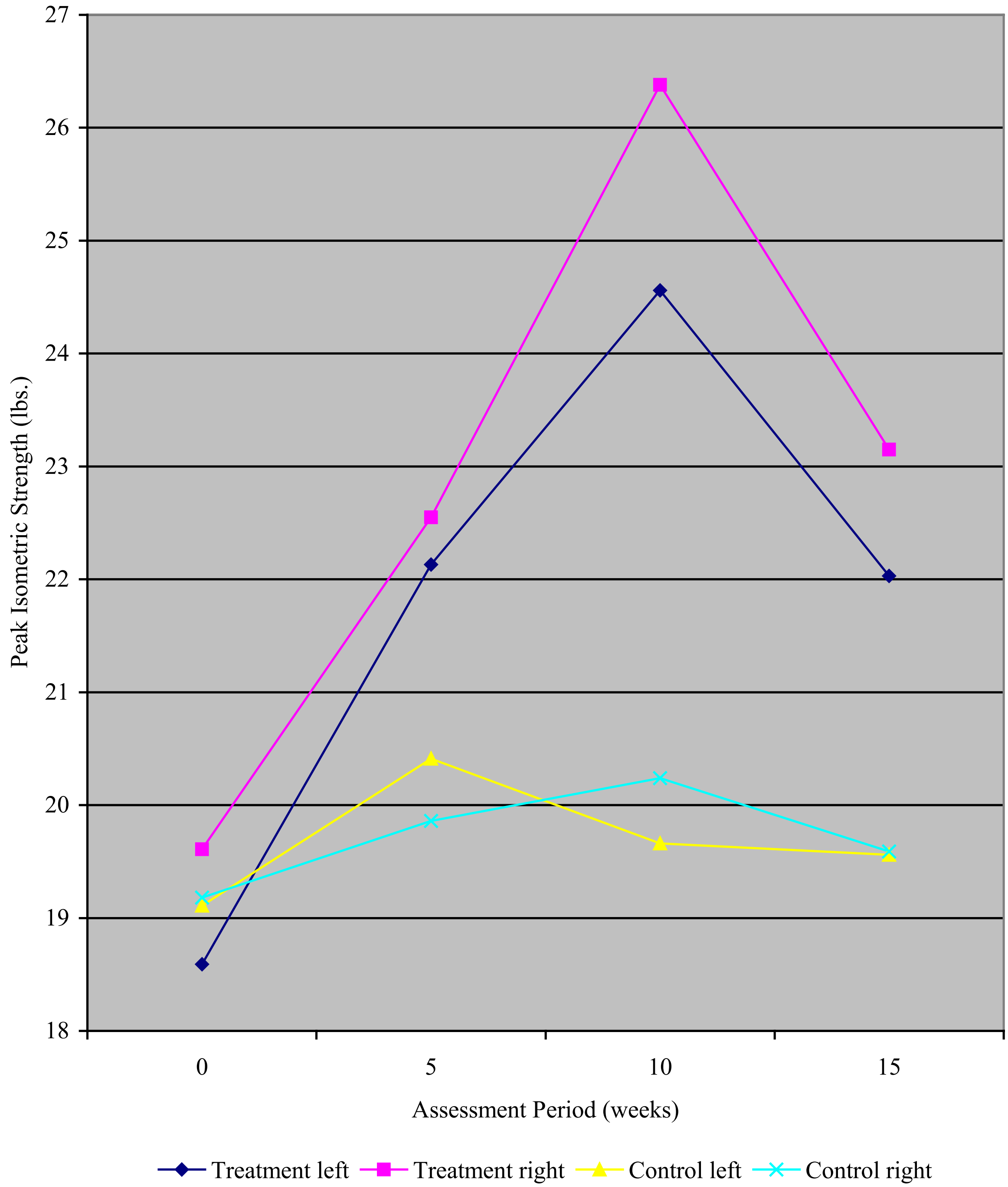

Figure 4.2 Means for Lower Body Strength Composites by Assessment Period

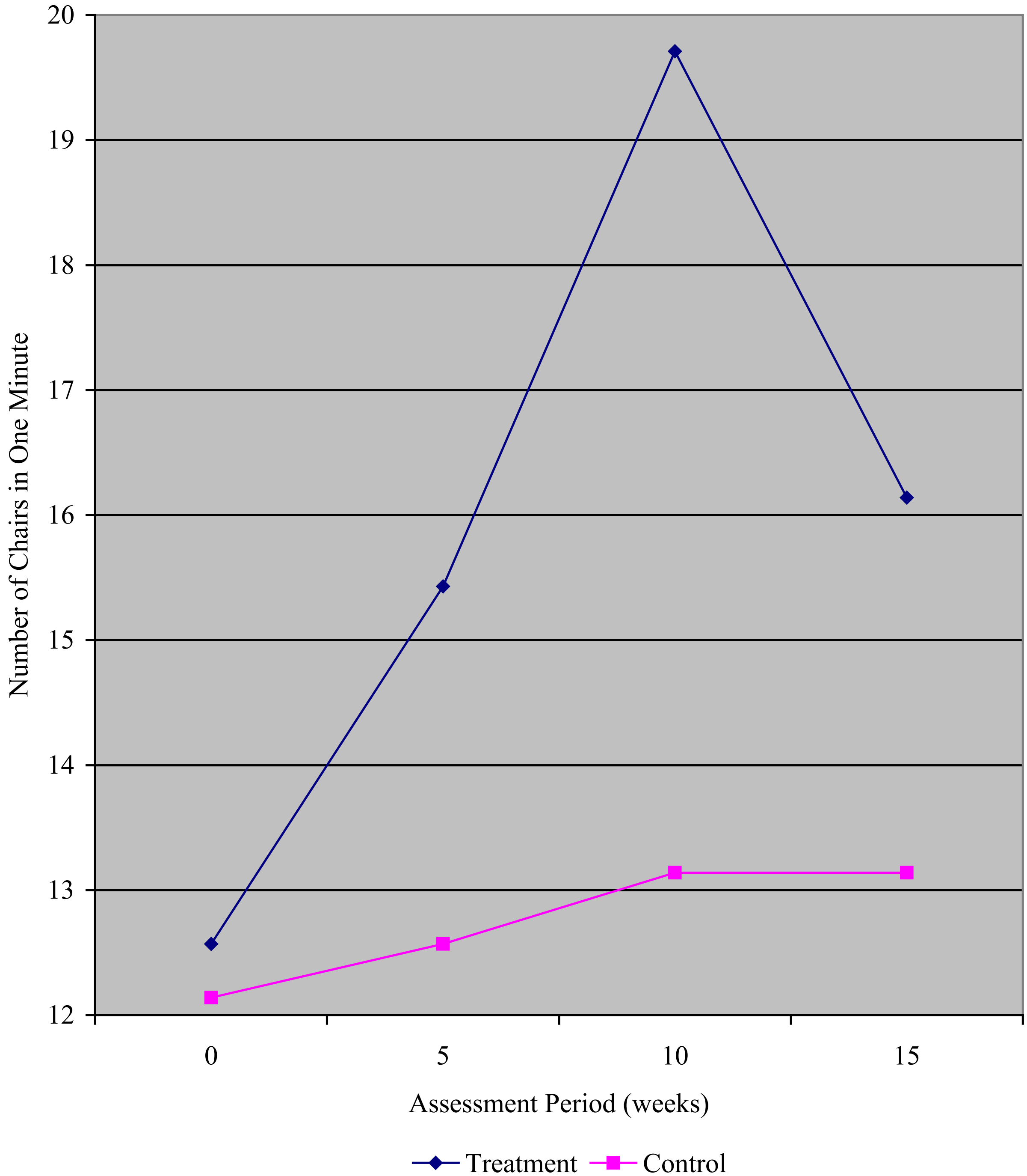

Figure 4.3 Means for Chair Stacking by Assessment Period

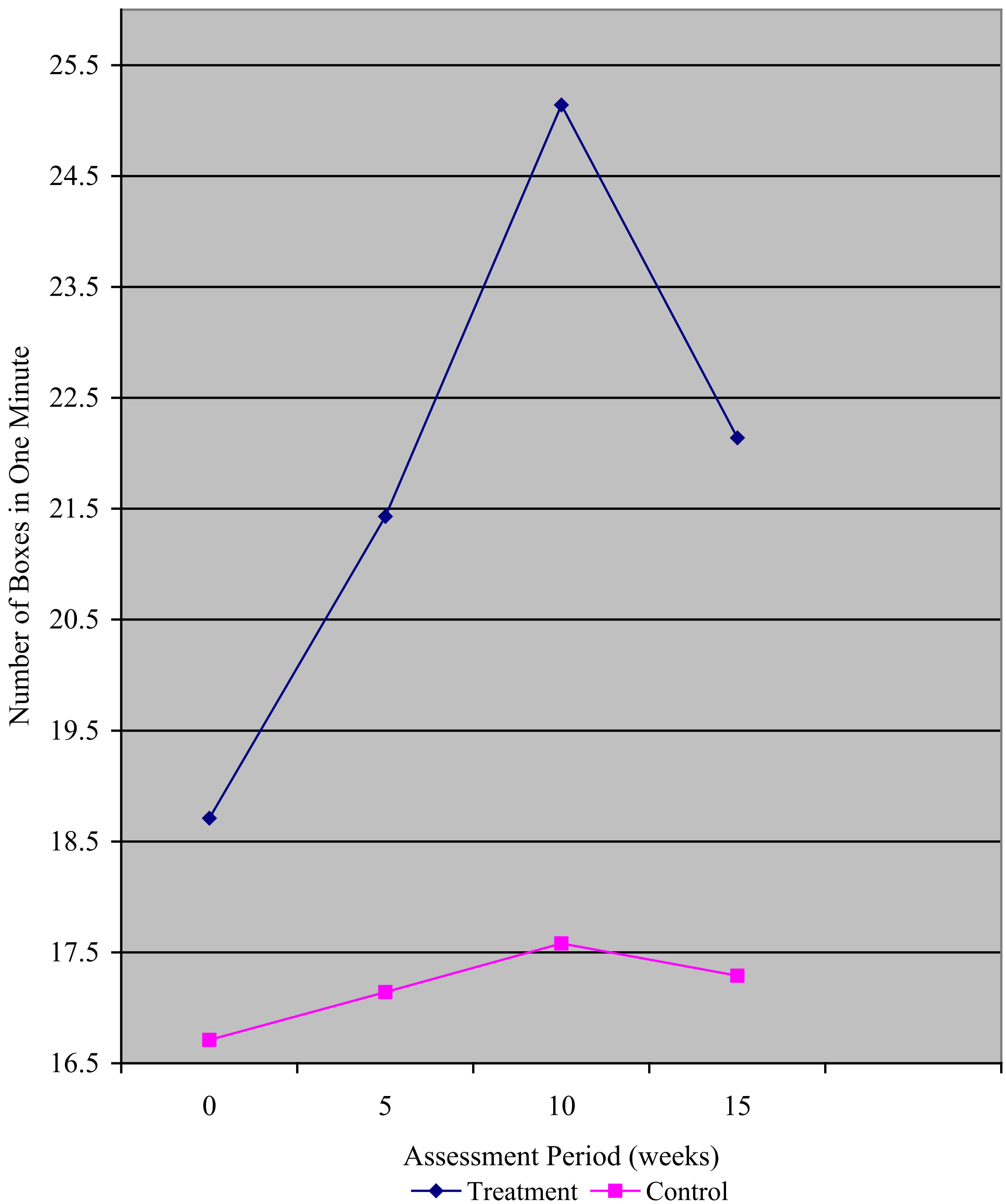

Figure 4.4 Means for Box Stacking by Assessment Period

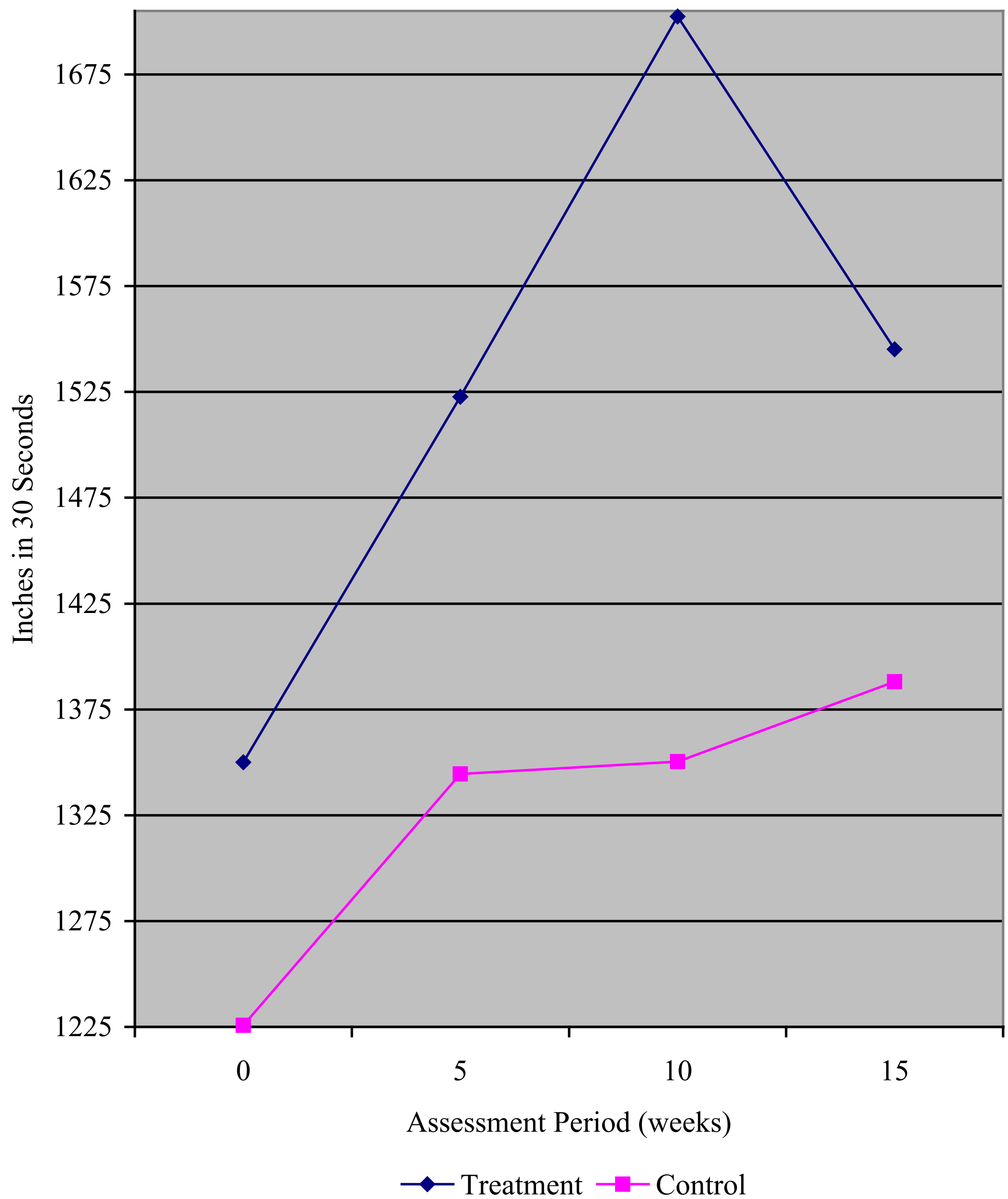

Figure 4.5 Means for Pail Carry by Assessment Period

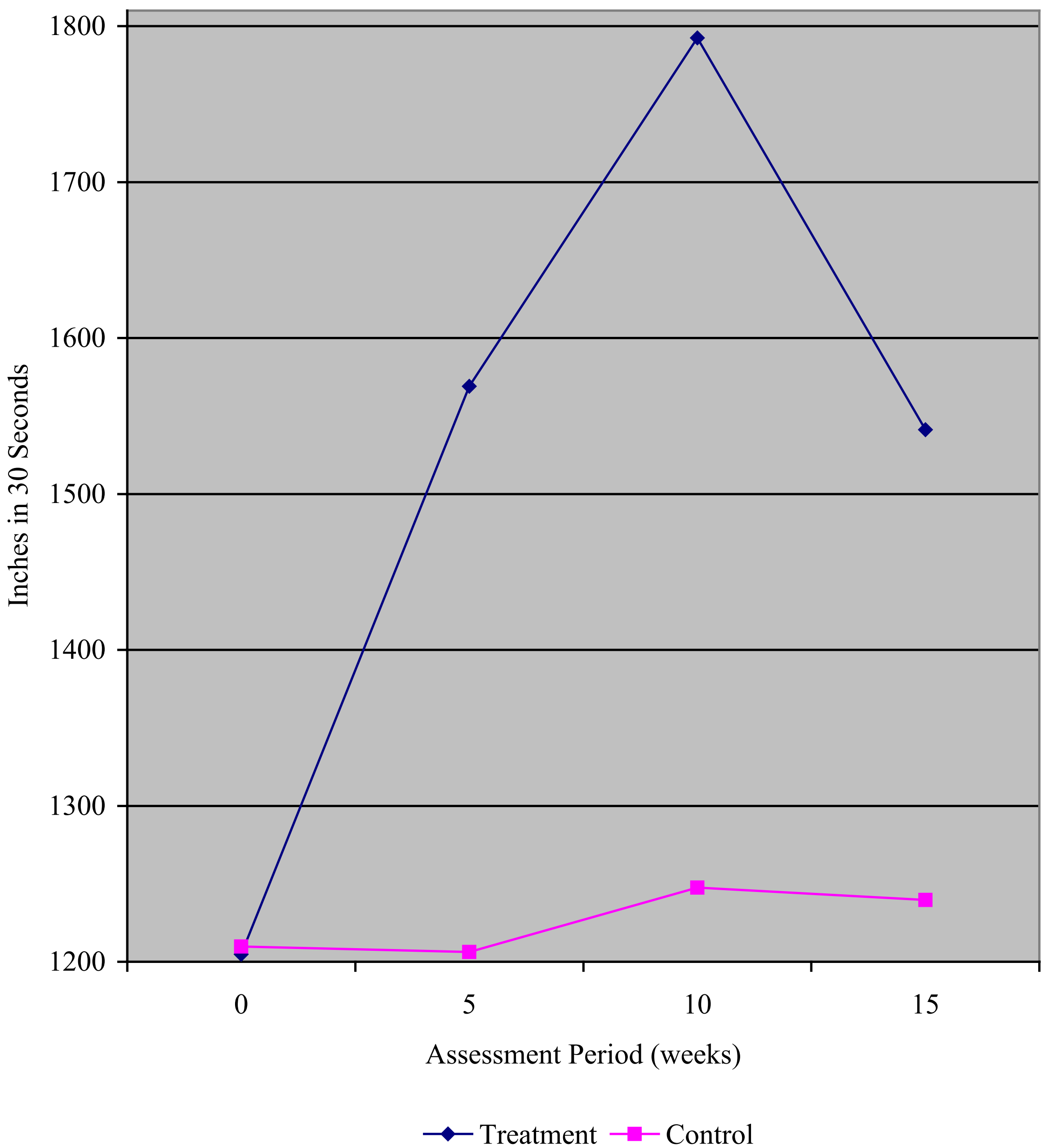

Figure 4.6 Means for Dolly Push by Assessment Period

CHAPTER 5

DISCUSSION

Recent legislation has provided more opportunities for individuals with disabilities to achieve and maintain gainful employment. Preparing participants with mental retardation for employment has individual as well as societal impact. However, most research has indicated that individuals with mental retardation lack some of the necessary pre-requisite physical skills required to perform work-related tasks, yet those deficits can be improved with proper training programs (Croce and Horvat, 1992). Based on the results of this study, significant increases were apparent for high school participants with mental retardation in performing vocational tasks in a physical education curriculum that included resistance training. This was expected and supports previous investigations that reported increases in work productivity after resistance training intervention programs (Croce & Horvat, 1992; Serr, Lavay, Young, & Greene, 1994; & Zetts, Horvat, & Langone, 1995). It appears that performance can be increased on job-related tasks and may be an essential component to aiding students with mental retardation with employment options and the transition process. For transition purposes this results may be noteworthy since this study focused on a school-based intervention and the facilities and equipment that are typically available to adapted physical education teachers.

In particular, the percent gains (Figures 5.1-5.4) for the treatment groups in the vocational tasks revealed average increases at week 10 of 50.49% (chair stack), 44.49% (dolly push), 31.85% (box stack), and 24.59% (pail carry) which were all significant at the .05 level. In contrast the control groups produced smaller average percentage gains of 10.18%, 3.7%, 5.14%, and 10.13% respectively. By examining the improvement at interval 1 it is apparent that increases can be attained early in the intervention phase and strengthens the importance of intervention programs designed to improve function and functional tasks. This is critical in the placement and retention of individuals with mental retardation who need to demonstrate the ability to assimilate and learn task demands for employment (Bolton, Bellini, & Brookings, 2000).

The strength composites gains (Figure 5.5-5.6) were statistically significant, with average percent increases of 30.02% and 31.97% (upper body left and right) and 59.45% and 31.13% (lower body left and right) were achieved by the treatment group. In comparison minimal increases in the control group of 3.13% (upper left), 5.46% (upper right), -3.17 (lower left), and 5.25% (lower right) tends to indicate the effects of training in eliciting strength development. Modest gains in muscular strength coupled with retention level decreases ranging from 8.68% to 13.98% highlight the need for sustained training to improve and maintain physical functioning in this population, which is supported by previous work (Croce & Horvat, 1992; Horvat, Croce, & McGhee, 1993; Zetts et al.,1995). This is consistent with Croce & Horvat (1992) and Zetts et al. (1995) in individuals with longer intervention phases produced greater gains in strength and increases regressed to pre-intervention levels once training was stopped, which is a central component of sustaining gains and rationale for ongoing intervention.

