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The Effects of Mixed Martial Arts on Behavior of Male Children with Attention Deficit Hyperactivity Disorder

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I dedicate this dissertation to my mother Gig and father Steve for teaching me love, truth, and happiness, to Ricky for his maturity, Nicholas for his intellect and Meegan for her friendship and emotion. To my extended family (Audie, Bruce, Bernie, Mima, Grandpa, Nana, Baba, and Woodmont), friends, Hashem and my martial arts family, thank you for supporting me all these years and for teaching me to have a "non-quitting spirit".

I am honored to have each of you in my heart…my love and respect.

ABSTRACT

In this research the effectiveness of a martial arts program two times per week at increasing the percentage of completed homework, frequency of following specific classroom rules, improve academic performance, and improve classroom preparation was explored. In addition, decreasing maladaptive behaviors including necessity for redirection to task, inappropriately calling out in class, and inappropriately leaving the seat during class were explored. Participants were male children ages 8 to 11 diagnosed with Attention Deficit Hyperactivity Disorder.

Schoolteachers completed a behavior checklist both initially during the baseline period and throughout the 12-week study to measure the effectiveness of both intervention groups and the non-intervention group on the behaviors of AD/HD children. A single subject design using multiple baselines across conditions was employed in this study. Participants were assigned to a martial arts intervention, exercise intervention, or control group condition and data was collected on the behaviors exhibited in school.

Results of this study were determined by a comparison between pre scores and post scores on the rating scale. Five of seven hypotheses were supported. Martial Arts was proven to increase percentage of homework completion, academic performance, and percentage of classroom preparation while decreasing the number of classroom rules broken and times inappropriately leaving the seat. This study lends empirical support to martial arts as a positive intervention for children with AD/HD. Results of the study are discussed in terms of future interventions in the physical education classroom or in a private setting to help children control symptoms associated with AD/HD.

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Chapter I. Introduction

Research suggests that Attention Deficit Hyperactivity Disorder (AD/HD) is one of the most common disorders found in children, totaling 30% to 50% of child referrals to mental health services (Barkley, 1996; Popper, 1988). Substantial impairments in peer, family, and academic functioning can be attributed to children with AD/HD (Barkley, 1996; Hinshaw, 1992). Therefore, it is essential to establish efficacious methods to treat symptoms associated with AD/HD.

Past research has been focused on interventions including medications, cognitive behavioral and behavioral therapies, social skills training programs, and applied behavioral analysis to help alleviate symptoms associated with AD/HD (The MTA Cooperative Group, 1999). Few of these controlled studies have examined the effectiveness beyond three months of short-term treatments (Spencer, et al., 1996; Swanson, 1993; Pelham & Murphy, 1986; Hinshaw, Klein, & Abikoff, 1998; Pelham, Wheeler, & Chronis, 1998).

Scientific progress has been significantly slowed by the lack of a single, consistent, and standard research protocol for case identification of AD/HD (Lesesne, Abramowitz, Perou, & Brann, 2000). The Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition Text Revision (DSM-IV-TR) (2000), indicates that laboratory tests and neurological or attentional assessments have yet to be validated for diagnosing AD/HD (DSM-IV-TR, 2000). It has yet to be established which cognitive processes are responsible for AD/HD.

A multitude of interventions have been utilized with AD/HD but have had mixed results. One area with limited research is exercise, specifically martial arts, and its effects

on the maladaptive and adaptive behaviors of children exhibiting AD/HD symptomology. This study will address the efficacy of a martial arts intervention program on behaviors of male children age 8 to 11 who have been diagnosed with attention deficit/hyperactivity disorder- combined type.

Incidence and Prevalence of AD/HD

Diagnostic difficulties have affected the ability to come to a consensus as to the incidence and prevalence of AD/HD. The differences have been noted throughout the literature and continue to be disputed (Barbaresi et al., 2002). Through greater media exposure, heightened awareness of parents, and availability of effective treatments, the number of children identified with AD/HD has risen over the past decade. Thus, it is difficult to determine whether the incidence or prevalence of AD/HD has risen over the past decade. Difficulties in estimating prevalence exist because some estimates only include diagnosed people while others include undiagnosed people who unknowingly have the condition. Incidence rates, much like prevalence rates may not be comparable either. Government notifications, physical or hospital diagnoses, and various other methods may result in different incidence rates.

Barbaresi et al. (2002) reviewed medical and school records for clinical diagnosis of AD/HD and identified cases as “definite”, “probable”, “questionable”, or “not AD/HD”. The four subtypes were categorized on the basis of; clinical diagnosis and supporting documentation; without diagnosis but two types of supporting documentation; without diagnosis with one type of supporting documentation; and without diagnosis and without supporting documentation respectively. The cumulative prevalance at age 19 years was 16% at its highest when “definite”, “probable”, and “questionable” cases were

included and 7.4% at its lowest when only the "definite" AD/HD categorization was included. In a similar study, Cohen, Becker, & Cambell (1990) indicated that preadolescent children's prevalence of AD/HD is between three to five percent. Other researchers have estimated that the prevalence of Attention Deficit/Hyperactivity Disorder is three to seven percent in school age children depending on the nature of the population sampled and the method of ascertainment. The method in which the data were obtained and the nature of the population sampled helps to explain the varying rates of AD/HD (DSM-IV-TR, 2000). The National Institute of Mental Health (NIMH) (2003) suggested that AD/HD is estimated to affect 3 to 5 percent of school-age children and occurs three times more often in boys than in girls.

History of AD/HD

The nomenclature AD/HD as an identifiable diagnostic category surfaced in the late 1960's. Prior to that time, many terms were used to describe the syndrome including superactive, minimal brain dysfunction, hyperkinesis, and hyperactivity (NIMH, 2003). IN the DSM-II (1968), hyperkinesias or motor excess was the defining characteristic of the disorder. The term Attention Deficit Disorder was created to underline the importance of inattentiveness that is often but not always accompanied by hyperactivity. This surfaced a decade later when it was included as a syndrome in the DSM-III. The term AD/HD emphasized the inclusion of hyperactivity within the diagnosis as it returned in the 1987 revisions of the DSM-III-R. There was delineation within the classification of AD/HD in the DSM-IV to include a predominance of one pattern (inattention or hyperactivity/impulsivity) of symptoms for at least the last 6 months or more (NIMH, 2003).

Lahey et al. (1994) suggests a high degree of overlap of previous and current definitions of AD/HD between previous diagnostic categorizations such as the DSM-III, DSM-IIIR and the DSM-IV (See Appendix A). Three types of diagnostic categories have been established in the DSM-IV according to the presence of symptoms in the individual. The DSM-IV-TR (2000) delineates Attention Deficit Hyperactivity Disorder into three subtypes: Attention-Deficit/Hyperactivity Disorder-Predominantly Inattentive Type; Attention-Deficit/Hyperactivity Disorder- Predominantly Hyperactive-Impulsive Type; and Attention-Deficit/Hyperactivity Disorder- Combined Type. For a diagnosis of AD/HD to be made, the onset of symptoms must occur before age seven, be at least six months in duration, must be present in at least two settings, and there must be clear evidence of impairment in social and academic functioning.

Predominantly Inattentive Type

Inattention may be the predominant characteristic for some children with AD/HD. The Predominantly Inattentive type includes behaviors such as the inability to follow through with directions, having high distractibility and forgetting details of daily routines. Children categorized as having AD/HD, Predominantly Inattentive Type (ADHD-I) must meet at least six DSM-IV criteria for inattention, that are disruptive and inappropriate for developmental level for at least a six month period. Some of the symptoms include behaviors such as the inability to follow through with directions, having high distractibility and forgetting details of daily routines. In addition, less than six symptoms of hyperactivity-impulsivity must be present (American Psychiatric Association, 2000) (See Appendix B).

Predominantly Hyperactive-Impulsive Type

Attention Deficit/Hyperactivity Disorder, Predominantly Hyperactive-Impulsive Type (AD/HD-H/Im) is defined in the DSM-IV-TR, as a disorder in which at least six criteria for hyperactivity-impulsivity are present for at least a six months period and that are disruptive and inappropriate for developmental level. In addition, less than six symptoms of inattention may be present. Symptoms of hyperactivity include a child's inability to remain seated, often fidgeting with hands or feet, having trouble playing quietly, and often "on the go" or acting as if "driven by a motor" (American Psychiatric Association, 2000) (See Appendix B).

AD/HD Predominantly Combined Type

Children who meet the criteria for both ADHD-I and ADHD-H/Im may be diagnosed as children with AD/HD Predominantly Combined Type" (ADHD-C) (American Psychiatric Association, 2000). Children with ADHD-C maintain at least six symptoms of each hyperactivity-impulsivity and inattention. A diagnosis of any of the three AD/HD subtypes requires that the symptoms that cause impairment were present before age seven years; some impairment from the symptoms is present in two or more settings (e.g. at school/work and at home); there must be clear evidence of significant impairment in social, school, or work functioning; and the symptoms do not happen only as a factor of a pervasive developmental disorder, schizophrenia, or other psychotic disorder.

Diagnosis of AD/HD

Barkley (1990) suggests that there are discrepancies in diagnostic procedures resulting from professionals having different conceptualization of AD/HD. The National

Institute of Mental Health (2003) suggested that well tested diagnostic interview methods coupled with diagnosis based on history and observable behaviors in the child's usual settings are reliable procedures to diagnose AD/HD. Dulkan and Benson (1997) suggest that to establish a correct diagnosis of AD/HD a comprehensive medical evaluation of the child must be conducted. Furthermore, The National Institute for Mental Health (2003) states that the key elements to diagnosis include medical, developmental, school, psychosocial, and family histories coupled with a thorough history of the presenting symptoms, differential diagnosis, and possible comorbid conditions. DuPaul and Stoner (1994) suggest that school professionals must be knowledgeable regarding appropriate evaluation procedures even though the diagnostic criteria for this disorder have been developed and published primarily by physicians (i.e., American Psychiatric Association, 1987). School psychologists must be cognizant of community-based professionals who could provide an appropriate evaluation or be able to conduct the evaluation of ADHD themselves.

Behavioral Difficulties Associated with AD/HD

There are a multitude of behaviors associated with AD/HD that vary according to development and age. These associated features include but are not limited to low frustration tolerance, outbursts in class, temper tantrums, loss of possessions, mood lability, poor self-esteem, lack of focus, inability to maintain attention and concentration, lack of academic achievement, poor social skills, and family and school conflict (DSM-IV-TR, 2000). These difficulties are noticeable in the academic realm (DuPaul & Stoner, 1994; Mannuzza, Klein, & Bessler, 1993; Sealander et al., 1997, DSM-IV-TR, 2000) and the social realm (Wheeler & Carlson, 1994, Center for Disease Control, 2003). Barkley

(1997) states that behavioral inhibitions can be linked to the disruption of five other neuropsychological abilities, four being executive functions and the fifth being that of the motor control system. These abilities depend upon inhibition for their own efficient execution and are the central impairment in AD/HD. Campbell et al. (1994) used resistance-to-temptation and delay-of-gratification tasks to evaluate 69 boys identified as AD/HD in comparison to 43 non-AD/HD control children. The children with AD/HD were permitted to play with a battery-operated train that visited four rides in a pretend amusement park. When the experimenter left the room, children were instructed not to touch the toy in her absence. Behavioral coding was recorded for how often the children touched the toy in the experimenter's absence and latency to the first touch. Results indicate that ADHD boys touched the toy approximately twice as often as the control boys, 35% sooner, and were less likely to use the delay strategy of attending to and talking about the toy than did control boys.

Barkley (1997) suggests that difficulty in inhibiting prepotent responses is largely comprised in behavioral inhibition. Poor inhibition in AD/HD is evidenced by responses to a go/no-go task. Barkley describes this task as one that requires the inhibition of a movement when a second cue is provided as subjects emit a motor response to an initial cue, such as a finger tap, as fast as possible when cued to do so. Inhibiting responses to a no-go signal has been routinely found in subjects with AD/HD (Iaboni, Douglas, & Baker, 1995; Milich, Hartung, Martin, & Haigler, 1994; Shue & Douglas, 1989; Trommer, Hoeppner, Lorber, & Armstrong, 1988; Voeller & Heilman, 1988).

Academic Difficulties Associated with AD/HD

Researchers and other professionals agree that the prevention of academic underachievement and other negative effects on the lives of children, adolescents, and adults affected by ADHD can be accomplished by early intervention (DuPaul & Stoner, 1994; Mannuzza, Klein, & Bessler, 1993; Sealander et al., 1997). Students with AD/HD may attain their potential when entering into the workplace or postsecondary education if counselors address the needs (Schwiebert, Sealander, & Bradshaw, 1998).

There are numerous symptoms associated with AD/HD and academic difficulties which lead to a shorter amount of time in years of schooling on average and poorer vocational achievement for AD/HD individuals than their peers (DSM-IV-TR, 2000). Searight, Nahlik, and Campell (1995) found that children with AD/HD are more likely to have speech/language problems in early childhood, while affected children frequently present with poor academic functioning, distractibility, disruptiveness, and inappropriate peer relationships during middle childhood. Conduct and substance abuse problems, employment and interpersonal relationship maintenance, and demonstrating poor academic functioning may be found in AD/HD adolescents and adults (Searight, Nahlik, and Campell, 1995).

Furthermore, Barkley (1990) noted that adolescents with hyperactivity have academic outcomes that are significantly poorer than outcomes for adolescents without AD/HD. Additionally, Barkley concluded that adolescents affected by the disorder are more likely to fail a grade, be suspended or expelled from school, or score at significantly lower levels of academic achievement on standard tests of math, reading, and spelling when compared with their classmates without AD/HD.

Social Skills Difficulties Associated with AD/HD

There are numerous ways in which the social behaviors of children with AD/HD are problematic (Landau & Moore, 1991). Sheridan, Susan, and Candace (1996) suggest that children with AD/HD have behaviors that are deficient in subtle ways with regard to style, content, and appropriateness. Furthermore, Sheridan et al. state that negative interpersonal experiences occur resulting from their high social activity level. Missed opporuntunities for social learning occur because children with AD/HD tend to be aggressive and therefore are placed at-risk for being disliked and excluded. Frederick & Olmi (1994) suggest that most of the maladaptive behaviors typically found in children with AD/HD explain the various maladaptive social relationships these children experience, especially considering that these inappropriate behaviors are manifested in school. Increasing demands for individuals to conduct themselves in a socially acceptable manner may make the symptoms of AD/HD more problematic during the adolescent years (Schwiebert, Sealander, & Dennison, 2003). These researchers stated that the adolescent with AD/HD must cope with issues of sexual identity, peer acceptance, emerging physical changes, courtship, and dating. They hypothesized that this only adds to the distress that the adolescent is undertaking.

Research conducted by Wheeler & Carlson (1994) suggests that the most frequently cited behavior problems for teacher and parents of children with AD/HD are social difficulties. The Center for Disease Control (2003) states that children may often be perceived as shy or withdrawn by peers when they have predominantly inattentive AD/HD. Additionally, the Committee for Disease Control (CDC) indicates that peer

rejection may be a result of the symptoms of aggressive behavior exhibited by children with impulsivity/hyperactivity difficulties.

Significant adjustment problems in various venues such as frequent defiance and noncompliance with authority figures and rules; significant antisocial behaviors including physical fighting, stealing, and vandalism; and difficulty establishing peer relationships may be displayed by adolescents with AD/HD (Barkley, 1990; Sealander, Eigenberger, Schwiebert, Wycoff, & Ross, 1997). Furthermore, behavioral disinhibition includes excessive talkativeness, loud and abnoxious vocal noises, difficulty following instruction, more trouble deferring gratification and resisting temptation, tendency to blurt out incorrect verbal responses, and frequent disruptions of others' conversations (APA, 1994; Barkley, 1997; Campbell, Pierce, March, Ewing, & Szumowski, 1994; Milich, Landau, Kilby, & Whitten, 1982).

Interventions for Children with AD/HD

Different approaches have been utilized to diminish the symptoms associated with AD/HD. The MTA Cooperative Group (1999) conducted a review of interventions considered by professionals to be beneficial treatments for AD/HD. Interventions mentioned in this study included medications and behavioral therapies. Social skills training programs and applied behavioral analysis have also been used to help the individual better control their behaviors. Each intervention has varying degrees of success and failure.

Rapport (1992) researched the historical progression of strategies used to manage the symptoms of AD/HD. He suggested that a progression occurred dating from the 1930's clinical trials of psychoactive medication to contingency management techniques

of the 1960's. He further discussed the dominant movement towards the use of psychostimulant treatment combined with behavioral interventions in the 1970's. Finally, the 1980's and 1990's research of Rapport focused on epidemiological and diagnostic classification issues and psychostimulant medication as the mainstay strategy for treating AD/HD. Rather than relying solely on single treatment modalities as will be discussed further below, optimal management of AD/HD typically requires a multifaceted and long term treatment approach (DuPaul & Stoner, 1994). Relatively few non-behavioral treatment programs have been implemented successfully with AD/HD children aside from pharmacological interventions (Frazier & Merrell, 1997).

Behavioral and Cognitive-Behavioral Interventions

Behavioral and cognitive-behavioral interventions have been used in classroom environments for children with AD/HD. These interventions are important as six to eight hours a day, five days per week, school-aged children are in school and classroom settings. The behavioral characteristics of these children frequently interfere with classroom learning and socially acceptable behavior. Imparting the knowledge and skills comprising the curriculum and teaching children to behave in a manner consistent with social, cultural, and organizational requirements are more demanding when it involves children diagnosed with AD/HD (DuPaul and Stoner, 1994). The teaching of adaptive behaviors has been attempted by a multitude of behavioral and cognitive behavioral interventions as outlined below.

DuPaul and Stoner (1994) state that especially when behavior management is concerned, classroom-based interventions tend to consist of manipulations of consequent events (i.e., reinforcers and punishers). The use of positive reinforcement, response cost,

time outs, and applied behavior analysis has been emphasized in intervention research. These researchers suggest that behavior interventions may capture the child's attention through enhancement of the stimulation or motivational value of the task at hand and therefore increase the overall level of appropriate classroom behavior.

Contingency management procedures such as token reinforcement programs can be effective in producing positive behavior changes in children. These include school-based token reinforcement systems designed to identify problematic areas of the child, create a targeted intervention, select target behavior and secondary reinforcer (i.e., tokens) to be used, determine the values of target or goal behaviors, develop a list of privileges for which tokens can be exchanged, and demonstration of the program to involved children (DuPaul and Stoner, 1994). Dupaul, Guevermont, and Barkley (1992) investigated the efficacy of response-cost contingencies alone and in combination with directed-rehearsal procedures. The researchers used a within-subject reversal design with multiple-baseline components across academic work periods and concluded that students had marked improvements in task-related attention and reductions in adverse AD/HD symptoms as evidenced by academic performance measures, behavioral observations, and teacher ratings.

Dunlap et al. (1994) researched choice making as an intervention to promote adaptive behavior for students with emotional and behavioral challenges. In their first analysis, reversal designs showed that the choice-making conditions increased task engagement and reduced disruptive behavior for participants when they were given choices from menus of academic tasks, pertinent to educational objectives in English and spelling. The second analysis demonstrated the choice-making condition of the first

analysis was superior to baseline and yoked control phases as determined by levels of task engagement and disruptive behavior for a third participant.

Strategies incorporating self-monitoring, self-reinforcement, and/or self-instruction are strategies of self-management interventions for AD/HD (Barkley, 1989). Christie, Hiss, and Lozanoff (1984) researched modification of inattentive classroom behavior with hyperactive children by having three hyperactive participants participate in a training program to teach them how to self-record their behavior in a regular classroom. Each participant was signaled when to record his behavior at intervals of time convenient for the teacher in a regular classroom setting. Data suggested reduction in inattentive and inappropriate classroom behavior and increased on-task behavior was produced for all subjects who used signaled self-recording.

A change in thinking, such as cognitive restructuring and self-evaluation, is the basic premise of cognitive interventions. Cognitive-behavioral techniques consisting of self-evaluation, cognitive restructuring and basic behavioral techniques helped to shape resurgence in cognitive interventions during the late 1990's and into the 21st century (Frazier and Merrell, 1997). DuPaul and Stoner (1994) suggest that because of their emphasis on changing within-child variables, especially those incorporating self-instruction, self management-interventions have sometimes been referred to as cognitive behavioral interventions. A change in thinking such as cognitive restructuring and self-evaluation is the basic premise of cognitive interventions.

Two types of cognitive-behavioral techniques commonly utilized are reinforced self-evaluation and anger management. Hinshaw & Melnick (1992) studied reinforced self-evaluation by using the Match Game, a game in which criterion behaviors are

discussed, good and bad behaviors are modeled, and children are given the opportunity to earn points for 'matching' adult's ratings of their behavior. As comparisons of ratings were discussed, the core of the training occurred. The researchers found that the behavior of an AD/HD child was successfully improved when self-evaluation was utilized.

Self-reinforcement procedures focus on teaching students to systematically rate their own behavior according to the rating of their teacher. Rhode, Morgan, and Young (1983) used self-monitoring and self-reinforcement strategies to facilitate mainstreaming of behaviorally handicapped elementary school students. A six-point criterion hierarchy ranging from unacceptable to excellent, is used for rating of student behavior for a token reinforcement program and verbal feedback from the teacher is the initial stage of the program. The participant is trained in evaluating his or her own behavior once behavioral and/or academic gains are exhibited. The student can then earn bonus points for matching the teacher's ratings exactly, and the teacher's ratings continue to be used to determine the earning of points by the student. Contingencies such as deviating more than one point from the teacher rating with the consequence of losing all points for an interval are associated with behavioral improvement and rating one's performance similar to the teacher. According to Rhode, Morgan, and Young's research, this program led to maintenance of significant behavioral improvements across resource and regular classroom settings.

Social Skills Training

Social skills intervention programs have been utilized as a method of treatment for children with AD/HD. Sheridan, Susan, & Dee (1996) focused on target skills in the areas of social entry, maintaining interactions, and solving problems when implementing

a child-based social skills intervention program comprised of 10 weekly sessions. The multimodal intervention involved children with AD/HD who were taking medication, a parent group who met separately but simultaneously with the children's group to teach parents skills to help children with their social problems, and parents were taught debriefing skills, problem solving, and goal setting. Experimental control was not evidenced in all cases of Sheridan's study. However, child-subjects demonstrated positive changes in analogue observations. Home-based audiotape assessments demonstrated improved parents' skills in debriefing, problem solving and goal setting. Parent and teacher reports suggested general improvement for most participants. In addition, self-report social skills rating scales data suggested at least one standard deviation improvement as reported by all participants.

Antshel and Remer (2003) assessed social skills training on 120 children aged 8-12 with AD/HD-Inattentive type and AD/HD-combined type. Eight weeks of social skills training was provided to children randomly assigned within diagnosis subtype to either treatment condition or the no-intervention control condition. Prior to intervention and again, after treatment condition, children were pre-tested using the Social Skills Rating System (SSRS). Parent-SSRS Total Score, Parent-Problematic Behavior Total Score, and Child-SSRS Total Score were the three dependent variables, which the effects of the social skills treatment were calculated on. Greater improvement of both parent and child perceived assertion skills in the children with AD/HD resulted from social skills training, yet did not affect the other domains of social competence.

Limitation of Behavioral, Cognitive Behavioral Techniques and Social Skills Training

Limitations to token economy programs include maintenance and generalization issues. They may be implemented during only a portion of the school day or the child may be moved to a setting in which the token system cannot be wholly or even partially implemented as a result of practical restraints and consequences of the relative complexity of token programs.

Frazier and Merrell (1997) explain that behavioral interventions by themselves are rarely sufficient to bring a child to the normal range of functioning. Additionally, these interventions must be lengthy, intensive, used throughout the child's environment and require a great deal of trial and energy. Pelham et al. (1991) stated that long-term effects and generalizability of behavioral interventions lack evidence supporting them. Abikoff (1985) states that self-management interventions have not been uniformly successful despite their apparent potential in ameliorating AD/HD symptoms. Additionally, DuPaul and Stoner (1994) note that continued use of external reinforcers contingent on student ratings are a key variable influencing the success of self-management procedures. If backup reinforcement in self-management (self-reinforcement) is reduced or eliminated earlier in the sequence of program steps, it is unlikely that the effectiveness of this intervention would be maintained. Furthermore, Frazier and Merrell (1997) state that cognitive interventions have not been empirically validated as an effective treatment for AD/HD like they have been validated as effective treatment for depression and anxiety. Barkley (1997) stated that methods of effective management will prove to be those that assist individuals with performing what they know when it should be performed and not simply with giving them more knowledge or skills if AD/HD results in a disability of behavioral performance rather than a deficit in knowledge or skill.

Barkley further states little benefit for those with AD/HD will result from treatments focusing on social skills, self-control, or cognitive-behavioral training. Gonzalez (2002) states that although investigators have researched the effectiveness of different treatment programs, such studies have yet to fully examine the long-term impact of social skills training on the social problems/skills of children with AD/HD. Furthermore, many studies on social skills training have limitations such as internal threats to validity to maturation posed when examining long-term effects of treatment.

Medication

The use of stimulants for treating AD/HD has been ongoing for over 50 years. Some health care practitioners are reluctant to prescribe medication due to widespread misunderstandings, and questions about the safety and effectiveness of stimulants commonly prescribed for AD/HD. The stimulants include, but are not limited to methylphenidate (Ritalin), dextroamphetamine (Dexedrine), and amphetamine (Adderall) (National Institutes of Health Consensus Development Conference Statement, 2003). Risks such as addictiveness to drugs, decreased appetite and insomnia may occur when taking medication for AD/HD. In addition, little information concerning the long-term effects of psychostimulants exists (National Institute of Mental Health, 2003). Further, medical expenses can often be very costly. There is no assurance that these costly medications will improve every child's behaviors. Additionally, changes may be short lived or persist only as long as the child is on medication. Families often have to face high out-of-pocket expenses because treatment for AD/HD is often not covered by insurance policies (National Institute of Mental Health, 2003).

The most commonly prescribed drug for AD/HD, Methylphenidate (MPH), necessitates multiple doses because it has a short half-life (Pelham et al. 2001). There have been several limitations relating to its course of action as children usually take morning and mid-day doses, with many children receiving an after school dose to cover evening hours. This is because each dose typically lasts up to four hours, peaks after two hours, and yields its first effects within 30 minutes (Solanto & Conners, 1982; Pelham, Greenslade, & Vodde-Hamilton, 1990; Pelham, Aronoff, Midlam, et al, 1999; Pelham, Gangy, & Chronis, 1999; Swanson, Kinsbourne, Roberts, & Zucker, 1978). Pelham et al. (2001) suggest that a child may be left experiencing a trough in medication level during some times of the day when following a schedule of two or three doses per day. As the morning dose wears off inattention may increase during late-morning hours. Similarly, the child may experience difficulty concentrating on after-school homework when the midday dose begins to wear off.

Musser et al. (1998) stated that although illegal in most states, but not all, school staff other than nurses sometimes have to administer medication when nurses are absent. This is often done unreliably. Therefore, children with AD/HD would like to avoid taking medication during school hours. Safer and Krager (1994) explain that school personnel are prohibited from administering psychoactive medication or controlled substances in other schools as written in administration policies. Furthermore, children may be on a school bus or in sports and other leisure activities when a third dose of medication is required after school, creating more difficulties for children. (Pelham, et al, 2001). Sherman and Hertzig (1991) state that the vast majority of treated children with AD/HD

take medication for only one or two months because difficulties in administration play an important role in feasibility.

A form of Methylphenidate (Concerta) may reduce difficulties that children with AD/HD face when having to take multiple doses of medication (Pelham et al., 2001). Concerta was designed to be administered as one dose in the morning, an equivalent to a three times daily dosage of immediate release Methylphenidate. Pelham et al. conducted a study comparing Concerta, given once daily in a 12 hour dose, versus the more traditional three times daily dosage of Methylphenidate. The researchers concluded that the two drug conditions did not differ significantly from each other when parents rated AD/HD behaviors on children when Concerta was compared to a standard three times dosage of methylphenidate. Additionally, the pervasive problem of treatment compliance may be minimized with an effective, once daily, medication such as Concerta because children can avoid the embarrassment of having to take trips to the nurse's office for medication during the day.

Some patients fail to respond to stimulants or are intolerant of them (Michelson et al., 2001). Atomoxetine (Straterra) is a once-daily non-stimulant pharmacological medication that may broaden the therapeutic options available to patients and clinicians (Michelson et al., 2002). Michelson et al. conducted research with participants who went on a medication-free period followed by random assignment to either a group receiving atomoxetine once daily or a placebo group under double-blind conditions for six weeks. Data suggested that atomoxetine-treated patient outcomes assessed by investigators, parent, and teacher ratings, were superior to the placebo treatment group (See Appendix C for a non-exhaustive list of medication used with those diagnosed with AD/HD).

Combining Behavioral and Psychopharmacological Techniques

Interventions combining pharmacotherapy and behavior therapy have been relied upon (Barkley, 1991; DuPaul & Barkley, 1993; Whalen & Henker, 1991). There are differing results as to the efficacy of combining behavioral and psychopharmacological techniques. Rapport, Murphy, & Bailey (1982) found response cost to be superior in raising levels of on-task behavior and in improving performance on the off-task behavior of two AD/HD boys given various doses of Ritalin and response cost as the reinforcer. Additionally, Schell et al. (1986) found in a controlled case study with a developmentally disabled child that learning of the child was improved with both behavioral and psychostimulant procedures. Only the reinforcement intervention reduced defiance in this study.

However, research by Carlson, Pelham, Milich, and Dixon (1992) on the combination of behavior therapy and methylphenidate administration on a classroom setting study suggests that no definitive conclusions can be drawn on the effects of the combination of behavioral therapies and psychopharmacological treatment. They compared six possible combinations of two doses of methylphenidate (.3 and .6 mg/kg), a placebo treatment, and two classroom settings--a regular classroom and a classroom including a token economy system, time-outs and daily home report cards. The researchers measured the effects on on-task and disruptive behavior, academic work completion and accuracy, and daily self-ratings of performance. Their results suggested that both treatments alone significantly improved behavior of the children but only methylphenidate improved academic productivity and accuracy. Appendix D includes an

overview of nine behavioral approaches useful in treating AD/HD, their advantages, and their side effects (Frazier & Merrell, 1997).

Abramowitz, Eckstrand, O'Leary, and Dulcan (1992) indicated that case-by-case assessments are necessary as each child responds differently to various combinations of treatments. These statements are based on their research findings that examined two boys, age 10 and 11 attending a summer program for off task behavior in the classroom. They found that the effects of a simple behavioral intervention alone were better than an intervention combining the behavioral intervention with stimulant medication. This was accomplished by comparing six possible combinations of two doses of methylphendiate plus placebo and two intensities of teacher reprimands, immediate and delayed reprimand timing. The simple behavioral intervention was sufficient for some children, while for others, medication appeared to be necessary for strong treatment effects (Abramowitz et al., 1992). Frazier and Merrell (1997) suggests these examples as reasons why case-by-case assessments are pertinent to deciding treatment affects as each child responds differently to treatment combinations.

Research was also conducted by the MTA Cooperative Group (1999) in a 14-month randomized clinical trial of treatment strategies for AD/HD. The researcher's data suggest that participants assigned to a combined treatment program did not show higher levels of improvement of any behaviors when compared to either medication management or behavior treatment programs alone. This further suggests that more research should be conducted to assess combined intervention strategies versus single intervention strategies.

Benefits of Exercise as a Treatment

Families may turn to other means for treatment. For example, exercise has been studied as an alternative to medication. In a study conducted by Wendt (2000), it was concluded that exercise significantly improved the behavior of 5-12 year old AD/HD children when pre and post test comparisons were made over the six-week duration of the study utilizing exercise five out of seven days per week. Furthermore, the side effects of an exercise program are less invasive to those exposing children to long-term psychotropic mediation use (Wendt, 2000).

Brink (1995) purports that one of the best ways to stimulate the brain and learning is by engaging in physical exercise. Pollatscheck and O'Hagen (1996) researched measures of motor fitness, academic performance, and attitude toward school before and after completion of either a daily physical education program or a normal physical education program which was not daily. Their research suggested that of the 222 primary school children tested, superior motor fitness, academic performance and attitude towards school are found in children engaged in a daily physical education class when compared to counterparts who do not participate in daily physical education. In addition, Pollatscheck and O'Hagen found that superior attitudes toward school and schoolwork were more evident in daily physical activity participants than in non-daily physical activity participants. Davey (1973) found that after subjects pedaled a bicycle ergometer for various periods of time, that a submaximal amount of physical exertion improved mental performance on the Brown and Poulton test of attention. This evidence suggests that mental performance is affected by physical exertion. The effects of exercise can be found in areas other than academic performance and attitudes toward school as well.

Physical exercise has been indicated as having positive effects on social skills, an area of deficit often found in children with AD/HD. Page's (1994) research found that loneliness, shyness, and hopelessness are not as often reported in active adolescents compared to physically inactive peers. Benefits may extend to the development of skills in the social realm from participation in programs of physical activity (Branta & Goodway, 1996). Branta and Goodway further suggest that opportunities to learn how to get along with one another, sharing, and cooperation occur through children who play and are active. Experiences in positive socialization can be provided through games and activities of a cooperative nature (Orlick, 1979; 1981). Bredemeier, Weiss, Shields, & Shewchuk (1986) express that rich opportunities for peer interaction, shared expectations, adherence to rules, competition, and cooperation, all are provided by youth sports and games.

Mcgimbsy and Favell (1988) indicated that physical activity used as an intervention for children with AD/HD decreased rates of aggression and hyperactivity. Rates were decreased in eight of ten mentally retarded participants. Leith and Taylor (1990) found that 56 of 81 studies on exercise have reported that improvements have been found on the psychological constructs under consideration.

Jones and Offord (1989) offered skill development through sports to participants at an experimental complex in Ottawa, Canada, and other skills development through activities such as guitar, baton, and scouting to a second group. The participants living in this impoverished area participating in physical education and sports had fewer serious offenses, a decrease in juvenile charges for crime, fewer fire calls, and a reduction in the quantity of security reports than participants in other interventions.

Research has also been conducted on the effects of exercise on attentional focus. This is one of the deficiencies of individuals with attention deficit hyperactivity disorder inattentive and combined types. For example, Salmela and Ndoye's (1986) research suggests there was a narrowing of attentional focus that resulted from an increase in physical arousal. It was illustrated by asking subjects to pedal to exhaustion on a stationary bicycle while responding to a visual five-choice reaction time task. Results suggested that a narrowing of the subject's ability to focus their attention occurred after subjects were asked to identify twenty different light positions, activated every two minutes during exercise. This increase in attentional focus was directly related to increase of physical stress brought on by pedaling to exhaustion on a stationary bike (Salmela and Ndoye, 1986).

Aks (1998) investigated the ability to identify whether a specific target was in a display shown to an individual via visual search before and after exercise. The study showed an improvement of performance, specifically faster search and identification of the items in the display, when under conditions of focused attention after exercise. The results of Aks (1998) study suggest that response times and errors decreased following ten minutes of exercise, which shows a reliable effect of exercise on visual search.

One curvilinear pattern well-suited to describe many of the arousal effects on performance is the classic Yerkes-Dodson's inverted-U hypothesis (1908) that states that optimal performance occurs when anxiety levels are neither under-stimulated nor overstimulated but stimulated to a middle ground. A change in attentional processes will be produced by variations in arousal. An increase of performance and narrowing of attention will occur as arousal increases up to a certain point, and thereafter, performance

will be impaired (Easterbrook, 1959). A linear relationship between intensity of exercise and attentional narrowing, specifically, attention expected to become more focused as exertion increases, is predicted from theories based on attentional narrowing (Aks, 1998).

This research is consistent with Davey (1973) and Levitt and Gutin's (1971) work, which suggests that exercise of intermediate exertion facilitates performance on everyday tasks. Research suggests that it is a certain amount of stimulation/arousal that occurs when engaging in exercise that improves performance and focused attention. Enhanced sleep level, mood, mental performance, and concentration and decreased tension, stress, anxiety, depression, and hostility occur by participating in physical fitness alone such as walking, running, or swimming (Berger & Owen, 1983; Folkins & Sime, 1981; Hogan 1989; King, Taylor, Haskell, and DeBusk, 1989; O'neil, 1989; Sacks & Sachs, 1981; Thayer 1987; Wilfley & Kunce, 1986).

Wendt (2000) explains that during sustained aerobic activity, blood vessels go through rapid changes as stimulation of nerve and chemical signals cause artery walls to relax and widen. Subsequently, increased blood flow occurs as peripheral vein constriction occurs. Millions of dormant capillaries open up as smaller arterioles leading to muscle fibers also widen. This results in enormously increased blood flow to exercising muscles. The body immediately begins to increase metabolism to fuel the muscle contractions, as the process of converting oxygen and nutrients into Adenosine Triphosphate inside the individual cells of the muscle occurs (Body Response to Exercise, p.1). As activity and exercise begin, an increase in epinephrine (adrenaline) and norepinephrine (noradrenaline) occurs in the bloodstream from signaling of nerve receptors in the blood vessels, muscles, and joints (Body Response to Exercise, p.1)

These same stimulations to the body's system occur when psychotropic medication such as Concerta are ingested into the body system.

