ABSTRACT

JOINT CONTROL AND THE ACQUISITION OF SEQUENCES
IN A GROUP EXERCISE SETTING

Adults often cite lack of enjoyment among their reasons for not exercising and research has suggested that increased competence in a form of physical activity leads to increased reports of enjoyment and greater adherence. Given this, focusing on skill acquisition may help maintain engagement in physical activities, allowing individuals to reap many of the related benefits. This study evaluated the effects of a joint control procedure on skill acquisition in a group exercise format, using a multiple-probe design. Specifically, 15 adult participants, ages 19-29 years, were recruited for this study. As the purpose was to focus on acquisition, data analysis was focused on five participants who did not meet a minimum of 80% during baseline sessions. During the joint control intervention, all participants were taught the names of each movement, the verbal sequence of movements in each sub-section, and to engage in a self-echoic of the verbal sequence while the engaging in the sequence of moves themselves. Percentage of correct movements was recorded as the main dependent variable. Results suggest that the joint control procedure was effective in increasing skill acquisition among all participants, and notably so for those with lower acquisition rates in baseline. Participants also demonstrated higher levels of correct movements and faster acquisition during generalization probes with a new sequence.

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JOINT CONTROL AND THE ACQUISITION OF SEQUENCES IN A GROUP EXERCISE SETTING

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CHAPTER 1: INTRODUCTION

Methods that increase physical activity is an area investigated by many health professionals. According to the National Heart, Lung, and Blood Institute (NHLBI; 2016), physical activity generally refers to movement that enhances health and consists of four main types of movement: aerobic, muscle-strengthening, bone-strengthening, and stretching.

Some health benefits that can result from physical activity include lowered risk of cardiovascular disease and a variety of other chronic diseases, such as diabetes mellitus, cancer (colon and breast), obesity, hypertension, bone and joint diseases (osteoporosis and osteoarthritis), and depression (Warburton, Nicol, & Bredin, 2006). According to the US Department of Health and Human Services (HHS), the *2008 Physical Activity Guidelines for Americans* recommend that adults should engage in at least 150 minutes of moderate-intensity aerobic activity per week to attain health benefits (HHS, 2008). It is recommended that all forms of exercise should include varying levels of moderate-intensity aerobic, vigorous-intensity aerobic, muscle-strengthening, and bone-strengthening activities.

Despite the numerous health benefits mentioned above, only about 49% of adults regularly meet these guidelines (Centers for Disease Control and Prevention [CDC], 2016). In addition, there is a 50-65% expected dropout rate within 3-6 months of initiating or returning to a routine of planned physical activity (Annesi & Unruh, 2007). One reason for this may be that individuals engaged in a physical activity regime often do not contact desirable outcomes immediately (e.g., aesthetic or health benefits) often experiencing significant delays to such reinforcers. As a result, many interventions have focused on contriving contingencies to provide more immediate supporting reinforcers to increase

exercise behavior during this delay to more natural outcomes or reinforcers (Andrade, Barry, Litt, & Petry, 2014; Hagberg, Lindahl, Nyberg, & Hellenius, 2009). While many have been successful, the results are often relatively short lived, effortful, or expensive to implement on an ongoing basis, and exercise is likely to decrease again when supporting contingencies are removed (Andrade et al., 2014).

Other barriers related to sustained exercise regimes include undesirable weather, feeling tired, family needs, a lack of time, perceived financial cost, lack of enjoyment, and the lack of confidence in their ability to engage in the exercise activity (Ivanova, Yaakoba-Zohar, Jensen, Cassoff, & Knauper, 2015; CDC, 2016). Given these barriers and the difficulty in maintaining behavior change using buttressing reinforcers, it may be useful to target variables promoting enjoyment of exercise and physical activity as a source of automatic reinforcement that is more immediate and comes directly from engaging in the activity itself.

A key factor affecting individuals' enjoyment of exercise is competence, which has been reported to directly impact exercise participation and adherence (Sherwood & Jeffery, 2000). Furthermore, studies have reported a direct relationship between competency in physical activity and enjoyment (Cairney et al., 2012; Fairclough, 2003). In other words, the more competent people are, or feel, in a particular activity, the more they enjoy it. As a result, it may be helpful to identify interventions that result in more rapid skill acquisition and competency as this also may increase enjoyment, or the reinforcing property of the particular activity.

CHAPTER 2: LITERATURE REVIEW

Interventions for Skill Acquisition

A variety of researchers in several areas of study have developed interventions to increase skill acquisition in exercise behavior. Sport and exercise psychology is a prominent area of research and is defined by the American Psychological Association (2009) as "the scientific study of psychological factors that are associated with participation and performance in sports, exercise, and other types of physical activity." The application of sports and exercise psychology involves the extension of theories and research used to educate coaches, athletes, parents, exercisers, fitness professionals, and athletic trainers about the psychological aspects of their sport and or activity (Association for Applied Sport Psychology, 2010). In addition, the sport and exercise psychology discipline aims to facilitate optimal involvement, performance, and enjoyment.

Applied Behavior Analysis (ABA) is a related but distinct approach that has also conducted research and developed interventions to increase skill acquisition in exercise behavior; however, ABA differs from the sport and exercise area of study in the way they define terminology and on their methodological approaches towards changing behavior, and specifically for our purposes, teaching new skills.

ABA is a science devoted to the understanding and improvement of human behavior by the discovery of environmental variables that reliably influence socially significant behavior. (Cooper, Heron, & Heward, 2007). The relationship between the organism and its environment is often described by the three-term contingency, which is the basic unit of analysis in the analysis of operant behavior and encompasses the antecedent stimulus, the response, and the reinforcing

consequences. The interrelationship between the three makes up the contingencies of reinforcement (Skinner, 1969, p. 7). Contingencies of reinforcement are used to explain changes in simple and complex forms of behavior. This analysis can be used in a variety of research areas, including exercise.

In particular, behavioral sport psychology uses principles derived from ABA to produce effective changes in athletic performance and other sport related activities (Martin & Tkachuk, 2000). Researchers in the field of behavioral sport psychology often begin by identifying the target behavior and then analyze it using principles of classical or operant conditioning. Single-subject research designs are most commonly used, and interventions target socially valid behaviors and procedural integrity (Martin & Pear, 2011). Furthermore, skill acquisition is one of the most important areas of application in behavioral sport psychology research. Over the last 30 years, 72% of their research consists of teaching and or improving new skills (Martin, Thompson, & Regehr, 2004).

Sport and exercise psychology and ABA utilize similar interventions to improve skills among group and individual exercise activities (e.g., football, soccer, basketball, volleyball, tennis, climbing, golf, gymnastics, swimming, dancing and figure skating) although they may define, analyze, or discuss them differently (Martin et al., 2004). Commonly used interventions include: modeling, imitation, observational learning, goal setting, feedback, and self-talk.

Modeling, Imitation, and Observational Learning

Research in the areas of sport and exercise psychology and ABA have examined interventions using modeling, imitation, and observational learning to increase skill acquisition; however, they differ based on their definition of terminology and interpretation of findings.

In sport and exercise psychology, modeling is the most commonly used term for interventions based on these methods. It is defined as a process in which an individual observes others and attempts to imitate the observed action or skill performed by another individual (McCullagh, Weiss, & Ross, 1989). Modeling has been a primary means by which skill acquisition and modification occur, and it can be conducted either in practice or off the field through video recordings. In addition, the literature in sport and exercise psychology describe that modeling a behavior during practice sessions as the main process for observational learning, which is described as a process in which one individual observes (i.e., in-person, video replay or video training) another individual engaging in the desired target and be reinforced for doing so (Anderson & Campbell, 2015). The individual is then able to adjust their performance accordingly and operate the skill under appropriate conditions.

In the field of behavior analysis, these types of interventions are often discussed in terms of modeling, imitation, and observational learning as related but distinct processes. For example, imitation is defined as a behavior, immediately following a model of any physical movement, that has formal similarity with that model (Cooper et al., 2007). Imitation may also occur after a delay, referred to as delayed imitation, which is considered to be a more complex form of behavior (Pierce & Cheney, 2013). Observational learning is defined as complex behavior that is learned and repeated based on the consequences others have received for engaging in such behavior. According to Pierce and Cheney (2013), observational learning involves the integration of generalized imitation, verbal behavior, as well as rule-governed behavior.

Despite these definitional differences, several studies have shown that interventions involving modeling and observational learning can be successful in

promoting skill acquisition in the areas of sport and exercise psychology and behavioral sport psychology. Modeling interventions have increased leg-extension endurance tasks, gymnastics skills, and teaching children to swim (George, Feltz, & Chase, 1992; Gould & Weiss, 1981; McAuley, 1985). Video modeling is a variation of this intervention that is often used to improve skills. For example, video modeling has shown to be effective in teaching non-experienced participants climbing techniques, while also increasing the rate of acquisition and fluency in movement patterns (Boshker & Bakker, 2002).

Despite the effectiveness of these methods, studies have also suggested that learning from others (expert or novice models) does not always increase a person's self-reported belief that they are capable of carrying out the target or activity (i.e., perceived confidence or competence). As a result, modeling, imitation, and/or observational learning methods are often combined with other intervention components such as feedback. For example, video modeling by experts in combination with video feedback has been shown to increase skill acquisition more rapidly than regular practice and coaching alone among gymnasts (Boyer, Miltenberger, Batsche, & Fogel, 2009). Despite these additions, authors indicated that video modeling with experts' feedback rarely increased skill acquisition rates to 80% or above and performance did not improve above intervention levels during follow-up probes. Therefore, further research is warranted to identify methods to maintain performance over time, and to improve towards near-flawless skill performance.

Goal Setting and Feedback

Goal setting and feedback are frequently used interventions in the area of sports and exercise to increase athletic performance (Martin & Thompson, 2011).