It should be noted, that in previous research, single subject designs were utilized that compared individuals to themselves over a period of time. Croce and Horvat (1992) used similar resistance training equipment and reported increases of 34.58% for composite isometric strength, which lead them to conclude that their protocol was appropriate for obtaining a training effect. The increase of 39.23% for upper body isometric strength and 37.47% for lower body isometric strength found in this investigation were slightly higher than Croce and Horvat (1992) and support the adequacy of the intensity level. While some studies have reported greater gains, these interventions occurred outside of a school-based setting and do not represent traditionally available resources for participants with mental retardation in a public school setting. While the results of this intervention program were effective in producing strength and work productivity gains in high school participants with mental retardation there is still a great deal that can be accomplished to develop model programs and interventions that are tied to the transition process. For example, it is essential for all individual service providers involved in a student's individual transition plan (ITP) to address each student's strengths and weaknesses towards specific job skills by careful planning and coordination to allow them to reach their full potential. An ideal program would be contingent on the integration of school and community resources and be offered throughout the year. Additionally, it would be advisable for schools without training facilities to seek community sites for intervention programs.

Protocols for the vocational tasks used in this study were performed in the work setting and similar to those in the Zetts et al (1995) investigation. These were selected because they represent tasks that are used in the workplace and were assembled from observation of individuals with mental retardation in specific work settings. Percentage increases reported by Zetts et al. (1995) for the box stack of 37.62% were slightly higher than the increase of 34.37% (average across treatment groups) found in this study. The pail carry was the task that produced the smallest gains in both studies with a 13.81% increase in Zetts et al. (1995) and 28.55% (average across treatment groups) increase for the present study indicate this task is more difficult and requires more skill. In comparison to the other vocational tasks investigated, the pail carry requires multiple skills such as balance, grip, shoulder girdle, torso, leg strength, and coordination to accomplish, which may provide some justification for the results. Variations in the dolly push course protocol used between the current study and the Zetts et al. (1995) study indicate a discrepancy in results with an increase of 24.36% in Zetts et al. (1995) and (48.8% average across treatment groups) in the current study. The dolly push protocol