Exercise appears to have a similar impact on the central nervous system as peptide molecules (endorphins) act as our emotional systems messengers (Wendt, 2000). Wendt further suggests that it is at the cellular level where endorphins act on the neurotransmitters, which have a causal effect on electro-cellular action much like the action of psychostimulant drugs. This occurs because peptides synthesized within one cell attach to receptors on the outside of another, and cellular action is consequently increased or decreased. Moyer (1992) suggests that if this causal effect on electro-cellular actions occurs in a large population of cells, the emotional state of the individual can be changed. Limited research has been conducted on the similar neurological impact of stimulants and exercise. Levinthal (1988) states that positive social contact and exercise can elevate endorphin levels.

In addition, memory, learning, response to stress, appetite regulation, and other physiological and psychological areas are positively affected by increased endorphin levels (Harrison, 1994). According to Donevan (1986), the greater the physical exertion, the higher the endorphic response in the body. This suggests that exercises effect on endorphins may have some correlation to that of psychotropic medication's effect on endorphin levels.

Goldfarb (1987) found that a twofold increase of heart rate above resting levels would signal an endorphic response to exercise. Goldfarb's study is in agreement with others such as Donevan's (1986) study finding physical exertion increases resulted in greater endorphic responses.

Benefits of Martial Arts on Behavior

There are a plethora of martial arts that are practiced in the world today, but little empirically validated research as to their effects on children with AD/HD. To date there has been a lack of sophistication in the questions posed and in the methodology adopted to answer those questions regarding empirical research on martial arts (Fuller, 1988). Sports psychology repeatedly advocates for alternatives to psychotherapy such as exercise (Fuller, 1988). Therefore, research on martial arts could prove beneficial as a treatment for AD/HD as martial arts is a form of exercise.

History and Types of Martial Arts

Martial arts originated out of interest for combat methods to defeat an enemy. Its popularity has waxed and waned over the years but has still found a way to evolve into a set of activities and methods used for personal growth and self-development (Lewis, 1996; Payne, 1997). According to Lewis (1996) the five most practiced forms of martial arts today are Aikido, Judo, Karate, Kung Fu, and Tae Kwan Do.

Fuller (1988) explains that Aikido is comprised of purely defensive techniques and principles of movement used to neutralize an attack by redirecting the energy of the aggressor by absorbing that energy or leading it away. He further explains that Aikido is classified as a 'soft' (internal) Japanese martial art that is non-competitive. Aikido has a potential contribution to assertiveness training as it pays less attention to the issues of social strategy involved in assertive social encounters and conversely dwells upon the coaching of verbal and non-verbal assertive behaviors. Fuller asserts that Aikido lessons entail approaching problems positively, moving around resistance, ignoring distracting tactics, timing of evasion and confrontation, and remaining positive during retreat.

Judo is similar to Aikido in that an opponent's energy is used as an advantage (Lantz, 2002). Lantz further states that Karate, Kung Fu, and Tae Kwon Do rely on kicking and punching primarily.

Karate training, an Oriental martial art form, focuses on learning an aggressive repertoire including the learning of punches and kicks of various types (Nosanchuk, 1981). Additionally, Karate classes are likely to teach in "combinations" format to teach a student to immediately act when an aggressor attacks.

Martial arts are different than ordinary physical activities and have been empirically validated to have positive effects on self-esteem and self confidence, better management of both feelings of aggression and feelings of vulnerability, and decreased sleep disturbance and depression are some of the mental health benefits of martial arts training and practice (Finkenberg, 1990; Fuller, 1998; Nosanchuk, 1981, 1989 & Trulson, 1986).

A considerable amount of evidence exists on the effects on dimensions of personality of those engaging in formal martial arts training (Fuller, 1988; Richman & Rehberg, 1986; Rothpearl, 1980). Kroll & Crenshaw (1970) found that Karate students were more self-sufficient, reserved and detached than competitive American football players and wrestlers.

Research suggests that the longer an individual studies Karate, the greater the affects. Duthie, Hope & Baker (1978) utilized the Gough's Adjective Checklist and found that the self-confidence and achievement are higher for those marital artists that are superior as opposed to average. Additionally, a beneficial trend occurred following extended training in martial arts overall for beginner, intermediate, and advanced Karate

students (Rothpearl 1979, 1980). The results of beginner, intermediate and advanced Karate students given the 16PF personality questionnaire were positive, as advanced participants were found more emotionally stable, lively, venturesome, imaginative, forthright, self-assured and more relaxed than those less experienced in martial arts. Since intelligence is usually regarded as a stable characteristic, improved reasoning ability resulting from enhanced concentration and mental relaxation is believed to be the reason why intelligence seemed to increase for these Karate students (Konzak and Boudreau, 1984).

Research such as that by Madenlian (1979) and Kurian (1994) suggests that martial arts, specifically Aikido, is better for the self-concept than different psychotherapies. Madenlian's (1979) study comparing self-concept of students in martial arts training with students engaged in conventional psychotherapies resulted in greater Piers-Harris Self-Concept Scale scores for Aikido students than for those engaged in psychotherapy. Kurian's (1994) study of 72 boys attending American Taekwondo Association Certified schools found that training time was significantly related to the factor of being naïve vs. socially perceptive on the Children's Personality Questionnaire. Participants completed the 1973 Form A of the Children's Personality Questionnaire following a regular training session and conversion of belt ranks to numerical values ranging from 1 (beginner) to 10 (master). Socially perceptive behavior increased as length of time involved in Tae Kwon Doe increased. This was evident by standard-ten (STEN) mean scores on factor N (Naïve vs. Socially Perceptive) significantly relating to training time (Kurian, 1994). When looking at aggression, Nosanchuk (1981) found

consistency with these traditional expectations in that a negative correlation exists between aggression and skill level of a martial artist.

Martial Arts Versus Other Forms of Physical Activity

Martial arts differ from other physical activities in their effect on AD/HD children as there is a systematic influence of meditation, rhythmic breathing, and relaxation amounting to self-hypnosis; adherence to etiquette; constant group reinforcement; mutual help and criticism; and a sense of group cohesion with shared goals and ideology. It has been found that AD/HD children who engage in martial arts as opposed to exercise improve in these areas (Konzak & Boudreau, 1984). Konzak & Boudreau suggest that martial arts is a socialization process in that appropriate training can become a socialization agent and a therapeutic activity. The difference between martial arts and other exercise is further elaborated by discussing James and Jones' 1982 field study. In this study, the novice martial artist acquired a new social identity, learned appropriate role behavior, and conformed to the expectations of the group to which he aspired through a process of interactions. New physical skills, values and beliefs are fostered as the beginner's class follows a regimented schedule of instruction, modeling, imitation, positive reinforcement, and observation (Fuller, 1988). The readjustment of social skills, meditation to clear ones mind to focus and physical exercise may make for a multifaceted program to treat maladaptive behavior found in children with AD/HD. The martial art form Aikido utilizes concepts of centering, grounding oneself, relaxation, extension, and movement with its students much like other martial arts forms as well. Certain Aikido exercises have an aim at teaching mental calmness, relaxation of the body, adaptation to obstacles, and one-at-a-time problem solving strategies, which you will not find in an

exercise routine such as weightlifting or jogging. Assertiveness training has paid less attention to social strategy involved in assertive social encounter and more to that of coaching of verbal and non-verbal assertive behavior (Fuller, 1988).

Important to this study is martial arts affect on concentration. Weiser, Kutz, Kutz, & Weiser (1995) explain that while striving for improvement is a goal of the martial artist, the martial art itself will teach a practitioner to focus, relax, communicate, be self-aware, and to integrate the mind and body so as to minimize fear and anger in order to maximize focus and concentration. Martial arts, specifically Aikido, provide simple but strategic procedures for assertive behavior. Positive problem solving, concentration abilities by ignoring distractions and confrontation work are all part of the lesson structure (Fuller, 1988). Lantz's (2002) phenomenological study of the impact of martial arts on the process of family development utilized nine couples and 23 families in Ohio who participate in martial arts. The identified themes include but are not limited to increased self-defense abilities, self-confidence, physical vitality, concentration, respect, friendship, and moral development (Lantz, 2002). The repeated movements and continual practice associated with martial arts necessitates the student to attend more frequently to learn. As opposed to chaotic thoughts and behaviors of individuals who cannot focus their attention, the repetitive, fixed exercises of martial arts can become organizing for them (Weiser, Kutz, Kutz, & Weiser 1995).

Summary

AD/HD is the most commonly diagnosed disorder of childhood. The National Institute of Mental Health (2003) estimated three to five percent of all American children have AD/HD. This equates to 1 in 82 or 3.3 million people in the United States of

America. The symptomology is present in the home and in school. There are a lack of effective interventions to decrease maladaptive behavior and increase adaptive behaviors in the classroom. The estimated prevalence of Attention-Deficit/Hyperactivity Disorder (AD/HD); it's significant impairment in the areas of school performance and socialization; the chronic nature of the disorder; the inability to demonstrate that sizeable benefits will occur for long-term results; and the limited effectiveness of current interventions to attend to all the impairments associated with AD/HD make it a serious public health problem (Lesesne, Abramowitz, Perou, and Brann, 2000).

The purpose of this study is to address the efficacy of a martial arts intervention program on maladaptive and adaptive behaviors of children age 8 to 11 who have been diagnosed with attention deficit/hyperactivity disorder- combined type**.** The goal of this project is to demonstrate the efficacy of martial arts to decrease maladaptive behaviors of children with AD/HD in areas such as poor academic and behavioral performance, leaving the seat in class, and outbursts. Additionally, a second goal is to increase adaptive behaviors such as accuracy of completed homework and frequency of following instructions in children with AD/HD.

Hypotheses:

Based upon the literature reviewed, the following hypotheses are made:

1. It is hypothesized that a martial arts program two times per week will increase the percentage of completed homework, as measured by the Morand-Klein Behavior Checklist, of children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program.

2. It is hypothesized that a martial arts program two times per week will increase the frequency of following specific classroom rules, as measured by the Morand-Klein Behavior Checklist, of children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program
3. It is hypothesized that a martial arts program two times per week will decrease the number of inappropriate callouts, as measured by the Morand-Klein Behavior Checklist, of children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program.
4. It is hypothesized that a martial arts program two times per week will decrease the number of times the participant inappropriately leaves the seat in class, as measured by the Morand-Klein Behavior Checklist, of children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program.
5. It is hypothesized that a martial arts program two times per week will improve academic performance, as measured by the Morand-Klein Behavior Checklist, of children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program.
6. It is hypothesized that a martial arts program two times per week will decrease redirection to task, as measured by the Morand-Klein Behavior Checklist, of

children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program.

7. It is hypothesized that a martial arts program two times per week will improve classroom preparation, as measured by the Morand-Klein Behavior Checklist, of children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program.

Chapter II. Method

Participants

Eighteen children participated in this study with the assistance of three Nassau County, New York elementary schools. The selection process took place over a one-month period. Participants (eighteen boys) ranged in age from 8 to 11 years.

The sample was randomly and evenly divided into three groups of six participants. Treatment group one consisted of six children, ages 8 to 11, who engaged in a regimented mixed martial arts program. Treatment group two consisted of six children, ages 8 to 11 who engaged in a regimented exercise program. Group three acted as the control group and did not receive any treatment.

All children involved in this study had been diagnosed with Attention Deficit Hyperactivity Disorder-Combined Type. Criteria for diagnosis was an existing Individualized Education Plan with a classification of Other Health Impaired or diagnoses by a physician and classified under Section 504.

The participants in this study were predominantly of Caucasian (94%) with one Hispanic (5.5%) participant. All were not involved in any other sport. An identification code based on number was given to all participating children for confidentiality purposes.

Methods

The Morand-Klein Behavior Checklist (Appendix E), a self-created measure, was used both initially during the baseline period and throughout the 12-week study to measure the effectiveness of both intervention groups and the non-intervention group on the maladaptive behaviors of AD/HD children. The Morand-Klein Behavior Checklist was used as an objective measure of adjustment for use by teachers to assess maladaptive and adaptive behaviors (academic performance, accuracy of completed homework, frequency calling out in class without raising a hand, number of times participant inappropriately leaves the seat in class, number of times student needs to be redirected, and classroom preparation) of children in school. The seven-item measure provided information based on hardcopy data observed and documented in the classroom by each participant's classroom teacher. Each question yielded its results based on the number of times a maladaptive behavior occurred or adaptive behavior did not occur and the number of tasks that are required versus the number of tasks that were completed on a specific day. Each question was derived based on consensus by classroom teachers as to the most typical behaviors exhibited by students with AD/HD. Each teacher indicated specific classroom rules for question two of the Morand-Klein Behavior Checklist and scored item two accordingly. This measure contains administration and scoring simplicity coupled with reliability based on the hard copy data provided by teacher results.

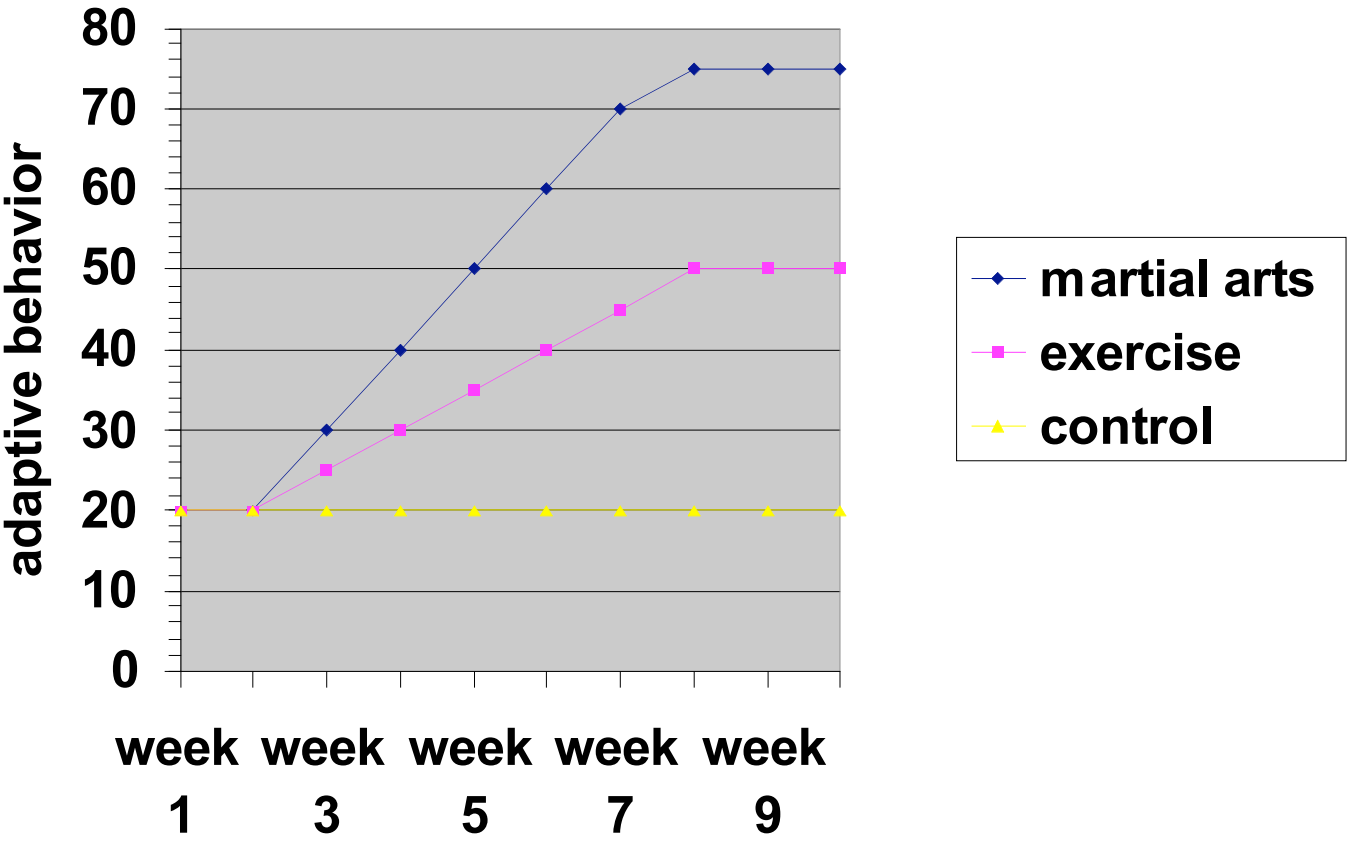
A demographic form was completed by each participant's parent for standardization purposes. The form included questions pertaining to age, sex, ethnicity, sports history previous martial arts and intensive exercise experience, health difficulties, previous

diagnosis of AD/HD, Individualized Education Plans, and school services offered to the participant.

Design

The design of this study was a multiple baseline across conditions (See Figure 1). Week one and two consisted of a collection of baseline data across all three groups of AD/HD children. The mixed martial arts group received the martial arts intervention program twice a week during weeks three and four while the exercise intervention group and control group continued without intervention. The mixed martial arts participants

Figure 1



attended class with students already currently enrolled in the martial arts program. The exercise intervention group began to receive their regimented exercise program intervention twice weekly during weeks five and six. At no point did the control group receive either the mixed martial arts intervention or the regimented exercise intervention during the study. The mixed martial arts group and the exercise group received their respective interventions twice weekly during weeks eight through twelve. The control group received the mixed martial arts program at the conclusion of the initial twelve-week program to substantiate for ethical considerations. Although most participants had different schoolteachers, all participants involved in either intervention program attended the specific intervention program on the same day, taught by the same instructor and under identical guidelines to the specific intervention. Teachers for all participants were required to fill out the Morand-Klein Behavior Checklist every day of the study in order to be included in the study. A raffle for participating teachers who complete the Morand-Klein Maladaptive Checklist each day took place at the conclusion of the study to help prevent attrition of teachers.

Independent Variable

There were three levels of one independent variable, the control non-intervention, the martial arts intervention program, and the exercise intervention program.

Dependent Variables

The dependent variables were the change in measurable maladaptive and adaptive behaviors including poor academic performance, percentage of completed homework, frequency calling out in class without raising a hand, number of times participant

inappropriately left the seat in class, number of times the participant needed to be redirected, and classroom preparation.

Procedure

The head instructors at three local (Long Island) martial arts schools were initially contacted by phone and secondarily in person to determine whether they would be willing to participate in this study. One of the three school's (Tiger Schulmann's Karate© of Massapequa Park, New York) was able to provide a dojo (a room with a white mat) for use in the study. Cover letters (Appendix F) were sent out to five local schools in Nassau County, New York, asking for assistance in identifying AD/HD children ages 8-11 with current classifications as Other Health Impaired in their Individualized Education Plan. The schools were asked to offer parents a chance to have their child chosen for an after hours physical activity program study that would last 8-12 weeks. Forty requests were received to be a part of this program. Participants were chosen at random for all three groups.

Parents of the children were contacted via telephone and provided with a brief outline of the purpose of the study within two weeks of stated initial interest in participation. When the parent verbally agreed to participate, a one-week deadline was set for them to return a consent form provided via mail asking for legal consent to participate. A separate sheet explaining travel directions, attire and the schedule for participation was included. Eighteen consent forms were returned of the eighteen that were sent out.

The impairments to executive functions related to AD/HD were assessed by the Brown Attention-Deficit Disorder Scales for Children (Brown, 1996). All parents

successfully completed the Brown's ADD Scales for Children for their child and had a score that fell within the Clinically Significant range for AD/HD combined type. All symptoms included in the DSM-IV AD/HD diagnostic criteria are addressed in the Brown ADD Scales for Children. Parents were to read to the participant each symptom listed and circle the colored number beneath the words that tell how much the participant believes that feeling or behavior has been a problem in the past six months for 40 items. Internal consistency of the Brown ADD Scales for Children aged 8-12 is evidenced by alpha coefficients at .74 to .93. Total Score alpha coefficients ranged from .95 to .98, suggesting adequate internal consistency (Brown, 1996). Corrected test-retest reliabilities for Cluster Scores of parent ratings of children age 8-12 are .84 to .91, suggesting adequate test-retest reliability. Inter-Rater Consistency across clusters between parents and teachers ranged from .46 to .57. Parents and teachers have different perspectives representing different domains of the child's functioning. Therefore, scoring among these raters is expected to differ (Brown, 1996). In addition, inter-correlation of the clusters with one another provides evidence of sound internal structure validity. Inter-correlations of Cluster Scores for parent ratings of children aged 8-12 and teacher ratings of children 8-12 ranged from .72 to .87 and .72 to .90 respectively. Furthermore, Self-report ratings of children 8-12 years ranged from .65 to .82 for inter-correlations of Cluster Scores. Differentiation of children aged 3-12 years diagnosed with AD/HD from those who do not have an AD/HD diagnosis is demonstrated by findings of the criteria group comparison for the Brown Attention Deficit Disorder Scales (Brown, 1996).

Participants could not be enrolled nor participate in any form of martial arts. Once established a consent form for participation (Appendix G) and a demographic

information sheet (Appendix H) was completed. The Morand-Klein Behavior Checklist was sent to the teachers of each participant. All teachers were required to make sure that the Morand-Klein Behavior Checklist was filled out daily. The Morand-Klein Behavior Checklist was used to clarify to the researchers the amount of academic performance, percentage of completed homework, frequency of calling out in class without raising a hand, number of times the participant inappropriately left the seat in class, number of times student needed to be redirected, and classroom preparation that had occurred for the participant each school day**.** Six teachers, serving as the teacher of students participating in the martial arts and exercise intervention group completed the Morand-Klein Behavior Checklist instrument for the first two weeks prior to beginning the intervention. The control group was provided with the Morand-Klein Behavior Checklist instrument at the inception of the martial arts intervention and were told that in three months, their children would begin the intervention if the teachers had successfully completed the Morand-Klein Behavior Checklist each day for the child in the class.

Teachers were instructed to rate the child on each item of the Morand-Klein Behavior Checklist by filling in the blank corresponding with the scale of descriptors. It was pointed out to the teacher that whoever was going to fill out the Morand-Klein Behavior Checklist instrument was required to be the person to complete the instrument each time to control for consistency of rater reliability.

A session log was completed to assure consistency to the martial arts intervention guidelines outlined below (Appendix I). Furthermore, parents were asked to complete the Intervention Rating Profile-15 (IRP; Witt & Martens, 1983). This self-report inventory consisted of 15- six point Likert items measuring treatment acceptability for interventions

implemented in school settings. The IRP-15 is a shortened version of the Intervention Rating Profile used in previous research (Witt, Martens, & Elliot, 1984). Higher scores on the IRP-15 denote greater treatment acceptability. (Appendix J).

Slight modifications in the wording of the IRP-15 were necessary to make it appropriate for use in this study. Items that used verbs in the future tense were changed to the past tense since teachers were required to rate the interventions after implementation. An additional phrase was added to last sentence in the directions, which stated, "In the intervention you just used…" This phrase was necessary to help specify to the teachers what they should have rated.

Martial Arts Intervention

The martial arts intervention program is multi-faceted creating what is known as a three dimensional-workout. The program is geared towards attaining results, enjoyment, and adding a repertoire of practical self-defense moves, which will enhance the child's ability to protect him or herself. The program is geared not only to be stimulating to the cardiovascular system but stimulating mentally as well. The martial arts intervention program is consistently followed as a fixed curriculum via an instructor's manual.

Tiger Schulmann's Karate© program was chosen as the preferred marital arts intervention because it employs a hybrid style of karate. This style includes Karate or "empty hand" which builds on the student's ability to defend themselves by learning defensive and offensive techniques integrating techniques of different body parts. The second style included in the martial arts program is Jujitsu or "the art of gentleness". This is a form of mostly on the ground fighting/wrestling involving submission maneuvers, disengaging from an attacker, and locking up small joints and body parts so they cannot

be effectively used against someone else's offense. This is called the art of gentleness as strength will not make the learner successful, but technique, which comes with attention, focus and practice, will help the learner to succeed. Finally, Aikido or "the blending inner force" is a martial arts form utilized to use your opponent's strength and energy to your own advantage. A hybrid form of martial arts was used because past studies have concentrated on only one form of martial arts, limiting the generalizability of the results to that form particularly and not to martial arts in general. This allowed the researcher to generalize the intervention's success or failure to the overall martial arts discipline as opposed to one specific martial arts discipline.

The martial arts intervention utilized a highly structured and disciplined program. The atmosphere was one of traditionalism coupled with an effort to run a class disciplined so the participant was empowered to act with self-discipline. The highly structured environment coupled with clear rules, realistic goals, minimized distractions, and training of the essentials all coagulated into a multifaceted program that not only teaches marital arts but promotes other necessary life skills. While engaging in the martial arts program, participants were discouraged from attending to physical discomfort and external stimuli outside the realm of the activity they are engaged in. This was to accomplish the goal of retention of the material presented to the participant and in turn to enhance the skill level of the martial artist (p.12).

Participants in this specific martial arts program not only engaged in sharpening their strengths, but they trained their weaknesses as well (p.12). This was expected to inspire the participant to be the best they can be and to not settle for mediocrity.

A belt system is utilized as a measure of positive reinforcement for learning in Tiger Schulmann's Karate©. Like in most other traditional martial arts forms, the participant's rank can be assessed based on their current belt. Stripes were utilized as an added reinforcement between belts to help encourage students to continue training (p.13). Participants in this study earned a white belt on their first day of class. Every two classes they earned a stripe on their belt.

The curriculum followed specific lesson plans. Lesson plans were used to make sure that the program was organized so that everything that needs to be covered was covered thoroughly. Each class had a lesson plan that was repeated to exhaustion within the 10 weeks of martial arts training. With mastering the programs material, the student moves up in rank and belt color (p.26). In this study, participants earned 10 stripes on their white belt.

Minutes 1-3 Meditation and KIAI

Meditation was broken down into both an inactive portion and an active portion (p.3). The inactive portion incorporated the children standing in a line arms distance apart. The children were asked to stand in an attention stance and close their eyes. If any child did not partake in this exercise when asked, all children were prompted as follows, "Let's see who can be the best statue." This verbal prompt was given once. If unsuccessful a second verbal prompt was given stating, "It is time to pay attention and clear our minds, everyone stand like a statue and close your eyes." If still unsuccessful, a final verbal prompt was given to the individual participant to "Stay on your line so we can begin." At this juncture the meditation process began whether all participants were following directions or not. Meditation consisted of the participant standing at attention

with eyes closed as the instructor said, “It is time to make our minds empty inside and think about nothing but the class we are going to do today. For the whole class, we will make sure to pay attention to everything we are learning so we can be the best Karate superstars we can be. The only way to learn how to do Karate is to listen and practice.” After the full three minutes had been completed, participants were asked to open their eyes. The instructor repeated to the class and point to the ears and the eyes when asking, “So we need to listen with our what? We need to pay attention with our what?” The instructor prompted for the participants to say the words “ears” and “eyes”.

While teaching meditation, the instructor explained that whenever participants want to let their inner energy out, they were to use a “special word”. This word is “KIAI”.

Students were also told that they will say yell out the word “OSU” whenever they want to say that they understand the instructor or say hello.

Rational for inactive meditation

The rationale of inactive meditation is to signal that formal Karate training is about to begin and the mind needs to be cleared to focus on this task. The attention and focus of the participant is to delineate itself from the multiple issues and tasks of daily life to the specific training the participant is about to receive (p. 3).

Active meditation will occur throughout the entire class. It is called active as the meditation consists of total concentration on the physical task attempting to be accomplished (p.3).

Meditation often forces concentration and focus. It is hoped that the inactive meditation helped the participants to focus their attention at the task at hand while the

active meditation is ongoing throughout the class and enables the participants to maintain that higher level of concentration. It is also believed that with this constant focus on meditation, a generalization would occur to the outside world at the times which the participant in school or at home is required to pay attention.

Rationale for KIAI and OSU

KIAI can be defined as inner energy and is used to unlock the inner force inside of each person, to add power to the technique of the student, and to call attention to a situation (p.4). As previously mentioned, KIAI is a way for the student to let out their inner energy proactively. It is also used to make sure the student is paying attention as the instructor requires that on every 5th and 10th repetition of a specific martial arts exercise, that this word is repeated out-loud by the participants. OSU is used much in the same way as KIAI is used in relation to trying to increase the student's attention, but it is also used to make sure that the instructor knows that his instructions are understood. Additionally, it builds a respect level between the participant and the instructor.

Minutes 3-5 Explanation of Defensive Stance

Minute three to five consisted of explaining the "defensive stance". From an attention stance position, participants were shown the proper way to both place their hands and their feet. This was called the defensive stance and participants were required to jump back into this stance when the instructor would say "defense stance". Participants were asked to imagine that there were train tracks running between their feet and that they needed to make sure not to stand on the tracks. One participant during each session (the best behaved so as to reinforce the participant for good behavior) was asked to come to the front of the class to help demonstrate the defensive stance. The instructor then

showed the class why it is important to turn the body inward so as to avoid being hit in the stomach, face, throat, or groin. The instructor positively reinforced the one participant who demonstrated the defensive stance and then asked that participant to fall back into their original position on the mat. The class was then instructed to jump back into the defensive stance. They were then asked to return to the attention position. This occurred throughout minutes 3-5.

Minute 5-40 Intensive Marital Arts Training Drills

Participants were taught a series of hand techniques (jab, cross, hook, upper-cut) and foot techniques (snap kick, front kick, side kick, round kick). In addition they were taught how to combine skills together to make combinations. For example, the participant would first learn a snap kick during a particular session. After satisfactorily performing this kick, the instructor taught the participant a jab hand technique. After satisfactorily performing this hand technique, the two were combined into a jab and a snap kick. Each exercise in the program was 2 minutes long with a 30 second break in between for instruction on how to correctly engage in the next martial art movement. During the 30-second break, participants were asked to sit at attention and listen to the instructor. The instructor then called upon one participant to help demonstrate the next movement. When engaged in the drill, each participant had 20-30 seconds to be the offensive person while the partner was holding kicking pads and hand mitts for feet and hand techniques respectively. When the instructor said “switch”, the participant who was striking the pad and mitts then held the pad and mitts for the partner to practice on.

Rationale for Intensive Martial Arts Training Drills

By engaging in the martial arts training drills, the participants will benefit on numerous levels. First, it is important for the participants to be involved in something physically active. As it is hypothesized that martial arts is better than physical exercise for maladaptive behavior, it is necessary for the martial arts drill to be as physically strenuous as an exercise program. Teaching specific movements such as hand and foot techniques both individually and in combination help to focus the participants' attention to something specific and engage the participant in two and three step tasks that may normally be difficult to attend to under other circumstances. As combination movements increase in difficulty, the more attention a participant will need in order to learn the movements. Sitting still and at attention in between movement drills teaches children to pay attention to their instructor and to respect their fellow martial artist. Working one on one with a partner is done to try and foster interpersonal relationships and appropriate social skills and social interactions.

Minutes 40-50 Close Range Defense Moves

A participant was called up to the front of the room to help the instructor demonstrate what to do when the hand and foot techniques are not useful. Participants and partners rotated around so each participant is able to do their moves.

Rationale for Close Range Defense Moves

Close range defensive moves are not only a secondary way to protect yourself when an attacker makes it past your initial punches and kicks, but a high level of academic structuring. Similar to the martial arts training drill, it involves a number of specific movements in combination for a final outcome. The difference lies in the level of

difficulty as the close range defense moves are at a much higher level of difficulty to accomplish. The rotation from partner to partner will once again work on the social interaction and interpersonal skills of the participants. The close range defense moves expend less energy than the martial arts drill and is usually used as a wind down towards the end of class. Additionally, working with a partner will once again help to develop good social skills and social interactions.

Minutes 50-60 Meditation and Stripes

After completion of close range defense moves, participants were asked to line up in their original spots from the beginning of class and then meditation began for two minutes. Meditation consisted of the participants standing at attention with eyes closed as the instructor said, "It is time to make our minds empty inside and think about nothing but the class we just finished. When we go home tonight, we will focus the same way we did in class on our homework and follow directions that adults give us." After the full two minutes had been completed, participants were asked to open their eyes. When a participant earned a stripe on his or her belt, the participant was called up individually to the front of the room in front of other participants and given a stripe on his belt. Each student was called up at the end of class for their stripe.

Rationale for Meditation and Stripes

Meditation at the end of class is a way to clear your mind of everything but what you have accomplished over the past hour. It is used to visualize what you accomplished in class and more importantly the way you see yourself in the future. The giving out of stripes is a form of positive reinforcement for the participants. It is a tangible way to explain that they are doing a good job in the program.

Exercise Intervention Program

The exercise intervention program consisted of numerous exercises broken down into fifteen-minute intervals. The instructor divided the groups into three teams and had participants engage in calisthenics and stretching for ten minutes. After relay had been completed, two teams were formed and participants engaged in 15 minute exercises such as freeze tag, ultimate Frisbee, basketball, jumping rope, and similar exercises. Participants engaged in a five-minute cool down of walking.

Rationale for Exercise Intervention Program

The program was designed to engage participants in numerous different types of activities. The exercises were chosen to foster competition, team building, and to promote good health through increasing the heart rate to allow for healthy exercise. The exercise intervention was designed with less structure than the martial arts program to account for the structured environment that is typical of a martial arts program.

Chapter III. Results

Data were converted to percentiles of work completion in order to facilitate interpretation. The Effect sizes were calculated utilizing Kazdin's (1998) method. This was accomplished by subtracting the mean of the treatment data for each intervention group from the mean of the baseline data, and dividing the result by the standard deviation of the baseline data. Effect size was calculated for each intervention group's results for each question on the behavior checklist. These are presented in Table 1.

Hypothesis 1. In the first hypothesis it was posited that a martial arts program two times per week would increase the percentage of completed homework of children diagnosed with Attention Deficit Hyperactivity Disorder, as compared to an exercise program or control group receiving no treatment program. Individual participants' daily results are presented in Appendix K for the two treatment conditions and control group during the baseline and treatment conditions for question one. Aggregate daily and weekly data are respectively presented in Figures 2 and 3 for the two treatment conditions and control group during the baseline and treatment conditions.

Visual analysis of the data suggests the children involved in the martial arts program greatly increased the percentage of homework completed. The mean percent for homework completed weekly for the martial arts intervention group as evidenced by teacher ratings increased from 36% during the baseline period to 85.66% during the treatment period**.** The mean percent for homework completed weekly for the exercise intervention group increased from 35% during the baseline period to 52.78% during the treatment period. In addition, the mean percent for homework completed weekly for the

Table 1. Descriptive statistics and effect sizes of dependent variables.