Sports and exercise psychology and ABA both describe goals and goal setting similarly. Goals are described as specified behavior and goal setting involves stating a level of performance for a behavior within a specified time period (Latham & Locke, 2006, p. 332; Martin, 2011). Additionally, research studies in both fields emphasize that feedback is a critical determinant of how goals affect behavior (O'Hora & Maglieri, 2006). Feedback provides the performer with information regarding goal attainment (Locke & Latham, 2002). In addition, O'Hora and Maglieri (2006) found goal setting in combination with feedback has been shown to have a greater effect on performance than goal setting alone.

Despite the similarities in their definitions, the two fields differ in the way they interpret goal setting and feedback. Sports and exercise psychology often describe goal setting and performance feedback as having a motivational effect (Kyllo & Landers, 1995; Martin, 2011). That is, the interventions increase coach and individual player performance through verbal statements that increase the value of the desired outcome or reinforcer. Behavioral sports psychology primarily describes goals and goal setting as rules, which exert control as antecedents and their effects are maintained by consequences (Martin & Thompson, 2011).

Although the two areas of study differ slightly on their interpretation of the terminology, both have found goals and feedback to be effective at improving performance outcomes. Behavioral sports psychology research has increasingly used single-subject designs to evaluate the effects of goal setting and feedback on athletic performance over the last 30 years (Luiselli, Woods, & Reed, 2011; Martin et al., 2004). These interventions have been utilized to increase individual performances in a variety of exercise and sport domains (Horn, 2009; Luiselli et al., 2011; Martin et al., 2004). For example, goal setting and feedback interventions have shown to be effective in increasing performance in football

related targets (Stokes, Luiselli, Reed, & Fleming, 2010), weekly running distance (Wack, Crosland, & Miltenberger, 2014), novice golf targets (Fogel, Weil, & Burris, 2010), and dance movements (Quinn, Miltenberger, & Fogel, 2015).

Researchers have also evaluated the effects of goal-setting and different types of feedback techniques (e.g., (1) goal-setting plus verbal feedback, (2) public posting plus verbal feedback, and (3) goal-setting, public posting, and verbal feedback) among group athletes and found that the majority of the targeted skills improved by using the combination of goal-setting, public posting, and verbal feedback (Smith & Ward, 2006).

Although research studies evaluating goal setting and feedback have demonstrated its effects on increasing skill acquisition in exercise and athletic performance, several limitations remain. First, the packaged interventions often used do not allow researchers to identify the separate effects of each component (Smith & Ward, 2006). Second, there are a limited number of studies conducted in different sports settings (Martin & Thompson, 2011). Finally, there has been a lack of research examining maintenance effects; it is unknown whether the participants' performance will continue at the increased level without the support of the studied interventions (Wack et al., 2014).

While this body of literature has examined the effects of these interventions on overt behaviors, most of these studies include typically developing adults who likely engage in a variety of covert forms of verbal behavior. Although these are difficult to measure as dependent variables, some studies have taught such covert behaviors as part of independent variables (Panteli, Charilaos, Efthimiou, & Smirniotou, 2013; Theodorakis, Weinberg, Natsis, Douma, & Kazakas, 2000).

Self-Talk

Several studies in sport psychology have focused on the effectiveness of self-talk among athletes for skill acquisition, error correction, action initiation, and sustained effort (Johnson, Hrycaiko, Johnson, & Hala, 2004). Self-talk is often described as what people say to themselves either overtly or covertly and is categorized as either positive or negative (Moran, 1996). Positive self-talk (i.e., statements that function as reinforcement) involves the use of verbal statements that are said to enhance self-esteem, motivation, concentration, and performance. In contrast, negative self-talk (i.e., statements that function as punishment) involves demeaning, critical statements that are said to foster self-doubt and anxiety (Johnson et al., 2004; Weinberg & Gould, 2003). Moreover, motivational and instructional self-talk are two subtypes further discussed in the literature (Panteli et al., 2013). Research suggests that these two types of self-talk techniques are effective for different tasks. While motivational self-talk has been shown to be most effective for strength and endurance tasks, instructional self-talk has been shown to be more effective for skill, timing, coordination, and precision tasks (Panteli et al., 2013; Theodorakis et al., 2000). Only a small number of studies in behavior analysis have focused on covert behaviors and even fewer on its use in exercise and sport interventions.

Motivational self-talk. As previously mentioned, research in sports and exercise psychology indicates that motivational self-talk is a useful strategy for increasing performance. The behavior analytic interpretation of motivational variables conceptualizes its role as motivating operations. Motivating operations are variables in the environment that alter the value of a stimulus, event, or object and alter the behavior previously engaged in to either contact or avoid the stimulus, event, or object (Laraway, Snycerski, Michael, & Poling, 2003). In

particular, establishing operations are the variables that temporarily increase the value of a stimulus, object or event and behavior relevant to contacting those events as consequences (Michael, 1993). Verbal stimuli that seem to serve this function have been described as verbal-establishing stimuli or motivational augmentals (Jackson et al., 2016; Ju & Hayes, 2008; Valdivia, Luciano, & Molina, 2006).

Jackson et al. (2016) conducted a study that examined the effects of such verbal stimuli in relation to the long-term consequences of exercise reported by the adult participants. The verbal stimuli consisted of reinforcer-focused verbal statements identified by the Implicit Relational Assessment Procedure (IRAP; Barnes-Holmes et al., 2006) and were assessed to determine whether they had motivational effects on participants' responding in an indoor cycling class. The participants were exposed motivational phrases (i.e. reinforcer-focused statements identified by the IRAP) and instructional phrases (e.g., statements related the form of activity). The dependent variable in the study was the participants' heart rates as a ratio of the instructor's heart rate averaged across each session.

The results suggest that these verbal stimuli served a motivational function and increased exercise intensity for 9 of the 11 participants during the motivational condition (Jackson et al., 2016). More specifically, reinforcer-focused verbal statements may have served as motivational stimuli in an exercise setting and temporarily altered the effectiveness of reinforcing outcomes, while also evoking behavior that leads to that outcome (Jackson et al., 2016).

One limitation of Jackson et al. (2016) is that it requires an analysis of individual statements that may function as reinforcers. It may be more efficient to examine methods that can be taught and utilized by larger groups of individuals. Researchers should also consider interventions that will generalize to a variety of

skills. In addition, although this increased the intensity of exercise, in accordance with previous research in sport's psychology, its effects on skills acquisition are relatively unknown (Panteli et al., 2013; Theodorakis et al., 2000).

Instructional self-talk. According to the sports and exercise literature, instructional self-talk may be more effective in acquiring and executing specific skills as well as timing and coordination (Panteli et al., 2013; Theodorakis et al., 2000). Self-talk procedures can be effective in improving performance when they are used in conjunction with other interventions and have been shown to be a useful technique for breaking down the complex task into smaller segmented parts to enhance skill acquisition for novice or experienced learners (Panteli et al., 2013).

In particular, research studies have found that task-specific self-talk instructions are more likely to prompt correct movements and eliminate errors in several sport and exercise activities such as, tennis, basketball, and soccer (Johnson et al., 2004; Landin & Hebert, 1999; Perkos, Theodorakis, & Chroni, 2002). The studies found that task-specific instructional self-talk in the form of a two-word self-talk sequence increased performance for a majority of participants. Self-report measures also identified that the self-talk strategy was highly accepted and indicated that most of the participants believed that self-talk increased their confidence in the target skill. One limitation of the studies was that the skills were not tested for generalization in a game or competitive setting. In addition, several of the studies did not record video footage showing the participants executing the target skill (i.e., low-drive kick, dribbling, shooting), which did not provide permanent product of the behavior. Therefore, the experimenters were unable to review previous performance and compare it with future performance. Despite

these limitations, the results from using task specific self-talk may increase skill acquisition and lead to enhanced athletic performance and self-reported confidence among novice and elite athletes.

Behavioral researchers also suggest that instructional self-talk can be utilized for improving skill acquisition and performance, as well as problem solving and planning (Zinsser, Bunker, & Williams, 2006). According to Martin (2011), self-talk may serve four behavior functions. First, it may function as a conditioned stimulus for eliciting respondent behavior such as emotions. Second, it can help focus the individual on specific cues. Third, particular words may serve as discriminative stimuli that evoke a motor response. Last, it can function as a conditioned reinforcer for completion of desirable actions (Martin, 2011).

There has been research to support the second behavior function, the use of self-talk to enhance an individual's focus on specific cues. Some sports have constantly changing cues (e.g., basketball, football, tennis) and these can complicate feedback provided by others (Ziegler, 1987). In these situations, it may be useful for individuals engaged in the exercise activity to self-direct their movement based on significant cues (e.g., when a ball bounces, is hit with a racket, or hit across the court). For example, a study conducted by Ziegler (1987) evaluated the effects of a four-step self-directed stimulus cueing technique on the skill acquisition of beginning tennis players. The participants were required to focus on the stimulus (i.e., the ball) and vocalize the specific action that occurred during the each of the steps (e.g., (1) "ball" when it first seen, (2) "bounce" when it bounced, (3) "hit" when it contacted the racket, and (4) "ready" to prepare for the next sequence). The results indicate that each individual exposed to the stimulus cueing technique showed a significant increase in performance for both forehand and backhand returns. Furthermore, research in the area of stimulus self-

cueing suggests that it can accelerate initial skill acquisition, enhancing enjoyment and adherence to physical activity and exercise. Existing procedures in verbal behavior and more specifically joint control may be useful in conceptualizing these procedures and utilizing them to accelerating skill acquisition in exercise behavior, specifically those involving such complex sequences of behavior.