in the previous study required more skill because it used an obstacle course type track while the current study used an oval type track accounting for the larger increases. These findings support the training of vocations that may be available in job tasks and importance of training the underlying components of the tasks (coordination and strength etc.) for individuals with mental retardation. Finally the largest increase found in the current study was a 56.8% (average across treatment groups) increase in the chair-stacking task. Interestingly some members of both groups perform this task daily, but the control group increased only 8.24% highlighting the impact of the strength training intervention.

Although all strength data indicated modest increases in functioning for the treatment groups, potential changes in the intervention program may be considered. For example, Pitetti (1990) indicated that motivation is a critical factor in obtaining valid results with individuals with mental retardation; therefore, the power of the data collection protocol could possibly be strengthened by multiple assessment sessions (within 24 hours) at the four data points. Kraemer and Fleck (1993) also recommend tracking of strength consistently across the program for evaluation to appropriately monitor progress and facilitate necessary changes. Horvat and colleagues stated that frequent examination of programs for individuals with mental retardation contributes to greater success and recommended implementation of token reinforcement in conjunction with the program to provide additional motivation for the participants Croce & Horvat, 1992; Horvat & Croce, 1995; Meghee & Horvat,). Finally, Horvat, Croce, Roswal, and Seagraves (1995) indicate that when using manual muscle testing, the ability to exert and sustain effort needed to induce change may require behavior prompting.

The individual group comparison results revealed that strength measures provided the greatest differences in percentage gains between treatment and control participants. For example, treatment group 1 increased 59.09% (upper) and 58.76% (lower) while the corresponding control group increased only 5.42% and 3.03% respectively. Group 5 had similar data with the individual participating in the treatment protocol increasing 49.3% (upper) and 82.51% (lower), while the individual receiving no treatment increased only 2.87 and 5.4% respectively. Taking into consideration that the control groups were not completely sedentary and did participate in group and individual games results indicate that while strength scores did increase for the control group they were substantially lower than the treatment group which received progressive training intervention.

Conversely, the data for vocational tasks were much closer when comparisons were made between treatment and control participants indicating a learning effect may have occurred for the vocational tasks in all participants. This is consistent with the literature in motor learning and strengthens the philosophy that individuals with mental retardation can increase their learning capabilities while performing work-related and self-help skills (Horvat & Croce, 1995). Based on the overall performance it appears that the additional percentage gains resulted from the intervention program and further confirms previous work (Croce & Horvat ,1995 & Zetts et al., 1995).