Behavior Exhibited	Baseline Mean % HW Completed	Treatment Mean % HW Completed	*SD*	Effect size
Percentage of Homework Completion:				
Martial Arts	36%	85.66%	.3209	-1.547
Exercise	35%	52.78%	.2661	-0.688
Control Group	42%	37.11%	.1666	0.293
Number of Teacher Rules Broken:				
Martial Arts	39.8	15.00	2.775	-8.937
Exercise	30.0	19.67	3.674	-2.812
Control Group	38.0	37.17	2.345	.3539
Number of Inappropriate Call-Outs:				
Martial Arts	62.2	25.33	7.886	-4.674
Exercise	23.4	14.46	1.140	-7.835
Control Group	35.8	34.88	4.816	-0.189

Number of Times Inappropriately Leaving Seat:				
Martial Arts	37.2	12.09	3.420	-7.341
Exercise	20.4	12.69	5.771	-1.336
Control Group	23.2	25.69	6.834	0.364
Percentage of Academic Performance:				
Martial Arts	45.2%	81.61%	.0228	-15.97
Exercise	56.6%	61.06%	.0658	-0.677
Control Group	37.8%	39.57%	.0818	0.216
Percentage of Redirection:				
Martial Arts	53.7%	40.31%	.1969	-.6809
Exercise	55.3%	35.75%	.0585	-3.338
Control Group	73.6%	71.88%	.0528	-.3322
Percentage of Classroom Preparation:				
Martial Arts*	47%	87.35%		
Exercise*	50%	67.40%		
Control*	27%	34.81%		

Figure 2. Percentage of Homework Completion Aggregated for all Participants Daily

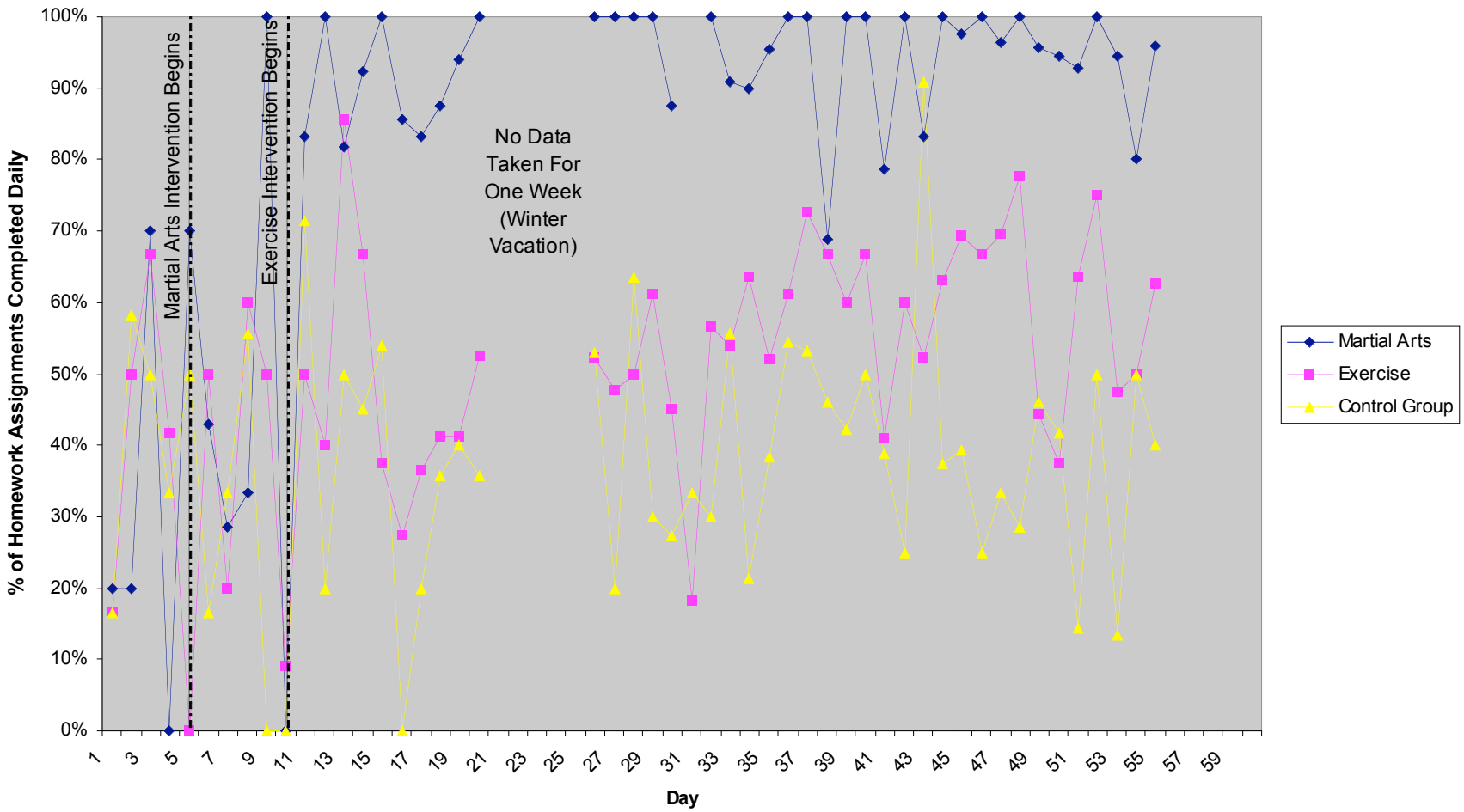
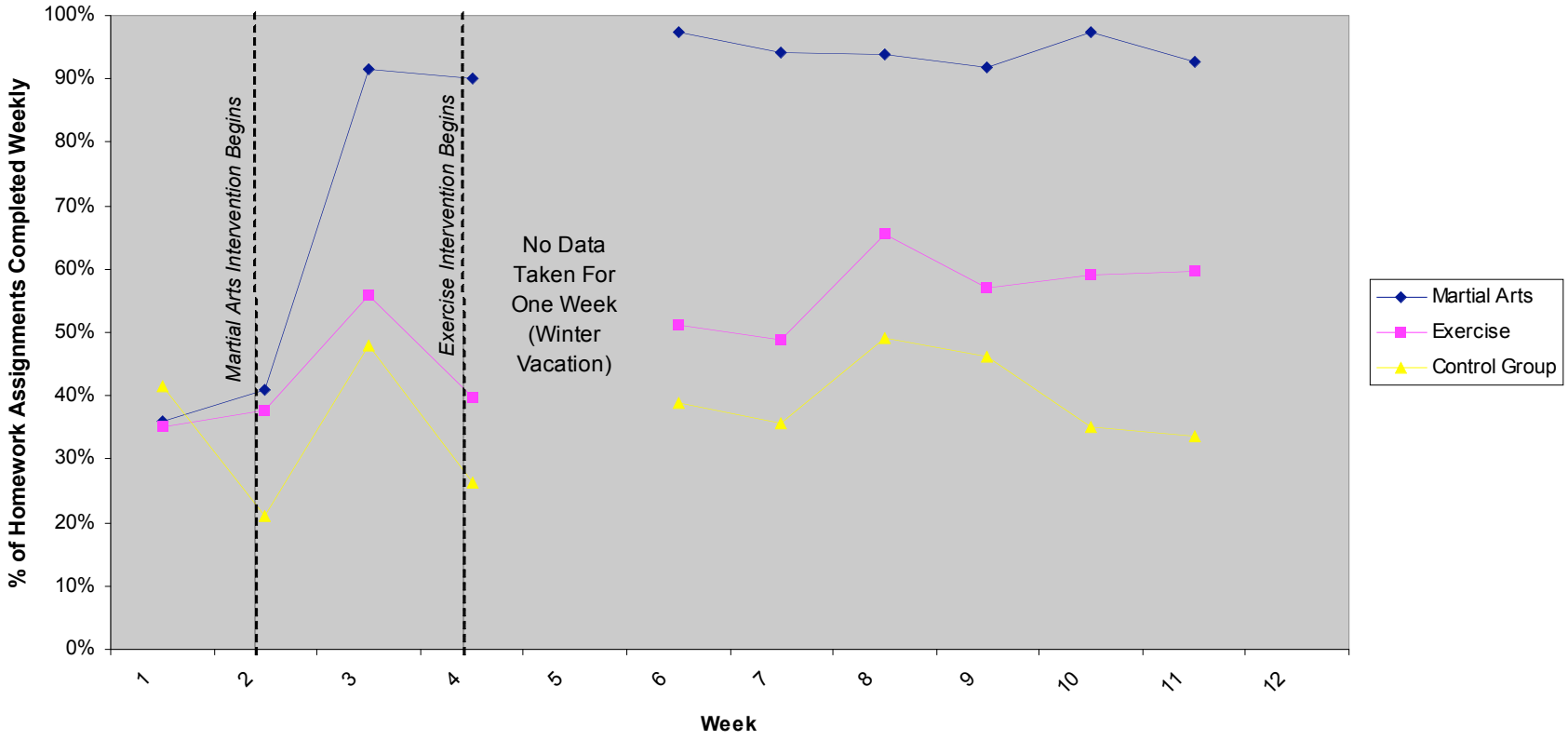


Figure 3. Percentage of Homework Completion Aggregated for all Participants Weekly



control group decreased from 42% during the baseline period to 37.11% during the treatment period. The effect size for percentage of homework completed weekly for the Martial Arts Intervention was –1.547. The effect size for percentage of homework completed weekly for the Exercise Intervention was –0.688. Additionally, the effect size for percentage of homework completed weekly for the Control Group was 0.293. Therefore, hypothesis 1 was supported as the percentage of homework completed weekly increased for the martial arts intervention group as compared to the exercise intervention and control group. This was evidenced by the visual analysis of the data and the greater effect size for the martial arts intervention than the exercise intervention and control group.

Hypothesis 2. In the second hypothesis it was posited that a martial arts program two times per week would decrease the frequency of breaking specific classroom rules of children diagnosed with Attention Deficit Hyperactivity Disorder, as compared to an exercise program or control group receiving no treatment program. Individual participants' daily results are presented in Appendix L for the two treatment conditions and control group during the baseline and treatment conditions for question two. Aggregate daily and weekly data are respectively presented in Figures 4 and 5 for the two treatment conditions and control group during the baseline and treatment conditions.

Visual analysis of the data suggests the children involved in the martial arts program greatly decreased lack of rule compliance. The mean number of specific classroom rules broken for the martial arts intervention group as evidenced by teacher ratings decreased from 39.80 times weekly during the baseline period to 15.0 times

Figure 4. Average Number of Teacher Rules Broken Aggregated for all Participants Daily

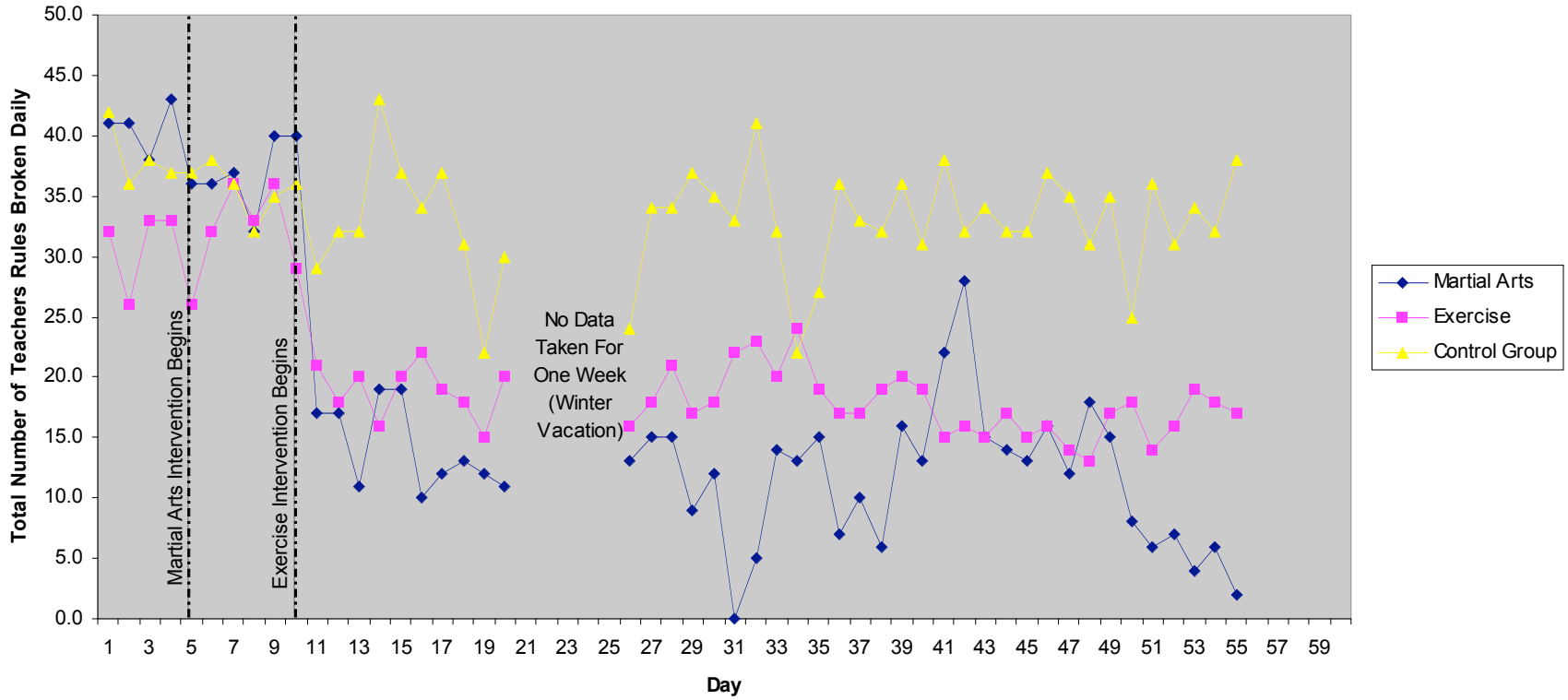
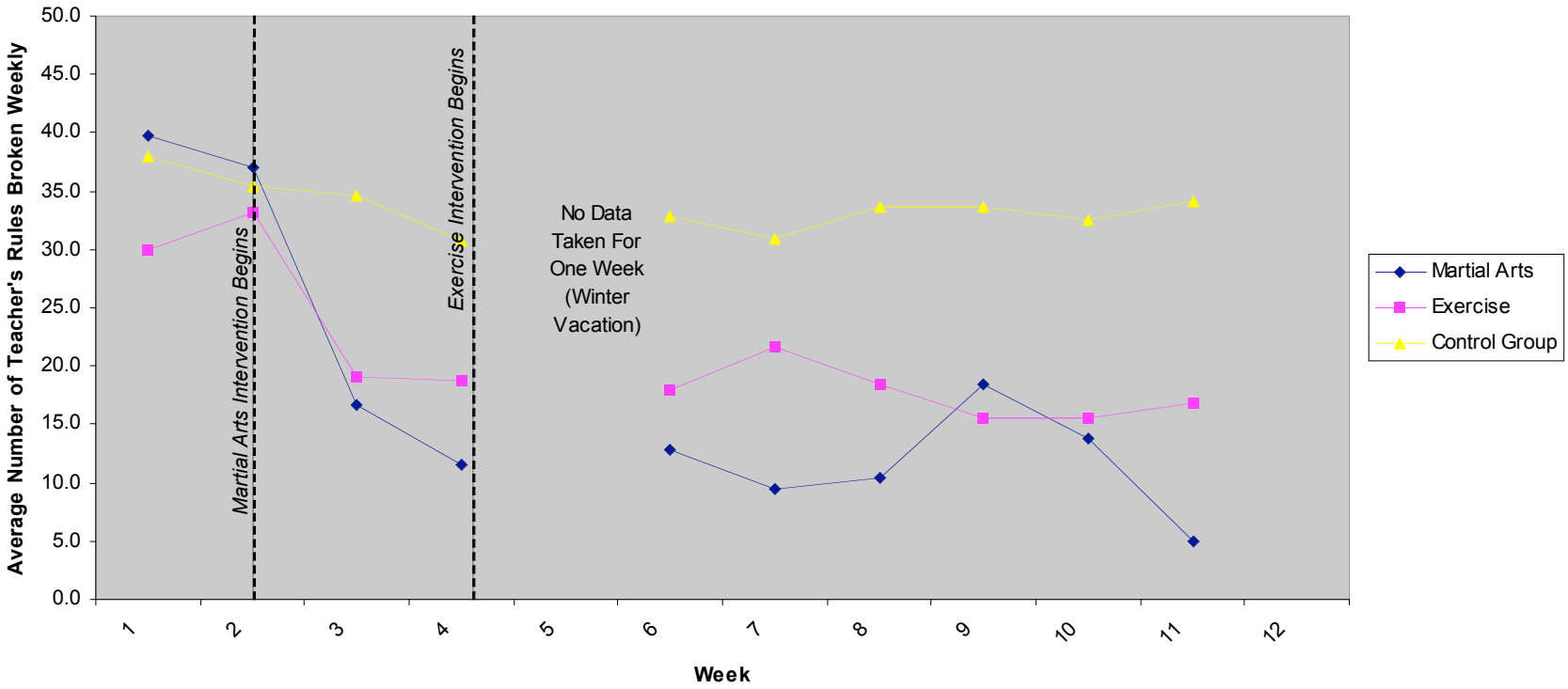


Figure 5. Average Number of teacher's Rules Broken Aggregated for all Participants Weekly



weekly during the treatment period**.** The mean number of specific classroom rules broken for the exercise intervention group decreased from 30.0 times weekly during the baseline period to 19.67 times weekly during the treatment period. In addition, the mean number of specific classroom rules broken for the control group decreased from 38.0 times weekly during the baseline period to 37.17 times weekly during the treatment period. The effect size for frequency of following specific classroom rules for the Martial Arts Intervention was –8.937. The effect size for frequency of following specific classroom rules for the Exercise Intervention was –2.812. Additionally, the effect size for frequency of following specific classroom rules for the Control Group was –2.056. Therefore, hypothesis 2 was supported, as the frequency of following specific classroom rules weekly increased for the martial arts intervention group as compared to the exercise intervention and control group. This was evidenced by the visual analysis of the data and a greater effect size for the martial arts intervention than the exercise intervention and control group.

Hypothesis 3. In the third hypothesis it was examined as to whether a martial arts program two times per week would decrease the number of inappropriate callouts of children diagnosed with Attention Deficit Hyperactivity Disorder, as compared to an exercise program or control group receiving no treatment program. Individual participants' daily results are presented in Appendix M for the two treatment conditions and control group during the baseline and treatment conditions for question three. Aggregate daily and weekly data are respectively presented in Figures 6 and 7 for the two treatment conditions and control group during the baseline and treatment conditions.

Figure 6. Average Number of Inappropriate Call-Outs Aggregated for all Participants Daily

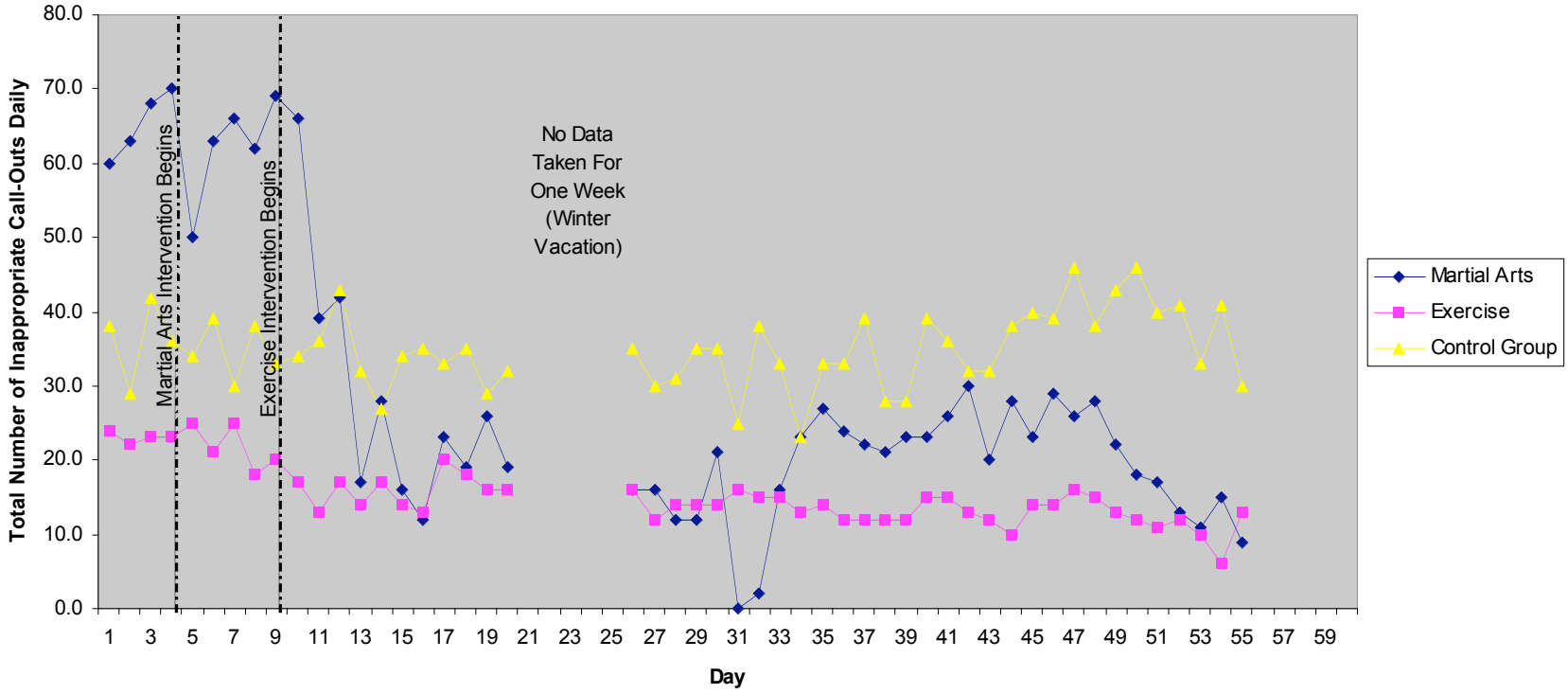
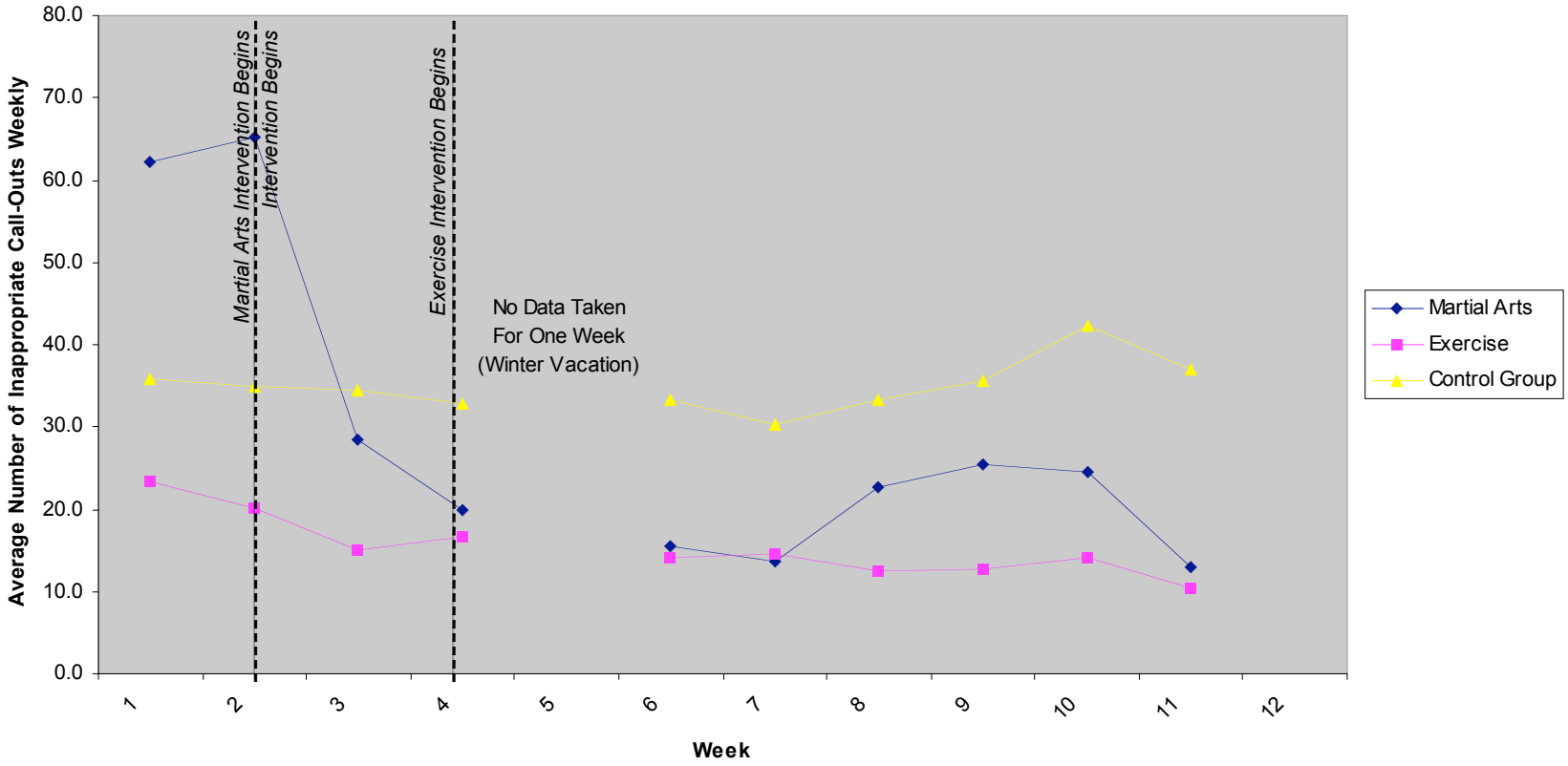


Figure 7. Average Number of Inappropriate Call-Outs Aggregated for all Participants



Visual analysis of the data suggest the children involved in the martial arts program and exercise program greatly decreased the amount of times they inappropriately called out in class. The mean number of inappropriate callouts for the martial arts intervention group as evidenced by teacher ratings decreased from 62.2 times weekly during the baseline period to 25.3 times weekly during the treatment period**.** The mean number of inappropriate callouts for the exercise intervention group decreased from 23.4 times weekly during the baseline period to 14.5 times weekly during the treatment period. In addition, the mean number of inappropriate callouts for the control group decreased from 35.8 weekly during the baseline period to 34.9 times weekly during the treatment period. The effect size for inappropriate callouts for the Martial Arts Intervention was –4.674. The effect size for frequency of following specific classroom rules for the Exercise Intervention was –7.835. Additionally, the effect size frequency of following specific classroom rules for the Control Group was –0.189. Therefore, hypothesis 3 was only partially supported, as there was a greater decrease of the mean number of inappropriate callouts weekly for the exercise intervention when compared to the martial arts intervention, however, both groups showed substantial gains as suggested by visual analysis of the data and a significant effect size for both the martial arts intervention and the exercise intervention. This suggests that the martial arts and exercise interventions were both effective in decreasing the number of inappropriate callouts weekly.

Hypothesis 4. In the fourth hypothesis it was stated that a martial arts program two times per week would decrease the number of times the participant inappropriately leaves the seat in class of children diagnosed with Attention Deficit Hyperactivity

Disorder, as compared to an exercise program or control group receiving no treatment program. Individual participants' daily results are presented in Appendix N for the two treatment conditions and control group during the baseline and treatment conditions for question four. Aggregate daily and weekly data are respectively presented in Figures 8 and 9 for the two treatment conditions and control group during the baseline and treatment conditions.

Visual analysis of the data suggests the children involved in the martial arts program greatly decreased he number of times they left their seat inappropriately during school. The mean number of times the participant inappropriately left their seat in class for the martial arts intervention group as evidenced by teacher ratings decreased from 37.2 times weekly during the baseline period to 20.0 times weekly during the treatment period**.** The mean number of times the participant inappropriately left their seat in class for the exercise intervention group decreased from 20.4 times weekly during the baseline period to 12.7 times weekly during the treatment period. In addition, the mean number of times the participant inappropriately left the seat in class increased from 23.2 times weekly during the baseline period to 25.69 times weekly during the treatment period for the control group. The effect size for inappropriately leaving the seat weekly for the Martial Arts Intervention was –7.241. The effect size for inappropriately leaving the seat weekly for the Exercise Intervention was –1.336. The effect size for inappropriately leaving the seat weekly for the Control Group was .3642. Therefore, hypothesis 4 was supported as the number of times the participant's inappropriately left the seat in class weekly decreased for the martial arts intervention group as compared to the exercise intervention and control group. This was evidenced by visual analysis of the data and a

Figure 8. Average Number of Times Student Leaves Seat Aggregated for all Participants Daily

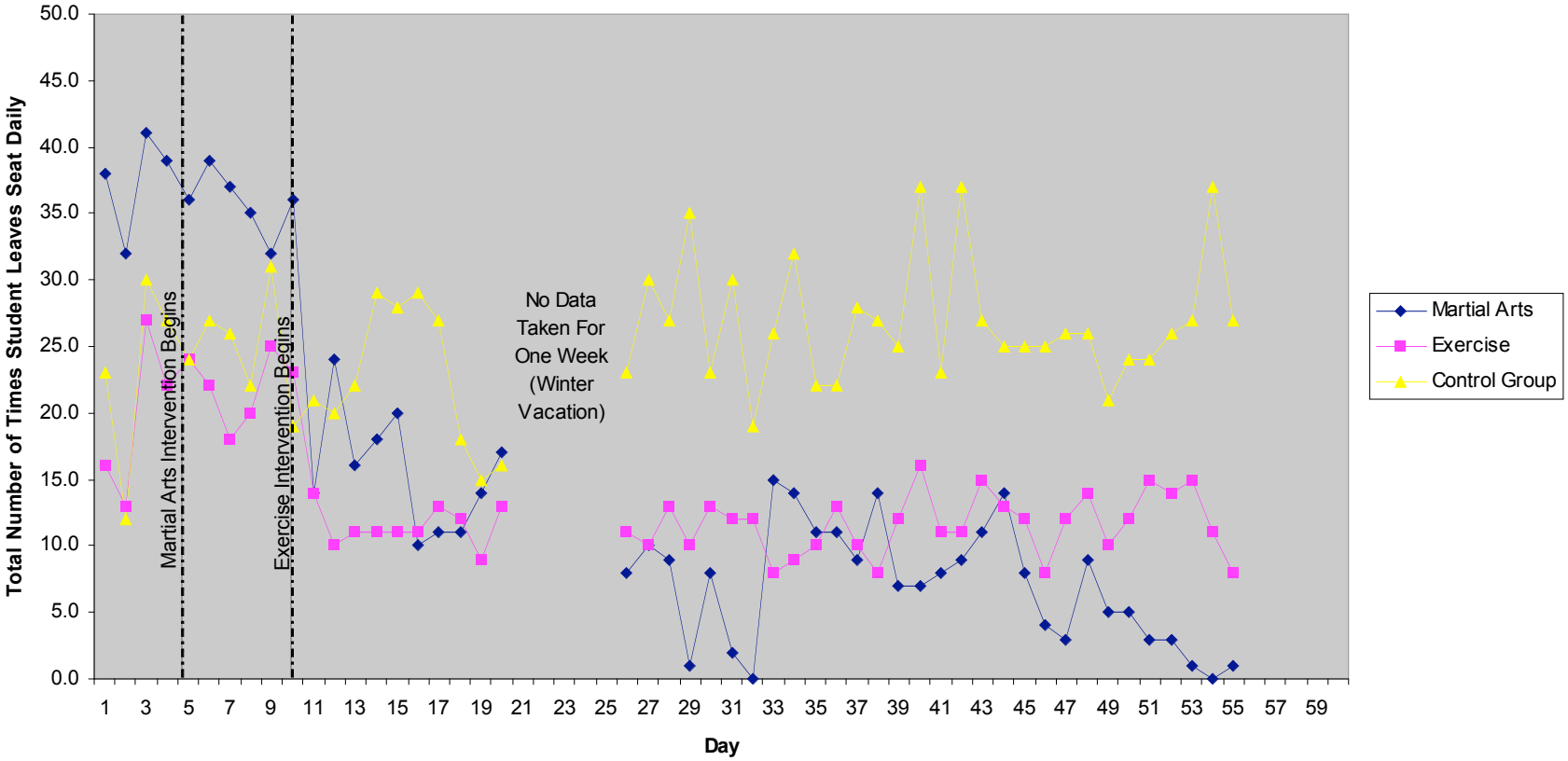
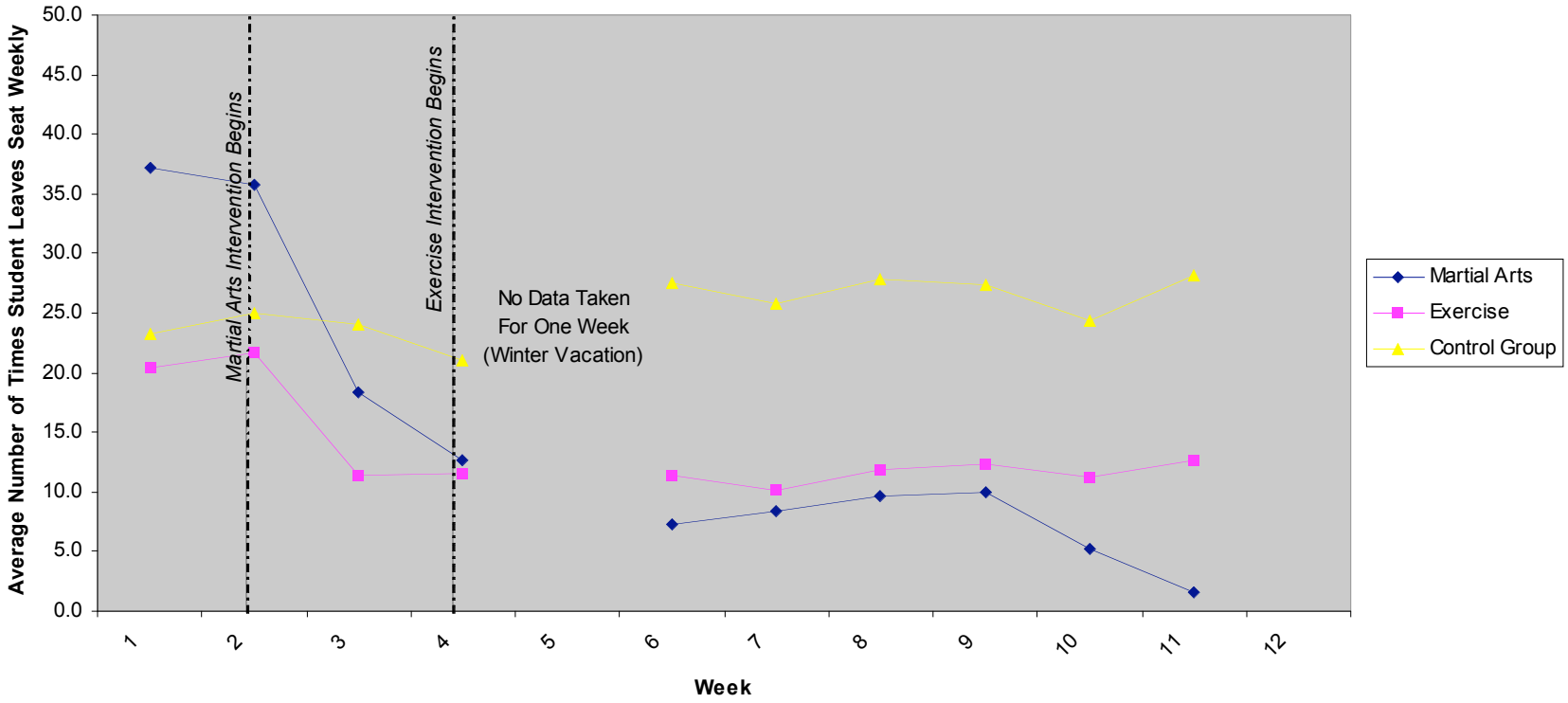


Figure 9. Average Number of Times Student Leaves Seat Aggregated for all Participants Weekly



greater effect size for the martial arts intervention than the exercise intervention and control group.

Hypothesis 5. In the fifth hypothesis it was posited that a martial arts program two times per week would improve academic performance of children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program. Individual participants' daily results are presented in Appendix O for the two treatment conditions and control group during the baseline and treatment conditions for question five. Aggregate daily and weekly data are respectively presented in Figures 10 and 11 for the two treatment conditions and control group during the baseline and treatment conditions.