Joint Control

Lowenkron (1998) described joint control as a discrete event in which two discriminative stimuli act jointly to exert stimulus control over a common response topography. This is a parsimonious model that has been developed to account for complex behavior using a purely behavioral framework without the use of hypothetical constructs such as agents or processors of information (Lowenkron, 2006). The joint control account emphasizes the role of the listener and the role as a speaker while using established operant principles, concepts, and terms (Lowenkron, 2006). It has also been described as a by-product of related repertoires (Miguel, 2016). For example, two of Skinner's (1957) elementary verbal operants, echoics and tacts, are most commonly involved in the joint control process. The tact is a verbal response under the control of a nonverbal stimulus (an object or event or a property of an object or event) and is established and maintained by generalized reinforcement from the verbal community (Skinner, 1957). For example, when a teacher holds up an item and asks a student, "What is this called? (Student names the item) or "What do you see?" (Student says, "An airplane"), the response is then followed by generalized reinforcement (e.g., praise). Echoic behavior is a vocal response controlled by a prior auditory verbal stimulus that has point-to-point correspondence and formal similarity between the prior stimulus and the response-product (Skinner, 1957). For

example, when a teacher asks a student to select a car from an array of five items, the spoken sample ("Car" in the phrase "Point to car") evokes the self-echoic on the part of the student (e.g., "Car, car, car").

Therefore, joint control provides a directly observable account of matching performances based on tact/self-echoic stimulus control (Lowenkron, 2006). An example often cited in the joint control literature, is when one is instructed to locate a six-digit number when presented with an array of comparison numbers that are not in numerical order (Gutierrez, 2006; Lowenkron, 2006). First, a speaker presents the discriminative stimulus, "Find the set of numbers 123567" and then a listener is shown an array of numbers. To preserve the response topography evoked by the first discriminative stimulus, rehearsal is needed. Rehearsal of the six-digit number can first occur as an echoic, and later as a self-echoic (often covertly), while the other numbers are presented and serve as discriminative stimuli that evoke tacts of each number. Thus, the individual identifies the correct six-digit number ("123567") under joint self-echoic/tact behavior (Lowenkron, 2006). In other words, one response topography occurs jointly under two sources of stimulus control (the echoic, or self-echoic, and the tact of comparison numbers). Furthermore, additional research conducted by Lowenkron (1988) supports the importance of mediating responses (e.g., rehearsal) in the accurate selection in delayed-matching tasks.

Research in joint control has been shown to play a role in complex human behavior in establishing generalized relational matching, listener responding, and generalized sequencing responses (Gutierrez, 2006; Lowenkron 1984; 1988; Tu, 2006). These studies have been conducted with a variety of populations including children with intellectual and developmental disabilities (Causin, Albert, Carbone,

& Sweeney-Kerwin, 2013; Tu, 2006) and college students and other typically developing adults (DeGraaf & Schlinger, 2012; Gutierrez, 2006).

A study conducted by Gutierrez (2006) demonstrated how a joint control procedure may be used to acquire generalized sequencing behavior and the importance of response mediation in complex human behavior among six typically developing adults using an unfamiliar language (Mandarin Chinese). The dependent variable was the sequencing of picture cards (e.g., pen, cup, fork and water).

During echoic training the participants engage in echoic responses prompted by the *echoic gesture* (the experimenter's palm faced his body and repeatedly waved his hand in a circular motion toward and away from himself), with the names of the four pictures used in baseline. Echoic training ceased once the participant was able to emit three consecutive responses of the modeled name. Tact training followed echoic training and consisted of immediate vocal prompts provided by the experimenter while presenting the stimuli and ceased once the participant accurately tacted three consecutive stimuli independently (i.e., without vocal prompts).

Following echoic and tact training, participants were exposed to joint control training, to produce the joint tact/echoic control. The experimenter first presented the names of the four-item sequence one at a time (e.g., "Pen, cup, fork, water"). Then repeated the sequence of names while using the echoic gesture, prompting the participants to repeat the sequence named by the experimenter. The participants where then instructed to arrange the four pictures in the corresponding sequence while also repeating the sequence. Following the arrangement, participants tacted the Chinese-Mandarin terms in their corresponding sequence (e.g., "Pen, cup, fork, water"). Training continued until participants made three

consecutive correct arrangements of the four pictures without the echoic gesture prompt. If any errors occurred, the sequences were repeated. The echoic gesture prompt was faded as sequences were presented.

To identify whether generalization occurred, participants were exposed to four different arraignments for stimuli Set 2. As a result of employing a joint control procedure, all participants accurately produced untrained picture sequences. The results in the study further support Lowenkron's analysis of joint control in complex human behavior (1984, 1988).

A more recent study conducted by DeGraaf and Schlinger (2012) attempted to replicate the procedures used by Gutierrez (2006) to evaluate sequencing behavior among five undergraduate students also using Mandarin Chinese. The purpose of the study was to evaluate the rate of acquisition between a prompt-and-fade procedure compared to joint control training, on delayed sequencing behavior (i.e., the delay between instruction and the opportunity to respond), and to further evaluate response blocking (DeGraaf & Schlinger, 2012). The study employed a few procedural modifications. For example, different set of stimuli sets were used for each of the different procedures, and participants were exposed to 1 of 24 sequencing combinations (without being repeated). Instead of a generalization test, the study employed delay probes to assess whether responses maintained following training conditions (DeGraaf & Schlinger, 2012).

The results of the study demonstrate that all participants acquired correct sequencing responses faster after the echoic and tact training were directly taught. In other words, each participant acquired correct responses with fewer trials (ranging from 3 to 7 trials) during the joint control procedure versus the prompt-and-fade procedure (7 to 17 trials). This finding further supports the hypothesis that complex tasks, such as sequences of responses, mastered in echoic and tact

training sessions followed by joint control training may lead to faster acquisition of the task compared to when the responses are taught using more traditional methods (e.g., prompt-and-fade procedure) (Degraaf & Schlinger, 2012). In addition, the results from delay probes for the prompt-and-fade procedure were inconsistent and varied across participants. In general, the delay interfered with accurate sequencing; however, after joint control training, all participants responded at 100% accuracy for all delay probes, providing further support that self-echoic behavior may preserve the response topography over time and bring the response under joint stimulus control, leading more efficiently to correct responses.

Research in joint control may be useful in increasing skill acquisition in group exercise classes as they are comprised of complex sequences of responses. According to Palmer (2006), previous research has shown that joint control is a necessary controlling variable for correct performance and explains how correct performance emerges. In addition, Palmer (2006) stated that "joint control is a discriminable event that may be a conditioned reinforcer commonly regarded as underlying imitation, generalized imitation, and all conformity to patterns established by the social community" (p. 214). In other words, a person undergoing joint control may recognize when their response matches the correct selection and that this serves a reinforcing function. For example, in a group exercise class where a person follows an instructor, engaging in responses that match the form and timing of the instructor's may be reinforcing.

In summary, the joint control literature suggests that complex sequences of skills may be acquired more quickly using joint control training than with traditional teaching methodologies (Degraaf & Schlinger, 2012; Tu, 2006). As such, joint control may be a viable method of teaching complex sequences of

behavior involved in various forms of physical activity and may also provide a direct and immediate source of reinforcement in the activity itself.

Group Exercise

The majority of the sport and exercise research has focused on the performance of athletes either in individual or group sport activities. Although group exercise activities provide many of the health and fitness benefits similar to individual exercise activities (Delextrat, Warner, Graham, & Neupert, 2016), some studies have suggested that individuals prefer participating in group exercise classes over other exercise formats (Stephens & Craig, 1990). However, drop-out rates are still high (Delextrat et al., 2016). Increased rates of skill acquisition may lead to greater feelings of competency and enjoyment and reduce drop-out rates in group exercise formats. Joint control procedures may be one way to do this that increases skill acquisition more rapidly than traditional teaching methods alone (Degraaf & Schlinger, 2012; Palmer, 2006; Tu, 2006).

Purpose

The purpose of the current study is to examine the use of a joint control procedure on the acquisition of sequences of physical movements in a group exercise setting. In addition to correct movements, we will measure the intensity of exercise, and the self-reported enjoyment of the individual participating.

CHAPTER 3: METHODOLOGY

Participants

Recruitment

This study initially recruited 15 adult participants (4 males, 11 females, ages 19-29 years old) via flyers distributed at an event held at UC Davis and via social media (see Appendix A). Five participants met a criterion of 80% or better during baseline, therefore, they were regarded as secondary participants and the focus of the study was on five participants who failed to meet 80% during baseline. The remaining five participants who met the mastery criteria of 90% or better during baseline were excluded from analysis, although many continued to participate in the group.

To qualify for the study, individuals could not have prior exposure to the specific workout routine prior to baseline and could not be familiar with joint control research.

Setting and Materials

The study was conducted across two settings. Baseline, post intervention probe and generalization sessions were conducted in 20 ft X 20 ft group fitness room equipped with fans, large mirrors, floor mats, and a sound system. Intervention sessions were conducted in a smaller room (approximately 10 ft X 12 ft) located near the large fitness room.

Materials

Fliers were used to recruit participants from the local area. All participants were provided with an informed consent form that explained, in detail, procedures, the duration of the study, and potential risks and benefits of their participation (see

Appendix B). All participants were provided with contact information to answer any questions or concerns they may have had regarding this study. In addition, they were notified that the instructor was formally certified in the exercise format used. Lastly, the participants were also informed that their participation was voluntary and were free to withdraw from the study at any time Each participant was assessed using the 2017 Physical Activity Readiness Questionnaire for Everyone [PAR-Q+], a pre-participation health screening, and the International Physical Activity Questionnaire (IPAQ) to identify whether individuals had any injuries or conditions that would prevent them from participating or pose any risk to participating. In addition, participants also filled out a self-report questionnaire to identify their individual learning techniques, if any, in a group exercise format (Appendix C). Three cardio kickboxing sequences from a commercially available group exercise format were used for baseline, intervention, and post intervention probes. Each of the sequence formats were approximately 10-12 min in duration and consisted of a repeating section and three other sections that each occurred twice (punches, kicks and form). However, patterns within each section varied across sequences. Sequence 1 contained 662 exercise moves, Sequence 2 contained 672 exercise moves and Sequence 3 contained 712 exercise moves.