Possibly one of the most important aspects of the investigation is the finding after cessation of treatment during the 5-week retention period. Based on the retention data (Figures 5.7-5.8) it is evident that individuals gravitate back towards initial levels of functioning. Mean percentage changes for vocational tasks ranged from –9.25 (pail carry) to –18.11 (chair stack), while isometric strength composites decreased 11.31% (upper) and 11.32% (lower). The finding is central to the philosophy of not only implementing training for this population but continuing that intervention. From previous work we see that loss of employment is high in this population and potential employment and job retention may be linked to ongoing intervention in strength as well as job skills. This is also supported by Horvat & Croce (1995) whereas individuals with mental retardation have lower physical capacities than peers without disabilities and physical deficits are directly related to employability (Croce & Horvat, 1992). The results of this study can be directly generalized to programs that serve individuals with mental retardation in that school physical education programs can be implemented to meet requirements of job tasks and skills for transition. The adapted physical educator should work with other individuals involved in the ITP to ensure that individuals with mental retardation have the necessary skills to increase employability. It is also suggested that ongoing programs be implemented to sustain gains made in intervention and alleviate deficits in retention. In addition other forms of resistance training are available that are consistent with the school setting, can be replicated by other teachers, and are conducive to a wide range of environments.

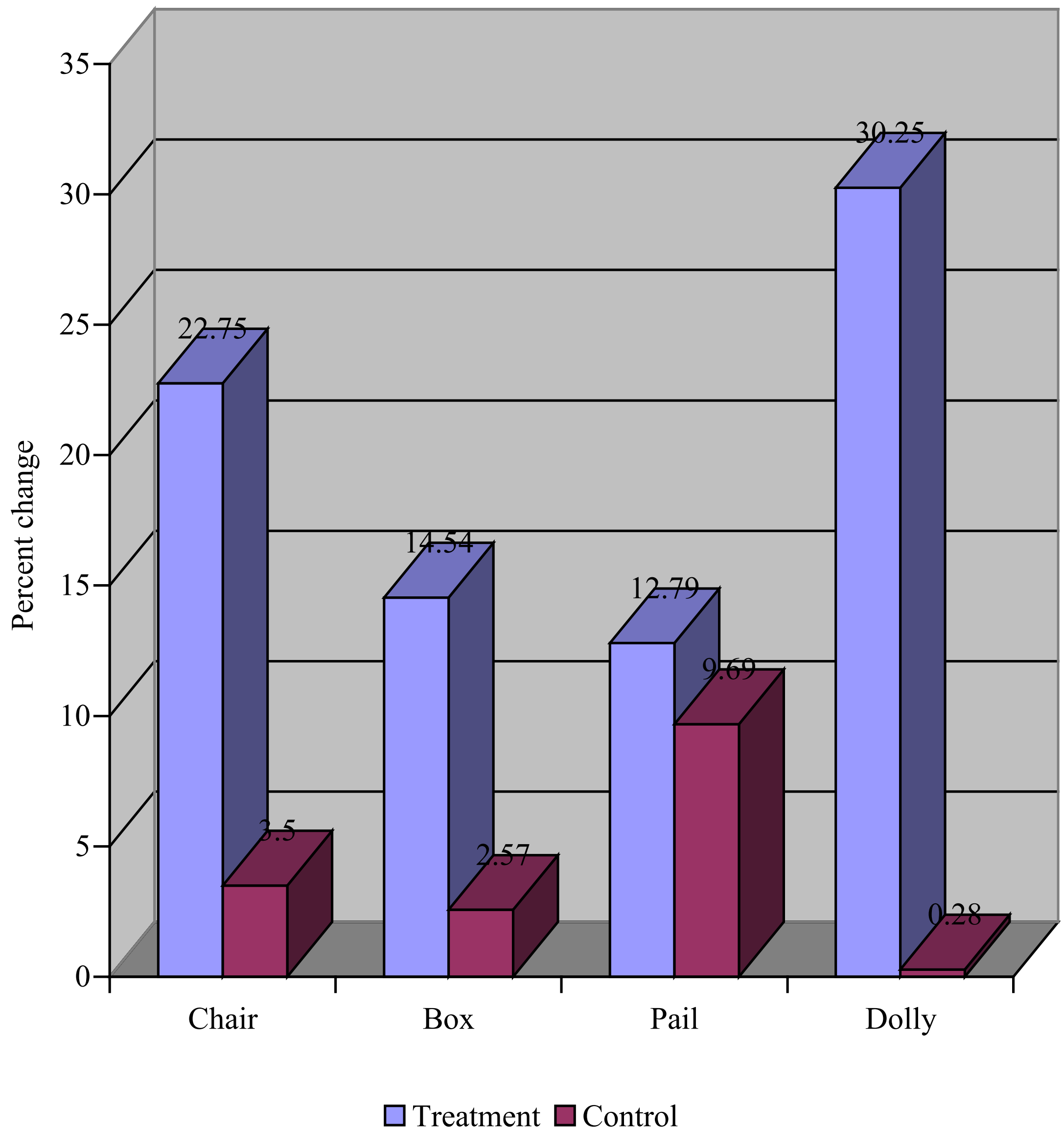

Figure 5.1 Percent Change for Vocational Tasks Weeks 0-5

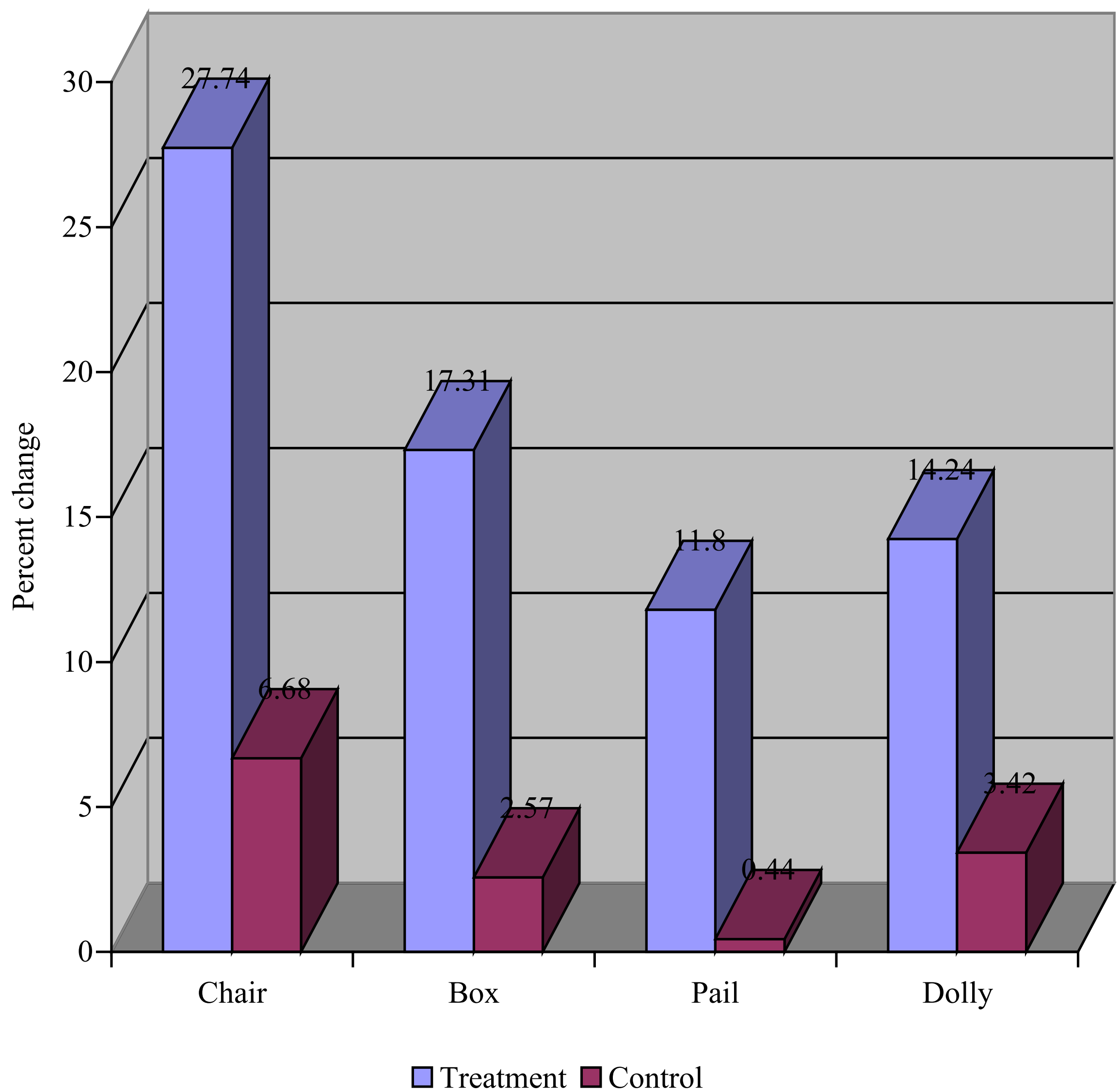

Figure 5.2 Percent Change for Vocational Tasks Weeks 5-10

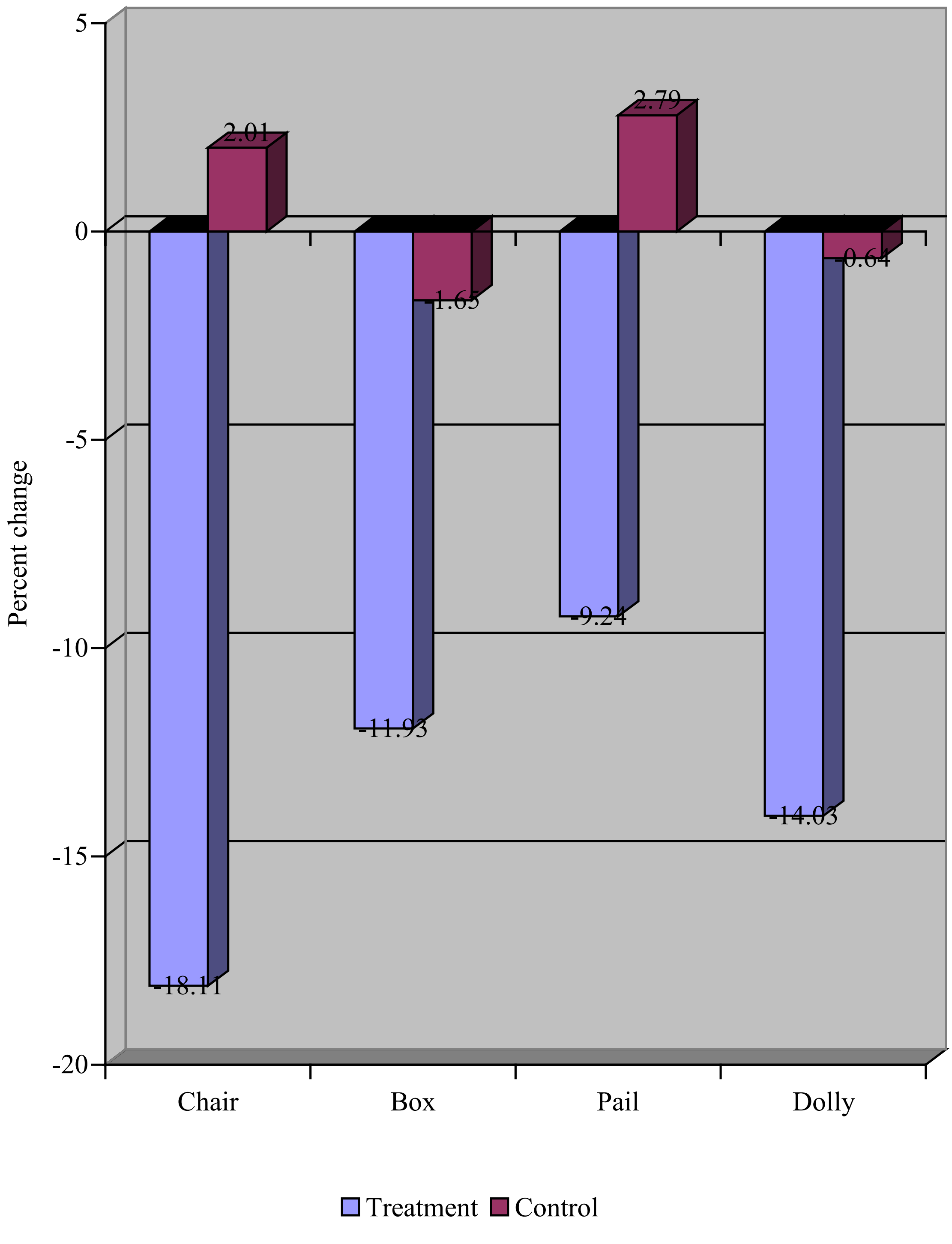

Figure 5.3 Percent Change for Vocational Tasks Weeks 10-15

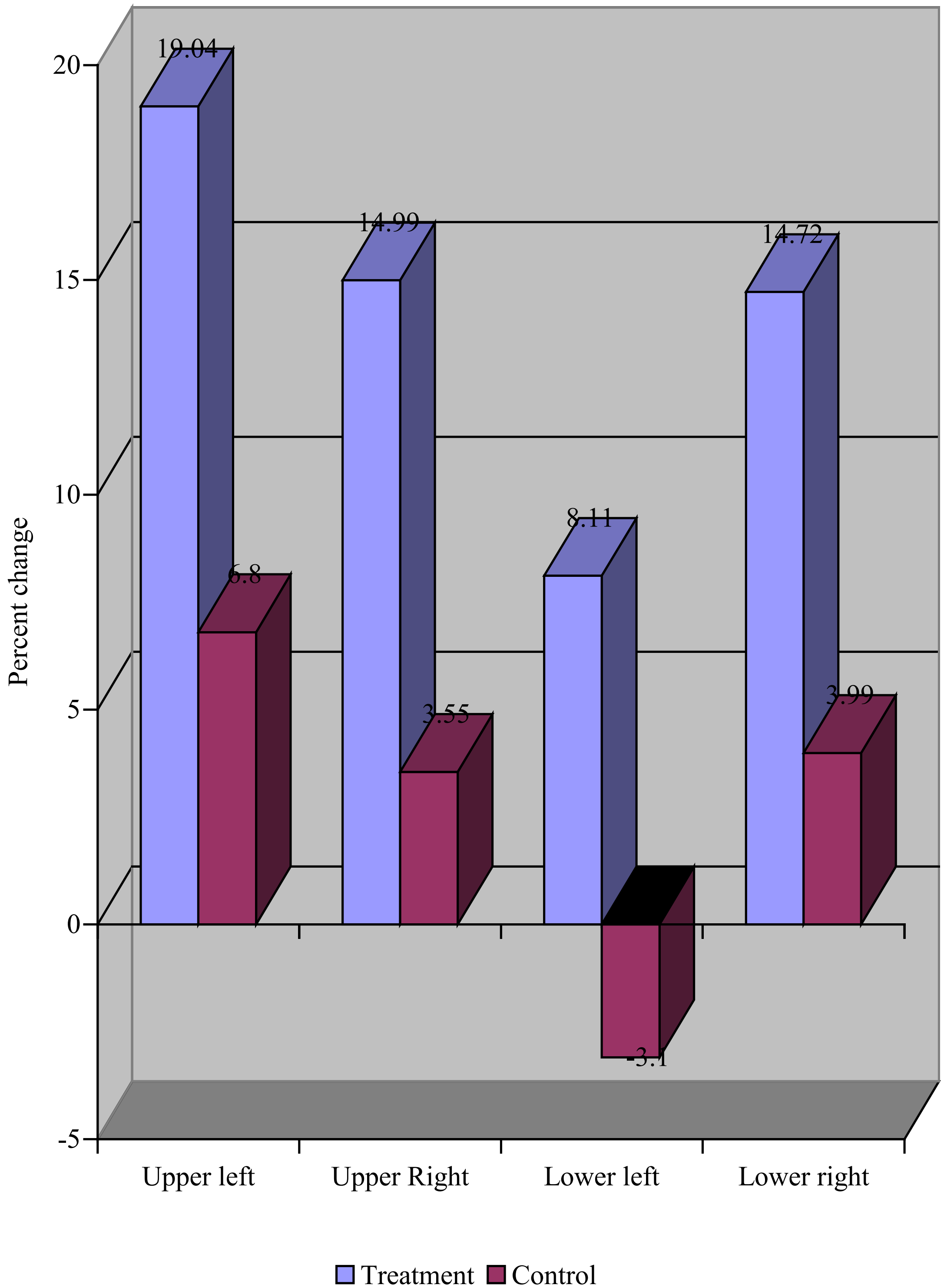

Figure 5.4 Percent Change in Isometric Strength Composite Weeks 0-5

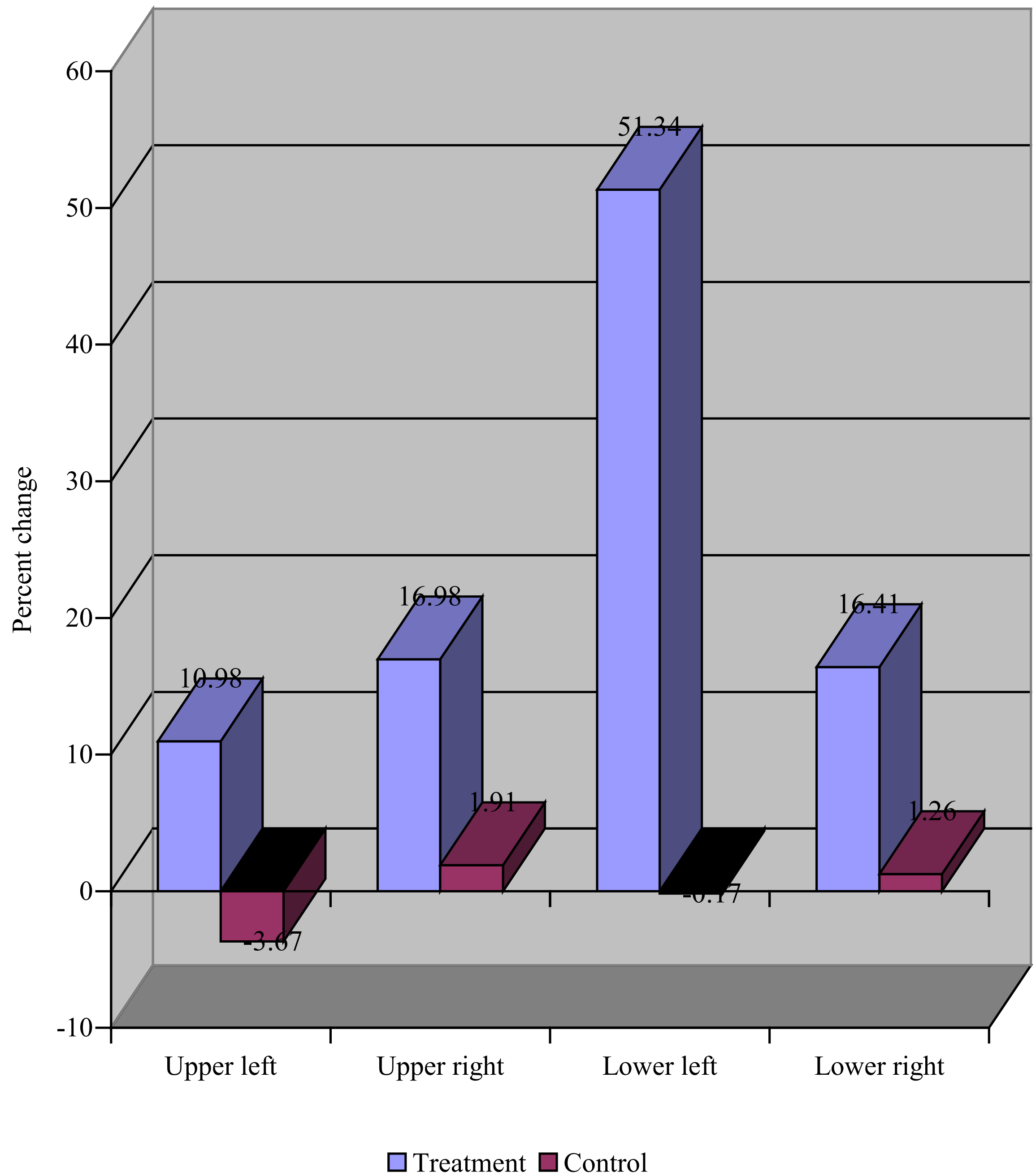

Figure 5.5 Percent Change in Isometric Strength Composites Weeks 5-10

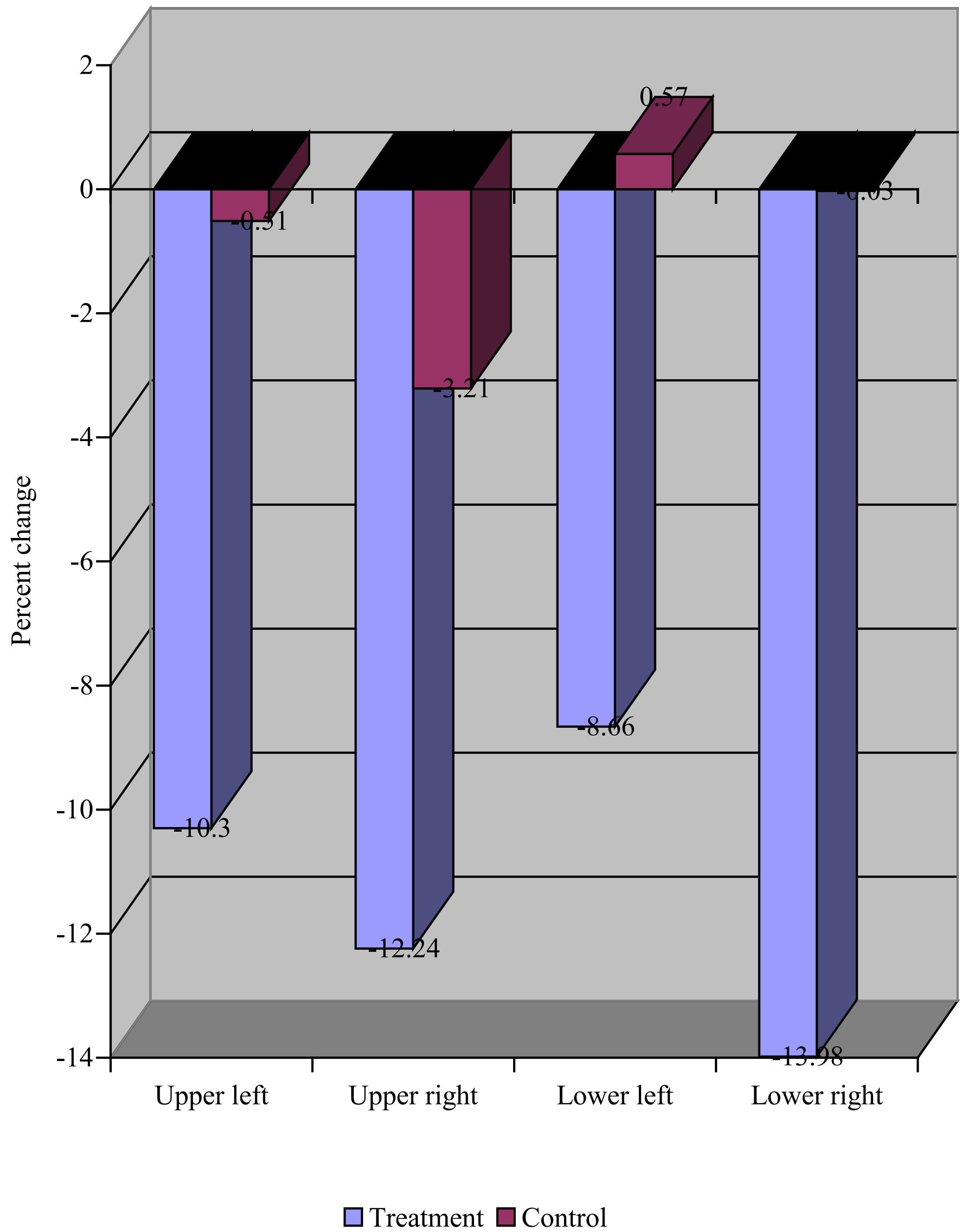

Figure 5.6 Percent Change in Isometric Strength Composites Weeks 10-15

REFERENCES

Adams-Shollenberger, G.E. & Mitchell, T.E. (1996). A comparison of janitorial workers with mental retardation and their non-disabled peers on retention and absenteeism. *Journal of Rehabilitation*, *62*(3), p. 56-61.

Asfour, S.S., Ayoub, M.M., & Mital, A. (1984). Effects of an endurance and strength-training program on lifting capability of males. *Ergonomics*, *27*(4), p.435-42.

Auxter, D., Pyfer, J., & Huettig, C. (1997). *Principles and methods of adapted physical education and recreation* (8TH ed.). Chicago: Brown and Benchmark.

Beasley, C.R. (1982). Effects of jogging program on the cardiovascular fitness and work performance of mentally retarded persons. *American Journal of Mental Deficiency*, *6*, p.609-613.