Visual analysis of the data suggests the children involved in the martial arts program greatly increased their academic performance. The mean percent of academic performance for the martial arts intervention group increased from 45.2% weekly during the baseline period to 81.6% weekly during the treatment period**.** The mean percent of academic performance for the exercise intervention group increased from 56.6% weekly during the baseline period to 61.1% weekly during the treatment period. In addition, the mean percent of academic performance for the control group increased from 37.8% weekly during the baseline period to 39.6% weekly during the treatment period. The effect size for increase of academic performance for the Martial Arts Intervention was –15.97. The effect size for increase of academic performance for the Exercise Intervention was –0.677. Additionally, the effect size for increase of academic performance for the Control Group was 0.216. Therefore, hypothesis 5 was supported as academic performance increased weekly for the martial arts intervention group as compared to the

Figure 10. Percentage of Task Completed Aggregated for All Participants Daily

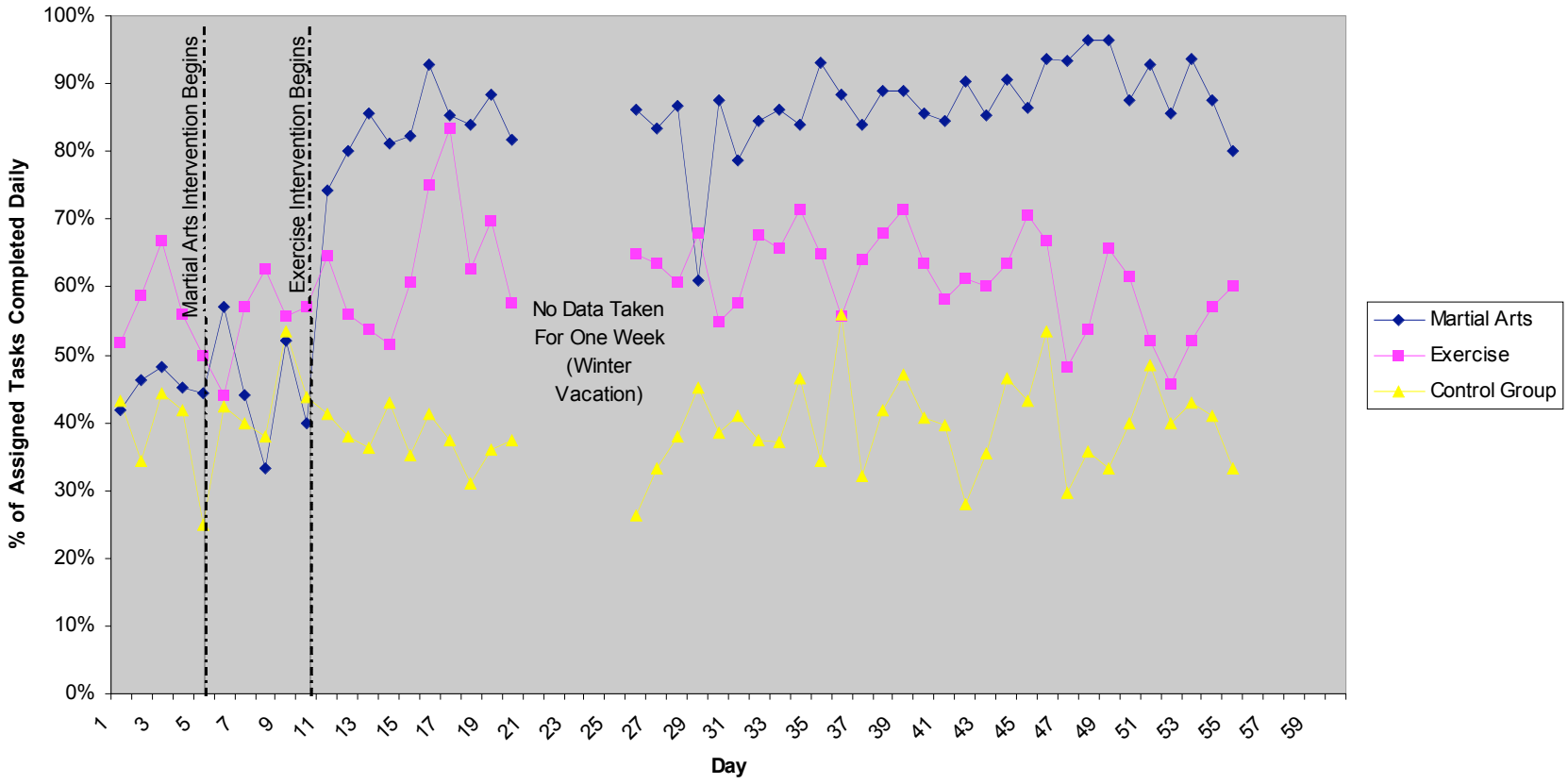
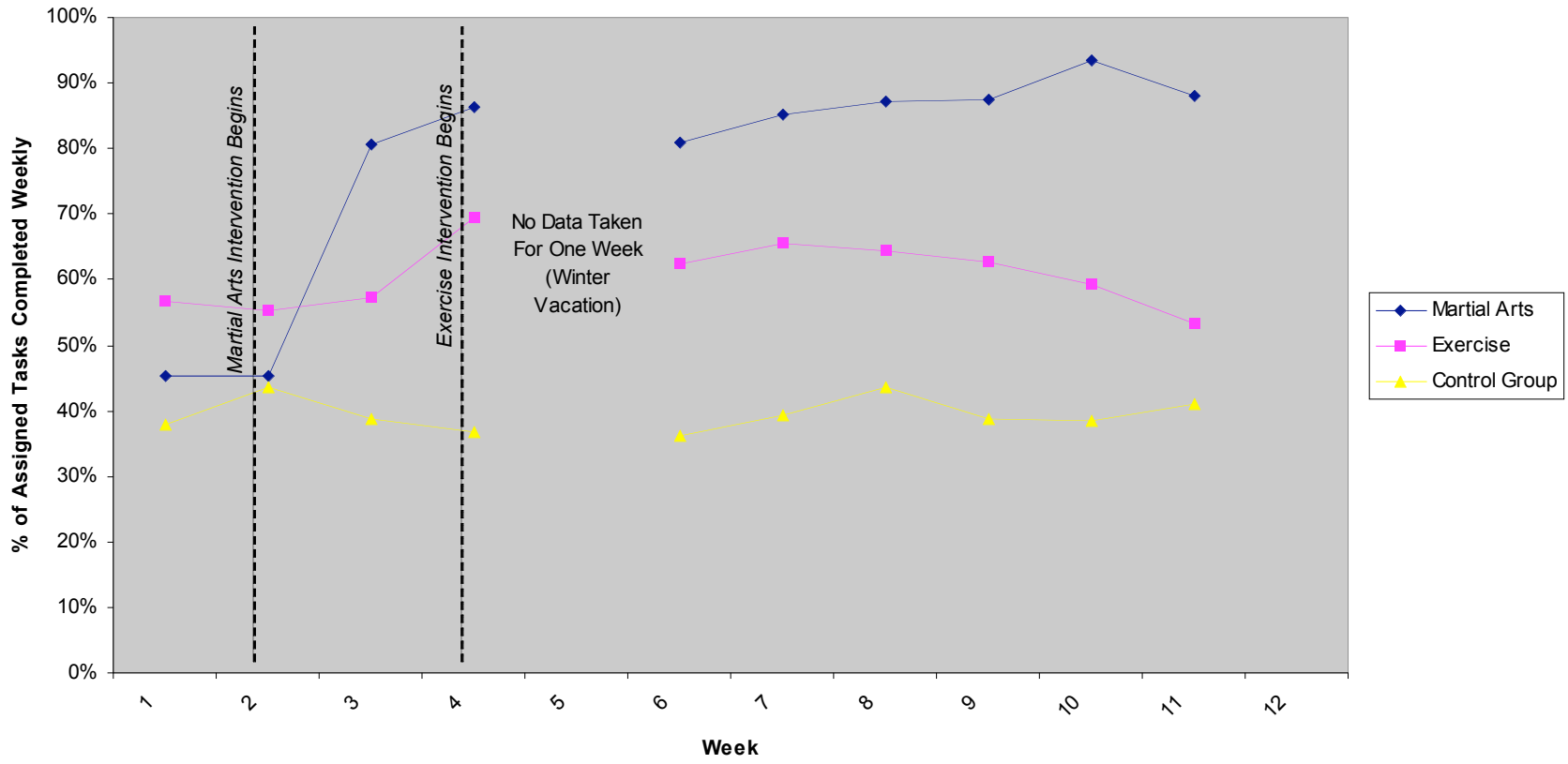


Figure 11. Percentage of Tasks Completed Aggregated for All Participants Weekly



exercise intervention and control group. This is evidenced by visual analysis of the data and a greater effect size for the martial arts intervention than the exercise intervention and control group.

Hypothesis 6. The sixth hypothesis stated that a martial arts program two times per week will decrease the amount of redirection to task of children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program. Individual participants' daily results are presented in Appendix P for the two treatment conditions and control group during the baseline and treatment conditions for question six. Aggregate daily and weekly data are respectively presented in Figures 12 and 13 for the two treatment conditions and control group during the baseline and treatment conditions.

Visual analysis of the data suggest the children involved in the martial arts program and exercise program significantly decreased the percentage of times they needed to be redirected to task. The mean percent of redirection to task for the martial arts intervention group as evidenced by teacher ratings on the Morand-Klein Behavior Checklist decreased from 53.7% weekly during the baseline period to 40.21% weekly during the treatment period**.** The mean percent of redirection to task for the exercise intervention group decreased from 55.3% weekly during the baseline period to 35.75% weekly during the treatment period. In addition, the mean percent of redirection to task for the control group decreased from 73.6% weekly during the baseline period to 71.9% weekly during the treatment period. The effect size for decrease in redirection to task for the Martial Arts Intervention was -.6809. The effect size for redirection to task for the

Figure 12. Percentage of Times Redirected to Task Aggregated for All Participants Daily

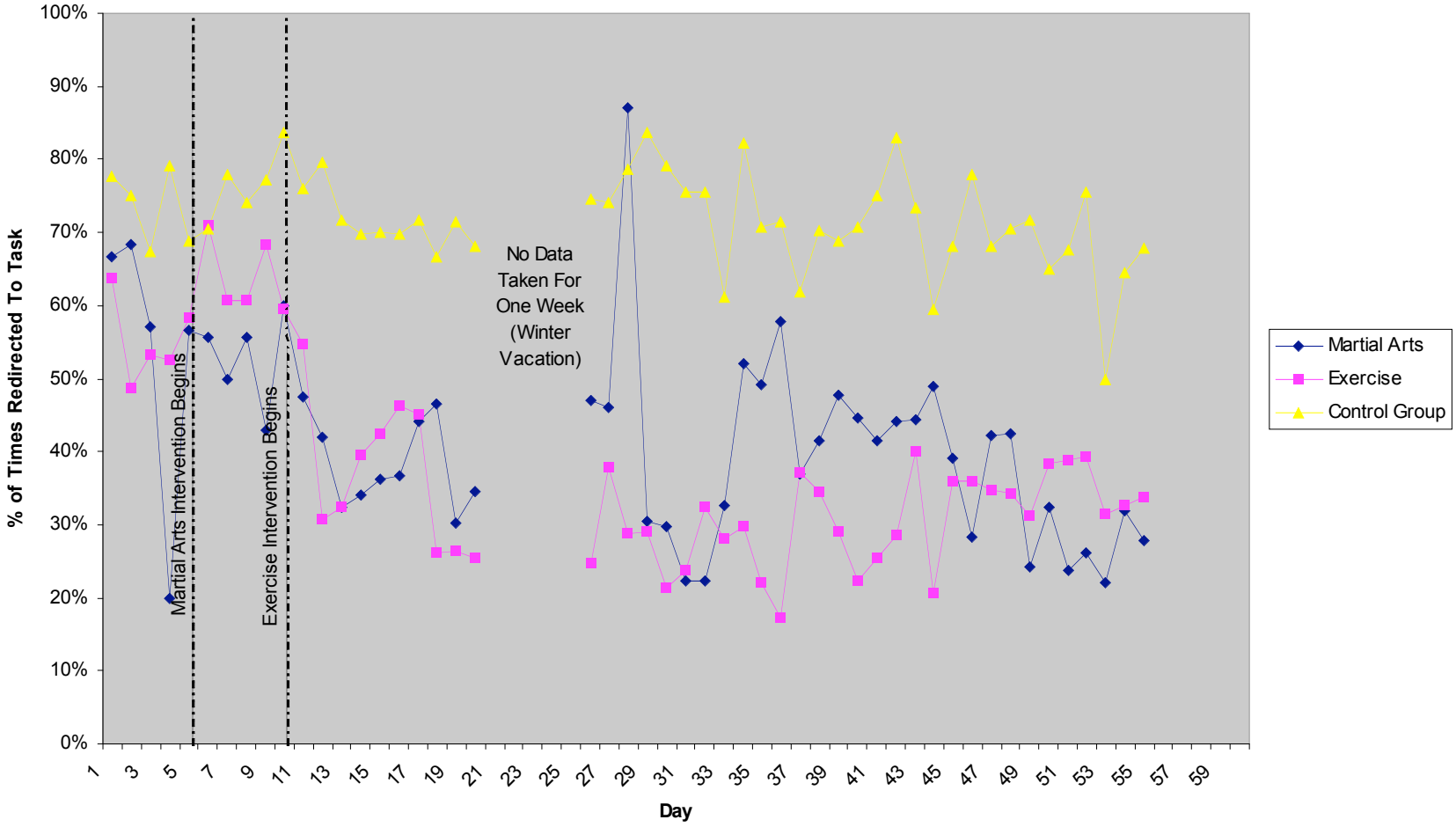
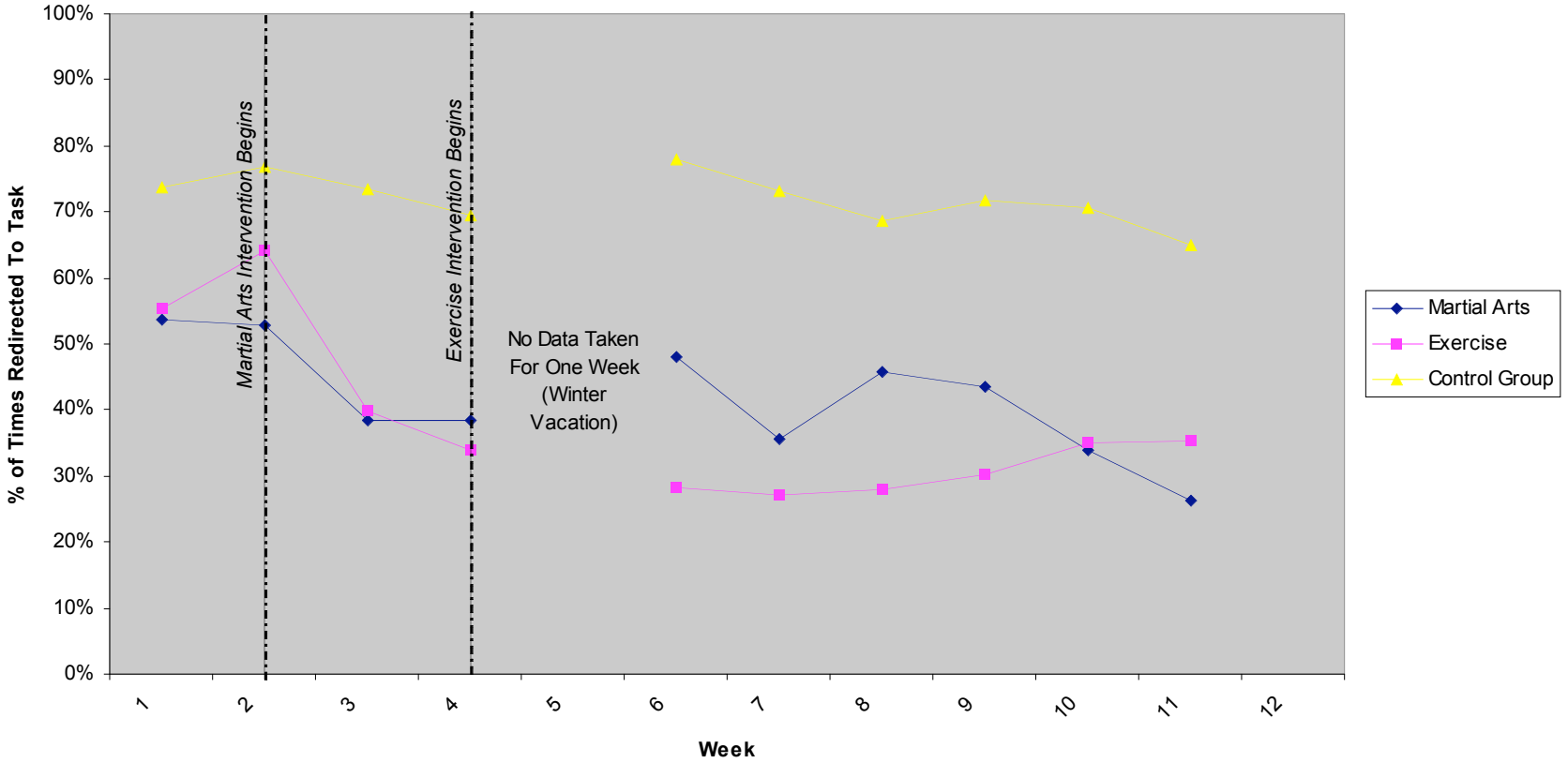


Figure 13. Percentage of Times Redirected to Task Aggregated for all Participants Weekly

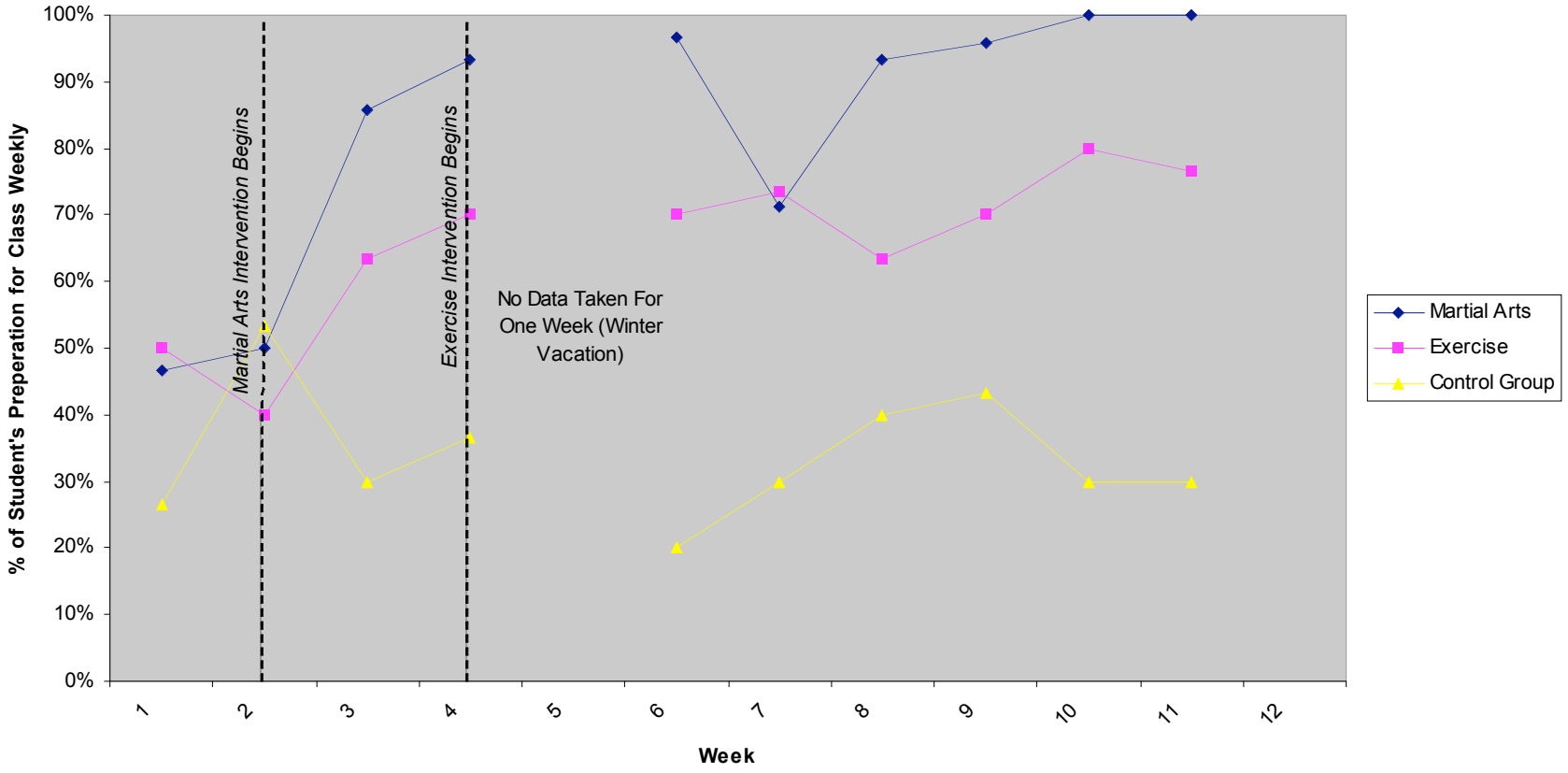


Exercise Intervention was –3.338. Additionally, the effect size for decrease in redirection to task for the Control Group was -.3312. Therefore, hypothesis 6 was only partially supported as the martial arts intervention program was not as effective as the exercise intervention program for decreasing the amount of redirection to task needed weekly. However, the martial arts intervention was more effective at decreasing weekly redirection to task than the control group. This is evidenced by visual analysis of the data and the greater effect size for the martial arts intervention than the control group.

Hypothesis 7. In the seventh hypothesis it was posited that a martial arts program two times per week would improve classroom preparation of children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program. Individual participants' daily results are presented in Appendix Q for the two treatment conditions and control group during the baseline and treatment conditions for question seven. Weekly data is presented in Figure 14 for the two treatment conditions and control group during the baseline and treatment conditions.

Visual analysis of the data suggests the children involved in the martial arts program greatly increased classroom preparation. The mean percent of classroom preparation for the martial arts intervention group as evidenced by teacher ratings increased from 47.0% weekly during the baseline period to 87.4% weekly during the treatment period**.** The mean percent of classroom preparation for the exercise intervention group increased from 50.0% weekly during the baseline period to 67.4%

Figure 14. Percentage of Preparation for Class Aggregated for all Participants Weekly



weekly during the treatment period. In addition, the mean percent of classroom preparation for the control group decreased from 27% weekly during the baseline period to 34.81% weekly during the treatment period. Therefore, hypothesis 7 was supported, as the martial arts intervention program was more effective than the exercise intervention program for increasing classroom preparation weekly. This is evidenced by visual analysis of data and a 40.4% increase in classroom preparation for the martial arts intervention program when compared to a 17.4% increase in classroom preparation for the exercise intervention program and a 7.8% increase for classroom preparation the control group.

Session logs were completed to assure consistency to the martial arts intervention guidelines (Appendix J). Treatment integrity was evaluated over each of the 20 sessions utilizing a daily checklist of nine questions. A checkmark in the yes column was tabulated as a score of 1. A checkmark in the no column was tabulated as a score of zero. A perfect score of 9 was attained for each day's intervention.

In addition, teacher satisfaction of the intervention was calculated with the IRP-15 (Witt & Martens, 1983). This measure has an obtained range of 15 to 90. Higher scores denote greater satisfaction. The mean score was 80 for the martial arts intervention on the IRP-15 suggesting a high teacher satisfaction. The mean score was 58 for the exercise intervention on the IRP-15 suggesting above average teacher satisfaction.

Chapter IV. Discussion

Attention Deficit Hyperactivity Disorder (AD/HD) is one of the most common disorders found in children, totaling 30% to 50% of child referrals to mental health services (Barkley, 1996; Popper, 1988). While there has been a large body of literature examining interventions including medications, cognitive behavioral treatments, behavioral therapies and social skills training programs to help alleviate symptoms associated with AD/HD (MTA Cooperative Group 1999), completely efficacious methods have yet to be established. Researchers are looking at more long term treatments, to help alleviate some of the difficulties noticeable in the academic realm (DuPaul & Stoner, 1994; Mannuzza, Klein, & Bessler, 1993; Sealander et al., 1997, DSM-IV-TR, 2000) the social realm (Wheeler & Carlson, 1994, Center for Disease Control, 2003) and in the home environment.

A large body of research has been conducted in the area of exercise and its effects on the symptoms of AD/HD (e.g. Brink, 1995; Davey, 1973; Pollatscheck and O'Hagen, 1996; Wendt, 2000). Brink (1995) purports that one of the best ways to stimulate the brain and learning is by engaging in physical exercise. In addition, it was concluded by Wendt (2000) that exercise significantly improved the behavior of 5-12 year olds children with AD/HD when pre and post test comparisons of behavior were made over the six-week duration of a study utilizing exercise five out of seven days per week. One form of exercise in which little research is available is martial arts. Fuller (1988) expressed that there has been a lack of sophistication in the questions posed and in the methodology adopted to answer those questions regarding empirical research on martial arts. However, research on martial arts could prove beneficial as a treatment for AD/HD. The intent of

the present study was to improve the adaptive behaviors and decrease the maladaptive behaviors of children with AD/HD by utilizing mixed martial arts. Martial arts was proposed to offer a new method of decreasing maladaptive behaviors such as the need to be redirected to task, the number of inappropriate callouts in class, and the number of times the participant inappropriately leaves the seat for children aged 8-11 with AD/HD. Additionally, it was proposed that martial arts would improve adaptive behaviors by increasing the percentage of completed homework, the frequency of following specific classroom rules, improvement of academic performance, and improvement of classroom preparation for children aged 8-11 with AD/HD. The central aim of this investigation was to establish that a martial arts program could effectively change the behaviors typically associated with 8 to 11 year old males with AD/HD better than a control group or exercise intervention group.

In order to test whether martial arts or exercise could change the behaviors associated with AD/HD, information was gathered on three adaptive and four maladaptive behaviors typically associated in children with AD/HD. These seven target areas were chosen because they were behaviors that could be visually assessed, and therefore able to be recorded by that student's individual teacher. Comparisons were then made between data obtained during the baseline phase for each of seven questions on a behavior checklist to data obtained over the complete treatment intervention phase for each of the three groups. Means of the data during the baseline portion and data during the treatment portion of the intervention were obtained. Additionally, the standard deviation's for the baseline portion were obtained and used with the calculated means to determine the effect size of each intervention for each question.

It had been hypothesized that a martial arts program two times per week would increase the percentage of completed homework of children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program. Support was found for this hypothesis. The effect size of –1.547 for accuracy of homework completed weekly compared to –0.688 for the exercise intervention and 0.293 for the Control Group may be accounted for by the martial arts intervention utilizing a highly disciplined program. The atmosphere set for the participants was one of traditionalism coupled with an effort to run a disciplined class so the participant would become empowered to act with self-discipline. The study of martial arts is one that necessitates practice and dedication in order to master the skills. Techniques and balance are obtained through hours of regimented study. Many initial exercises such as stretching and rote beginner techniques are over practiced in order to increase the ability to perform the martial arts at a higher level and establish greater flexibility and balance. Although this initial phase is considered to be much less enjoyable, the expected results help to urge the participant onward in order to obtain the desired goal of obtaining a higher level or *black belt* in that specific discipline.

The discipline taught to participants during the martial arts intervention seemed to generalize to the participant's life outside of the marital arts school. Participants in this specific martial arts program were not only engaged in activities which could enhance their strengths, but they trained their weaknesses as well. This was not an expected outcome of the exercise intervention group. The exercise intervention group was merely encouraged to participate but no direction was given to aid the participants to become disciplined and empowered in practicing the exercise they were engaging in to become

better at it. This is unlike the martial arts, which is expected to inspire the participant to be the best they can be and to not settle for mediocrity. Similar to practicing martial arts to become more skilled, the martial arts intervention participants would complete their homework more often because homework was looked at as a way to practice what they learned in school in an effort to become better at that subject.

Additionally, participants viewed both the martial arts and exercise intervention programs as very enjoyable. This resulted in a new contingency top us. Specifically, it was reported that parents frequently said, “If you want to do karate, you have to have all your homework done first” or “If you want to do exercise, you need to do your homework first”. Although the parents would always bring the participants to class whether or not the homework was completed, this was a powerful incentive for the participants to do their homework. If an incentive is given to someone that they have little or no interest in receiving, that person will be less likely to complete a task assigned. However, if the incentive is one that will bring pleasure to the person, they will in turn make sure to complete the task assigned to receive the incentive. This is similar to the Premack Principle which states hat a more reinforcing activity can be used to reinforce a less reinforcing activity. The martial arts instructor was able to use this same contingency of enjoyment with the participants as well by stating during meditation, “It is time to make our minds empty inside and think about nothing but the class we just finished. When we go home tonight, we will focus the same way we did in class on our homework and follow directions that adults give us.” The desired result of doing homework for the participant was not only to acquire better practice at their work in school in an effort to be viewed as a good student but to be able to have enough time to participate in the martial

arts program or exercise intervention program. The enjoyment aspect coupled with the disciplined atmosphere accounts for the greater effect size of the martial arts intervention program.

Support was found for the second hypothesis that a martial arts program two times per week would increase the frequency of following specific classroom rules of children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program. The effect size of –8.937 based on a decrease from 39.8 times weekly during the baseline period to 15 times weekly during the treatment period for the martial arts intervention program is accounted for by a number of reasons.

Participants in the martial arts intervention program were consistently given tasks based on a curriculum that followed specific lesson plans. Lesson plans were used to make sure that the program was organized so that everything that needed to be covered was covered thoroughly. Each class had a lesson plan that was consistently repeated within the 10 weeks of martial arts training. Participants were taught a series of hand techniques (jab, cross, hook, upper-cut) and foot techniques (snap kick, front kick, side kick, round kick). In addition they were taught how to combine skills together to make combination techniques. For example, participants would learn a snap kick first, satisfactorily performing this kick, and then be taught a hand technique such as a jab punch. After satisfactorily performing this hand technique, the two techniques would be combined into a jab and a snap kick. Each exercise in the program was two minutes long with a 30 second break in between for instruction on how to correctly engage in the next martial art movement. During the 30-second break, participants were prompted to sit at

attention and listen to the instructor. Participants of the martial arts intervention were not only consistently given directions as to how to perform techniques but rules as to what techniques to perform, how long they would be allowed to practice those techniques, and when they could incorporate other techniques previously learned. If a participant did not follow these rules then the skill of performing the combination technique was compromised and the participant was reprimanded to follow the guidelines given in order to perform the technique and when they could perform it. The necessity for the martial arts intervention participants to follow numerous rules that changed every few minutes carried over to the classroom where specific rules were expected to be followed by the participant's teachers. As participants in the martial arts intervention became used to following specific rules, these rules became second nature and the participant would wait at attention for the directives and rules given by the instructor.

It was hypothesized that a martial arts program two times per week would decrease the number of inappropriate callouts of children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program. The third hypothesis partially supported, as there was a greater decrease of the mean number of inappropriate callouts weekly for the exercise intervention when compared to the martial arts intervention. However, as stated in the results section, there was a significant effect size for both the martial arts intervention and the exercise intervention. This suggests that the martial arts and exercise interventions were both effective in decreasing the number of inappropriate callouts weekly. Although the effect size for the exercise intervention was –7.835, almost double the –4.674 effect size for the martial arts intervention, it is important to look at the actual number of

inappropriate call-outs per intervention group. The martial arts intervention group averaged 62.2 callouts during baseline compared to only 23.4 callouts during baseline for the exercise intervention group and 35.8 for the control group. There is a significantly large discrepancy between the three intervention groups initial number of inappropriate callouts weekly suggesting that the participants grouped into the martial arts intervention were more difficult behaviorally in certain instances during the baseline period when compared to the exercise intervention group and control group. In addition, the martial arts intervention group participants called out a total of 36.87 times less per week compared to 8.94 times less per week during the intervention stage. The very low standard deviation of 1.140 for the exercise intervention during the baseline period helps to account for the high effect size. Therefore it is suggested that the results may be better accounted for by the change in the actual amount of inappropriate callouts for each intervention. This equates to 36.87 times less per week for the martial arts intervention compared to 8.94 times less per week for the exercise intervention.

Different aspects of the martial arts intervention program were utilized to help decrease the number of times that participants called out in class. The meditation portion, both active and inactive, helped the participant to focus their attention on the task at hand and not allow external stimuli to affect their desired goal. Typically, when children call out in class, they do so in an effort to let out whatever thoughts are going on in their mind as their impulses are difficult to control. In the martial arts intervention, the participants engaged in the inactive portion of meditation were asked to stand in an attention stance and close their eyes. They were then prompted with, “Let’s see who can be the best statue.” The verbal prompt was repeated in different ways up to three times if necessary.

The meditation process began at that juncture whether all participants were following directions or not. By engaging the participants in the meditation process the attention and focus of the participant was to delineate itself from the multiple issues and tasks of daily life to the specific training the participant was about to receive. When participants called out during meditation they were verbally prompted to redirect themselves to the current task.

Active meditation occurred throughout the entire class. It consisted of total concentration on the physical task attempting to be accomplished to enable the participants to maintain that higher level of concentration. It is believed that this constant focus on meditation caused a generalization to occur in school. The more focused the participant was in meditation the less likely they were to call out during the intervention. Similarly, the more focused the participant is during school to the teacher's directions or class work, the less likely they will call out in class because their attention and concentration are on the task needing to be accomplished, whether simply listening to the teacher or completing an assignment.

Hypothesis four posited that a martial arts program two times per week will decrease the number of times the participant inappropriately leaves the seat in class of children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program. This hypothesis was supported as the mean number of times the participant inappropriately left their seat in class for the martial arts intervention group decreased from 37.2 to 20.04 times weekly while the exercise intervention group decreased from 20.4 to 12.69 and control group increased from 23.2 to 25.69 times weekly. The significant effect size of –7.241 for the

martial arts intervention group is believed to be attributed to the structured environment that the martial arts program offered. Although the exercise intervention program had small breaks in which the instructor would explain the rules and ask for participants to pay attention so they could play, there was little structure specifically relating to sitting still in a seat or on the ground while waiting for a turn to engage in the activity. In the martial arts intervention participants were expected to sit on their knees with their hands firmly placed by their sides. The instructor would not speak until all students were sitting properly. As the weeks progressed, the participants in the martial arts intervention progressed from standing every so often, to sitting incorrectly, to sitting properly for a short period of time but fidgeting to finally sitting properly at attention. This seems to directly relate to sitting still in class as the participants in the martial arts intervention were forced to sit properly so often that it carried over into the classroom. The negative consequences of not being allowed to engage in the martial arts during the class when not sitting properly generalized to the classroom. Participants left their seat less often in school because they had become disciplined in giving respect to whomever was instructing them.

The fifth hypothesis that a martial arts program two times per week will improve academic performance of children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program was supported as well. This was sustained by the martial arts intervention group increasing their academic performance by 36.41% compared to an increase of 4.46% for the exercise intervention group and 1.77% for the control group. The effect size of –0.667 for the exercise intervention and 0.216 for the control group could not compare to effect

size of –15.97 for the martial arts intervention group. This was the largest of effect sizes for all hypotheses in this study. The tremendous increase in academic performance is contributed to the overall martial arts program in general. Each hypothesis discussed thus far coupled with hypotheses six and seven looked at specific symptoms of AD/HD that affect academic performance. By changing these specific symptoms such as decreasing inappropriate call-outs, increasing homework compliance, decreasing the amount of times the participant left the seat, and the other behaviors mentioned, overall academic performance should increase. The participant spent less time acting out and more time acting properly, therefore was able to sustain attention longer, concentrate better and perform at a higher academic level. This is evident by the –15.97 effect size for the martial arts intervention group. The martial arts intervention included the aforementioned inactive and active meditation, speaking specific words such as KIAI and OSU during training to make sure the student is paying attention, positive reinforcement through a stripe and belt system, intensive training drills for multitasking, attention and concentration building, and social training through partner interaction and participant to instructor interaction. By decreasing the individual maladaptive behaviors and increasing the adaptive behaviors, the overall academic performance of the participants increased. This is evidenced by the –15.97 effect size.

Hypothesis six stated that a martial arts program two times per week will decrease the amount of redirection to task of children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program. The exercise interventions effect size of -3.338 when compared to the effect size of the martial arts intervention at .6809 suggests that this hypothesis was not

supported. The larger standard deviation of .1969 for the baseline phase in the martial arts intervention seems to lend rationale as to why the effect size was not significant. There was a much lower standard deviation at .0585 for the exercise intervention group during baseline treatment. Therefore, although there was only a seven percent difference between the martial arts intervention group and exercise intervention groups ability to decrease the need to be redirected to task, the effect size was still significant. One reason why the exercise group needed less redirection in class may be accounted for by teacher expectations. When a student needs consistent redirection, the task to give that redirection becomes so daunting that it may seem easier to ignore the behavior then to actually redirect it. Since the hypotheses were supported in almost all areas for the martial arts intervention group, the behaviors of needing to be redirected to task may have been noticed more often when compared to the exercise intervention group because the exercise intervention group was still having multiple behavioral problems in other areas. Teachers may have concentrated more on the martial arts intervention group needing to be redirected to task because although these behaviors had been decreasing, they were not decreasing at the same speed as the other behaviors that had decreased. For the exercise intervention and control groups, teachers were noticing all of the behaviors outlined by the hypotheses and may have spent less time concentrating specifically on necessity to be redirected to task because of all of the other behaviors being exhibited.

The final hypothesis that a martial arts program two times per week would improve classroom preparation of children diagnosed with Attention Deficit Hyperactivity Disorder as compared to an exercise program or control group receiving no treatment program was supported because generalization had occurred for the marital arts

class to the educational class. Each martial arts intervention session required the participant to wear a traditional uniform, consisting of white pants, a robe top, and a belt denoting that participants rank and progress. It was obvious to the participants if they were not wearing their uniform because all students and participants were required to wear that uniform during each session. This created a natural contingency in which participants who were unprepared would see themselves as different which reduced the likelihood of coming unprepared again.

The giving out of stripes is a form of positive reinforcement for the participants. It is a tangible way to explain that they are doing a good job in the program. A participant would not receive the stripe on his belt if he was not prepared for class with the proper uniform and belt tied securely. The participant would be told that they would need to bring this belt to the next class and wear the proper uniform in order to receive their stripe. Participants were eager to earn these stripes as they learned that the more stripes they have the closer they are to receiving the next belt. This generalized to the classroom where students are expected to bring proper school materials to class. As the participants became used to coming prepared to the martial arts class, this generalized to the school class and they began to become prepared for school more often. This is evidenced by the martial arts intervention group being prepared for class on average 87.35 percent at the end of the intervention compared to that of only 67.40 and 37.81 percent for the exercise intervention and control group respectively.

Limitations of the Study

Although the majority of the hypotheses were empirically supported, there are still several limitations to this study. The first limitation regards the specific form of

martial arts used in the research. Although Tiger Schulmann's Karate encompasses numerous martial arts disciplines, the results of the study cannot be necessarily generalized to all forms of martial arts. Each martial arts discipline encorporates different teaching methodologies and a different structured environment into its program. Therefore, results may not necessarily be the same if different martial arts form had been researched.

Additionally, there are limitations to the design of the study itself. Findings may be limited as there are limitations inherent to single subject designs generalizability and external validity. Kazdin (1998) suggests that external validity can only be demonstrated through replication of the findings. Furthermore, he suggests that conclusions from case studies cannot be made without great ambiguity as results can be reinterpreted in many ways. This is because inferences are drawn through nonstatistical evaluation or visual inspection of the data. Although effect sizes were calculated in addition to visual inspection of the data, the results have less reliability then a more traditional statistical research design method.

Consideration should be given to the limitations of participant characteristics that may have interacted with specific treatment. The research conducted had an under-representation of minority groups, no variation in gender, and very little demographic differences between participants as they were all from the suburbs of Long Island, New York. The limitation exists as to whether these results would generalize to participants from other demographics, ethnicities, and gender. This limitation makes it difficult to assess whether the sample generalizes to the general population of students with AD/HD aged 8-11.

An additional limitation is a threat to external validity in reactivity to experimental arrangements (Kazdin, 1998). Results of an experiment can be influenced by the fact that participants are aware that they are being studied. Participants in all interventions were aware that data was being collected relating to their behavior in school. The research comes into question as to whether or not the participant's results were at all biased to behave differently because they were aware of data collection.

Clinical Implications

The clinical implications of this research suggest that a martial arts program is another area to be explored as an intervention for children with AD/HD. School psychologists have different paths they can utilize resulting from this research. Many school districts provide extra curricular activities and after school programs for free or nominal charges at the schools location. Petitioning administration or the parent teacher association to subsidize hiring an outside instructor of a highly structured martial arts program to teach class two times a week could afford the opportunity for children with AD/HD to engage in martial arts at the school. Combining this martial arts program with a behavior intervention plan to positively reinforce the increase of adaptive and decrease of maladaptive behavior may be an excellent alternative to treatments such as medication, social skills training or other behavior interventions.