Recording Instruments

A GoPro camera was used to record all workout sessions for data collection, IOA, and treatment integrity purposes. The device was placed on a shelf above the mirrors to capture all the participants in the room. In addition to the GoPro camera, the instructor wore a microphone head set device. The purpose for the head set device was to allow participants to hear the instructor provide instructions while music was playing.

A paper datasheet and pencil were used to track the participant's rate of skill acquisition by recording the number of errors made during the exercise format (see Appendix D). The study also utilized the *Fitbit Charge HR Wireless Activity Wristbands* to measure the participants' heart rates. The *Fitbits* connected using Bluetooth and transferred data to an iPad. In addition, participants were asked to rate their enjoyment of the class by completing the Physical Activity Enjoyment Scale (PACE) (Moore et al., 2009; see Appendix E).

Dependent Variables

The primary dependent variable was the percentage of exercise moves executed in the correct sequence and approximately at the correct time during the pre and post intervention probes for two different workout sequences (i.e., the participants' exercise moves must be topographically similar to the movement of the instructor in the correct sequence and timing). The secondary dependent variables were the participants' heart rate and self-reported enjoyment. The dependent variables were consistent across all participants and conditions.

Data Collection and Interobserver Agreement

Exercise Moves

The primary dependent variable (exercise moves) were calculated by first tracking all incorrect moves, subtracting the number of errors from the total moves in the sequence, then dividing the number of correct moves executed by the participant by the total number of moves involved the exercise sequence. For example, sequence 1 had a total of 662 moves, so if the participant made 50 errors, this would be subtracted from the total number of moves (662) resulting in 616

correct moves, and their performance would be calculated as 93% of correct moves for that session. Data were collected using a pencil and paper datasheet.

Heart Rate

All *Fitbit* screens were covered prior to each exercise session. Heart rate data were collected during the exercise sessions by placing the *Fitbit* in exercise mode. At the start of the cardio kickboxing routine, the participant was instructed to press and hold the side button on the *Fitbit* until it vibrated. When the workout section ended, the participants was told to hold the side button once more until it vibrated. Data from each participant's heart rate monitor were collected at the end of the session and saved on an electronic device. This was used to measure physical activity intensity.

Enjoyment Levels

The participant's enjoyment levels were recorded on the Physical Activity Enjoyment Scale, which was made up of an 18-item scale. Participants were asked to rate their experience immediately after each of the 30 min pre and post probe exercise sessions regarding the physical activity they were doing. It is made up a 7-point bipolar rating scale where 11 items are reverse scored and higher levels of PACES scores reflect greater levels of enjoyment (Mullen et al., 2011).

Interobserver Agreement (IOA)

Research assistants were trained before the study began. They were given instructions of the targeted behaviors and provided with an exercise video as an example. The research assistants practiced tallying the number of missed steps using a video of people exercising and data sheet provided by the researcher until they reached at least 90% correspondence with the primary investigator for two

consecutive. Each participant was scored based on his or her percentage of correct responses during a cardio kickboxing sequence. Participants' heart rate measures were analyzed using *Fitbits*. This was used to measure physical activity intensity. Lastly, the participant's enjoyment levels were recorded on the PACE. Participants were asked to rate their experience immediately after each of the 30 min pre and post probe exercise sessions regarding the physical activity they were doing.

Two independent observers coded videos and collected data on a sheet of paper specifying whether the participants corresponded with the instructor by recording all incorrect moves in the exercise sessions. All self-report measures (e.g., PACE and post-intervention questionnaires) and heart rate scores were collected as written permanent products. Two independent observers reviewed and calculated the scores.

Interobserver agreement (IOA) for the percentage of correct moves was assessed across 40% of all sessions by the trained research assistants using point-to-point correspondence. The total percentage of agreement during the exercise sessions was 98.5% (ranging from 91%1 to 100%). Self-reports measures and heart rate data were also analyzed for point-to-point correspondence for 50% of all sessions. IOA for the enjoyment scales was 99.7% (ranging from 97% to100%) and 100% for heart rate measures. IOA was calculated by dividing the number of agreements, by the number of agreements plus disagreements, and multiplying that by 100. To consider the agreement as reliable, the two independent observers needed to be at 90% agreement.

Independent Variable

The independent variable was the joint control training procedure. During intervention sessions, the experimenter taught the participants a variety of verbal

sequences of moves from different sections of cardio kickboxing Sequence 2. The participants were taught to employ the joint control strategy for each of the sections by first learning the sequence of moves as an echoic and self-echoic response, then learning to tact each of the individual exercise moves, and finally, to demonstrate the moves while engaged in the self-echoic sequence (i.e., names of moves in order and with timing).

Research Design

A multiple-probes design was utilized for this study. At least three 30 min probe sessions were conducted during baseline. The number of baseline sessions varied across participants, such that the introduction of the intervention was staggered across participants. Although we expected some degree of acquisition (i.e., some increasing trend) in baselines, we implemented intervention at a point where baseline data were relatively stable. Intervention sessions were approximately 60 min and continued until participants meet mastery criterion for three sections. After intervention sessions are completed, follow up probes were conducted with a new sequence to test for generalization.

Procedures

Assessments and General Procedure

A consent form and two self-report assessments were required prior to experimental sessions. First, the participants filled out a consent form agreeing to participate in the experiment. Next, the 2017 PAR-Q+ a pre-participation health screening, and the IPAQ was utilized to identify whether the participants had any health conditions that may put them at risk. Any participants reporting such conditions, were excluded from the study. A questionnaire identifying their

previous history with group exercise classes were then given. If they had prior experience with group fitness classes, the assessment asked how often, how long, what types of classes, and their current method of learning exercise moves for those classes. Prior to baseline, each participant was given an HR Charge *Fitbit* with an assigned number. Each number corresponded to a specific participant. This allowed the participant to use the same *Fitbit* throughout the experiment and any margin of error was consistent across all phases. All *Fitbits* were covered prior to each exercise session. Heart rate data were collected during the exercise sessions by placing the *Fitbit* in exercise mode. At the start of the cardio kickboxing routine, the participant was instructed to press and hold the side button on the *Fitbit* until it vibrated. When the workout section ended, the participants were told to hold the side button once more until it vibrated. Data from each participant's heart rate monitor were collected at the end of each session and saved on an electronic device.

Participants were assigned to one of two session times. Both session groups underwent the same procedures, but with a different order of sequences (see Table 1). One group of participants was first exposed to the cardio kickboxing Sequence 1 and the other group was exposed to Sequence 3. For all participants, kickboxing sequence 2 was used during the joint control intervention.

Table 1

Primary Participants' Exercise Sequence Assignment

Probe Phase	Emily	Phoebe	Janice	Mona	Chandler
Baseline/Post Probes	1	1	3	3	3
Generalization	3	3	1	1	1

Baseline

All participants were exposed to 30-min sessions that included a warm-up, a cardio kickboxing sequence, and a cool-down. All participants were instructed to follow along for the entire exercise routine. No prior training was provided. The instructor led the class as they normally would by providing one demonstration before each section and vocalizing the names of the exercise movements in a sequence as they demonstrate the movement. For example, the instructor said while modeling the movements, “Next, we will do a jab, cross, body, body, knee, elbow.” During this phase, some degree of acquisition was expected due to prior history with sequences of movement (e.g. exercise, dance, etc.), repeated exposure to the same exercise sequence, and the resulting learning effects; however, several of the participants’ percentages were significantly higher than expected, leading us to be concerned about ceiling effects. Given this, any participants that reached 80% or better of correct exercise moves within the baseline sessions were considered as secondary participants. This was the case for five of the participants. The remaining five participants were designated as primary participants due to their lower baseline levels during the first three sessions (i.e. these participants had greater difficulty learning the exercise sequence). The participants were not informed that they were either designated as primary or secondary participants. The purpose of their classification was only for data analysis.

Intervention Phase

The intervention sessions involved joint control training and were conducted in a separate room from baseline and probe sessions. Intervention sessions were conducted on days in between probe session days to avoid missing exercise probe sessions. For example, we ran probe sessions on Mondays and Wednesday; therefore, when data were relatively stable we introduced the joint

control intervention on the weekend before the Monday session, or the Tuesday before the Wednesday session. Exercise Sequence 2 was used during intervention for all participants. The sequence consisted of four sections, one repeating section and three sections that are each completed twice (punches, kicks, and form). Each section was introduced and mastered individually before introducing the next section.

Several components of the Gutierrez (2006) and DeGraaf and Schlinger (2012) joint control training procedure were utilized throughout the intervention. As an overview, the procedure consisted of echoic training of the vocal sequence of the moves and tact component training of the names of each of the individual moves, to produce tact and echoic control. Once the participants emitted the echoic and tact responses, joint control training commenced. During joint control training, sequences were taught until participants were able to vocalize and execute the correct moves for each sequence at 100% trials, while overtly utilizing the intervention strategy. A separate datasheet was used to track the participant's correct responses during echoic, tact and joint control training (Appendix F).

Joint control component training. Participants first began with the component training consisted of both echoic and tact training and were then introduced to the joint control training across each section of exercise sequence 2.