Bernacki, E.J., & Baun, W.B. (1984). The relationship of job performance to exercise adherence in a corporate fitness program. *Journal of Occupational Medicine, 26*(7), p. 529-531.

Bolton, B.F., Bellini, J.L., & Brookings, J.E. (2000). Predicting client employment outcomes from personal history, functional limitations, and rehabilitation services. *Rehabilitation Counseling Bulletin*, *44*(1), p. 10-21.

Botuck, S., Levy, J.M., & Rimmerman, A. (1998). Post-placement outcomes in competitive employment: How do urban young adults with developmental disabilities fare over time? *Journal of Rehabilitation*, July/August/September, p. 42-47.

Brown, B.J. (1977). The effect of an isometric strength program on the intellectual and social development of trainable retarded males. *American Corrective Therapy Journal,* 31(2), p. 44-8.

Chaiwanichsiri D., Sanguanrungsirikul S., & Suwannakul, W. (2000). Poor physical fitness of adolescents with mental retardation at Rajanukul School, Bangkok. *Journal of the Medical Association of Thailand;* Nov; 83(11): p. 1387-92.

Cioni, M., Cocilova, A., Di Pasquale, F., Rillo Araujo, M.B., Rodrigues Siqueira, C., & Bianco, M. (1994). Strength deficit of knee extensor muscles of individuals with down syndrome from childhood to adolescents. *American Journal Of Mental Retardation, 99*(2), p.166-174.

Croce, R. & Horvat, M. (1992). Effects of reinforcement-based exercise on fitness and work productivity in adults with mental retardation. *Adapted Physical Activity Quarterly, 9,* p.148-178.