Additionally, school psychologists who have identified children as needing extra support outside the classroom could utilize this research by suggesting to parents of children with AD/HD to look in their local area for martial arts schools that specialize in structured programs such as Tiger Schulmann's Karate. This will empower the parents to become involved in finding adequate supports for their child.

Adaptive physical education classes may be an alternative to outside lessons or after school lessons. Creating a certification program for physical education instructors based on the research conducted in this study could be utilized for beginning an adaptive physical education class. This could be used as an alternative to attending outside classes in martial arts that may be costly or diminish the necessity to hire an instructor to teach after school programs. An adaptive physical education program may be more useful because there may be better generalization to the classroom if the child immediately goes to education class after participating in the martial arts program.

It is important to keep in mind the incurred monetary cost of a martial arts program. Martial arts schools typically charge students monthly or by a block of classes. This can range anywhere from 8 dollars per class at some smaller schools to 25 dollars or more per class at larger schools. Private lessons are even more expensive. This becomes a limitation as underprivileged families will have difficulty finding funds to enroll their child in a martial arts school. The free intervention program offered may have presented a bias because parents may be more likely to take advantage of the free program offered. If the program required payment, families with monetary difficulties may not have participated. Furthermore, parent's of participants may have been more likely to engage their child in a less expensive or free intervention in the school simply because it would cost less or nothing. Therefore, although parents were willing to enroll their children as participants into the research study, they may be less likely to enroll their child in martial arts classes if they have to pay for those classes.

Implications for Future Research

Future research should explore the combination of the martial arts intervention in conjunction with another intervention such as medication. Assessing whether children with AD/HD become more adaptive when utilizing a martial arts intervention and medication, medication alone, martial arts alone, or without any formal intervention can help to decipher whether a combination of treatments may be more effective than a single treatment or absence of treatment.

In addition, conducting the intervention in a participant's physical education class as a separate intervention could prove useful to test generalizabiltiy across settings. It could be posited that a martial arts intervention group is more likely to generalize the knowledge they have attained to the classroom because less time has elapsed between the intervention and the education class. Therefore, using the intervention in an adaptive physical education class for twelve weeks may help increase generalization.

Future research should take into account the logistic issues surrounding generating a larger N size. School district's confidentiality regulations decrease their ability to participate in research studies. The process to convince school districts to supply names of possible participants was exhaustive because many principals, school psychologists and school districts as a whole had to overcome the obstacle of confidentiality of school records. These regulations protect the privacy of the participants and made it difficult to attain information from schools as to who was classified as having AD/HD and would possibly benefit from the interventions. Although many school psychologists and principals verbally expressed their support for the intervention, it was often explained that the particular school district was unwilling to release names of students that would qualify for the research study because of individual district

guidelines. This resulted in many school districts opting to continue with the current interventions in their schools and left the researcher to find other means to fill up slots for the interventions. Certain school psychologists were willing to participate in the research by calling individual parents of possible participants and giving them a contact number if they were interested in the intervention. This created a limitation because if a possible participant's parent is not empowered to take an active role in that participant's life then the initial contact to the researcher may be less probable. Therefore, trying to create this intervention on a large scale would be difficult unless school districts can find a way to release student information to those controlling the intervention while still keeping to confidentiality regulations. This will allow for direct contact to parents by those running the intervention and not the other way around.

One possible solution to this limitation is to have release forms available and given to parents at parent teacher conferences. Teachers can ask parents if they would be willing to sign a release of information form in order to have the possibility of providing the child's name and parent's phone number to researchers who may have interventions available for their child if needed. This will eliminate the school's apprehension towards releasing the student's name. Furthermore, it will allow researcher's to directly contact parents and have a better chance of direct initial contact with a possible participant's parents.

Additionally, future researchers should coordinate the twelve week program around the school calendar year. School vacations, reading days, teacher absence, and weekends cut down the amount of days data was able to be taken. For example, the martial arts intervention was 12 weeks in length including a 2 week baseline. Data was

missing from week five to six and eleven to twelve because of school vacations. One teacher who was taking data on three of her students was absent for two days because of a teacher conference. This limited the amount of data taken as well.

A possible solution to account for this limitation in future research is to extend the length of the intervention and collection of data for two extra weeks in order to collect a sufficient amount of data. In addition, starting the intervention directly after winter recess may offset the loss of one week's data because there are typically enough weeks before spring recess and after spring recess to complete the study. Training substitute teachers on how to collect data for the intervention would allow for data to be taken on days in which a teacher is absent.

Furthermore, the research conducted was with males only. Reassessing this study across genders would be useful in finding out whether females with AD/HD become less adaptive, as adaptive, or more adaptive than males with AD/HD when engaged in a martial arts intervention program. If the level of adaptation proves to be different across genders, researchers may be able to decipher the best method of intervention when dealing with male and female children with AD/HD.

Summary

This research suggests that a martial arts program two times per week is effective at increasing adaptive behaviors and decreasing maladaptive behaviors. Schoolteachers completed a behavior checklist both initially during the baseline period and throughout the 12-week study to measure the effectiveness of both intervention groups and the non-intervention group on the behaviors of AD/HD children. The results suggest that five of seven hypotheses were proven which indicates the need to continue research in the field

of martial arts and AD/HD in an effort to create interventions in the school system as alternatives to interventions that may not be influencing the child life positively. This research is a starting point in the essential need to establish efficacious methods to treat symptoms associated with AD/HD.

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Appendix A

*DSM-III**	*DSM-III-R†*
A. Inattention. At least three of the following: 1. Often fails to finish things he or she starts 2. Often doesn't seem to listen 3. Easily distracted 4. Has difficulty concentrating on schoolwork or other tasks requiring sustained attention 5. Has difficulty sticking to play activity	A. A disturbance of at least 6 months during which at least eight of the following are present 1. Often fidgets with hands or feet or squirms in seat (in adolescents, may be limited to subjective feelings of restlessness) 2. Has difficulty remaining seated when required to do so 3. Is easily distracted by extraneous stimuli 4. Has difficulty awaiting turn in games or group situations 5. Often blurts out answers to questions before they have been completed 6. Has difficulty following through on instructions from others (not due to oppositional behavior or failure of comprehension), eg, fails to finish chores 7. Has difficulty sustaining attention in tasks or play activities 8. Often shifts from one uncompleted activity to another 9. Has difficulty playing quietly 10. Often talks excessively 11. Often interrupts or intrudes on others, eg, butts into other children's games 12. Often does not seem to listen to what is being said to him or her 13. Often loses things necessary for tasks or activities at school or at home (eg, toys, pencils, books, assignments) 14. Often engages in physically dangerous activities without considering possible consequences (not for the purpose of thrill-seeking), eg, runs into street without looking
B. Impulsivity. At least three of the following: 1. Often acts before thinking 2. Shifts excessively from one activity to another 3. Has difficulty organizing work (this not being due to cognitive impairment) 4. Needs a lot of supervision 5. Frequently calls out in class 6. Has difficulty awaiting turn in games or group situations	
C. Hyperactivity. At least two of the following: 1. Runs about or climbs on things excessively 2. Has difficulty sitting still or fidgets excessively 3. Has difficulty staying seated 4. Moves about excessively during sleep 5. Is always "on the go" or acts as if "driven by a motor"	
D. Onset before the age of 7	B. Onset before the age of 7
E. Duration of at least 6 months	
F. Not due to schizophrenia, affective disorder, or severe or profound mental retardation	C. Does not meet the criteria for pervasive developmental disorder

DMS-IV‡	
A. Either (1) or (2): (1) Six (or more) of the following symptoms of inattention have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level: *Inattention* (a) Often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities (b) Often has difficulty sustaining attention in tasks or play activities (c) Often does not seem to listen when spoken to directly (d) Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior) or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework) (e) Often has difficulty organizing tasks and activities (f) Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework) (g) Often loses things necessary for tasks or activities (eg, toys, school assignments, pencils, books, or tools) (h) Is often easily distracted by extraneous stimuli (i) Is often forgetful in daily activities	(2) Six (or more) of the following symptoms of hyperactivity-impulsivity have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level: *Hyperactivity* (a) Often fidgets with hands or feet or squirms in seat (b) Often leaves seat in classroom or in other situations in which remaining seated is expected (c) Often runs around or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings or restlessness) (d) Often has difficulty playing or engaging in leisure activities quietly (e) Is often "on the go" or often acts as if "driven by a motor" (f) Often talks excessively *Impulsivity* (g) Often blurts out answers before questions have been completed (h) Often has difficulty awaiting turn (i) Often interrupts or intrudes on others (eg, butts into conversations or games)
B. Some hyperactive-impulsive or inattentive symptoms that caused impairment were present before age 7 years	D. There must be clear evidence of clinically significant impairment in social, academic, or occupational functioning
C. Some impairment from the symptoms is present in two or more settings (eg, at school [or work] and at home	E. The symptoms do not occur exclusively during the course of a pervasive developmental disorder, schizophrenia, or other psychotic disorder and are not better accounted for by another mental disorder (eg, mood disorder, anxiety disorder, dissociative disorder, or a personality disorder)

[*] American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders.* 3rd ed. Washington, DC: American Psychiatric Association, 1980

[†]American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders.* 3rd ed, rev. Washington, DC: American Psychiatric Association, 1987

[‡]American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders.* 4th ed. Washington, DC: American Psychiatric Association, 1994

Appendix B

DSM-IV Criteria for AD/HD

I. Either A or B:

A. Six or more of the following symptoms of inattention have been present for at least 6 months to a point that is disruptive and inappropriate for developmental level:

Inattention

1. Often does not give close attention to details or makes careless mistakes in schoolwork, work, or other activities.
2. Often has trouble keeping attention on tasks or play activities.
3. Often does not seem to listen when spoken to directly.
4. Often does not follow instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions).
5. Often has trouble organizing activities.
6. Often avoids, dislikes, or doesn't want to do things that take a lot of mental effort for a long period of time (such as schoolwork or homework).
7. Often loses things needed for tasks and activities (e.g. toys, school assignments, pencils, books, or tools).
8. Is often easily distracted.
9. Is often forgetful in daily activities.

B. Six or more of the following symptoms of hyperactivity-impulsivity have been present for at least 6 months to an extent that is disruptive and inappropriate for developmental level:

Hyperactivity

1. Often fidgets with hands or feet or squirms in seat.
2. Often gets up from seat when remaining in seat is expected.
3. Often runs about or climbs when and where it is not appropriate (adolescents or adults may feel very restless).
4. Often has trouble playing or enjoying leisure activities quietly.
5. Is often "on the go" or often acts as if "driven by a motor".
6. Often talks excessively.

Impulsivity

1. Often blurts out answers before questions have been finished.
2. Often has trouble waiting one's turn.

3. Often interrupts or intrudes on others (e.g., butts into conversations or games).

II. Some symptoms that cause impairment were present before age 7 years.
III. Some impairment from the symptoms is present in two or more settings (e.g. at school/work and at home).
IV. There must be clear evidence of significant impairment in social, school, or work functioning.
V. The symptoms do not happen only during the course of a Pervasive Developmental Disorder, Schizophrenia, or other Psychotic Disorder. The symptoms are not better accounted for by another mental disorder (e.g. Mood Disorder, Anxiety Disorder, Dissociative Disorder, or a Personality Disorder).

Based on these criteria, three types of AD/HD are identified:

1. AD/HD, *Combined Type*: if both criteria 1A and 1B are met for the past 6 months
2. AD/HD, *Predominantly Inattentive Type*: if criterion 1A is met but criterion 1B is not met for the past six months
3. AD/HD, *Predominantly Hyperactive-Impulsive Type*: if Criterion 1B is met but Criterion 1A is not met for the past six months.

American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision. Washington, DC, American Psychiatric Association, 2000.

Appendix C

Brand Name	Generic Name	Additional Information
Stimulants		
Adderall	Amphetamine	Combination of amphetamine salts, believed to be longer-acting than regular methylphenidate.
Adderall XR	Amphetamine	Approved in Oct. 2001 by FDA, Adderall XR is an extended-release formulation of Adderall. Symptoms addressed in clinical trials included hyperactivity, impulsivity and the inability to work, focus and learn.
Concerta	methylphenidate	Approved in August, 2000 by FDA. First extended release form. Unlike other extended release medications, Concerta uses a unique system that relies on osmotic pressure to deliver the active medication. Tablets cannot be split or broken. Doses are available in 18mg, 36mg and 54mg.
Cylert	Pemoline	This medication has been associated with acute liver problems, and the manufacturers are now telling physicians to discuss the risks and obtain patient consent before prescribing.
Dexadrine	dextroamphetamine	Decreases distractibility, impulsivity, and hyperactivity. Available in long-acting spanules.
DextroStat	dextroamphetamine sulfate	Decreases distractibility, impulsivity, and hyperactivity. May also increase attention span.
Focalin	dexmethylphenidate hydrochloride	Approved in Nov. 2001 by FDA. Once-daily treatment believed to block the reuptake of norepinephrine and dopamine into the presynaptic neuron and increase the release of these monoamines into the extraneuronal space.
Metadate ER	methylphenidate	Approved in April. 2001 by FDA. Extended release form uses a two-phase release process to deliver an initial rapid release of methylphenidate followed by a second continuous release phase. Designed as a once-daily treatment for AD/HD
Methylin ER	methylphenidate	Approved in May, 2000 by FDA. Extended release form
Ritalin	methylphenidate	Oldest available medication for AD/HD. Still considered the "first choice" by many physicians.
Ritalin SR	methylphenidate	Extended release form
Antihypertensives		
Catapres	Clonidine	Comes in patches and tablets; often prescribed with a

		stimulant, Helps impulsivity, sleep problems, frustration tolerance, and activity; but not attention. Affects the neurotransmitter norepinephrine.
Tenex	Guanfacine	Primarily for blood pressure problems, but has found to reduce hyperactivity, sleep problems, frustration tolerance; no known affect on inattention. Affects the neurotransmitter norepinephrine.
Antidepressants		
Effexor	Verlafixine	Introduced in 1993; thought to provide the benefits of both SSRIs and TCAs. Not typically used for children.
Elavil	amitryptyline	Tricyclic antidepressant, works on impulsivity, hyperactivity and defiance.
Luvox	fluvoxamine	Selective Serotonin Reuptake Inhibitor (SSRI). Known to treat mood and anxiety disorders, might actually increase impulsivity. Usually prescribed if patient has comorbid disorders that apply, then additional medication will be used for other AD/HD symptoms.
Norpramin	desipramine	Tricyclic antidepressant, improves mood, hyperactivity and emotional ups and downs; some effect on attention.
Pamelor	nortryptyline	Tricyclic antidepressant; has been effective on young children who are impulsive, hyperactive, and defiant. Monitor cardiac activity during treatment.
Paxil	Paroxetine	Selective Serotonin Reuptake Inhibitor (SSRI). Known to treat mood and anxiety disorders, might actually increase impulsivity. Usually prescribed if patient has comorbid disorders that apply, then additional medication will be used for other AD/HD symptoms.
Prozac	Fluoxetine	Selective Serotonin Reuptake Inhibitor (SSRI). Known to treat mood and anxiety disorders, might actually increase impulsivity. Usually prescribed if patient has comorbid disorders that apply, then additional medication will be used for other AD/HD symptoms.
Tofranil	imipramine	Tricyclic antidepressant, improves mood, hyperactivity and emotional ups and downs, and concentration.
Wellbutrin	buproprion	Works by increasing the levels of the neurotransmitters dopamine and norepinephrine in the brain. Used to treat AD/HD and depression; under a different brand name (Zyban) used for smoking cessation.
Zoloft	Sertraline	Selective Serotonin Reuptake Inhibitor (SSRI). Known to treat mood and anxiety disorders, might actually increase impulsivity. Usually prescribed if patient has comorbid disorders that apply, then additional medication will be used for other AD/HD symptoms.
Anticonvulsants		

Depakote	Vaproate	This drug carries a warning about its use being associated with hepatic (liver) failure. Make sure you understand the substantial risks with this medication.
Tegretol	Carbamazepine	Often used in combination with a stimulant when bipolar disorder also indicated; considered a mood stabilizer.
Antianxiety Medications		
Ativan	Lorazepam	Used to relieve anxiety and nervousness; slows down CNS
BuSpar	Busiprone	Used to relieve certain anxiety states

Appendix D

BEHAVIORAL TREATMENT METHOD	ESSENTIAL COMPONENTS	ADVANTAGES
1. social reinforcement	-give social praise for appropriate behaviors -consistency	-improves environment and relationships -enhances generalization and maintenance
2. reinforcement means	-child contingently receives tangible rewards which he/she chooses for appropriate behavior -reinforces have to be feasible, reinforcing, and not otherwise available to the child	-predictable, tangible rewards have strong, immediate effects on behavior -allows child to take an active part in the treatment plan and increases motivation
3. time-out from positive reinforcement	-child is sent to a nonreinforcing environment for misbehaving -a general rule for time-out length is one minute per year of age	-very effective if correctly implemented -increases the strength of reinforcement techniques
4. reductive procedures (e.g., DRL, DRO, DRI, and DRA)	-differently reinforce lower rates other behaviors, incompatible behaviors, and alternative behaviors	-well-suited for initial decreasing of high rates of inappropriate behaviors -focuses on the appropriate, positive behaviors and provides the child with guidelines for

		what he/she should do
5. response cost techniques	-child loses a positive reinforcer (e.g., TV time, recess) for inappropriate behavior	-easy to implement -effective if loss is meaningful to the child
6. token economics	-combination of reinforcement and punishment components -child receives for appropriate behaviors and loses tokens for inappropriate behaviors -tokens can be used to purchase valued rewards or privileges	-the combination of reinforcement and punishment is very powerful and effective -helps child to clearly discriminate between appropriate and inappropriate behavior -child motivation enhanced through self-selection of reinforcers
7. contingency contracting	-draw up a contract with child specifying contingencies of specific appropriate and inappropriate behaviors -both parties (the authority figure and the child) agree to the contingencies and sign the contract	-can involve several environment (e.g., make home contingencies for school behavior) -child more willing to accept consequences since he/she helps determine and agrees agrees to them -peer pressure can be utilized through the use of group contingencies
8. behavioral parent training	-train parents in the use of behavioral	-helps the generalization and

	treatment programs	maintenance of treatment effects -gives parents a valuable tool to use with other children
9. training teacher training	-train teachers in the use of behavioral treatment programs	-helps the generalization and maintenance of treatment effects -gives teachers a valuable tool to use throughout their career

BEHAVIORAL TREATMENT METHOD	POTENTIAL PROBLEMS
1. social reinforcement	-may not have strong, immediate effects on behavior -difficult to be consistent
2. reinforcement means	-if used alone may not enhance generalization or maintenance of behavioral improvements -if reinforcers are not feasible, not reinforcing, commonly available, given noncontingently or inconsistently, they will not be effective
3. time-out from positive reinforcement	-difficult to implement correctly -can become a positive, attention-getting experience -will not be effective if

	used outside the context of a reinforcing environment
4. reductive procedures (e.g., DRL, DRO, DRI, and DRA)	-ineffective if not implemented in a consistent, contingent manner
	-behavioral changes may not maintain or generalize to other environments
5. response cost techniques	-ineffective if not Implemented in a consistent, contingent manner
	-ineffective if not used in the context of a reinforcing environment
6. token economics	-requires a lot of time and energy to implement
	-if not implemented consistently and contingently, will not be effective
	-long-term maintenance of behavioral change and generalization to environments where the token system is not in place may not occur
7. contingency contracting	-set up, implementation and follow through require time and energy
	-ineffective if contingencies are not implemented based on the behavior
8. behavioral parent training	-ineffective if parents are unwilling or unable to

	learn and implement the behavioral principles
9. training teacher training	-ineffective if teachers are unwilling or unable to learn and implement the behavioral principles

Appendix E

MORAND-KLEIN MALADAPTIVE BEHAVIOR CHECKLIST

Student Code Number_____ Date _____

Teacher _____

For each of the below items, please estimate the above student's performance during today's school day. Answer each item in the blank spaces provided. If a question does not apply for that particular day place the letters "n/a" in the blank space. If a behavior was not seen during that school day, place a "O" in the blank space provided.

---

1. Student completed homework assignment from previous night: tasks assigned ____ tasks completed ____

---

2. Student broke teacher's rules: number of times broken in school day ____

---

3. Student called out in class without raising his/her hand: number of inappropriate callouts ____

---

4. Student is inappropriately out of seat: number of times student leaves seat ____

---

5. Completion of in class assignments tasks assigned ____ tasks completed ____

---

6. Student needs to be redirected to task Number of times student needs to be redirected to task ____

---

7. Student is not prepared for class (must have all items necessary for class)
Missing pen ____
Missing Pencil ____
Missing Textbooks ____
Other ____

Appendix F

HOFSTRA UNIVERISTY
NEW YORK

Martial Arts As An Intervention for Maladaptive Behavior of Children With AD/HD

Hofstra University doctoral candidate is looking for children 8-11 years old who:

a) have been diagnosed with AD/HD-Combined Type by the Committee on Special Education or by a pediatric psychiatrist,
b) have an individualized education plan (IEP) currently in effect,
c) are not currently on any medication to address AD/HD symptoms,
d) have a schoolteacher who will fill out a short checklist each day from the inception of the program until completion
e) will be able to attend a martial arts or exercise intervention program twice a week for 8-12 weeks in a row,

to participate in a research project. The study is seeking to evaluate the effects of martial arts or exercise training on maladaptive behavior of children with AD/HD. All teacher's fully compliant with the checklist will be entered into a raffle for tickets to a Broadway show. For further information contact the researcher Matthew at (516) 241-4186.

Appendix G

HOFSTRA UNIVERSITY
NEW YORK

TEACHER CONSENT FORM

I, _____, agree to participate in an intervention program involving my student _____. I understand that I will have to fill out a questionnaire:

a) for a baseline of two weeks, Monday trough Friday, before my student begins his/her intervention program,
b) every day of the intervention program in which my student is present in class for 10 weeks,
c) the objective checklist I will need to fill out will be ready each Friday for the doctoral candidate to pick up.

I understand my name will not appear on any forms and will remain strictly confidential. Further, I understand that the information will be combined with the responses of a sizeable group of other schoolteacher's forms for a study on the effects of a Martial Arts training intervention or exercise training intervention on maladaptive behavior of children diagnosed with Attention Deficit Hyperactivity Disorder. At the completion of the study, I may have a copy of the report upon my request. I realize that the Department of Psychology faculty at Hofstra University is supervising this study. Participation in all aspects of this study is at the teacher's own risk. I have the right to end my participation in this study at any juncture that I see fit if necessary.

Teacher: _____ Date: _____

Parent/Guardian: _____ Date:_____

HOFSTRA UNIVERSITY
NEW YORK

PARTICIPANT CONSENT FORM

I, _____ give my permission to participate in a martial arts class two days a week for ten weeks at Tiger Schulmann's Karate studio in Massapequa Park, New York. I understand my name will not appear on any pieces of paper and my name no one will know that I am part of this program other than my parents, the instructor, and my schoolteacher. I will be involved in physical activity twice a week for one hour each time. I must attend every class in order to participate in this program. Further, I understand that my schoolteacher will fill out a form each day of the program. The information will be put together with other schoolteacher's forms for a study on Martial Arts training. At the completion of the study, I may have a copy of the report if I ask for it. I realize that the Department of Psychology faculty at Hofstra University is supervising this study. Participation in all aspects of this study is at my own risk. I have the right to end my participation in this study at any point that I see fit if necessary.

Participant: _____
Parent of Participant: _____
Date: _____

HOFSTRA UNIVERSITY
NEW YORK

PARENTAL CONSENT FORM

I give permission for my child _____ to participate in a martial arts intervention program two days a week for ten weeks at Tiger Schulmann's Karate studio in Massapequa Park, New York. I understand his/her name will not appear on any forms and his/her name will remain strictly confidential. Further, I understand that the participant's schoolteacher will fill out a form each day of the intervention program in which the child attends classes. The information will be combined with the responses of a sizeable group of other schoolteacher's forms for a study on the effects of a Martial Arts training intervention or exercise training on maladaptive behavior of children diagnosed with Attention Deficit Hyperactivity Disorder. At the completion of the study, I may have a copy of the report upon my request. I realize that the Department of Psychology faculty at Hofstra University is supervising this study. Participation in all aspects of this study is at the child and parent's own risk. I have the right to end my participation in this study at any juncture that I see fit if necessary.

Parent/Guardian: _____
Date:_____

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HEMPSTEAD NEW YORK

Appendix H

Code # _____

DEMOGRAPHIC FORM

1. Age: _____
2. Sex: M F
3. Ethnicity: _____
4. Is your child involved in any other sport at this time?
   Yes _____ No _____
   If yes, which sport (s)? _____
5. Has your child ever taken a martial arts class or intensive exercise class?
   Yes _____ No _____
6. Is your child experiencing any health difficulties at this time?
   Yes _____ No _____
7. Is your child diagnosed with Attention Deficit Hyperactivity Disorder Combined Type?
   Yes _____ Who diagnosed your child? _____ No _____
8. Does your child have an existing Individualized Education Plan (IEP)?
   Yes _____ No _____
9. What services does your child receive in school and out of school?
   _____

Appendix I

Martial Arts Daily Checklist

1.	Was initial meditation completed?	Yes___	No___
2.	Was KIAI explained?	Yes___	No___
3.	Was OSU explained?	Yes___	No___
4.	Was defensive stance completed?	Yes___	No___
5.	Were training drills completed?	Yes___	No___
6.	Were close range defense moves completed?	Yes___	No___
7.	Was closing meditation completed?	Yes___	No___
8.	Were stripes given out appropriately?	Yes___	No___
9.	Was TSK manual followed completely?	Yes___	No___

Appendix J

Intervention Rating Profile-15
(IRP-15)

The purpose of this questionnaire is to obtain information that will aid in the selection of classroom interventions. These interventions will be used by teachers of children with behavior, emotional, and/or academic problems. In relation to the intervention your child was a part, please circle the number which best describes your agreement or disagreement with each statement.

1 Strongly Disagree	2 Disagree	3 Slightly Disagree	4 Slightly Agree	5 Agree	6 Strongly Agree

1. This was an acceptable intervention for the child's problem behavior. 1 2 3 4 5 6
2. Most teachers would find this intervention appropriate for behavior problems in addition to the one treated. 1 2 3 4 5 6
3. This intervention was effective in changing the child's problem behavior. 1 2 3 4 5 6
4. I would suggest the use of this intervention to other teachers. 1 2 3 4 5 6
5. The child's behavior problem was severe enough to warrant the use of this intervention. 1 2 3 4 5 6
6. Most teachers would find this intervention suitable for the behavior problems treated. 1 2 3 4 5 6
7. I was willing to use this intervention in the classroom setting. 1 2 3 4 5 6
8. This intervention did not result in negative side-effects for the child. 1 2 3 4 5 6
9. This intervention would be appropriate for a variety of children. 1 2 3 4 5 6
10. This intervention was consistent with Those I have used in classroom settings. 1 2 3 4 5 6

APPENDIX K (con't)

1 Strongly Disagree	2 Disagree	3 Slightly Disagree	4 Slightly Agree	5 Agree	6 Strongly Agree

11. The intervention was a fair way to handle the child's problem behavior. 1 2 3 4 5 6

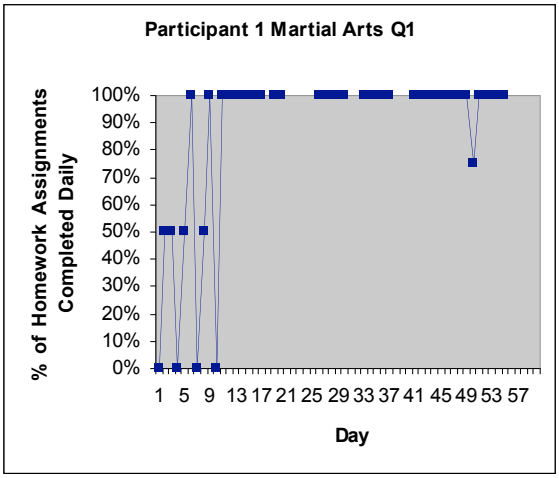
12. This intervention was reasonable for the behavior problem treated. 1 2 3 4 5 6

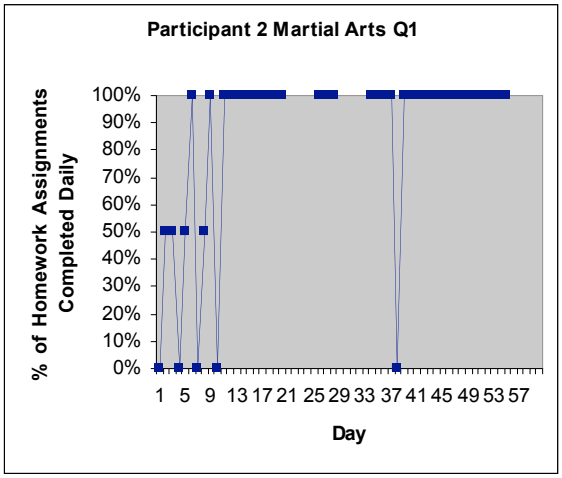
13. I liked the procedures used in this intervention. 1 2 3 4 5 6

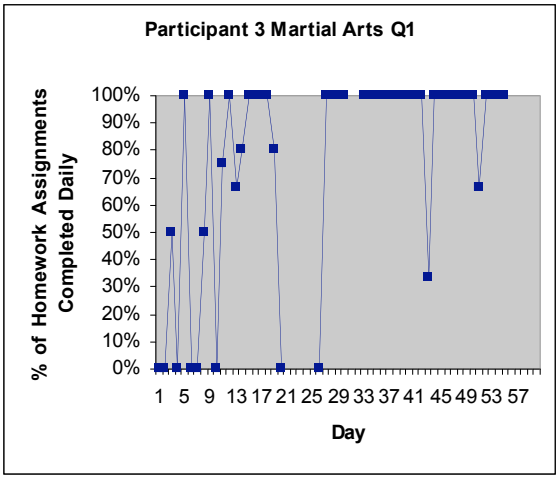
14. This intervention was a good way to handle this child's behavior problem. 1 2 3 4 5 6

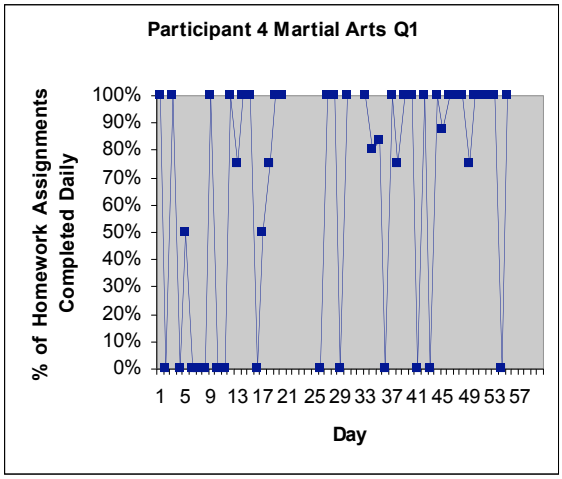
15. Overall, this intervention was beneficial for the child. 1 2 3 4 5 6

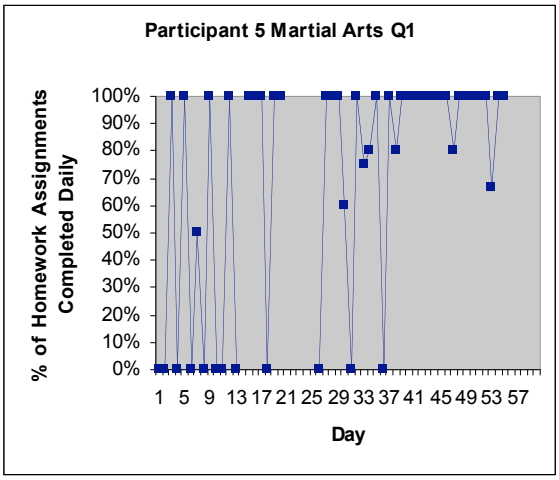
Appendix K- Individual Participant's Daily Results for Martial Arts, Exercise and Control Groups for Question One

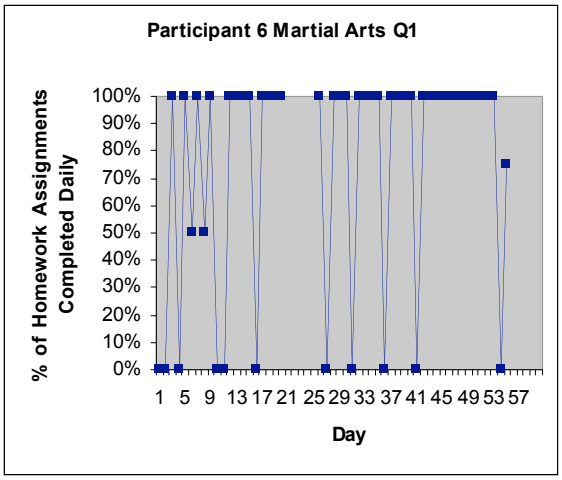


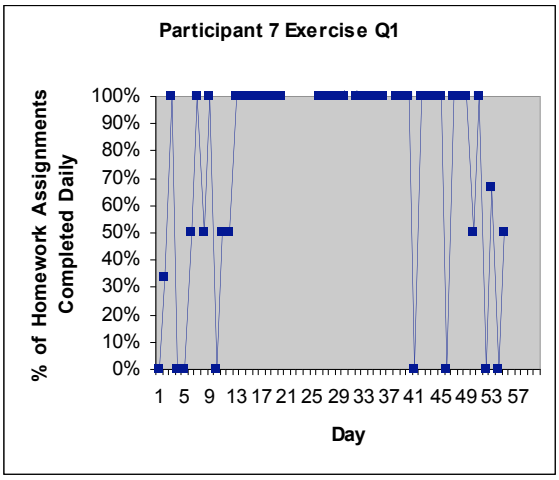


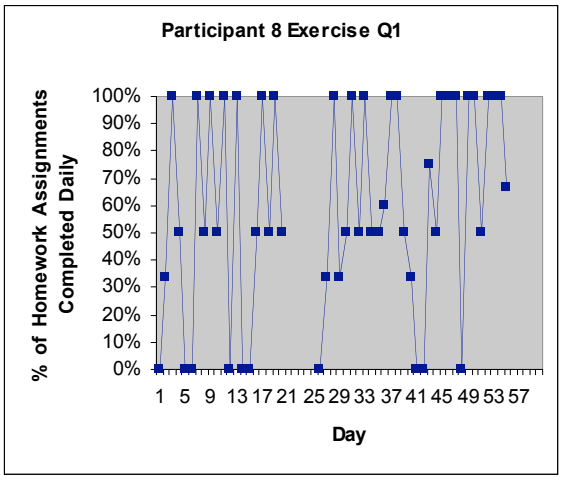









Participant 7 Exercise Q1
% of Homework Assignments Completed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day


Participant 8 Exercise Q1
% of Homework Assignments Completed Daily
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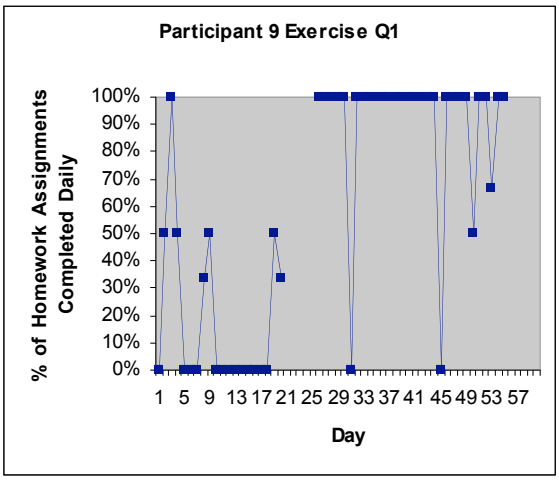
Day


Participant 9 Exercise Q1
% of Homework Assignments Completed Daily
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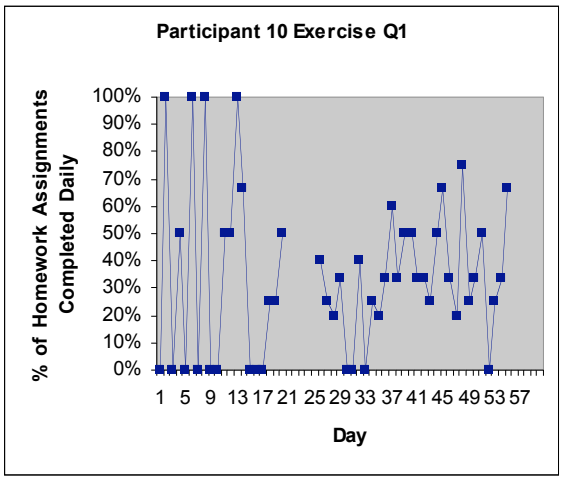
Day