Echoic training. Several vocal sequences consisting of exercise moves were trained as echoic responses without the presence of the corresponding action. Thus, the purpose of this section was to teach the participants to repeat the spoken moves stated by the experimenter. The experimenter first stated the sequence of moves (e.g., "jab, cross, hook, upper cut"). To execute the echoic responses, the experimenter provided an echoic gesture prompt in the form of a hand signal by

waving one hand in the air in a circular motion three times. The experimenter continued to vocalize the sequence of moves. Correct echoic responses were followed by social praise (e.g., “Yes, that’s right” or “good”). After an incorrect echoic response, the experimenter provided corrective feedback (e.g., “Not quite, let’s try again”), represented the vocal sequence and again provided the gesture prompt to execute the echoic response. Echoic training ceased once the participant engaged in the echoic response (i.e., repeated) for each section of moves in the correct sequence three consecutive times.

Tact training. The exercise moves taught during echoic training (e.g., jab, cross, hook, upper cut”) were demonstrated in random order one at a time. The participants were instructed to say the name of the move out loud after demonstration of each individual move. To avoid any errors, the experimenter first demonstrated the exercise move, and immediately prompted the name of the move. Once all the moves in the sequence were vocally prompted, the experimenter tested whether the participant could tact the moves without additional prompts. All participants were able to acquire the names of the exercise moves without further prompting. To ensure the participants’ responses were under the control of the exercise move and not the echoic prompt, the experimenter continued presenting the demonstrations and required overt responses until the participants named each of the moves at 100% correct for three consecutive trials. If the participant responded incorrectly, the experimenter provided corrective feedback in the form of a model prompt while engaging in the move once again.

<u>Joint-control training</u>. This phase required that the participants engage in the echoic response as they executed the moves to produce joint tact/echoic

control (DeGraaf & Schlinger, 2012). During this phase, the participants learned a variety of sequences:

1. The instructor said the target sequence as they demonstrated the movements.
2. The instructor provided the echoic gesture prompt.
3. The participants executed the echoic responses (overtly) while also engaging in the moves.
4. If the participant responded correctly (engaging overtly in the self-echoic sequence and/or tacting and executing the sequence of the moves simultaneously in the order that the instructor said them) the instructor provided social praise (e.g., “That’s it”).
5. If the participants made an error, steps 1-4 were repeated.
6. Training continued until each participant correctly responded to the sequences three consecutive times at 100% correct.

After participants met mastery criterion for section one, they underwent the same component training (echoic and tact) and joint control training with each remaining section. Joint control training was complete when participants met mastery criterion (i.e., 100%) for all four sections of the sequence. Participants were instructed to utilize the joint control strategy during the group exercise (probe) sessions. For example, “When you join the group exercise class and perform the cardio kickboxing workout routine, use this strategy to name the moves and repeat the sequences presented by the instructor to yourself as you are doing it.”

Post Probe Phase

Post probes were implemented exactly the same way as the baseline phase and the same measures were taken except for an additional questionnaire asking whether or not participant had employed the joint control strategy during the post probe exercise sessions (see Appendix G). The questionnaires were presented after the PACE questionnaire. Mastery criterion was set at 90% or better of correct exercise moves for three consecutive sessions. If the participants did meet mastery criterion of 90% or better after 10 post probe sessions, additional joint control training would have been provided; however, all participants met mastery under 10 exercise sessions; therefore, there was no need to provide additional joint control training.

Generalization Probe

Once participants met mastery criterion of 90% or better across three consecutive sessions for the post intervention probe, they were introduced to a new cardio kickboxing sequence. This phase was implemented the same way as the baseline and the post intervention probe phases and the same measures were taken.

Social Validity

At the end of the study, social validity questionnaires were administered to all participants (see Appendix H). The questionnaires assessed how acceptable and easy the joint control procedure was to implement in the exercise routine. It also assessed whether they noticed changes in accurate performance after implementing the joint control procedure and whether they will continue to use it in the future during exercise routines that require sequences of behavior.

Procedural Integrity

To ensure that the experimenter conditions were implemented with fidelity, the instructor teaching the cardio kickboxing sequences needed to be currently certified. The instructor needed to demonstrate adequate training to implement the three different cardio kickboxing sequences (e.g., 1, 2, and 3). Exercise demonstrations took place prior to the experiment and were recorded. The instructor performed at 100% accuracy with the commercially available cardio kickboxing training video before beginning the experiment.

To ensure the instructors adhered to the procedures in the study, video recording was conducted to ensure the exercise moves corresponded to the sequence and timing provided and that instructors cued sequences at the appropriate time. Data was collected on a checklist. The checklist consisted of the list of moves for each of the sequences (see Appendix I). The checklists were evaluated by research assistants for 40% of sessions and was 99% across all three exercise sequences.

Data Analysis

Visual analysis was used to examine the level, trend, and variability of the primary and secondary dependent variables. The primary dependent variable, percentage of correct exercise moves, was calculated by tracking the number of correct moves in each of the exercise sessions to determine the effectiveness of the intervention. The secondary dependent variables, exercise intensity and enjoyment, were tracked via *Fitbits* enabled with HR monitors and the PACE.

CHAPTER 4: RESULTS

Figure 1 depicts the results for the primary participants (Janice, Mona, Chandler, Emily, and Phoebe). These data show that the percentage of correct exercise moves increased above baseline levels after the joint control intervention was implemented. Based on the visual analysis all primary participants showed an increase in level of correct responding post-intervention, and an increase in level of correct responding during generalization, compared to the initial level of the first pre-intervention sequence.

Janice

Janice began Exercise Sequence 3 at 41% of correct exercise moves and when data were relatively stable she was exposed to the joint control intervention. Following the intervention, Janice moved from 56% to 92%, increasing by a 36% She met mastery criterion after three consecutive sessions at 90% or better. Janice mastered Exercise Sequence 3 after six exercise sessions. During generaliztion probes, Janice began Exercise Sequence 1 at 82%. The following three sessions were above 90%; therefore she met mastery criterion for Exercise Sequence 1 after four exercise sessions.

Mona

Mona began Exercise Sequence 3 at 32% correct moves. She was introduced to the joint control intervention after three relatively stable baseline sessions. Following joint control training, Mona moved from 37% to 63% correct moves. Her following three sessions were at 90% or better allowing her to meet mastery criterion. Mona finished Exercise Sequence 3 after seven exercise sessions. During the generalization probe, Mona reached 91% on her first session

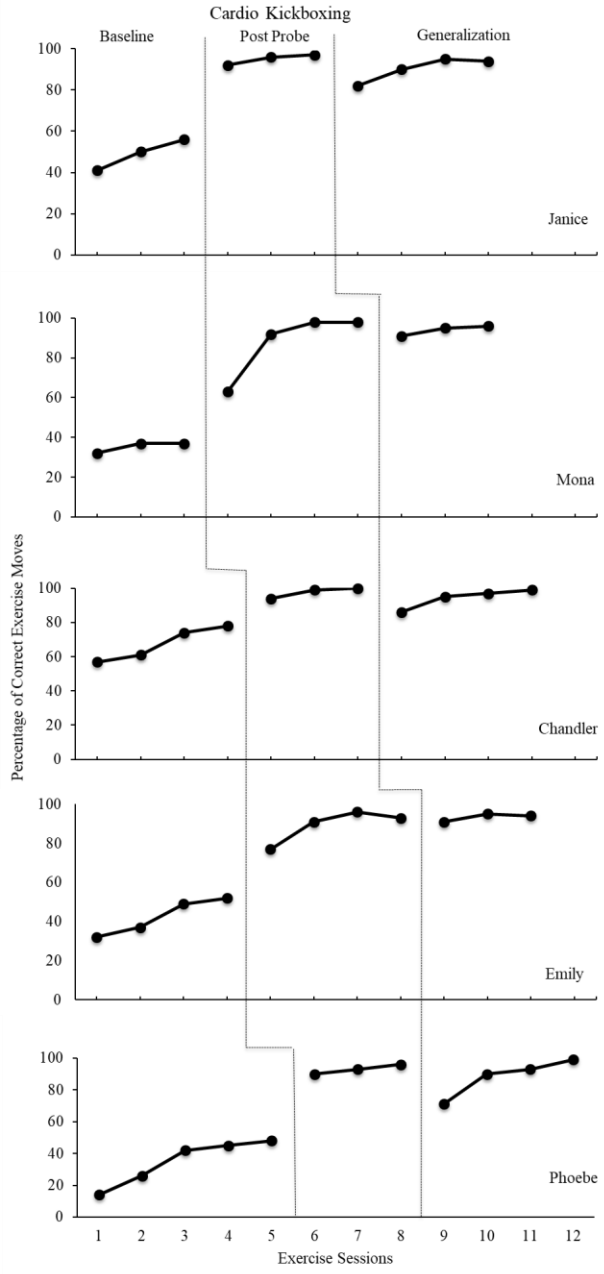


Figure 1. Percentage of correct exercise moves for all primary participants.

for Exercise Sequence 1. She met mastery criterion for Exercise Sequence 1 after three exercise sessions.

Chandler

Chandler began Exercise Sequence 3 at 57% and when data were relatively stable he was exposed to the joint control intervention. Following the intervention he moved from 78% to 94% correct moves, which allowed him to met mastery criterion after three consecutive sessions at 90% or better. Chandler finished Exercise Sequence 3 after 7 exercise sessions. During the generalization probe, Chandler began Exercise Sequence 1 at 86%. The following three sessions were above 90%; therefore he finished Exercise Sequence 1 after four exercise sessions.

Emily

Emily started at 32% correct moves during Exercise Sequence 1 and after the data were relatively stable she was introduced to the joint control intervention. Following the procedure she moved from 52% to 77% correct exercise moves. Emily's following probe sessions were all above 90%, allowing her to meet the mastery criterion for Exercise Sequence 1 at 90% or above for three consecutive sessions. She finished Exercise Sequence 1 after eight execise sessions. During the generalization probe, Emily started Exercise Sequence 3 at 91% correct moves and met mastery performing 90% or better for three consecutive sessions.