Fabian, E.S., Lent, R.W., & Willis, S.P. (1998). Predicting work transition outcomes for participants with disabilities: Implications for counselors. *Journal of Counseling and Development, 76*, p. 311-316.

Fernall, B. (1993). Physical fitness and exercise training of individuals with mental retardation. *Medicine and Science in Sports and Exercise, 25*(4), p.442-450.

Fernall, B., Tymeson, G.T., & Webster, G.E. (1988). Cardiovascular fitness of mentally retarded individuals. *Adapted Physical Activity Quarterly,* 5, p.12-18.

Fuqua, D.R., Rathbun, M., & Gade, E. M. (1984). A comparison of employer attitudes toward the worker problems of eight types of disabled worker. *Journal of Applied Rehabilitation Counseling, 15*(1), p.40-43

Genaidy, A.M. (1991). A training program to improve human physical capability for manual handling jobs. *Ergonomics, 34*(1), p.1-11.

Genaidy, A.M., Bafna, K.M., Sarmidy, R., & Sana, P. (1990). A muscular endurance-training program for symmetrical and asymmetrical manual lifting tasks. *Journal of Occupational Medicine, 32*(3), p.226-33.

Genaidy, A., Davis, N., Delgado, E., Garcia, S., & Al-Herzalla, E. (1994). Effects of a job-simulated exercise program on employees performing manual handling operations. *Ergonomics, 37*(1), p. 95-106.

Genaidy, A.M., Gupta, T., & Alshedi, A. (1990). Improving human capabilities for combined manual handling tasks through a short and intensive physical training program. *American Industrial Hygiene Association, 51*(11), p.610-4.

Gilmore, D.S., Schuster, J.L., Timmons, J.C., & Butterworth, J. (2000). An analysis of trends for people with mr, cerebral palsy, and epilepsy receiving services from state vr agencies: ten years of progress. *Rehabilitation Counseling Bulletin*, *44*(1), p.30-38.

Graham A., & Reid, G. (2000). Physical fitness of adults with an intellectual disability: a 13-year follow-up study. *Research Quarterly in Exercise and Sport;* Jun; *71*(2): p.152-61

Greenwood, R. & Johnson, V. (1987). Employer perspectives on workers with disabilities. *Journal of Rehabilitation, 53*(3), p.37-45.

Horvat, M.A. & Croce, R. (1995). Physical rehabilitation of individuals with mental retardation: Physical fitness and information processing. *Critical Reviews in Physical and Rehabilitative Medicine, 7*(3), p.233-252.

Horvat, M., Croce, R., & McGhee, T. (1993). Effects of a circuit training program on individuals with mental retardation. *Clinical Kinesology*, *47*(3), p. 71.

Horvat M., Croce, R., Pitetti, K.H., & Fernhall, B. (1999). Comparison of isokinetic peak force and work parameters in youth with and without mental retardation. *Medicine and Science in Sports and Exercise, 31*(8), p.1190-5.

Horvat, M., Croce, R., & Roswall, G. (1993). Magnitude and reliability of measurements of muscle strength across trials for individuals with mental retardation. *Perceptual Motor Skills, 77*, p.642-651.

Horvat, M., Croce, R., & Roswall, G. (1994). Intratester reliability of the Nichols manual muscle tester with intellectual disabilities by a tester having minimal experience. *Archives of Physical Medicine and Rehabilitation, 75*, 7, p.808-816.

Horvat, M., Croce, R., & Roswall, G. & Seagraves, F. (1995). Utilization of a single trial versus maximal or mean values for evaluation of upper body strength in individuals with mental retardation. *Adapted Physical Activity Quarterly, 12*, p.52-63.

Horvat, M., Pitetti, K.H., & Croce, R. (1997). Isokinetic torque, average power, and flexion/extension ratios in non-disabled adults and adults with mental retardation. *Journal of Sports and Physical Therapy, 25*(6), p.395-399.

Horvat, M.A., & Kalakian, L.H. (1995). *Assessment in Adapted Physical Education and Therapeutic Recreation*. Dubuque: Wm. C. Brown.

Individuals with Disabilities Education Act of 1997, Pub. L. 105-17, H.R.5, 20 U.S.C. 1400 et. seq. (1997)

Kraemer, W.J. & Fleck, S.J. (1993). *Strength training for young athletes*. Champaign: Human Kinetics

Knuttgen, H.G. & Kraemer, W.J. (1987). Terminology and measurement in exercise performance. *Journal of Applied Sports Science Research*, 1, p.1-10.

Komi, P.V. (Eds.). (1992). *Strength and power in sport*. London: Blackwel Scientific Publications.

Mank, D. (1994). The underachievement of supported employment. *Journal of Disability Policy Studies, 5*(2), p.1-24.

McMahon, B.T., & Bartley, P.A. (1981). Alternative work patterns and rehabilitation. *Rehabilitation Literature, 42*, (1-2), p.14-17.

Millington, M., Szymanski, E.M., & Hanley-Maxwell, C. (1994). Effect of the label of mental retardation on employer concerns and selection. *Rehabilitation Counseling Bulletin, 38*(1), p. 27-43.

Moulson-Litchfield, M., & Freedson, P.S. (1986). Physical training programs for public safety personnel. *Clinical Sports Medicine, 5*(3), p.571-87.

Nisbet, J.A. (1988). Exercise and mental disorders. In A.J. Ryan & F.L. Allman (Eds.) *Vocational Education for Persons with Handicaps*. (p. 65-86). Mountain View, CA: Mayfield.

Pitteti, K.H. (1990). Reliable isokinetic strength test for arm and leg musculature for mildly mentally retarded adults. *Archives of Physical Medicine and Rehabilitation*, p.699-672.

Pitetti, K.H., Climstein, M., Mays, M.J., & Barret, P.J. (1992). Isokinetic arm and leg strength of adults with down syndrome: A comparative study. *Archives of Physical Medicine and Rehabilitation, 73*, p.847-850.

Pitetti, K.H., & Fernall, B. (1997). Aerobic capacity as related to leg strength in youths with mental retardation. *Pediatric Exercise Science, 9,* p.223-230.

Pitteti, K.H., Rimmer, J.H., & Fernall, B. (1993), Physical fitness and adults with mental retardation: An overview of current research and future directions. *Sports Medicine, 16*(1), p.23-56.

Reid, G., Montgomery, D., & Seidl, C. (1985). Performance of mentally retarded adults of the canadian standardized test of fitness. *Canadian Journal of Public Health*, 76, p.187-190.

Rimmer, J.H., & Kelly, L.E. (1991). Effects of resistance training program on adults with mental retardation. *Adapted Physical Activity Quarterly, 8*,(1), p.46-153.

Sayers, K.L., Cowden, J.E., Newton, M., Warren, B., & Eason, B. (1996). Qualitative analysis of a pediatric strength intervention on the developmental stepping movements of infants with down syndrome. *Adapted Physical Activity Quarterly, 13*, p.247-268.

Schurrer, R., Weltman, A., & Brammell, H. (1985). Effects of physical training on cardiovascular fitness and behavior patterns of mentally retarded adults. *American Journal of Mental Deficiency, 90*, (2), p.167-169.

Serr, R, Lavay, B., Young, D., & Greene, G. (1994). Dexterity and bench assembly work productivity in adults with mild mental retardation. *Education and Training in Mental Retardation and Developmental Disabilities*, June, p.165-171.

Shephard, R.J. (1992). A critical analysis of work-site fitness programs and their postulated economic benefits. *Medicine and Science in Sports and Exercise. 24*(3), p.354-70.

Suomi, R., Suburg, P.R., & Lecius, P. (1995). Effects of hydraulic resistance strength training on isokinetic measures of leg strength in men with mental retardation. *Adapted Physical Activity Quarterly, 12*, p. 377-387.

Wehman, P. (1981). *Competitive Employment*. Baltimore: Paul H. Brooks.

Wehman, P. & Kregel, J. (1988). Adult employment programs. In R.Gaylord-Ross (Ed.). *Vocational Education for Persons with Handicaps*. (p.205-233). Mountain View, CA: Mayfield.

Zetts R.A., Horvat M.A., & Langone, J. (1995). Effects of a community-based progressive resistance-training program on the work productivity of adolescents with moderate to severe intellectual disabilities. *Education and training in mental retardation and developmental disabilities*, p.166-178.

APPENDIX A

CONSENT FORMS

Consent Form

I agree to allow my child ____________________________ to take part in a research study titled "The Effects of a School-Based Physical Education Curriculum on Work Productivity and Physical Fitness Parameters of High School Participants with Mental Retardation", which is being conducted by Trey Seagraves, University of Georgia, Department of Physical Education and Sport Studies, 706-543-8203, under the direction of Dr. Michael Horvat, Department of Physical Education and Sport Studies, 706-542-4455. I do not have to allow my child to take part in this study; my child and I can stop taking part at any time without giving any reason, and without penalty. I can ask that any information related to my child be returned to me, removed from the research records, or destroyed.