Participant 10 Exercise Q1
% of Homework Assignments Completed Daily
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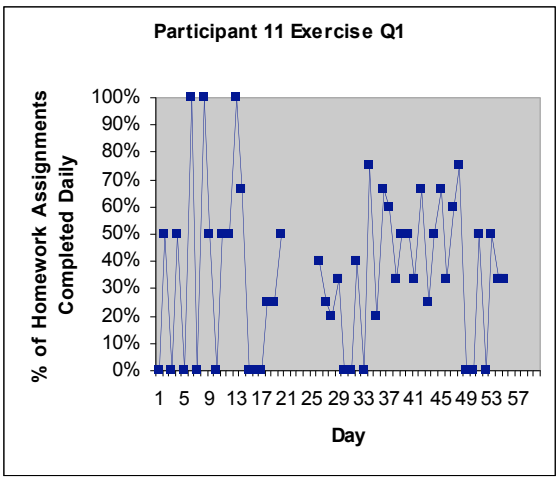
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day


Participant 11 Exercise Q1
% of Homework Assignments Completed Daily
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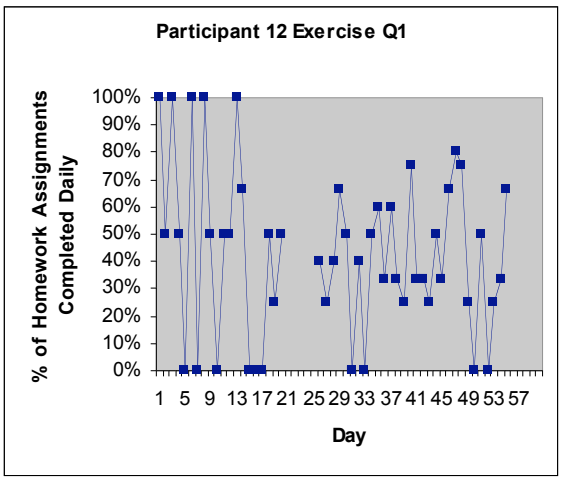
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day


Participant 12 Exercise Q1
% of Homework Assignments Completed Daily
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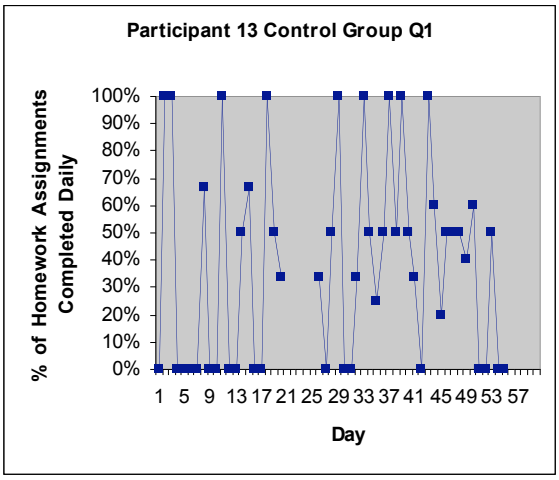
Day


Participant 13 Control Group Q1
% of Homework Assignments Completed Daily
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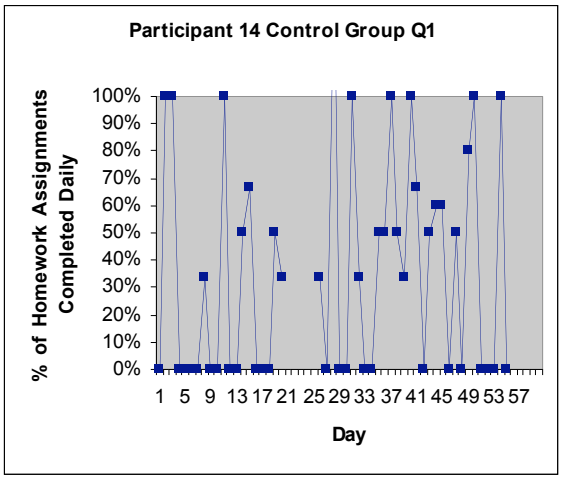
Day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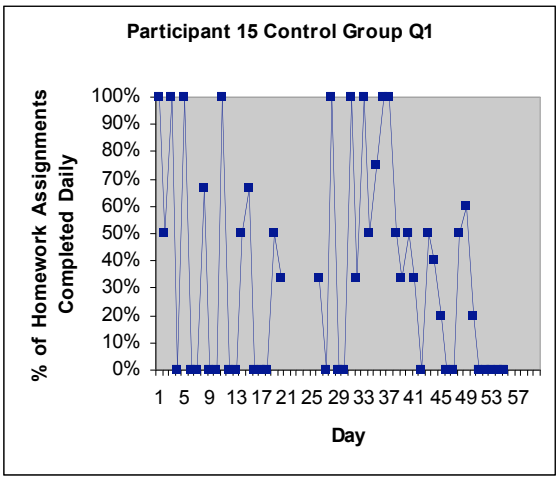
Day


Participant 15 Control Group Q1
% of Homework Assignments Completed Daily
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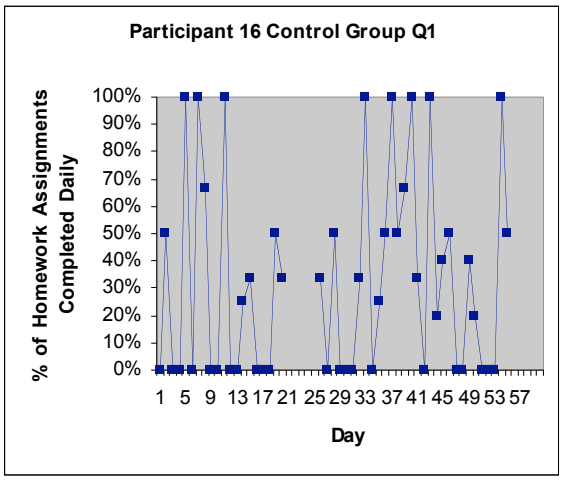
Day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% of Homework Assignments Completed Daily
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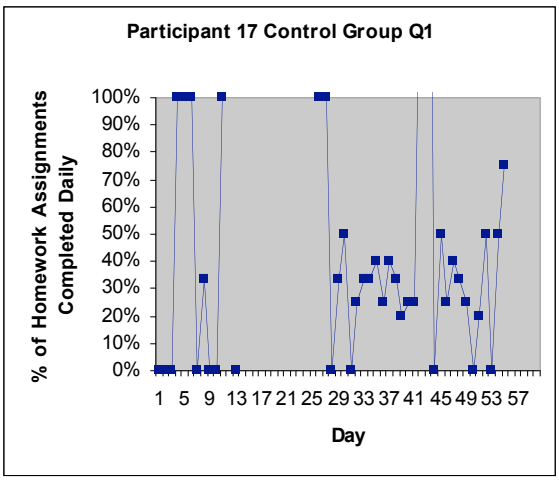
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day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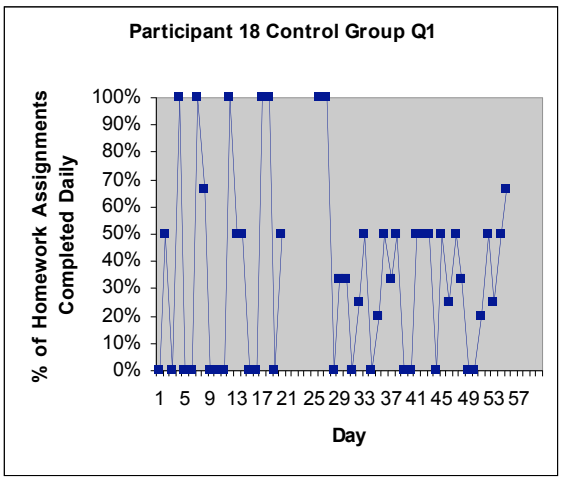
Day


Participant 18 Control Group Q1
% of Homework Assignments Completed Daily
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90%
80%
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60%
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30%
20%
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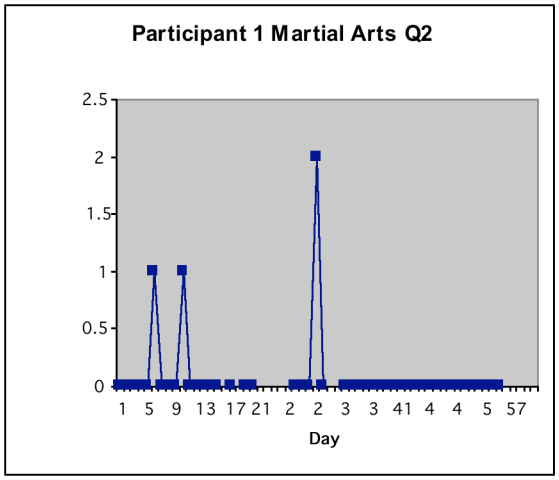
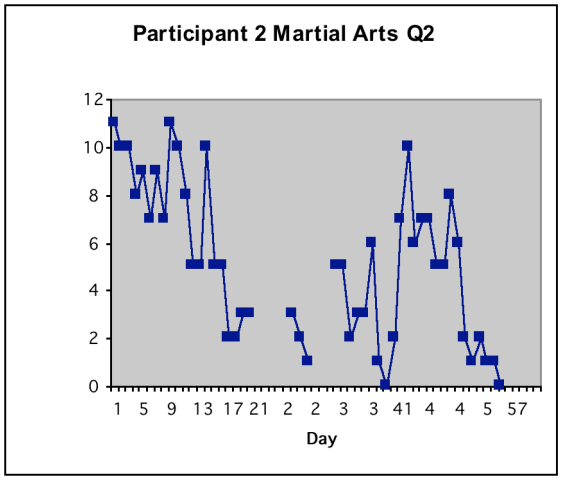
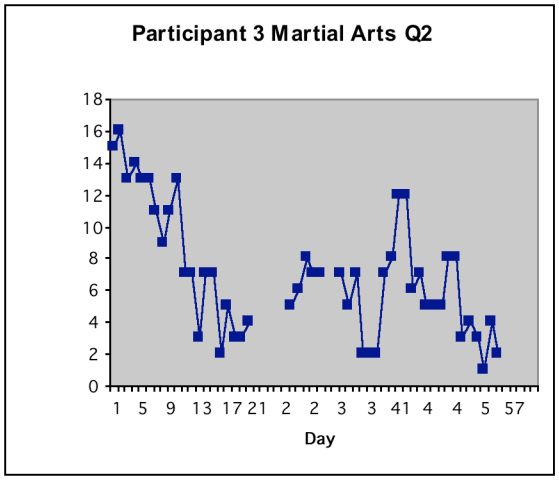
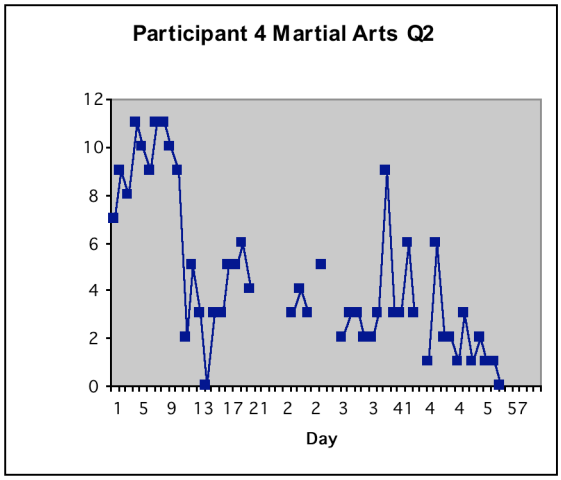
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

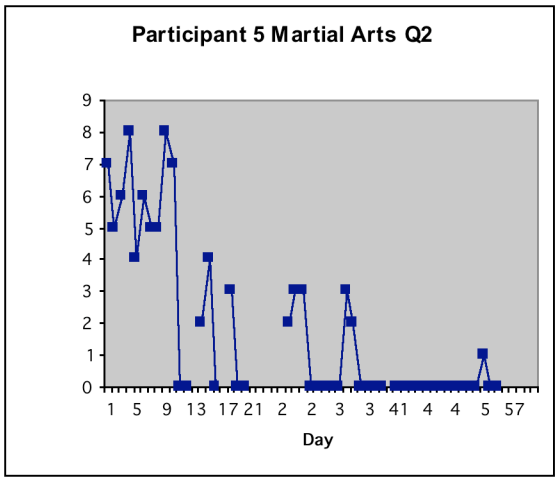
Appendix L- Individual Participant's Daily Results for Martial Arts, Exercise and Control Groups for Question Two

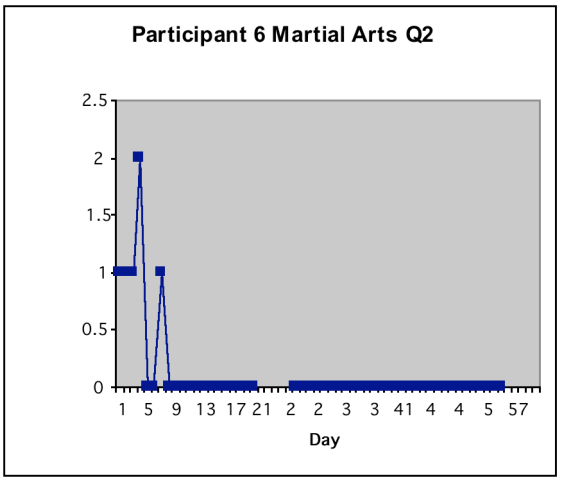


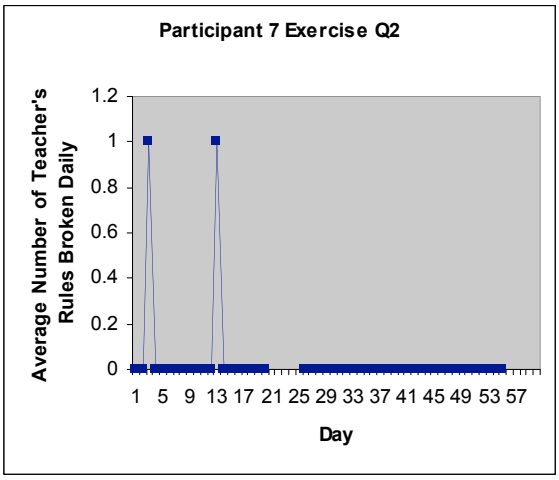











Participant 7 Exercise Q2
Average Number of Teacher's Rules Broken Daily
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0.8
0.6
0.4
0.2
0
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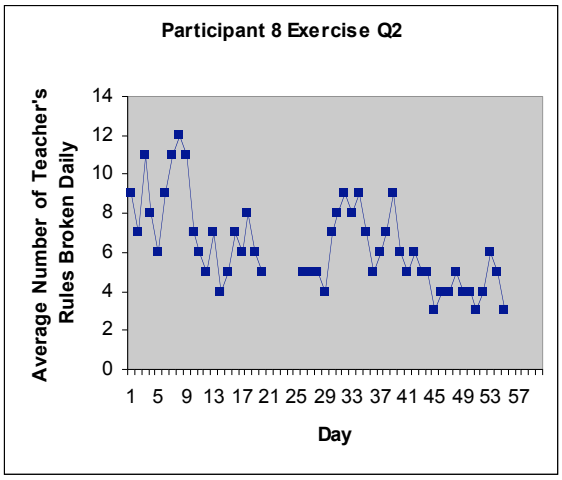
Day


Participant 8 Exercise Q2
Average Number of Teacher's Rules Broken Daily
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10
8
6
4
2
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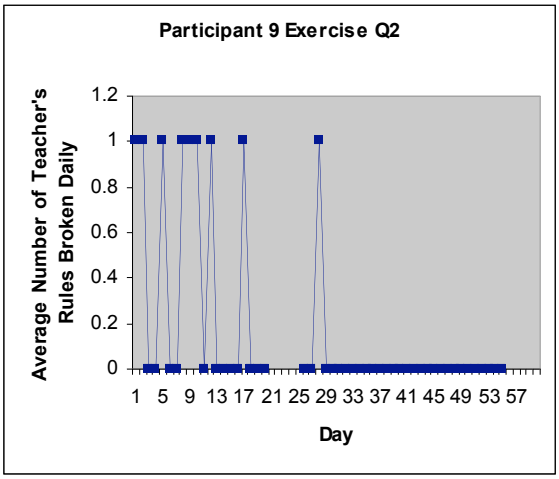
Day


Participant 9 Exercise Q2
Average Number of Teacher's Rules Broken Daily
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0.4
0.2
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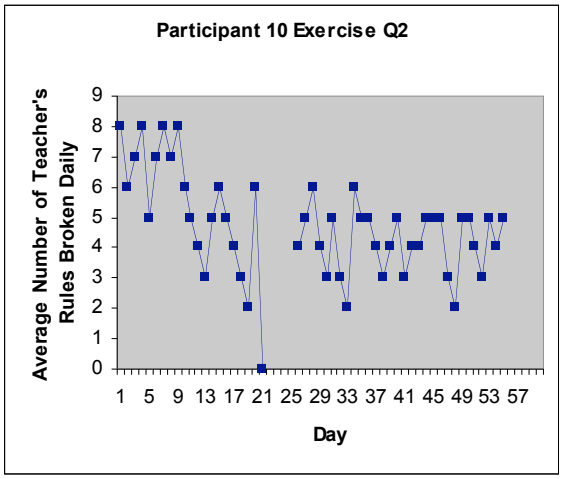
Day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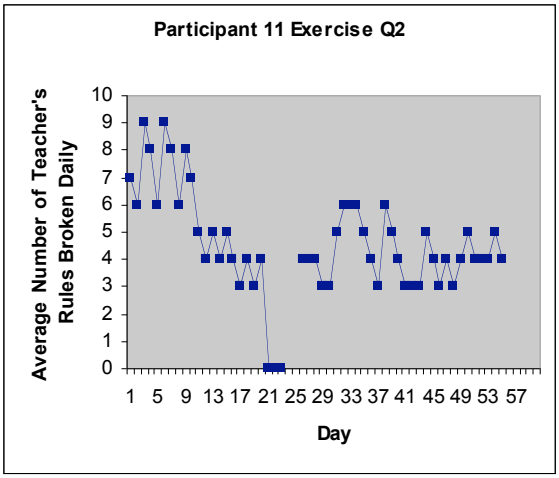
Day


Participant 11 Exercise Q2
Average Number of Teacher's Rules Broken Daily
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8
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6
5
4
3
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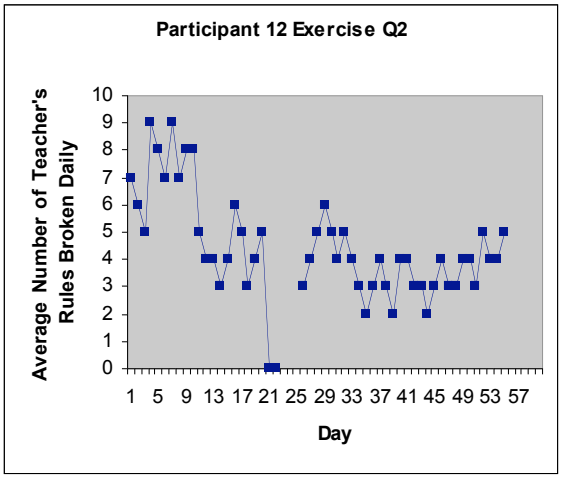
Day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Average Number of Teacher's Rules Broken Daily
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8
7
6
5
4
3
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1
0
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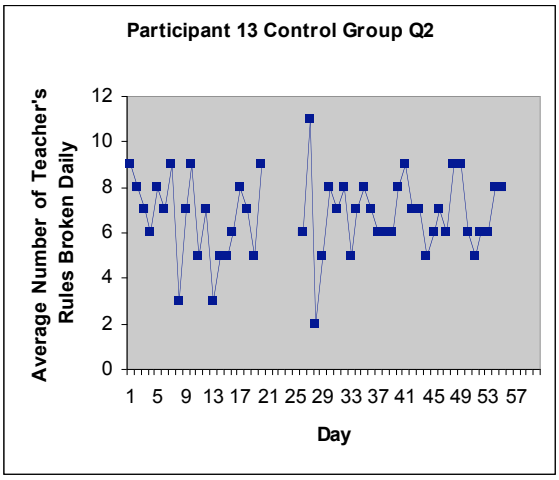
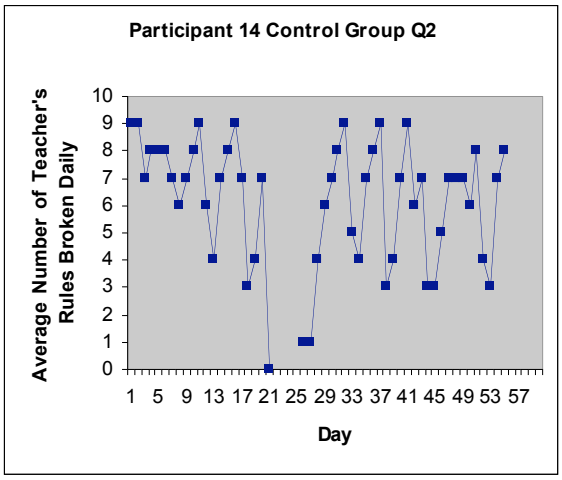
Day


Participant 13 Control Group Q2
Average Number of Teacher's Rules Broken Daily
Day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Average Number of Teacher's Rules Broken Daily
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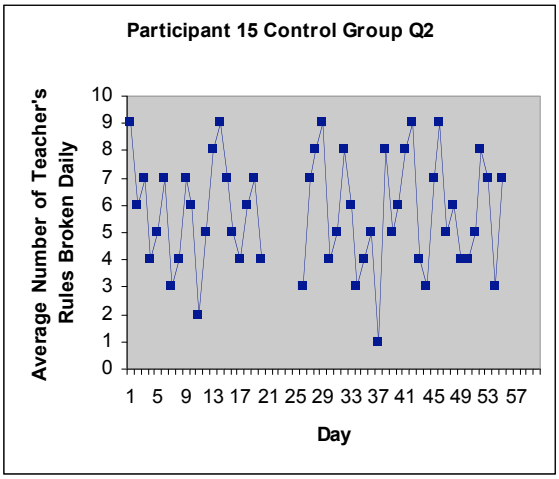
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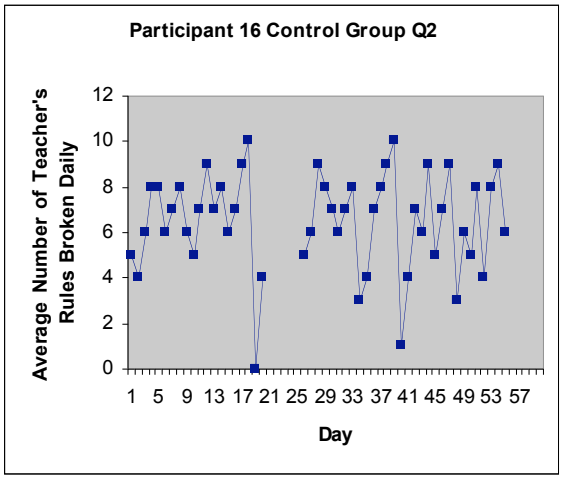
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Average Number of Teacher's Rules Broken Daily
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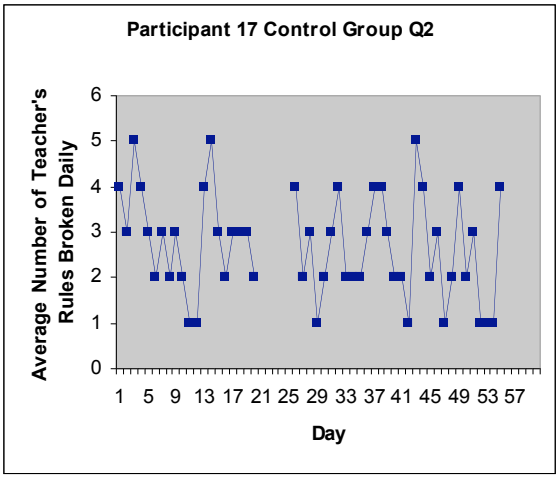
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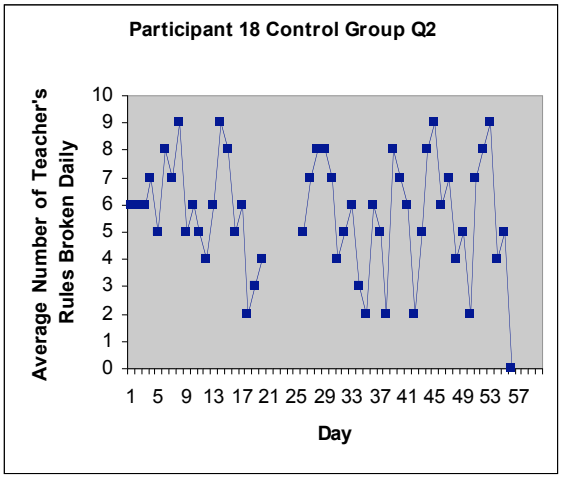
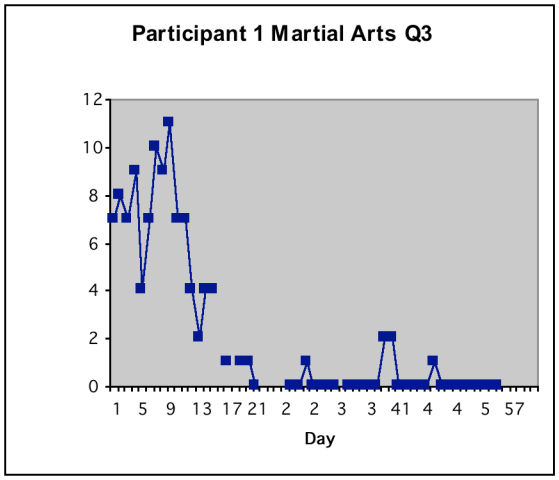
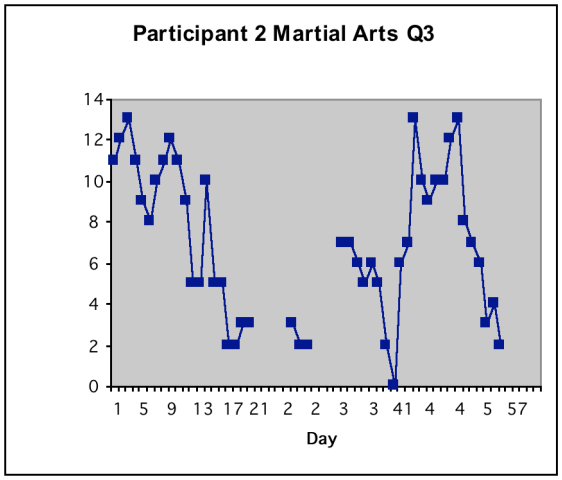
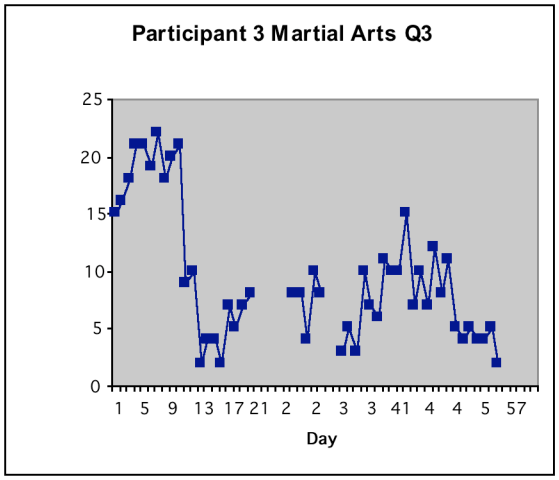
Average Number of Teacher's Rules Broken Daily
Day

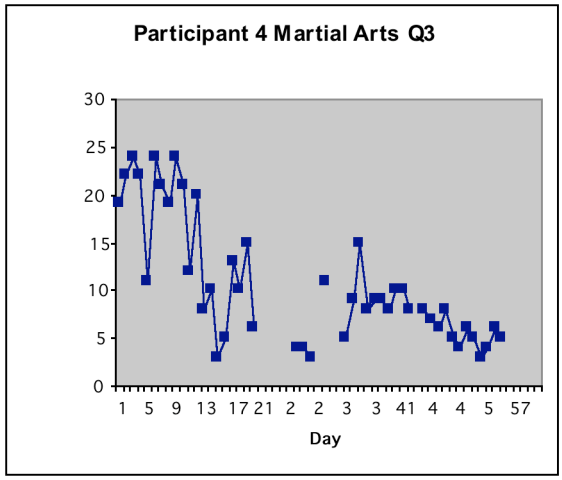

Participant 18 Control Group Q2
Average Number of Teacher's Rules Broken Daily
Day

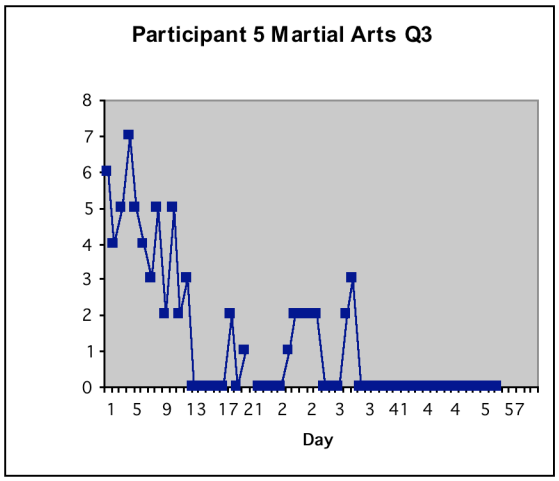
Appendix M- Individual Participant's Daily Results for Martial Arts, Exercise and Control Groups for Question Three

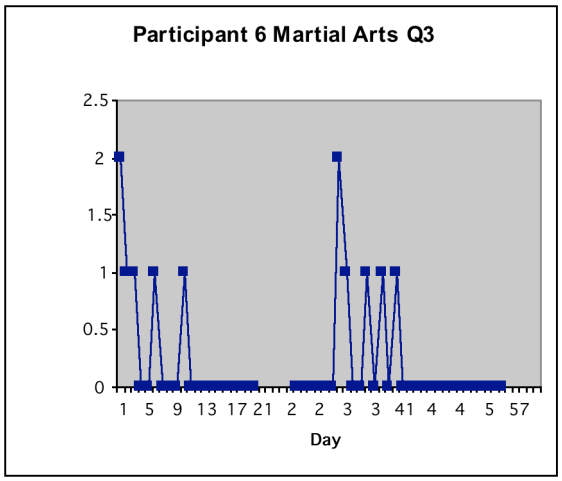


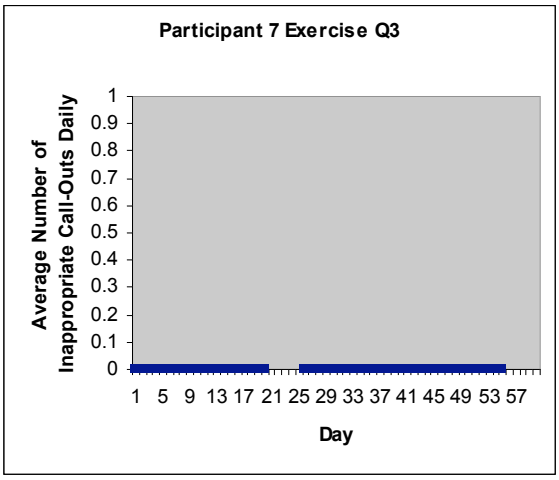


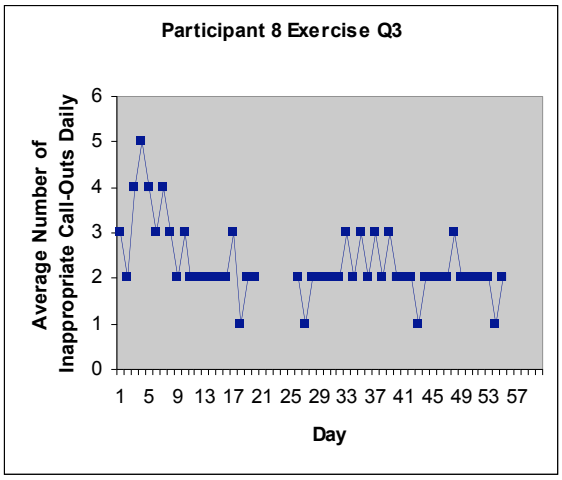


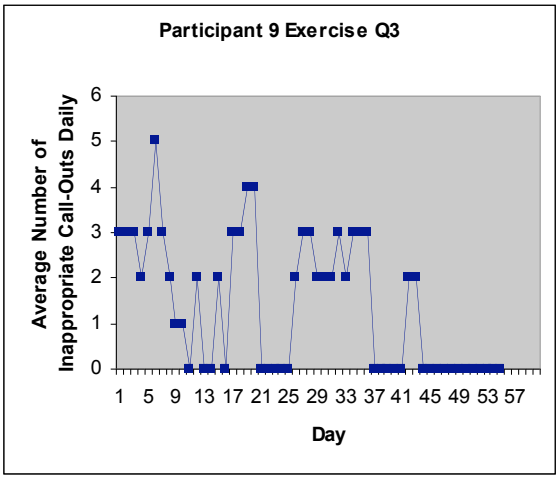


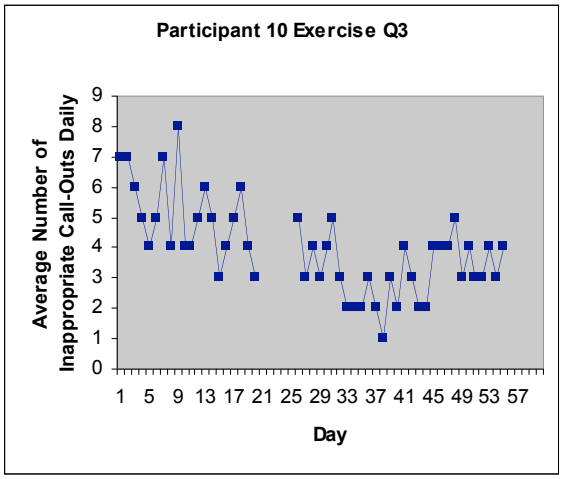


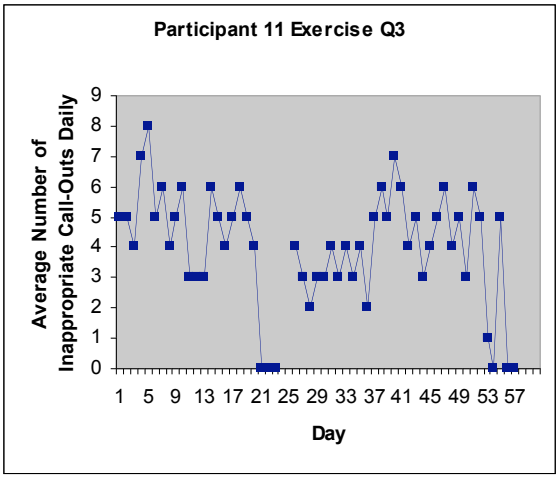


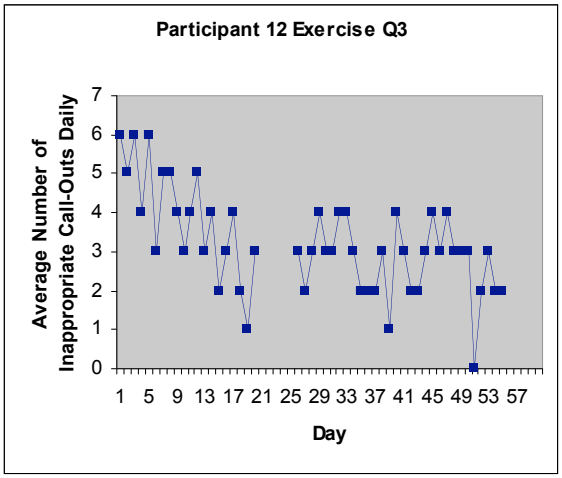

Participant 7 Exercise Q3
Average Number of Inappropriate Call-Outs Daily
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

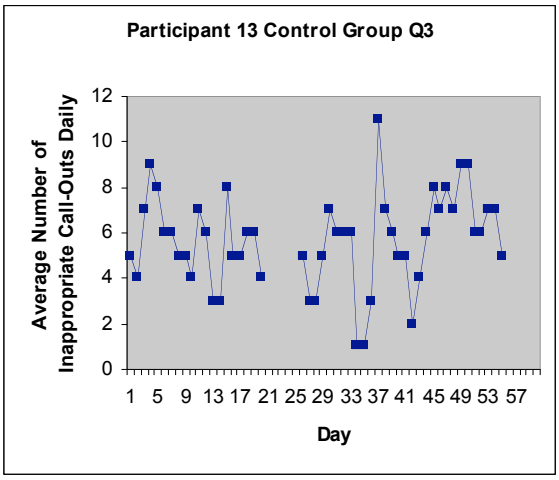

Participant 8 Exercise Q3
Average Number of Inappropriate Call-Outs Daily
0 1 2 3 4 5 6
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

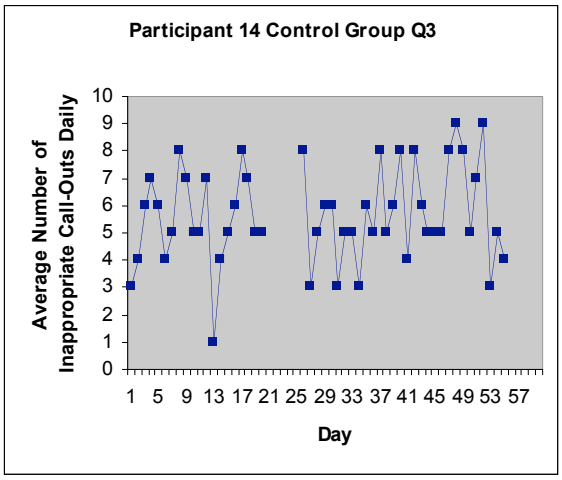

Participant 9 Exercise Q3
Average Number of Inappropriate Call-Outs Daily
0 1 2 3 4 5 6
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