Phoebe

Phoebe began Exercise Sequence 1 at 14% correct moves and after data were relatively stable she was introduced to the joint control intervention. Her last data point prior to the joint control intervention was at 48% and after the intervention she moved to 90% correct exercise moves. Phoebe met mastery

criterion for Exercise Sequence 1 after eight exercise sessions. During the generalization phase, Phoebe began Exercise Sequence 3 at 71% correct moves followed by three consecutive sessions at 90% or better.

Figure 2 depicts the average percentage of correct moves for each of the primary participants during the three phases (baseline, post-intervention, and generalization). Janice had an average of 49% correct exercise moves during baseline, followed by 95% during post-intervention, and 90% during generalization. Mona's average of correct exercise moves during baseline was 35%, followed by 88% during post-intervention, and 94% during generalization. Chandler had an average of 68% correct exercise moves during baseline, 98% during post-intervention, and 94% during generalization. Emily's average of correct exercise moves during baseline was 43%, followed by 89% during post-intervention, and 93% during generalization. Lastly, Phoebe had an average of 35% correct moves during baseline, followed by 93% during post-intervention, and 88% during generalization. Overall, the primary participants had an average of 46% correct exercise moves during baselines, 93% during post-intervention, and 92% during generalization.

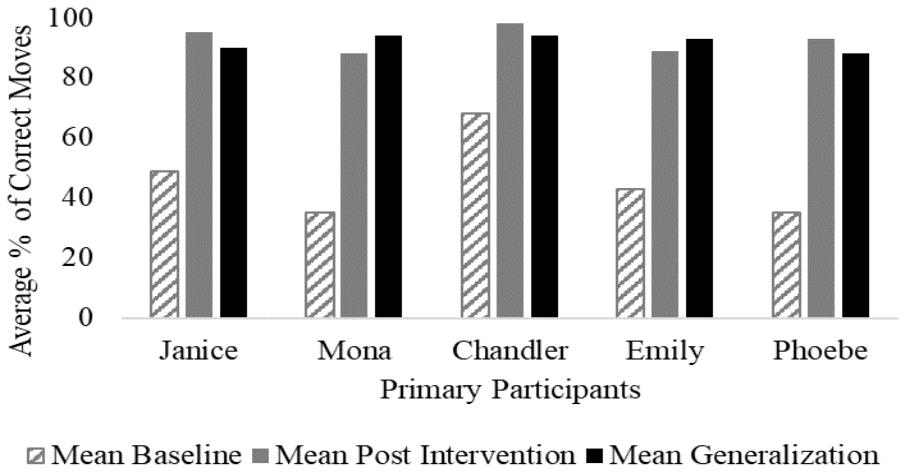


Figure 2. Average percentage of correct moves for each participant during each phase (baseline, post-intervention, generalization).

Secondary Participants

The results for the secondary participants exposed to the joint control intervention (Rachel, Fun Bobby, Elizabeth, Ross, and Monica) suggest there was a moderate increase in the percentage of correct exercise moves after undergoing joint control training (see Appendix J). Rachel, Fun Bobby and Elizabeth were first exposed to Exercise Sequence 1 during baseline and post probes, and Exercise Sequence 3 for generalization. Rachel finished both Exercise Sequence 1 and Exercise 3 after a total of seven exercise sessions. Fun Bobby and Elizabeth finished both sequences after nine exercise sessions. Ross and Monica were first exposed to Exercise Sequence 3 during baseline and post probes, and Exercise Sequence 1 for generalization. Ross finished Exercise Sequence 3 and Exercise Sequence 1 after a total of 10 exercise sessions. Monica finished both sequences after a total of 11 exercise sessions. Overall, the secondary participants had an average of 79% correct exercise moves during baseline, 98% during post-intervention and 95% during generalization (refer to Appendix J for individual means).

Heart Rate

Heart rate measures were recorded and graphed after each exercise session to indicate the level of intensity throughout the experiment. Figure 3 depicts the results for the primary participants. The results show that the participants' maximum (■) and average heart rate (♦) measures remained high (i.e., results did not show a change in level or trend throughout the study).

Secondary Participants

Heart rate measures for the secondary participants did not show a change in level or trend throughout baseline, post-intervention probes and generalization (see

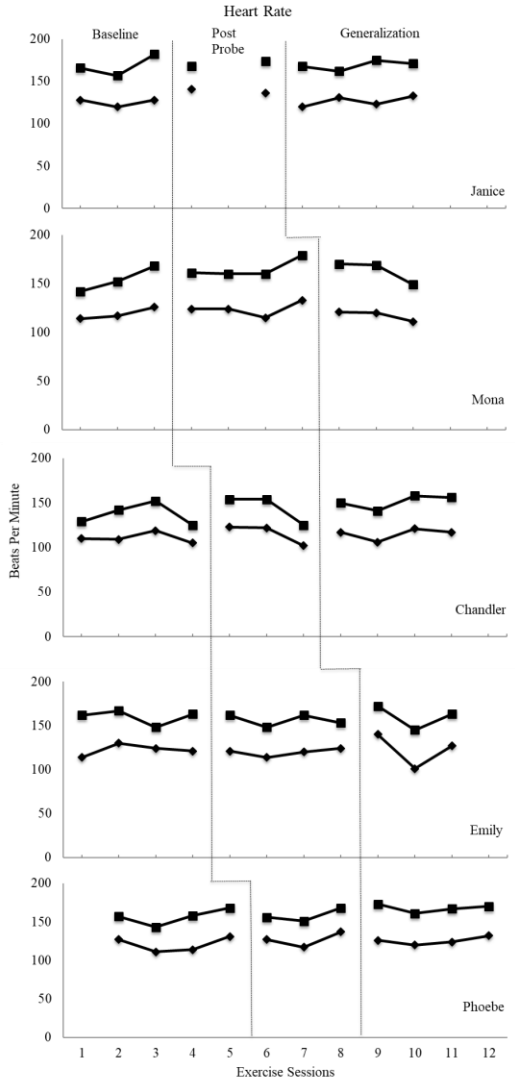


Figure 3. Maximum (■) and average (♦) heart rate measures for all primary participants.

Appendix K). All secondary participants remained in the moderate or vigorous intensity level as they progressed through each phase.

Physical Activity Enjoyment Scale

The Physical Activity Enjoyment Scale was given to all participants after each exercise sessions and their scores were recorded. Figure 4 depicts the results for the primary participants. The results show that the participants' enjoyment ratings stayed relatively stable throughout the study.

Secondary Participants

Enjoyment scores remained relatively high for all secondary participants throughout the three phases (refer to Appendix L). Enjoyment scores did not show a difference in level or trend.

Social Validity Results

Social validity results for the primary participants compared to the secondary participants are displayed in Figure 5. On average, primary participants were in 91% agreement with the social validity questions. Four of the five primary participants reported that they agreed that the joint control procedure could be easily implemented in the cardio kickboxing sections during the exercise sessions. All five participants agreed that they would continue using the joint control procedure in other exercise activities that require sequences of movements. All participants agreed that they noticed changes in accurate performance after implementing the joint control strategy, that it was effective in increasing their physical activity, and would recommend this study to others. Based on the social validity questionnaires, all participants "strongly agree" that they enjoyed

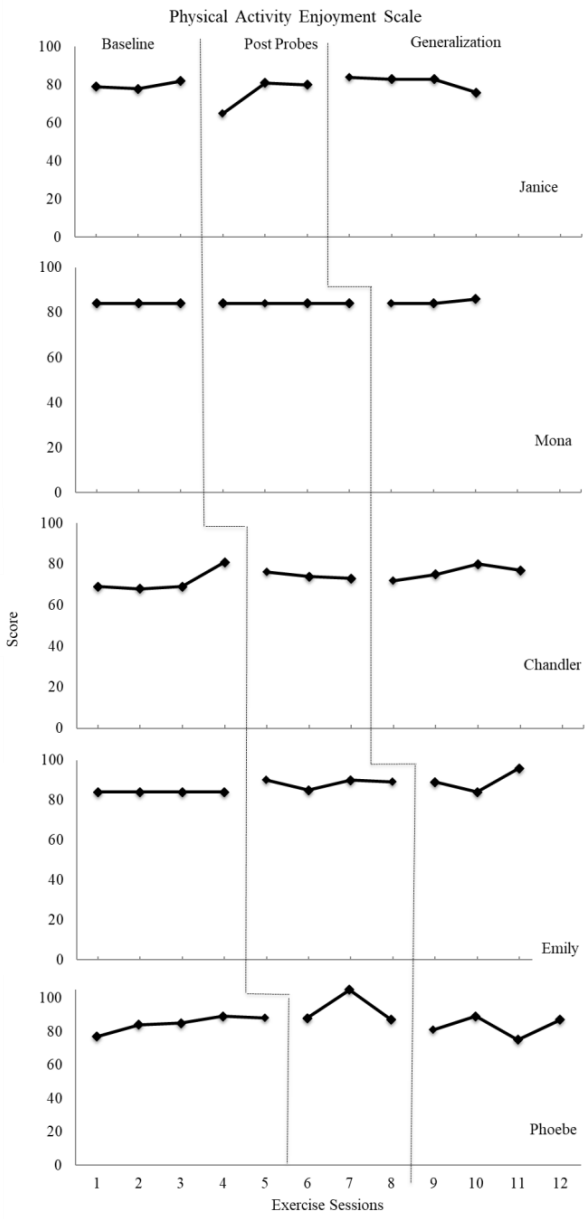


Figure 4. Enjoyment scores for all primary participants

participating in the study. Last, four of the five participants reported that the study did not require too much time or effort to participate in.