The following points have been explained to me:

1. The reason for this study is to determine if a physical education fitness program can change work performance skills. My child may benefit by increasing his physical fitness and work-related skills. In addition, the information gained may provide information for future program planning.
2. If I allow my child to participate in this study he will asked to participate in the regular classroom exercise program, which involves light weight lifting, work-related skills (such as lifting boxes, lunch trays, and chairs), stretching, and aerobic activity. He will also have their height, weight, muscular strength, and work performance assessed before and after the program. Each exercise session will last approximately forty-five minutes and will take place at my child's school during their physical education class. This study will last for ten weeks.
3. The discomforts or stresses that may be faced during this study are muscle soreness and fatigue. Muscle soreness may result from the use of muscles that have not been previously exercised, and fatigue may result from participation in the exercise program. The program will be structured so that exercise is started slowly and progresses in intensity to minimize both muscle soreness and fatigue.
4. All exercise sessions will be closely monitored to reduce the risk of an accident. In addition my child will be given instruction in the proper techniques of each exercise.
5. The results of this study will be confidential, and will not be released in any identifiable form without consent, unless otherwise required by law. Written information produced from this study will use fictional names for the participants. All data collected will also be coded with fictional names.
6. The researcher will answer any further questions about the research, now or during the course of the project, and can be reached by telephone at: 706-543-8203.

I understand the procedures described above. My questions have been answered to my satisfaction, and I agree to let my child participate in this study. I have been given a copy of this form.

Signature of Researcher Date Signature of parent/guardian Date

Please sign both copies. Keep one and return the other to school with your child.

For questions or problems about your rights please call or write: Chris A. Joseph, Ph.D., Human Participants Office, University of Georgia, 606A Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-6514; E-Mail Address IRB@uga.edu.

Student Consent Form

I, ________________________________, agree to take part in a research study that will be conducted during my physical education class by my teacher Trey Seagraves. This is something that I do not have to do. If I start and decide I do not want to continue I may stop at any time without any penalty. None of my scores will be shared with any one else but Mr. Seagraves, and will be destroyed if I ask.

The following things have been explained to me:

1. The reason for this study is to see if a strength-training program will change work performance skills. During this study, I may increase my physical fitness and work-related skills.
2. If I decide to do this study I will be asked to lift light weights, stretch, use stationary bikes for aerobic activity, and perform work-related tasks. Each exercise session will take place during my regular physical education time with my regular teachers.
3. My muscles may become sore from exercise. This is normal and will not be permanent. I may also become tired.
4. My teachers will be in each exercise session to help and show me how to do all exercises.
5. None of my scores will be seen by anybody other than my teachers.
6. I may ask questions at any time.

I understand the things explained above. My questions have been answered, and I agree participate in this study. I have been given a copy of this form.

______________________________ ____________________________________

Signature of Researcher Date Signature student Date

Please sign both copies. Keep one and return the other to your teacher.

For questions or problems about your rights please call or write: Chris A. Joseph, Ph.D., Human Participants Office, University of Georgia, 606A Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-6514; E-Mail Address IRB@uga.edu.

APPENDIX B

DATA COLLECTION FORMS

Work Performance Data Sheet

Name:___________________________

Test	0	5	10	15
Box Stacking 1 minute				
Chair Stack 1 minute				
Pail Carry 30 sec.				
Dolly Push 30 sec.				

MMT Data Sheet

Name:____________________________

Week 0 5 10 15

	Right			Mean		Left			Mean
Muscle Group	1	2	3			1	2	3	
Elbow Flexion									
Elbow Extension									
Knee Flexion									
Knee Extension									
Shoulder Abduction									

APPENDIX C

LEGISLATION FOR INDIVIDUALS WITH DISABILITIES

Legislation as it relates to the education and preparation of individuals with disabilities has its foundation in the Smith-Hughes Act of 1917, also known as The Vocational Act of 1917, and was passed in part in an effort to expand vocational education below the college level. It represented the first endorsement of vocational education in the public school system. It required that states develop plans outlining the types of vocational education programs each state would offer. Since that early vocational education legislation, many other acts have been passed that expands the role of vocational education, general education, and special education in the preparation of participants for opportunities after secondary education.

The Vocational Education Act of 1963 (Public Law 1963), also known as the Perkins-Morse Bill was the first piece of legislation that endorsed vocational education for individuals with disabilities. It was intended to provide federal grants to the states so that they would be able to maintain, expand, and improve existing programs, and to start new programs that would broaden the concept of vocational education. It was enacted in part due to President Kennedy's remark on American education in his 1961 message to Congress. Part of the funds allocated in this act were to be spent on vocational education for individuals who have academic, socioeconomic, or other disabilities that impedes their success in the regular vocational education program. Grants for research and development of experimental programs directed at improving the services provided to individuals with disabilities received ten percent of the total funds allocated.

The Vocational Education Amendments of 1968 (Public Law 90-576) went a step further and created funding categories of disadvantaged and disabled. The main purpose of these amendments was to provide access for all citizens to vocational training and retraining. This significant piece of legislation was intended to replace all other vocational education acts previous with the exception of the Smith-Hughes Act. It also created national, state, and local advisory boards that were instrumental in future legislation and planning at the various levels. This act also provided funds specifically for individuals who were mentally retarded and deaf.

The Rehabilitation Act of 1973 (Public Law 93-112) specifically sections 503 and 504 affirmed the rights of individuals with disabilities in the workplace. It created affirmative action incentives for employers to hire individuals (section 503) with disabilities and mandated that employers make "reasonable accommodations" for individuals with disabilities that were interested in jobs. Section 504 was designed to help individuals with disabilities enter mainstream life by prohibiting discrimination in any public or private facility receiving federal funds. It required that services, aid, opportunities, and benefits are provided in the same setting and in equal force to individuals with disabilities.

The Educational Amendments of 1973 (Public Law 93-380) was the first piece of legislation to encourage the writing of an individualized education plan (IEP) for each student identified as having special needs.

A landmark piece of legislation was the Education for All Handicapped Children Act of 1975 (Public Law 94-142). It was the first in the movement to provide a free and appropriate education to all children with disabilities. It was also the only piece of legislation that addressed the issue of physical education for individuals with disabilities. It went a step further than PL 93-380 in that it assured the development and maintenance of an IEP. In addition it defined an IEP and its component parts as: present level of performance, annual goals, short term objectives, specific services to be provided, length and initiation date, and evaluation procedures. It also included that due process be followed to ensure the rights of the individual were being protected as well as the rights of the parents or guardians. It also introduced the term least restrictive environment to the education of individuals with disabilities. This allowed for education to take place in the classroom with children without disabilities, where appropriate, and started the movement of mainstreaming.

The Carl D. Perkins Act of 1984 (Public Law 98-524) included many assurances for individuals with disabilities in vocational education. It endorsed equal access to all vocational programs for individuals with disabilities and emphasized that vocational education take place in the LRE. It assured that vocational education would be included in the IEP when appropriate. It also attempted to address the inclusion of the parents through dissemination of information at a time that precluded the year of vocational education onset or by the ninth grade year. This information was to include programs offered in addition to the requirements for eligibility. Finally it assured that equal assessment for all individuals be used, that adaptations for success in vocational education programs were to be available, and guidance and counseling be providing to assist the participants and parents in making informed decisions.

The Americans with Disabilities Act of 1990 (Public Law 101-336) prescribed the elimination of discrimination through the setting of standards for the assessment of discrimination. It like public law 93-112 addressed the employment of individuals with disabilities but went a step further by mandating that all public and private organizations meet physical accessibility, services, and employment needs regardless of whether they received federal funds or not. In the educational setting it required that public and private schools make any offered program or service accessible, provide information about each program or service, and provide for fair, accurate screening and testing procedures and instruments.

The Individuals with Disabilities Education Act of 1990 (Public law 101-476) did away with the term handicapped and replaced it with individuals with disabilities. It also provided for an individualized transition plan (ITP) to be included in the IEP by the age of sixteen. This ITP was to be used as a means to identify the participants strengths and weaknesses in vocational areas, options to address these issues, and prescribe a plan of passage of the student from the public school setting to post-secondary school training or job placement. A transition plan included any related services that would be needed such as a job coach, and specifically included the student to make sure their interests and preferences were reported. The ITP will be further defined in the following discussion of IDEA 1997.

The Individuals with Disabilities Education Act Amendments of 1997 (began as The Education of All Handicapped Children Act of 1975 amended in 1983, 1986, & 1990) included provisions that provided for transition services for participants with disabilities starting at age fourteen (as opposed to sixteen in PL 101-476). The term 'transition services' means a coordinated set of activities for a student with a disability that is designed within an outcome-oriented process, which promotes movement from school to post-school activities, including post-secondary education, vocational training, integrated employment (including supported employment), continuing and adult education, adult services, independent living, or community participation. Transition services should also be based upon the individual student's needs, taking into account the student's preferences and interests; and includes instruction, related services, community experiences, the development of employment and other post-school adult living objectives, and, when appropriate, acquisition of daily living skills and functional vocational evaluation.