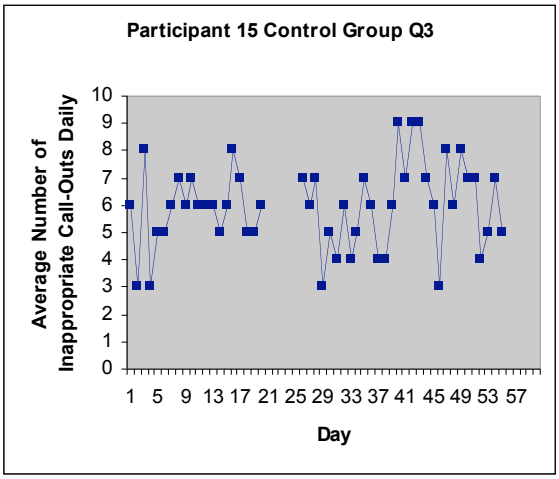

Participant 10 Exercise Q3
Average Number of Inappropriate Call-Outs Daily
0 1 2 3 4 5 6 7 8 9
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

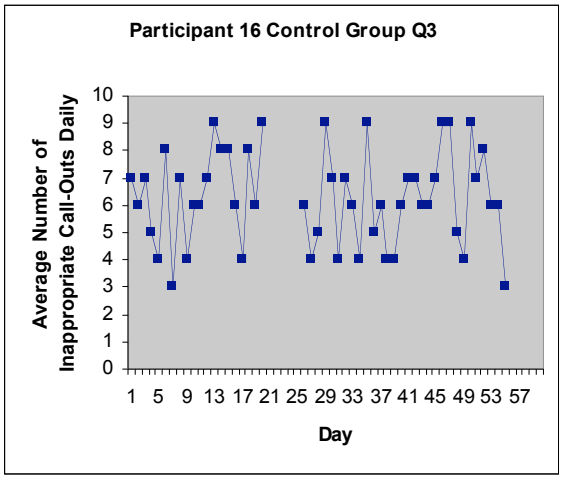

Participant 11 Exercise Q3
Average Number of Inappropriate Call-Outs Daily
0 1 2 3 4 5 6 7 8 9
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

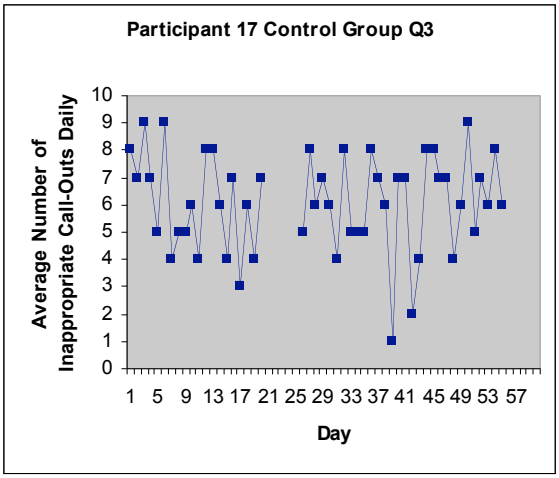

Participant 12 Exercise Q3
Average Number of Inappropriate Call-Outs Daily
0 1 2 3 4 5 6 7
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

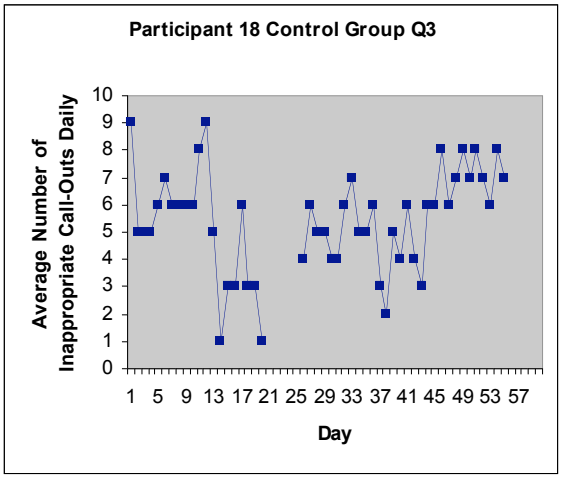

Participant 13 Control Group Q3
Average Number of Inappropriate Call-Outs Daily
Day


Participant 14 Control Group Q3
Average Number of Inappropriate Call-Outs Daily
Day

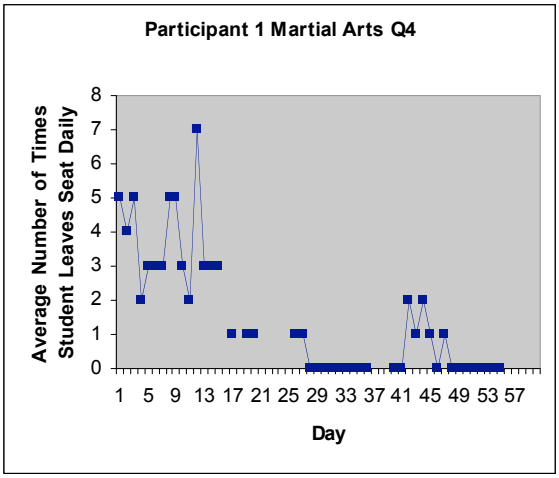

Participant 15 Control Group Q3
Average Number of Inappropriate Call-Outs Daily
Day

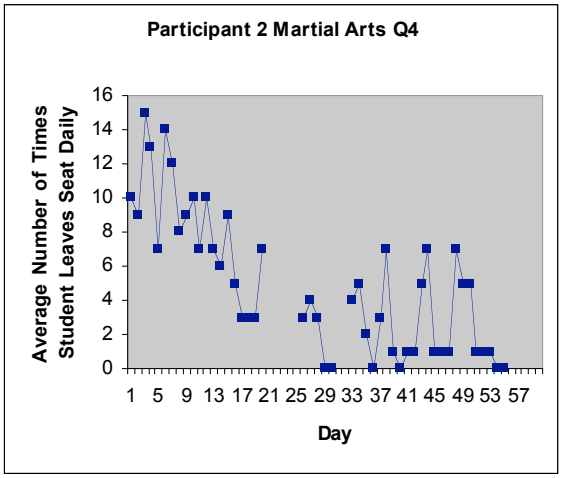

Participant 16 Control Group Q3
Average Number of Inappropriate Call-Outs Daily
Day

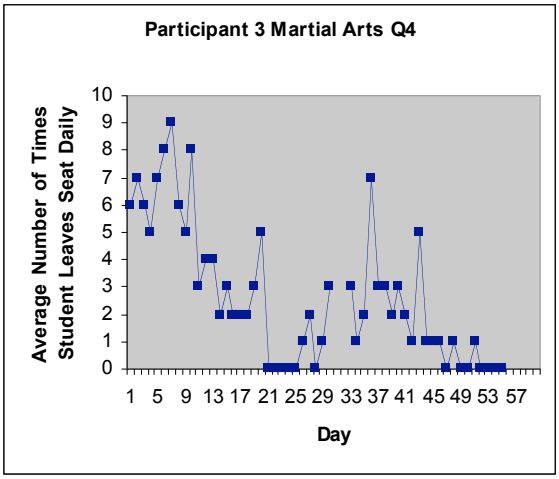

Participant 17 Control Group Q3
Average Number of Inappropriate Call-Outs Daily
Day

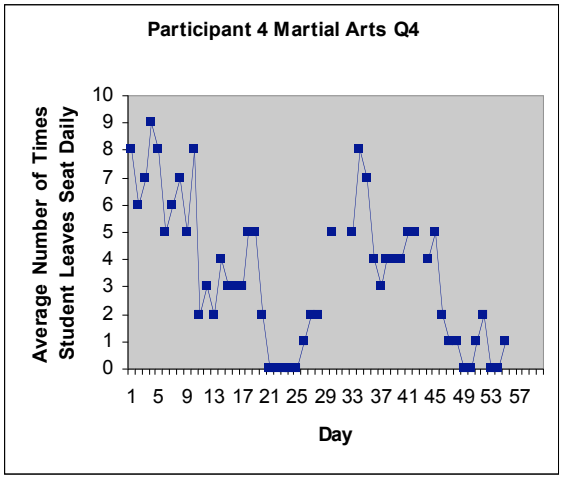

Participant 18 Control Group Q3
Average Number of Inappropriate Call-Outs Daily
Day

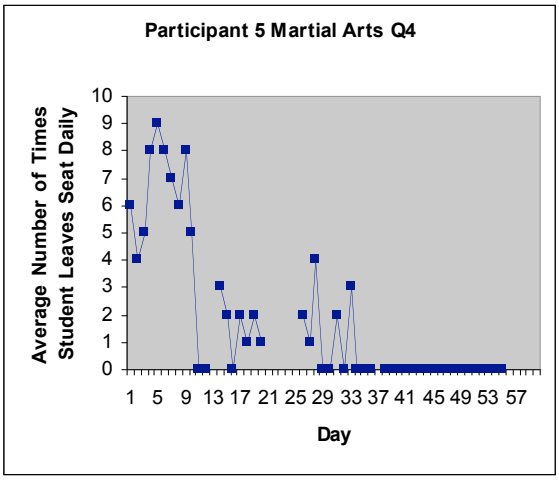
Appendix N- Individual Participant's Daily Results for Martial Arts, Exercise and Control Groups for Question Four

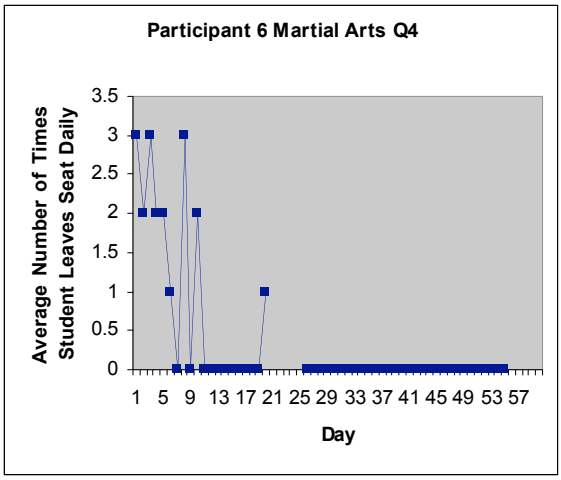


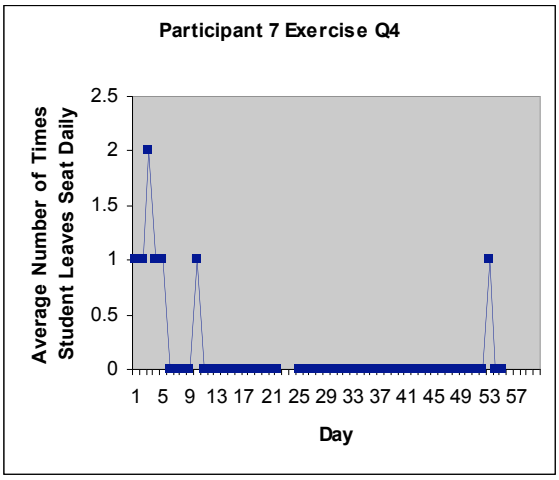


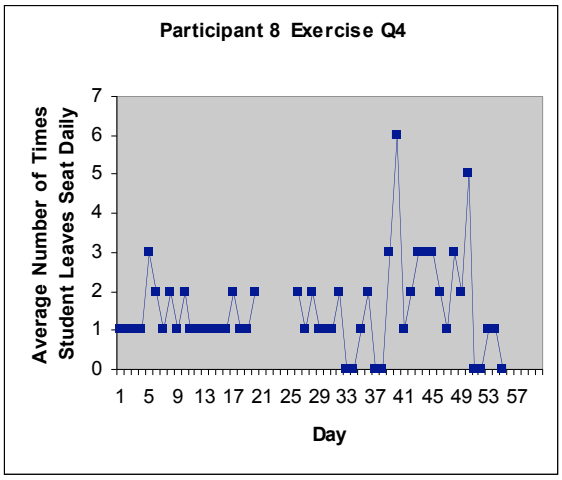


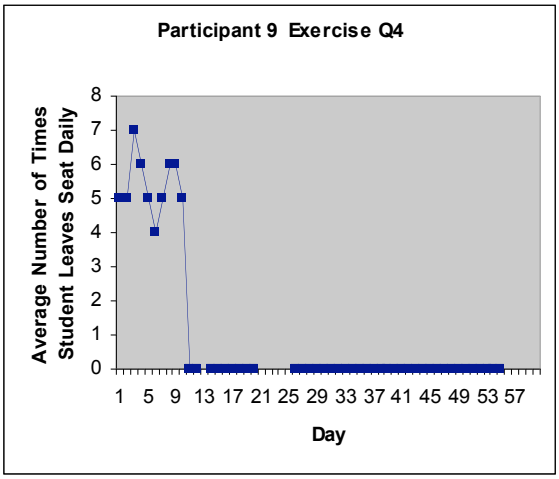


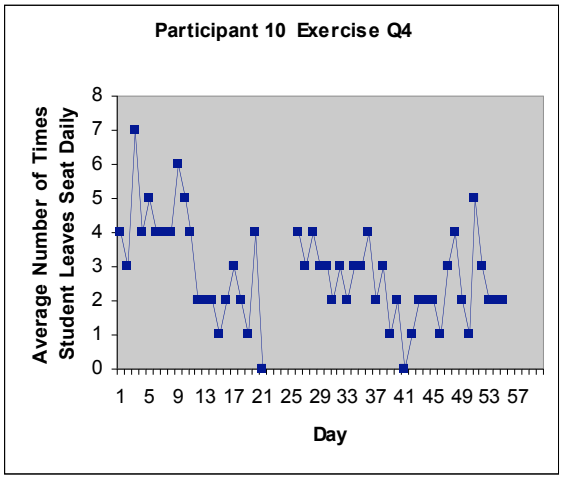


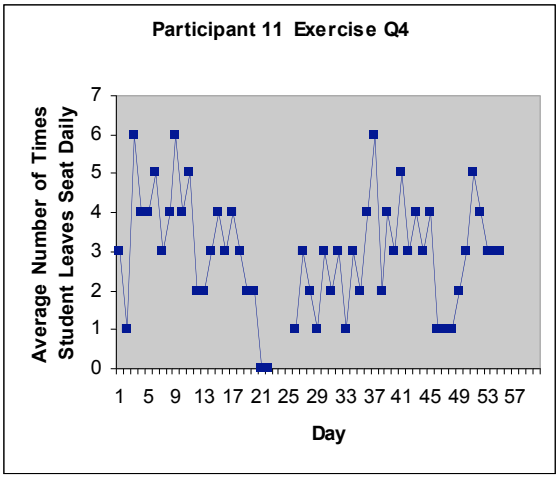


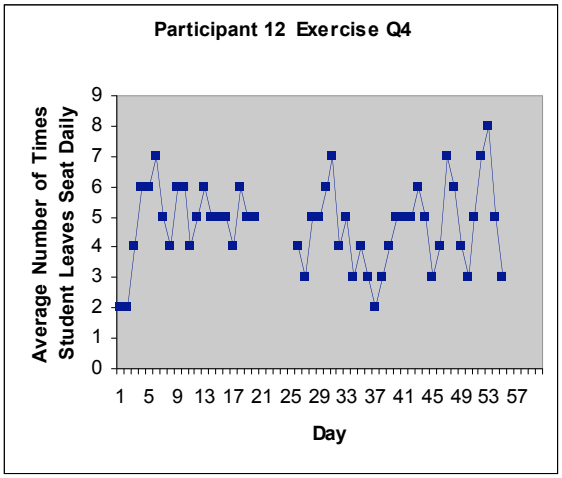

Participant 7 Exercise Q4
Average Number of Times Student Leaves Seat Daily
2.5
2
1.5
1
0.5
0
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

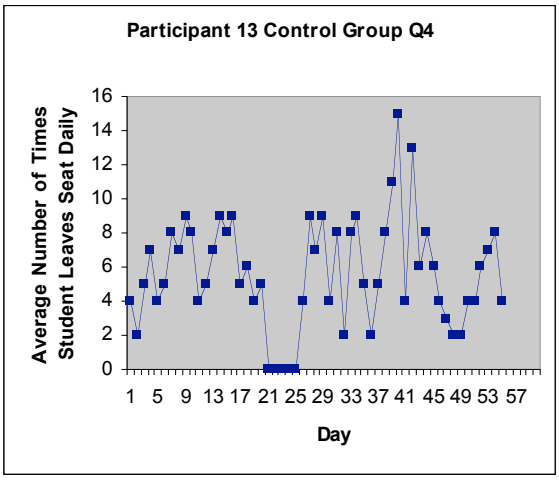

Participant 8 Exercise Q4
Average Number of Times Student Leaves Seat Daily
7
6
5
4
3
2
1
0
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

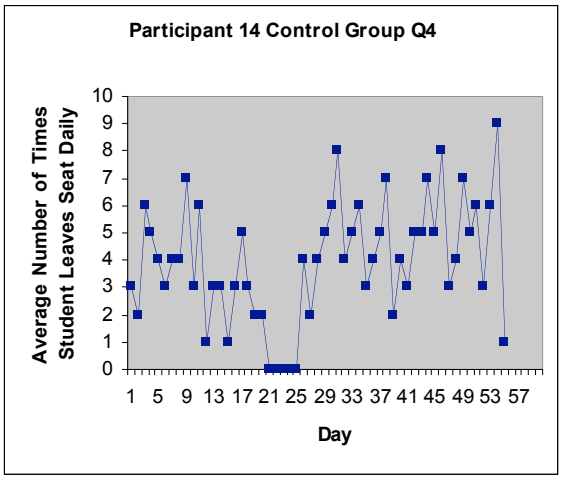

Participant 9 Exercise Q4
Average Number of Times Student Leaves Seat Daily
8
7
6
5
4
3
2
1
0
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

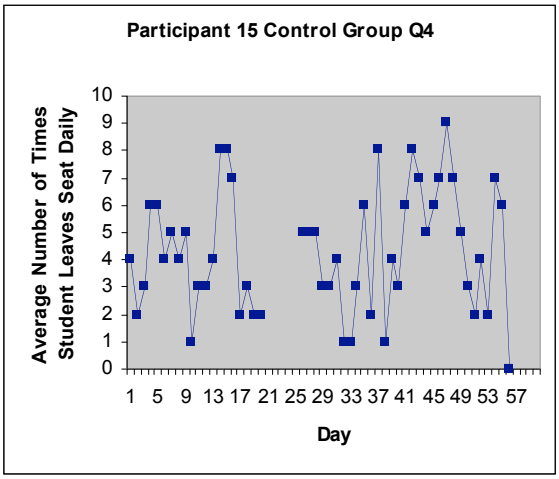

Participant 10 Exercise Q4
Average Number of Times Student Leaves Seat Daily
8
7
6
5
4
3
2
1
0
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

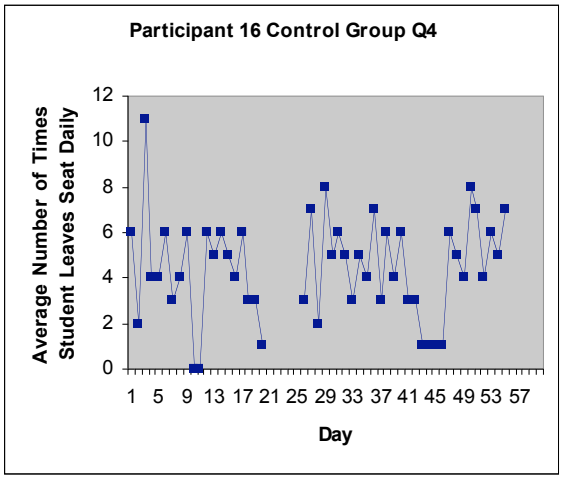

Participant 11 Exercise Q4
Average Number of Times Student Leaves Seat Daily
7
6
5
4
3
2
1
0
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

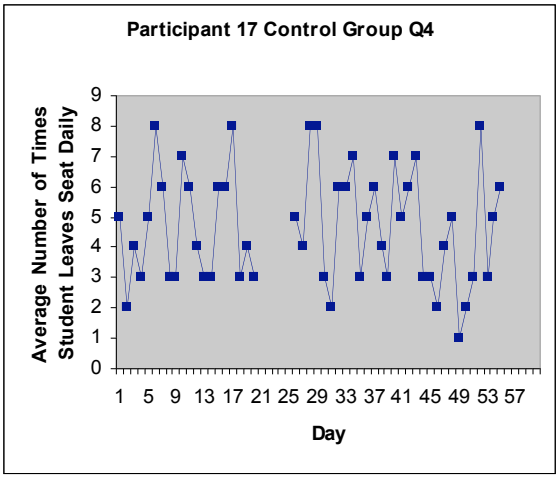

Participant 12 Exercise Q4
Average Number of Times Student Leaves Seat Daily
9
8
7
6
5
4
3
2
1
0
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

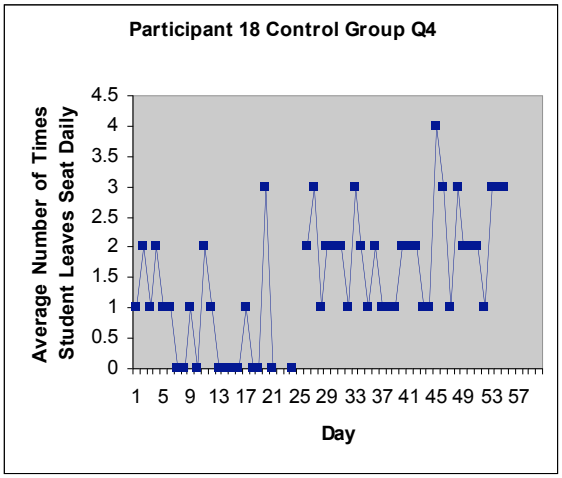

Participant 13 Control Group Q4
Average Number of Times Student Leaves Seat Daily
0 2 4 6 8 10 12 14 16
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day


Participant 14 Control Group Q4
Average Number of Times Student Leaves Seat Daily
0 1 2 3 4 5 6 7 8 9 10
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

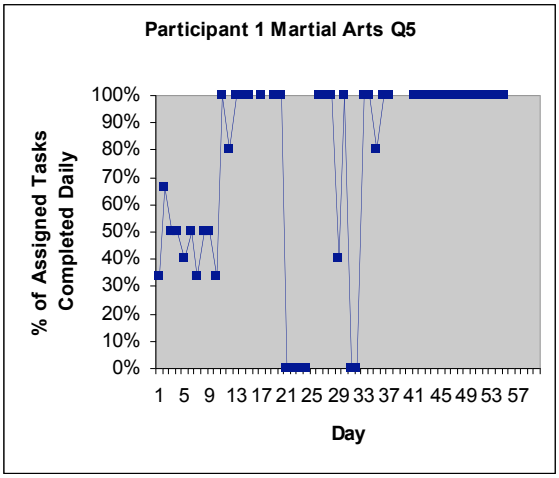

Participant 15 Control Group Q4
Average Number of Times Student Leaves Seat Daily
0 1 2 3 4 5 6 7 8 9 10
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

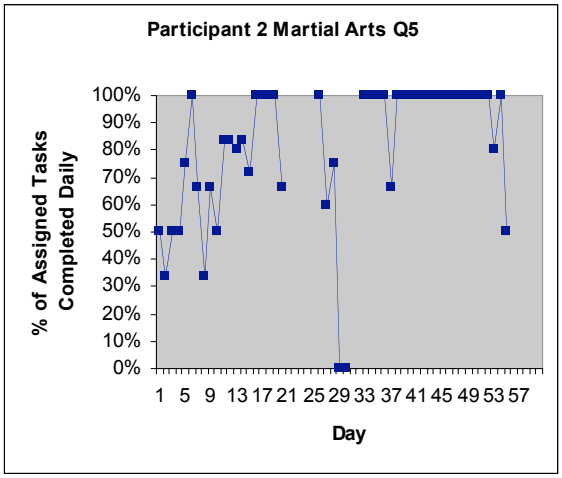

Participant 16 Control Group Q4
Average Number of Times Student Leaves Seat Daily
0 2 4 6 8 10 12
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

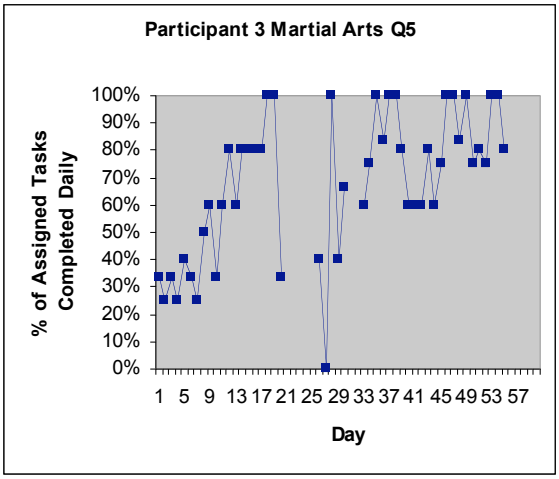

Participant 17 Control Group Q4
Average Number of Times Student Leaves Seat Daily
0 1 2 3 4 5 6 7 8 9
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

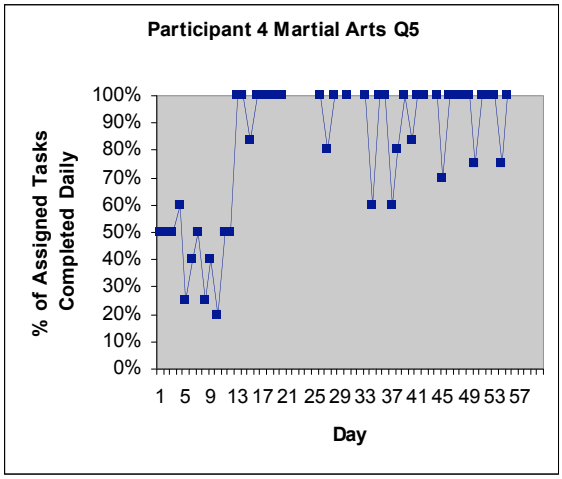

Participant 18 Control Group Q4
Average Number of Times Student Leaves Seat Daily
0 0.5 1 1.5 2 2.5 3 3.5 4 4.5
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

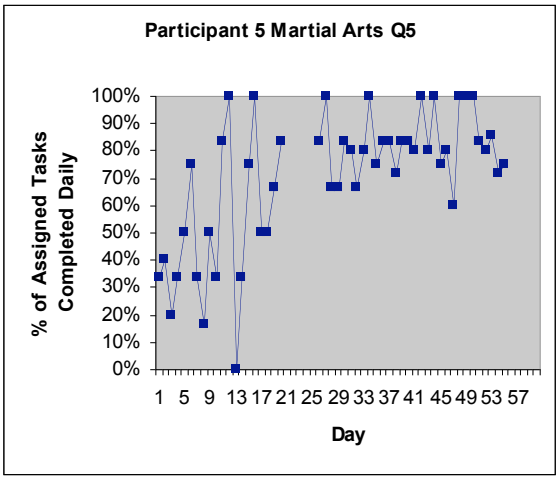
Appendix O- Individual Participant's Daily Results for Martial Arts, Exercise and Control Groups for Question Five

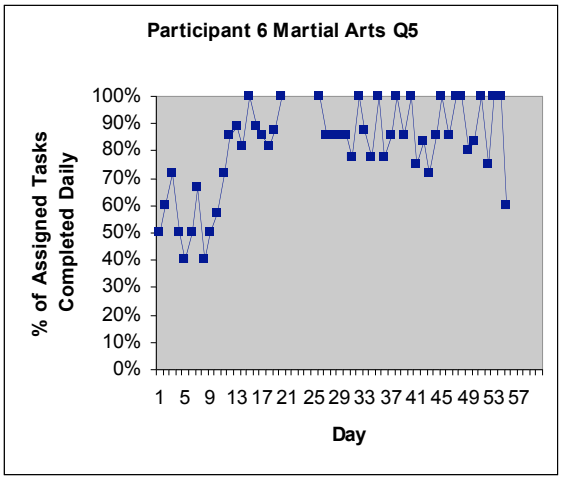


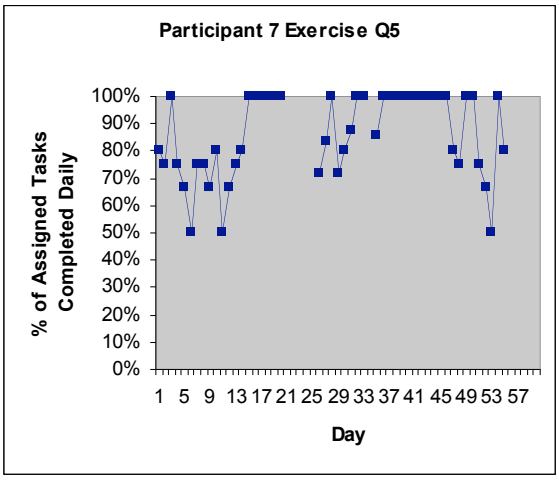


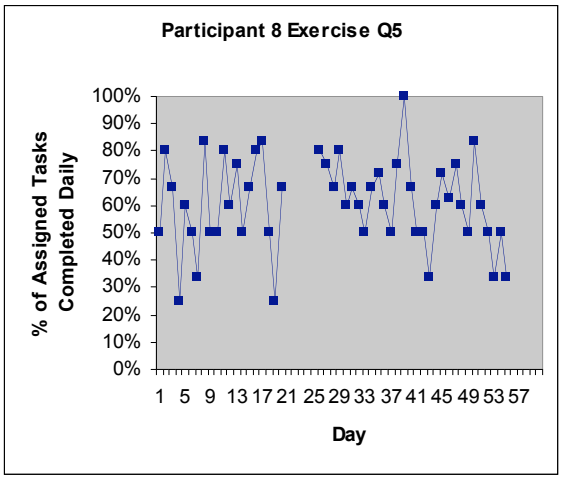


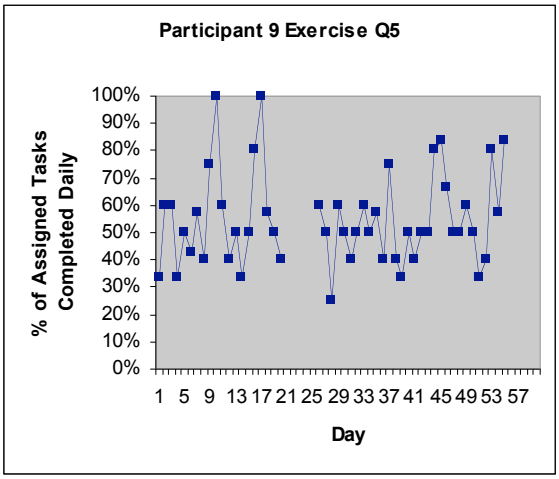


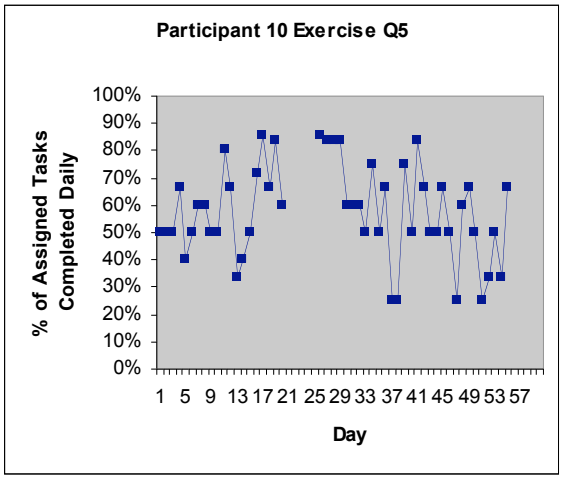


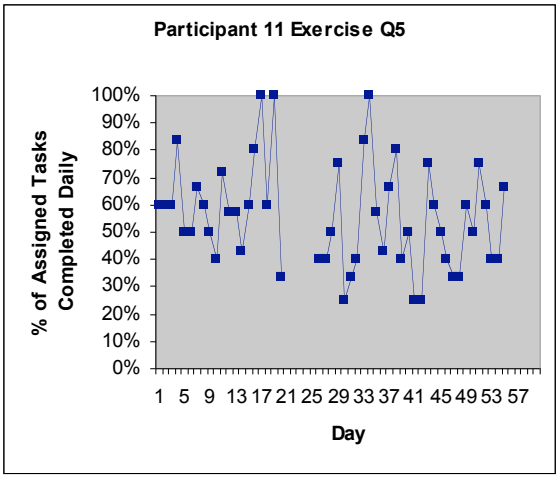


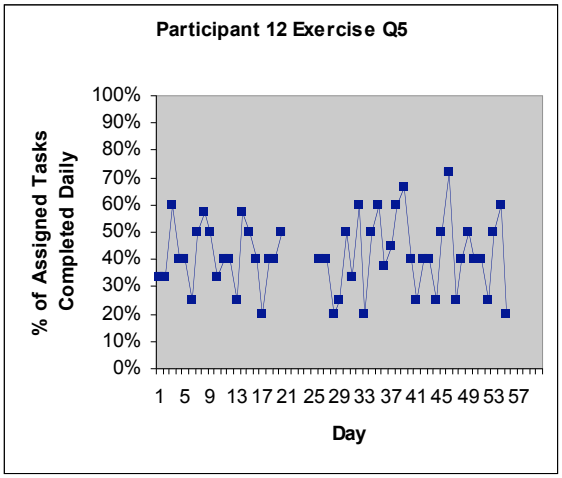

Participant 7 Exercise Q5
% of Assigned Tasks Completed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

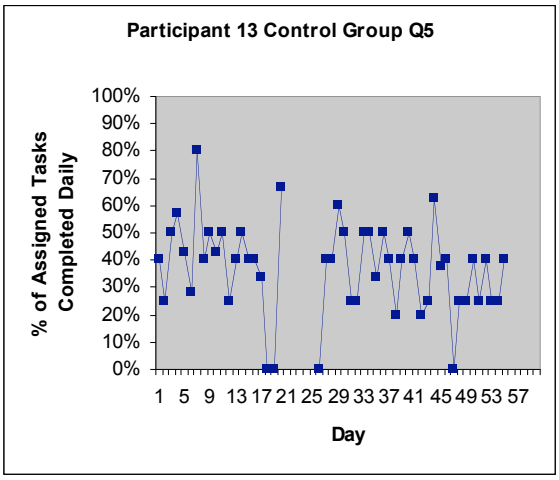

Participant 8 Exercise Q5
% of Assigned Tasks Completed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

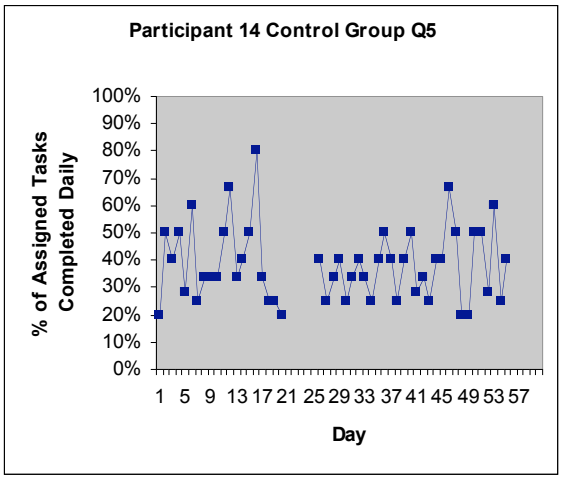

Participant 9 Exercise Q5
% of Assigned Tasks Completed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

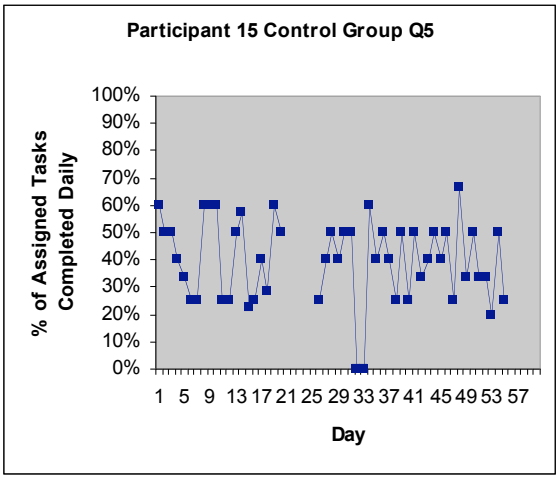

Participant 10 Exercise Q5
% of Assigned Tasks Completed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day


Participant 11 Exercise Q5
% of Assigned Tasks Completed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day


Participant 12 Exercise Q5
% of Assigned Tasks Completed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day


Participant 13 Control Group Q5
% of Assigned Tasks Completed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day


Participant 14 Control Group Q5
% of Assigned Tasks Completed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day