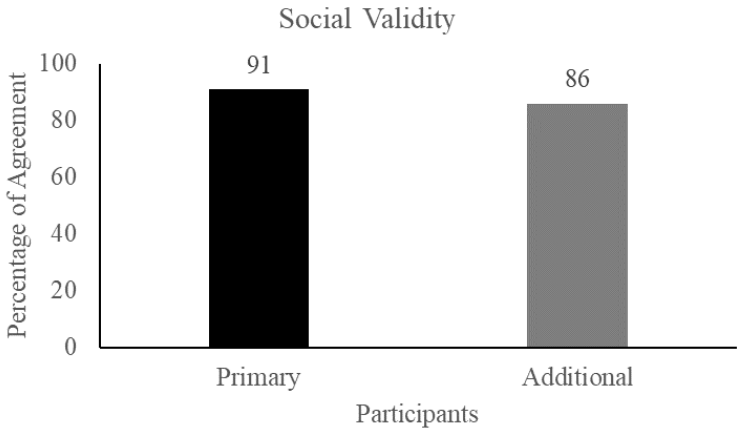


Figure 5. Social validity percentage of agreement on items 1-7 completed by primary and secondary participants.

Secondary participants were at 86% in agreement with the social validity measures. They agreed that they noticed changes in accurate performance after implementing the joint control strategy, would continue using the joint control procedure in other exercise activities that require sequences of movements, and would recommend this study to others. Four of the five participants stated that the study was effective in increasing their physical activity and would continue using the strategy in other exercise activities that require sequences of movements. Only two of the five participants reported that the study did not require too much time or effort to participate in. Lastly, all participants “strongly agree” that they enjoyed participating in the study.

CHAPTER 5: DISCUSSION

The current study evaluated the effects of a joint control procedure on skill acquisition in a group exercise format. The results suggest that the joint control intervention was effective in increasing acquisition and in establishing generalized sequences of behavior, particularly for those who initially had difficulty learning the exercise sequence.

For the primary participants, their percentage of correct exercise moves increased by an average of 29%. During the generalization sequence, all participants' first data point increased in level compared to their initial baseline data point. Although we did not require participants to use the strategy overtly, self-reports of use of the intervention were collected (Table 2). All primary participants self-reported that they used the joint control intervention during post intervention probes. Four of the five participants reported using the strategy during the generalization sequence. The fifth participant, Chandler, stated that he no longer needed to use the strategy and found it somewhat distracting. Although, the intervention could not be unlearned, it is difficult to identify if he used some component of the strategy.

Table 2

Post-Intervention Questionnaires for Primary Participants

Probe Phrase	Emily	Phoebe	Janice	Mona	Chandler
Post Probes	Yes	Yes	Yes	Yes	Yes
Generalization	Yes	No	Yes	Yes	Yes

The results for the secondary measures, heart rate and enjoyment, suggest that the intervention did not result in any consistent change in exercise intensity or enjoyment levels measured at baseline. Intensity levels remained in the moderate-to-vigorous levels, suggesting the intervention did not increase exercise intensity (although it was already high so there may have been ceiling effects) but also did not hinder or detract from exercise intensity. Enjoyment levels also began and remained relatively high throughout the study for all participants and may have suffered from similar ceiling effects. In addition, high enjoyment levels during baseline may have been the result a selection bias (participants who signed up for the study may have been more likely to do so because they already enjoy this type of physical exercise). Despite these findings, it is important to note that the intervention did not negatively affect the individual's self-reported enjoyment.

During baseline, ceiling effects were also seen in measuring the primary dependent variable for the secondary participants (Rachel, Fun Bobby, Elizabeth, Ross, and Monica). Although the results for the secondary participants suggests that an increase in the percentage of correct exercise moves occurred after the joint control training, the increase in level was minimal and suffered from ceiling effects. Most importantly, none of the participants' percentage of accurate responses decreased after the intervention, which suggests that the intervention did not hinder their exercise performance.

This study not only suggests that joint tact-echoic stimulus control may have led to the increase in accurate responding, but also that it may have led to quicker acquisition among the primary participants. The average percentage of correct moves for each participant during the individual phases (shown in Figure 2) suggest that after undergoing the joint control intervention, the primary participants were able to increase their percentage of correct moves to meet similar

results of the secondary participants who started with higher baseline levels (80% or better).

Overall, it is possible that the joint control intervention was an efficient method and could be implemented in an everyday group exercise setting. The average time to complete the intervention was 22 min (ranging 14-36 min) for each participant. The results support previous research that joint control may serve a critical role in the performance of complex listener behaviors (Degraaf & Schlinger, 2012; Tu, 2006) and may also serve as an effective and efficient avenue for the acquisition of other topographical response modalities (i.e., exercise movements). In addition, the post intervention generalization probes demonstrated that the joint control intervention may have allowed for generalized responses to occur and an increase performance.

Limitations

In summary, all participants in this study increased their percentage of correct moves after undergoing the joint control intervention. However, it is difficult to identify whether the participants exposed to the intervention were implementing it during each exercise session. Therefore, one limitation of the study was that we did not require overt joint control responding during post probes. Self-report of use of the intervention was measured. This makes it difficult to identify whether the participants engaged in the joint control strategy where both the echoic and tact responses lead to correct performance. The participants may have only engaged in the echoic or self-echoic responses and no longer need to tact the exercise moves as they became more fluent with the moves. Another limitation to this study was an implementation error, where participants were not asked which type of learning technique they used during baseline sessions.

Although none of the participants stated that they used any form of self-talk strategies during the history of group exercise questionnaire given to them at the beginning of the study, they could have been using a form of self-talk after the study began.

Lastly, this study was conducted in a class specially conducted for this experiment and it is unclear how the results may be affected by implementation in a regularly schedule group exercise class. Also, the primary researcher was the instructor for all exercise sessions and it is unclear how the results may be affected using a typically trained group exercise instructor.

Future Research

Future research may be designed to examine the joint control procedure in an existing group fitness exercise class that participants are already enrolled in. It would be beneficial to see if the results are similar in multiple settings with different exercise formats and instructors. Also, this study warrants further investigation to examine the importance of the echoic and tact components in the joint control strategy. This could help understand the effects of the individual components that make up the joint control procedure. Therefore, future studies could require overt responses. Another extension of this study could be to examine response mediation in exercise behavior. It may be beneficial to evaluate whether the responses decrease if mediating behavior is blocked (i.e., require participants to engage overtly in a verbal stimulus unrelated to the name of the moves or the sequence). It could provide further support for the importance of the rehearsal response in joint control among complex behaviors.

Research on interventions for increasing skill acquisition that are easily implemented and can generalize to other behaviors is necessary and beneficial to

help increase exercise level and adherence. This is important when considering exercise has been shown to reduce the prevalence of several serious health risks including various forms of cancer, cardiovascular disease, and diabetes.

REFERENCES

REFERENCES

American Psychological Association Division 47. (2009). *What is exercise and sport psychology?* Retrieved from http://www.apa47.org/pracExSpPsych.php

Anderson, R., & Campbell, M. J. (2015). Accelerating skill acquisition in rowing, using self-based observational learning and expert modelling during performance. *International Journal of Sports Science and Coaching, 10,* 425-437.

Andrade, L. F., Barry, D., Litt, M. D., & Petry, N. M. (2014). Maintaining high activity levels in sedentary adults with a reinforcement-thinning schedule. *Journal of Applied Behavior Analysis, 47,* 523-536.

Annesi, J. J., & Unruh, J. L. (2007). Effects of The Coach Approach intervention on drop out rates among adults initiating exercise programs at nine YMCAs over three years. *Perceptual and Motor Skills, 104,* 459-466.

Association for Applied Sport Psychology. (2010). *About applied sport and exercise psychology*. Retrieved from http://appliedsportpsych.org/about/about-applied-sport-psych

Barnes-Holmes, D., Barnes-Homes, Y., Power, P., Hayden, E., Milne, R., & Stewart, I. (2006). Do you really know what you believe? Developing the Implicit Relational Assessment Procedure (IRAP) as a direct measure of implicit beliefs. *The Irish Psychologist, 32,* 169-177.

Boshker, M. C. J., & Bakker, F. C. (2002). Inexperienced sport climbers might perceive and utilize new opportunities for action by merely observing a model. *Perceptual and Motor Skills, 95,* 3-9.

Boyer, E., Miltenberger, R. G., Batsche, C., & Fogel, V. (2009). Video modeling by experts with video feedback to enhance gymnastics skills. *Journal of Applied Behavior Analysis, 42,* 855-860.

Cairney, J., Kwan, M. Y., Velduizen, S., Hay, J., Bray, S. R., & Faught, B. E. (2012). Gender, perceived competence and the enjoyment of physical education in children: A longitudinal examination. *The International Journal of Behavioral Nutrition and Physical Activity, 9,* 145-164.

Causin, K. G., Albert, K. M., Carbone, V. J., & Sweeney-Kerwin, E. J. (2013). The role of joint control in teaching listener responding to children with autism and other developmental disabilities. *Research in Autism Spectrum Disorders, 7,* 997-1011.

Center for Disease Control and Prevention (CDC). (2015). *Target heart rate and estimated maximum heart rate*. Retrieved from http://www.cdc.gov/ physicalactivity/basics/measuring/heartrate.htm

Centers for Disease Control and Prevention (CDC). (2016). *Physical activity among adults*. Retrieved from https://www.cdc.gov/cancer/dcpc/prevention/ policies_practices/physical_activity/adults.htm

Cooper, J.O., Heron, T.E., & Heward, W.L. (2007). *Applied behavior analysis* (2nd ed.) Upper Saddle River, NJ: Pearson.