Participant 15 Control Group Q5
% of Assigned Tasks Completed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
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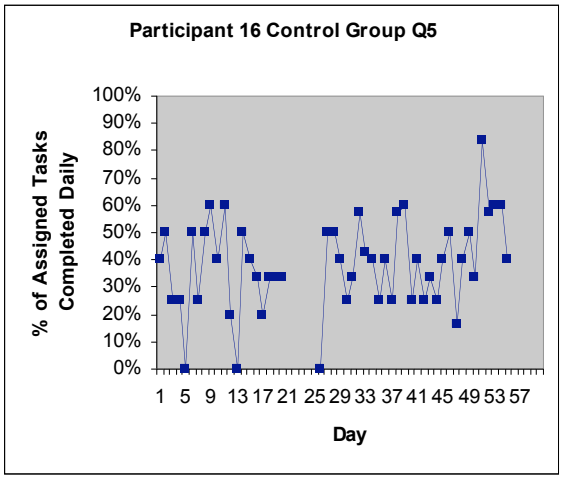
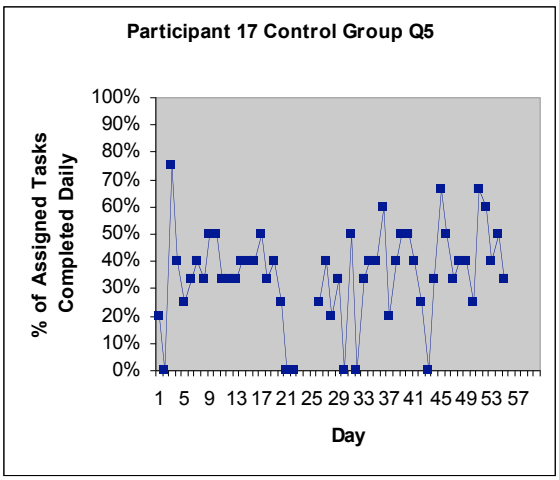
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day


Participant 16 Control Group Q5
% of Assigned Tasks Completed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day


Participant 17 Control Group Q5
% of Assigned Tasks Completed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
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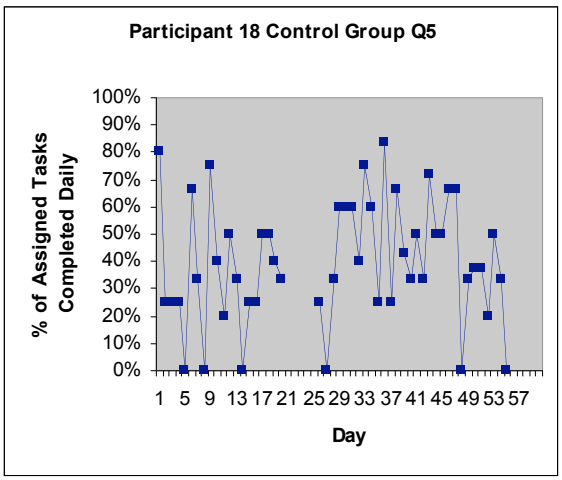
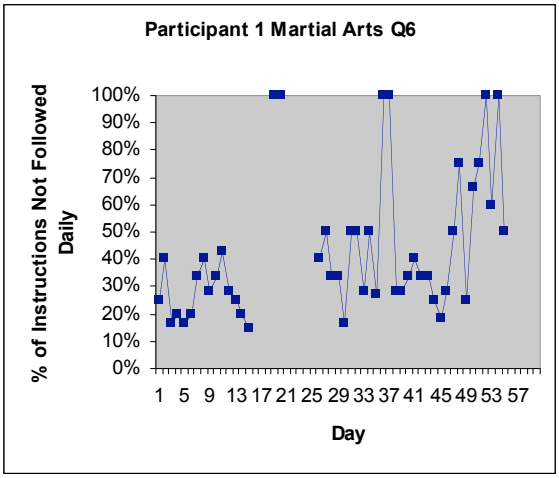
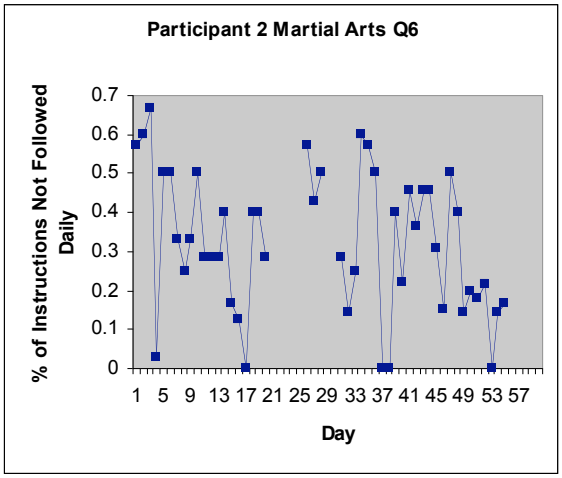
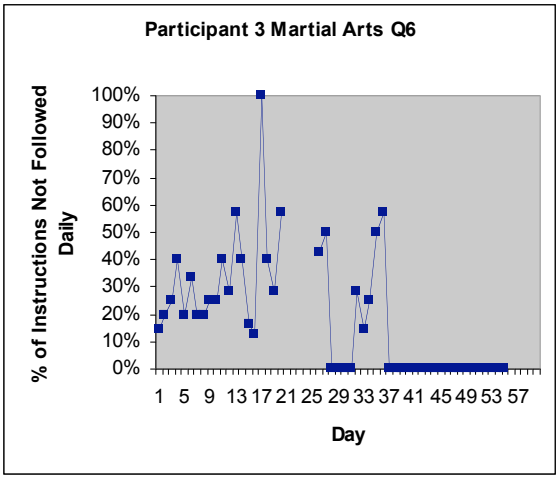
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

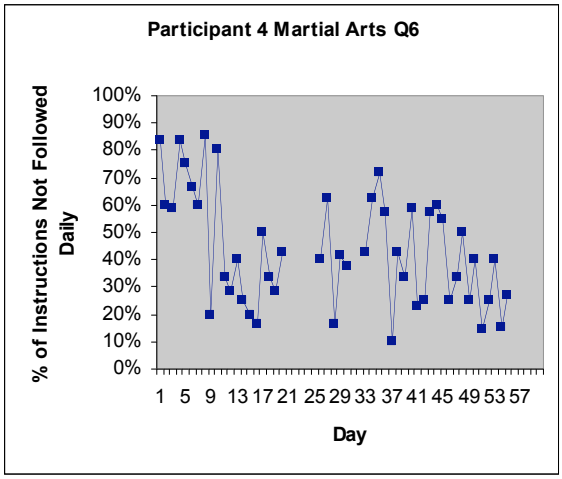

Participant 18 Control Group Q5
% of Assigned Tasks Completed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

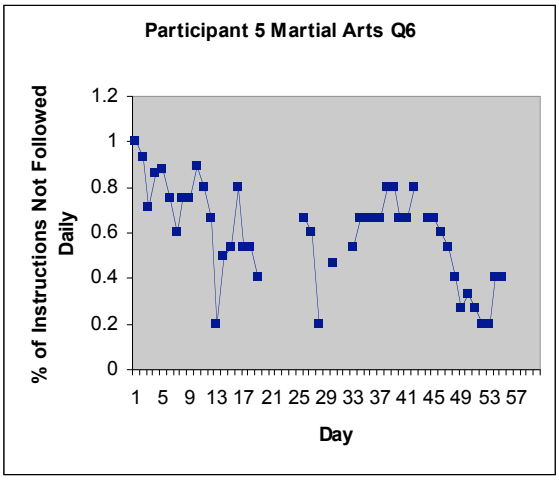
Appendix P- Individual Participant's Daily Results for Martial Arts, Exercise and Control Groups for Question Six

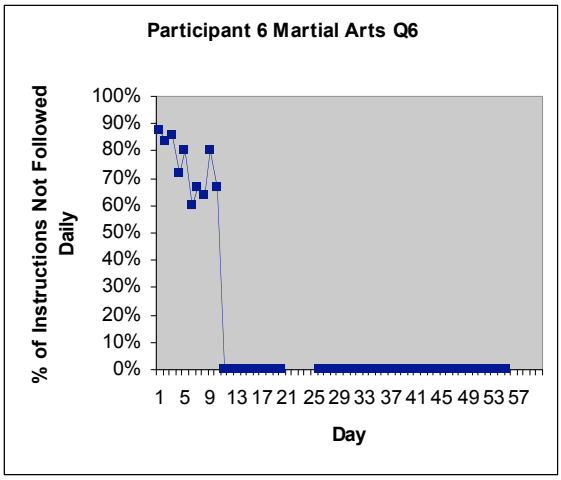


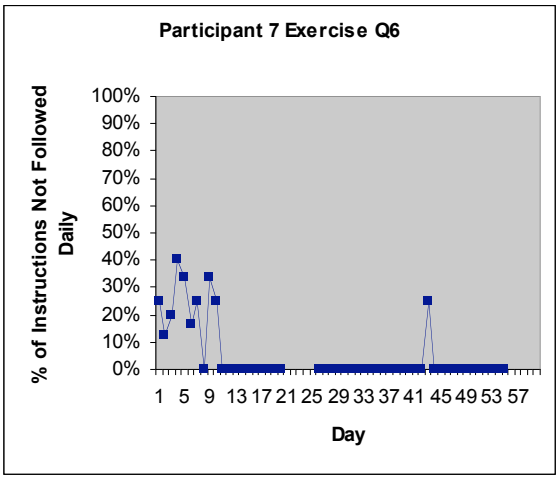


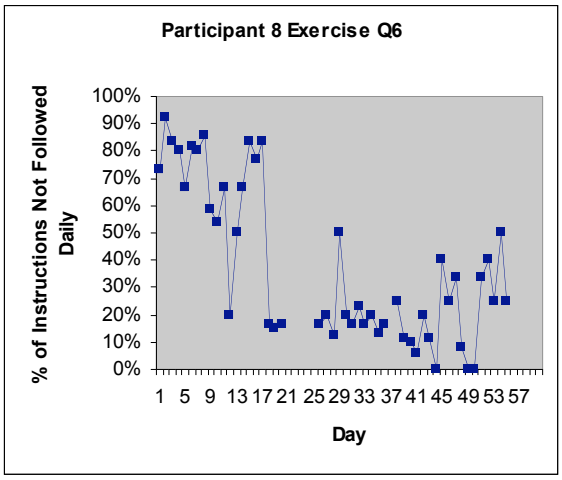


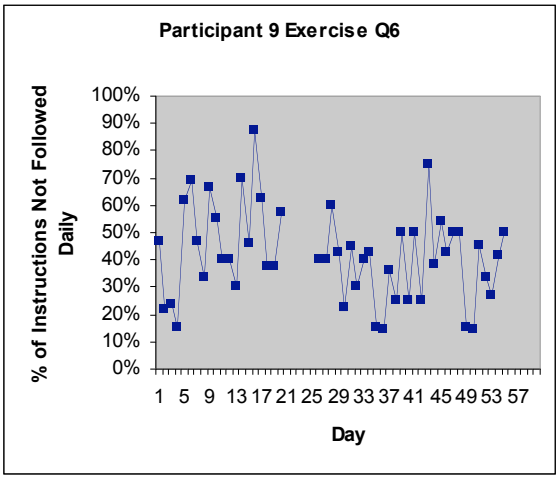


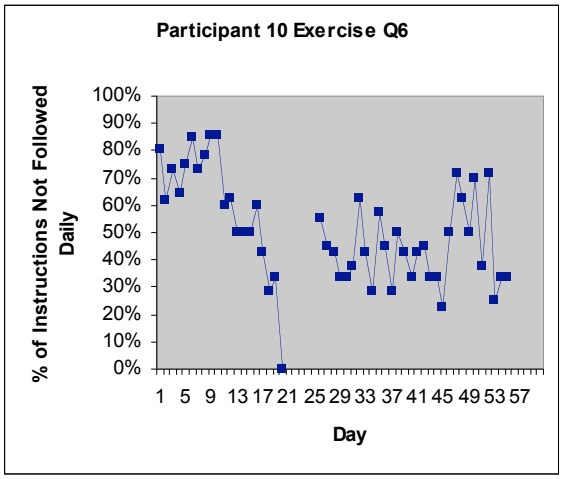


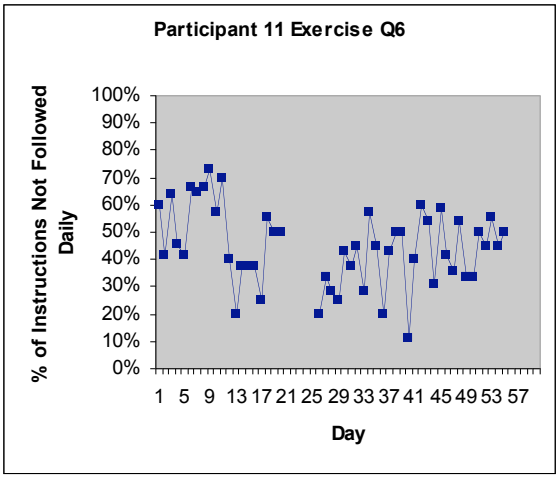


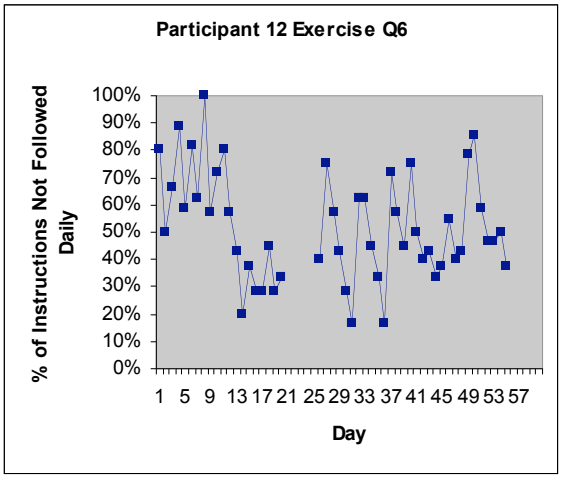

Participant 7 Exercise Q6
% of Instructions Not Followed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

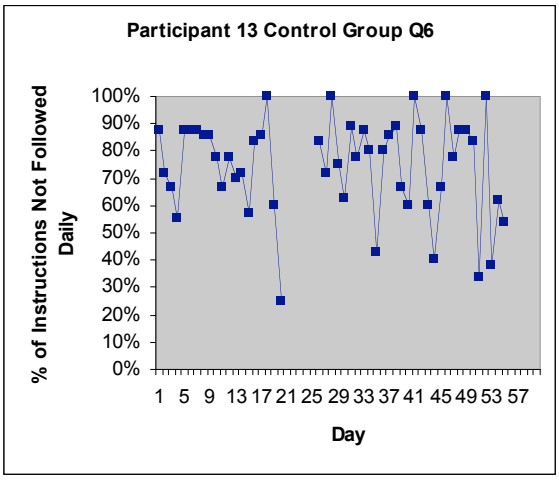

Participant 8 Exercise Q6
% of Instructions Not Followed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

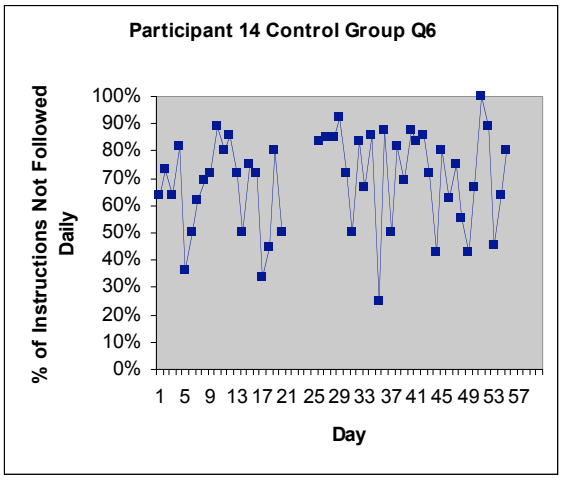

Participant 9 Exercise Q6
% of Instructions Not Followed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

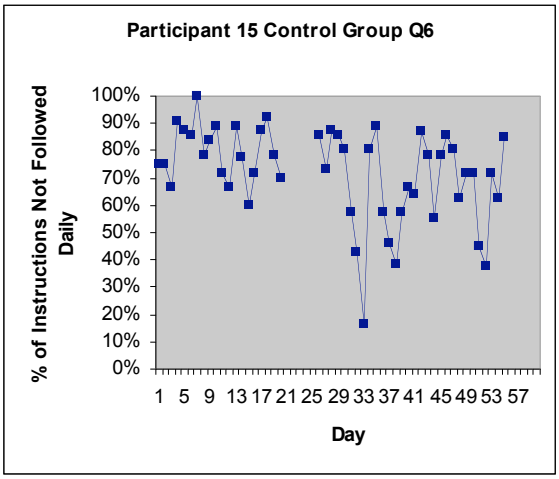

Participant 10 Exercise Q6
% of Instructions Not Followed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

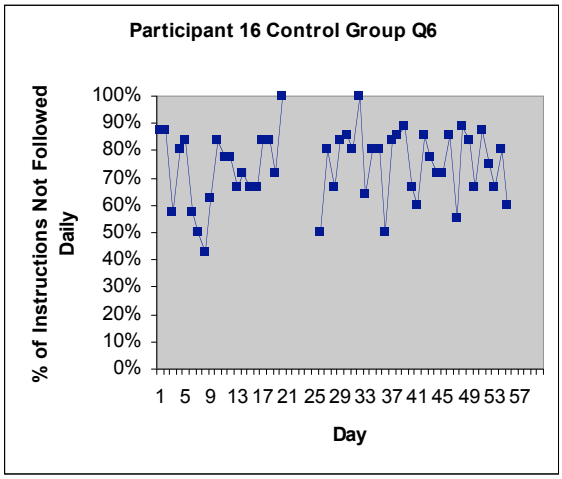

Participant 11 Exercise Q6
% of Instructions Not Followed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

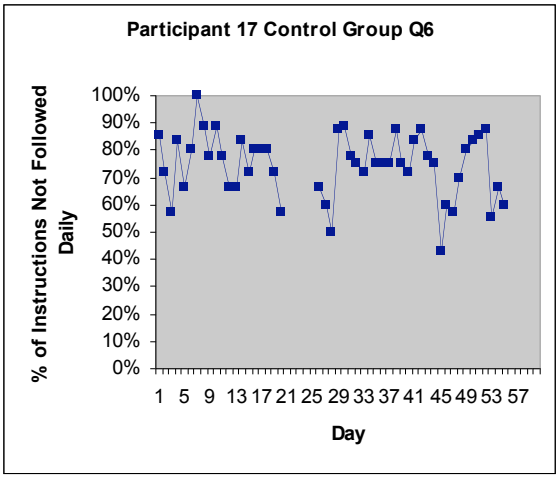

Participant 12 Exercise Q6
% of Instructions Not Followed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

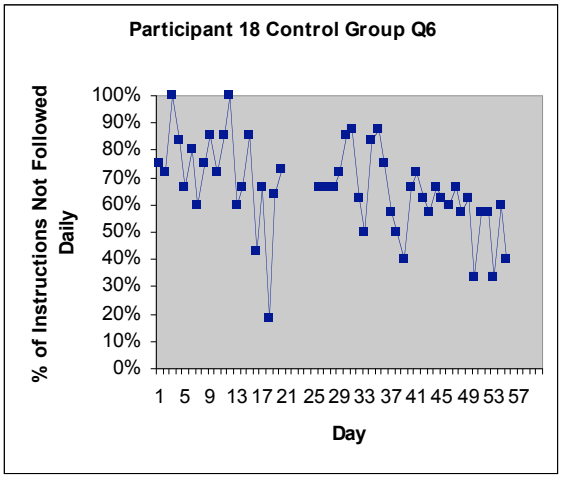

Participant 13 Control Group Q6
% of Instructions Not Followed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day


Participant 14 Control Group Q6
% of Instructions Not Followed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

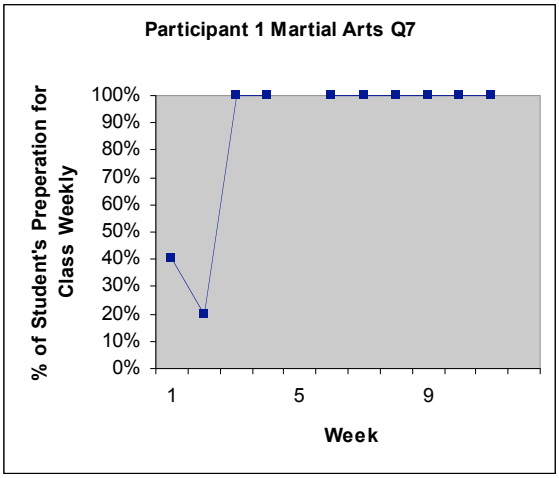

Participant 15 Control Group Q6
% of Instructions Not Followed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

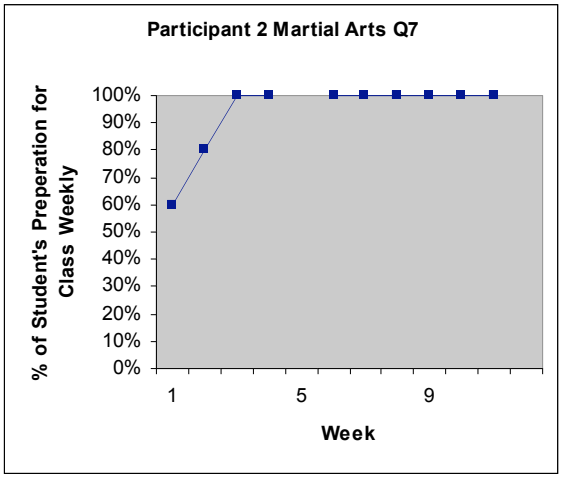

Participant 16 Control Group Q6
% of Instructions Not Followed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

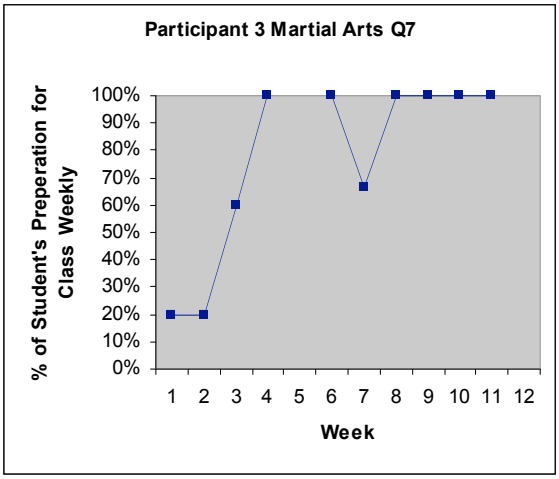

Participant 17 Control Group Q6
% of Instructions Not Followed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

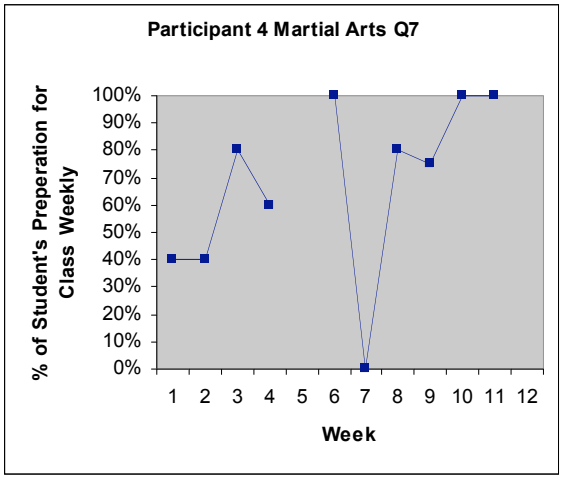

Participant 18 Control Group Q6
% of Instructions Not Followed Daily
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57
Day

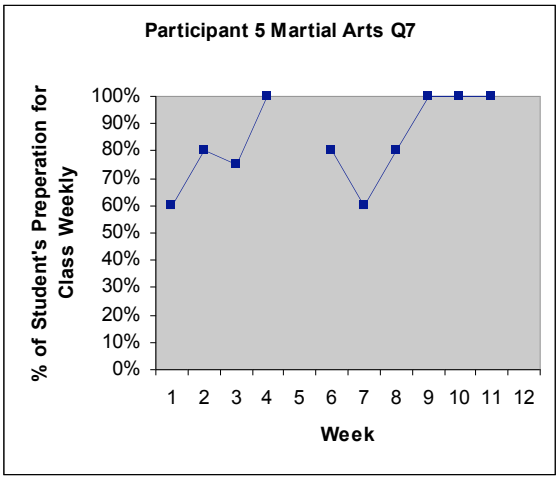
Appendix Q- Individual Participant's Weekly Results for Martial Arts, Exercise and Control Groups for Question Seven

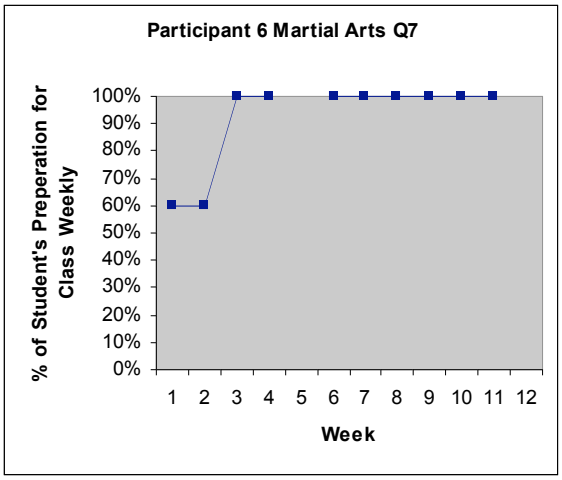


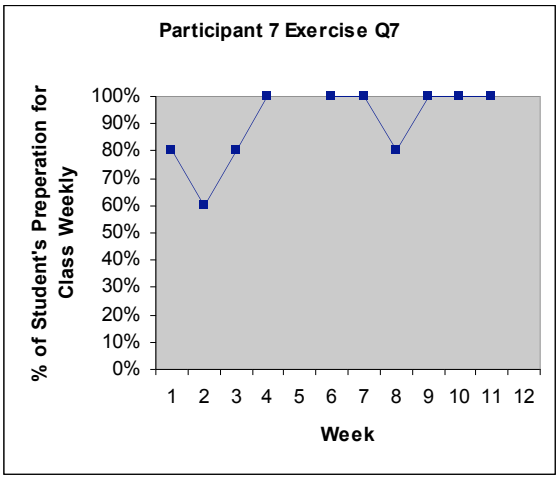


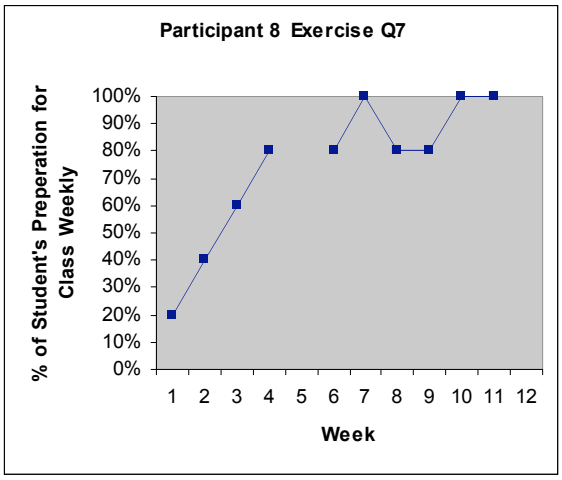


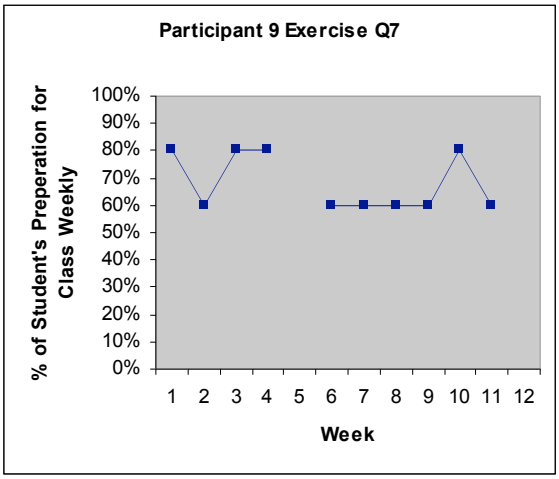


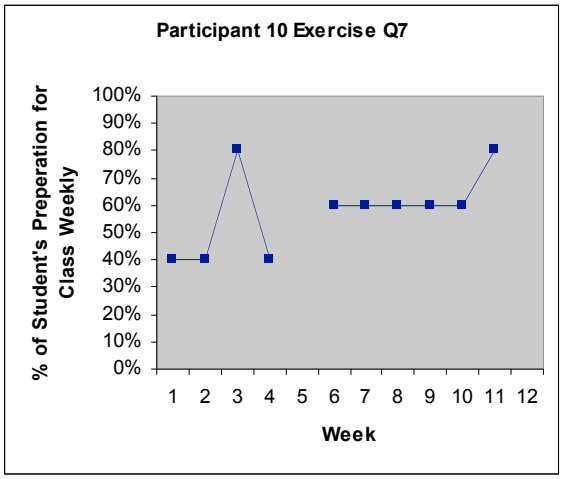


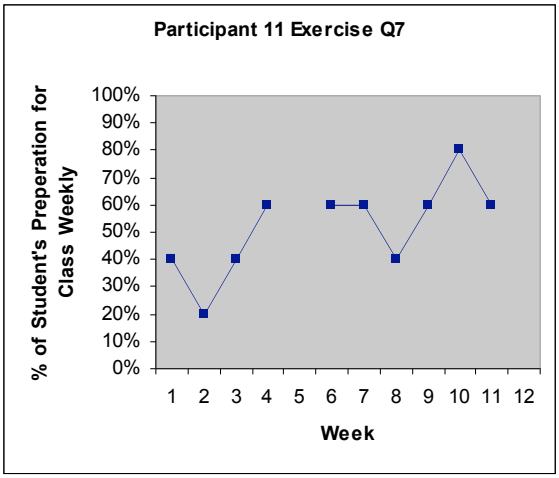


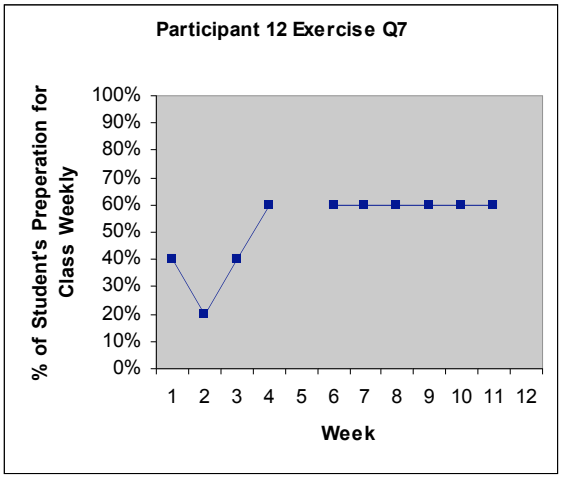

Participant 7 Exercise Q7
% of Student's Preperation for Class Weekly
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Week

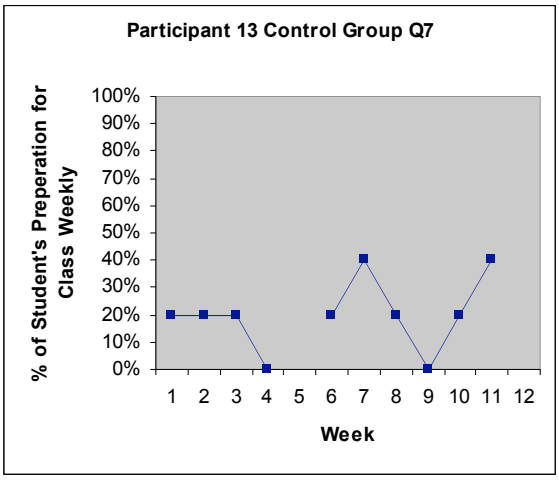

Participant 8 Exercise Q7
% of Student's Preperation for Class Weekly
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Week

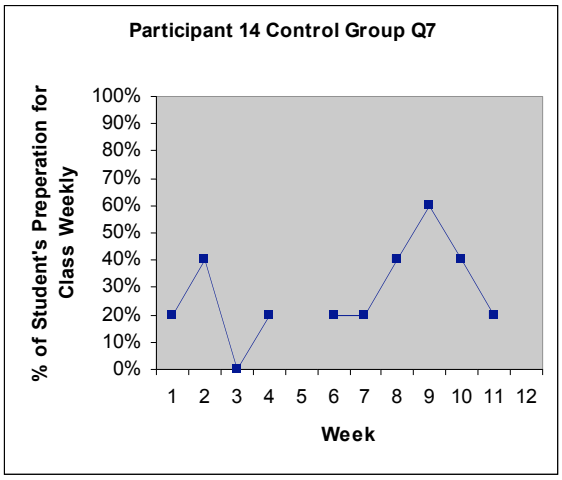

Participant 9 Exercise Q7
% of Student's Preperation for Class Weekly
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Week

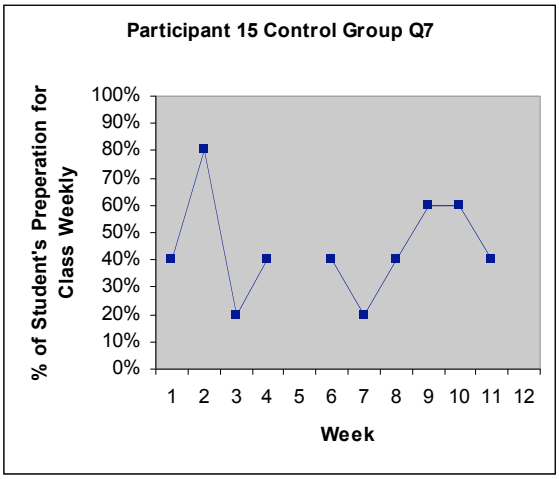

Participant 10 Exercise Q7
% of Student's Preperation for Class Weekly
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Week


Participant 11 Exercise Q7
% of Student's Preperation for Class Weekly
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Week


Participant 12 Exercise Q7
% of Student's Preperation for Class Weekly
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Week


Participant 13 Control Group Q7
% of Student's Preperation for Class Weekly
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Week


Participant 14 Control Group Q7
% of Student's Preperation for Class Weekly
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Week


Participant 15 Control Group Q7
% of Student's Preperation for Class Weekly
100%
90%
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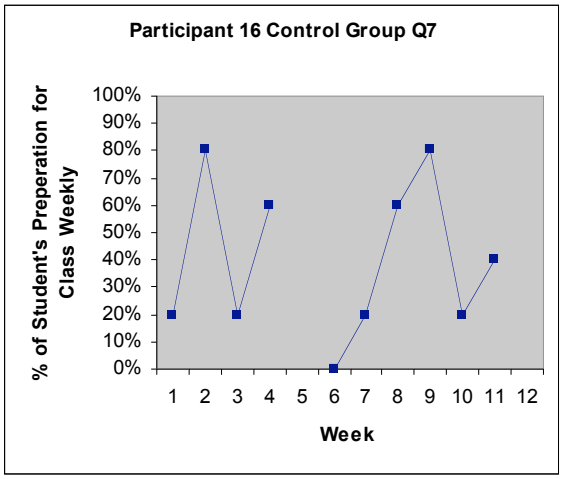
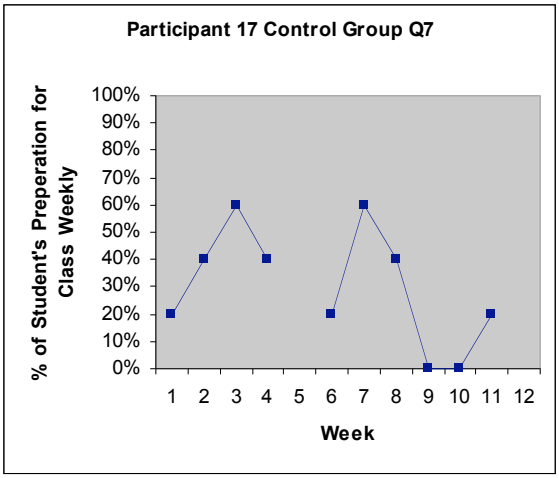
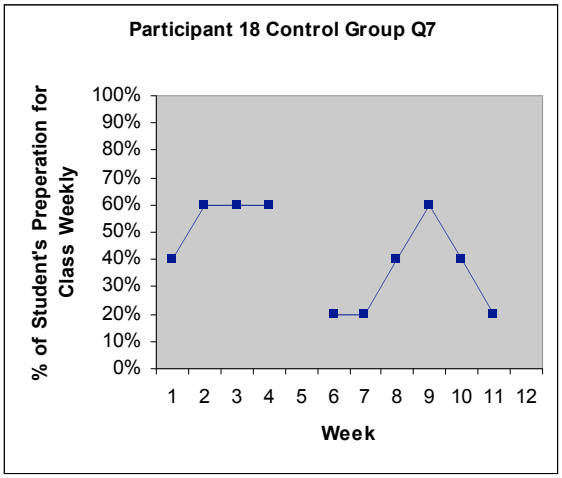
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Week


Participant 16 Control Group Q7
% of Student's Preperation for Class Weekly
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Week


Participant 17 Control Group Q7
% of Student's Preperation for Class Weekly
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Week


Participant 18 Control Group Q7
% of Student's Preperation for Class Weekly
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Week