DeGraaf, A., & Schlinger Jr, H. D. (2012). The effect of joint control training on the acquisition and durability of a sequencing task. *The Analysis of verbal behavior, 28,* 59-71.

Delextrat, A. A., Warner, S., Graham, S., & Neupert, E. (2016). An 8-week exercise intervention based on Zumba improves aerobic fitness and psychological well-being in healthy women. *Journal of Physical Activity and Health, 13,* 131-139.

Fairclough 1, S. (2003). Physical activity, perceived competence and enjoyment during high school physical education. *European Journal of Physical Education*, 5-18.

Fogel, V. A., Weil, T. M., & Burris, H. (2010). Evaluating the efficacy of TAGteach as a training strategy for teaching a golf swing. *Journal of Behavioral Health and Medicine, 1,* 25-41.

George, T. R., Feltz, D. L., & Chase, M. A. (1992). Effects of model similarity on self-efficacy and muscular endurance: A second look. *Journal of Sport and Exercise Psychology, 14,* 237-248.

Gould, D., & Weiss, M. (1981). The effects of model similarity and model task on self-efficacy and muscular endurance. *Journal of Sports Psychology, 3,* 17-29.

Gutierrez, R. D. (2006). The role of rehearsal in joint control. *The Analysis of Verbal Behavior, 22,* 183-190.

Hagberg, L. A., Lindahl, B., Nyberg, L., & Hellenius, M. L. (2009). Importance of enjoyment when promoting physical exercise. *Scandinavian Journal of Medicine and Science in Sports, 19,* 740-747.

Horn, T. S. (2009). *Advances in sport psychology*. Champaign, IL: Human Kinetics.

Ivanova, E., Yaakoba-Zohar, N., Jensen, D., Cassoff, J., & Knauper, B. (2015). Acceptance and commitment therapy and implementation intensions increase exercise enjoyment and long-term exercise behavior among low-active women. *Current Psychology, 35,* 108-114.

Jackson, M. L., Williams, W. L., Hayes, S. C., Humphreys, T., Gauthier, B., & Westwood, R. (2016). Whatever gets your heart pumping: the impact of implicitly selected reinforcer-focused statements on exercise intensity. *Journal of Contextual Behavioral Science, 5,* 48-57.

Johnson, J. M., Hrycaiko, D. W., Johnson, G. V., & Hala, J. M. (2004). Self-talk and female youth soccer performance. *The Sport Psychologist, 18,* 44-59.

Ju, W. C., & Hayes, S. C. (2008). Verbal establishing stimuli: Testing the motivative effects of stimuli in a derived relation with consequences. *The Psychological Record, 58,* 339-363.

Kyllo, L. B., & Landers, D. M. (1995). Goal setting in sport and exercise: A research synthesis to resolve the controversy. *Journal of Sport and Exercise Psychology, 17,* 117-137.

Landin, D., & Hebert, E. P. (1999). The influence of self-talk on the performance of skilled female tennis players. *Journal of Applied Sport Psychology, 11,* 263-282.

Laraway, S., Snycerski, S., Michael, J., & Poling, A. (2003). Motivating operations and terms to describe them: Some further refinements. *Journal of Applied Behavior Analysis, 36,* 407-414.

Latham, G. P., & Locke, E. A. (2006). Enhancing the benefits and overcoming the pitfalls of goal setting. *Organizational Dynamics, 35,* 332-340.

Locke, E. A., & Latham, G. P. (2002). Building a practical useful theory of goal setting and task motivation. *American Psychologist, 57,* 705-717.

Lowenkron, B. (1984). Coding responses and the generalization of matching to sample in children. *Journal for the Experimental Analysis of Behavior, 42,* 1-18.

Lowenkron, B. (1988). Generalization of delayed identity matching in retarded children. *Journal of the Experimental Analysis of Behavior, 50,* 163-172.

Lowenkron, B. (1998). Some logical functions of joint control. *Journal of the experimental analysis of behavior, 69,* 327-354.

Lowenkron, B., (2006). An introduction to joint control. *The Analysis of Verbal Behavior, 22,* 123-127.

Luiselli, J. K., Woods, K. E., & Reed, D. D. (2011). Review of sports performance research with youth, collegiate, and elite athletes. *Journal of Applied Behavior Analysis, 44,* 999-1002.

Martin, G. L. (2011). *Applied sport psychology: Practical guidelines from behavior analysis* (4th ed.). Winnipeg, MB: Sport Science Press.

Martin, G. L., & Pear, J. J. (2011). *Behavior modification: What it is and how to do it* (9th ed.). Upper Saddle River, NJ: Pearson-Prentice Hall.

Martin G.L., & Thomson, K. (2011) Overview of behavioral sport psychology. In J. Luiselli & D. Reed (Eds.). *Behavioral sport psychology* (pp. 3-21). New York, NY: Springer.

Martin, G. L., & Tkachuk, G. A. (2000). Behavioral sport psychology. In J. Austin & J. E. Carr (Eds.), *Behavioral sport psychology: Handbook of applied behavior analysis* (pp. 399-422). Reno, NV: Context Press.

Martin, G. L., Thompson, K., & Regehr, K. (2004). Studies using single-subject designs in sport psychology: 30 years of research. *The Behavior Analyst, 27,* 123-140.

McAuley, E. (1985). Modeling and self-efficacy: A test of Bandura's model. *Journal of Sport Psychology, 7,* 283-295.

McCullagh, P., Weiss, M.R., & Ross, D. (1989). Modelling considerations in motor skill acquisition and performance: an integrated approach. *Exercise and Sport Sciences Reviews, 5,* 475-513.

Michael, J. (1993). Establishing operations. *The Behavior Analyst, 16,* 191-206.

Miguel, C. F. (2016). Common and intraverbal bidirectional naming. *Analysis of Verbal Behavior, 32,* 125-138.

Moore, J. B., Yin, Z., Hanes, J., Duda, J., Gutin, B., & Barbeau, P. (2009). Measuring enjoyment of physical activity in children: validation of the Physical Activity Enjoyment Scale. *Journal of Applied Sport Psychology, 21*, S116-S129.

Moran, A. P. (1996). *The psychology of concentration in sport performance*. East Sussex, UK: Psychology Press.

Mullen, S. P., Olson, E. A., Phillips, S. M., Szabo, A. N., Wójcicki, T. R., Mailey, E. L., ... & McAuley, E. (2011). Measuring enjoyment of physical activity in older adults: invariance of the physical activity enjoyment scale (paces) across groups and time. *International Journal of Behavioral Nutrition and Physical Activity, 8*, 103.

National Heart, Lung, and Blood Institute. (2016). *Types of physical activity*. Retrieved from https://www.nhlbi.nih.gov/health/health-topics/topics/phys/types

O'Hora, D., & Maglieri, K. A. (2006). Goal statements and goal-direct behavior: A relational frame account of goal setting in organizations. *Journal of Organizational Behavior Management, 26,* 131-170.

Palmer, D. C. (2006). Joint control: A discussion of recent research. *The Analysis of Verbal Behavior, 22,* 209-215.

Panteli, F., Charilaos, T., Efthimiou, D., & Smirniotou, A. (2013). Acquisition of the long jump skill, using different learning techniques. *The Sport Psychologist, 27,* 40-52.

Perkos, S., Theodorakis, Y., & Chroni, S. (2002). Enhancing performance and skill acquisition in novice basketball players with instructional self- talk. *The Sport Psychologist, 16,* 368-383.

Pierce, W. D., & Cheney, C. D. (2013). *Behavior analysis and learning* (5th ed). New York, NY: Psychology Press.

Quinn, M. J., Miltenberger, R. G., & Fogel, V. A. (2015). Using TAGteach to improve the proficiency of dance movements. *Journal of Applied Behavior Analysis, 48,* 11-24.

Sherwood, N. E., & Jeffery, R. W. (2000). The behavioral determinant of exercise: Implications for Physical Activity Interventions. *The Annual Review of Nutrition, 20,* 21-44.

Skinner, B. F. (1957). *Verbal behavior.* New York, NY: Appleton-Century-Crofts.

Skinner, B. F. (1969). *Contingencies of reinforcement: A theoretical analysis*. Englewood Cliffs, NJ: Prentice Hall.

Smith, S. L., & Ward, P. (2006). Behavioral interventions to improve performance in collegiate football. *Journal of Applied Behavior Analysis, 39,* 385-391.

Stephens, T., & Craig, C. L. (1990). *The well-being of Canadians*. Canadian Fitness and Lifestyle Institute.

Stokes, J. V., Luiselli, J. K., Reed, D. D., & Fleming, R. K. (2010). Behavioral coaching to improve offensive line blocking skills of high school football athletes. *Journal of Applied Behavior Analysis, 43,* 463-472.

Theodorakis, A., Weinberg, R., Natsis, P., Douma, I., & Kazaka, P. (2000). The effects of motivational versus instructional self-talk on improving motor performance. *The Sport Psychologist, 14,* 253-272.

Tu, J. C. (2006). The role of joint control in the manded selection responses of both vocal and non-vocal children with autism. *The Analysis of Verbal Behavior, 22,* 191-207.

US Department of Health and Human Services. (2008). *2008 physical activity guidelines for Americans*. Retrieved from http://www.health.gov/ PAGuidelines.

Valdivia, S., Luciano, C., & Molina, F. J. (2006). Verbal regulation of motivational states. *The Psychological Record, 56,* 557-595.

Wack, S. R., Crosland, K. A., & Miltenberger, R. G. (2014). Using goal setting and feedback to increase weekly running distance. *Journal of Applied Behavior Analysis, 47,* 181-185.

Warburton, D. E. R., Nicol, C. W., & Bredin, S. S. D. (2006). Health benefits of physical activity: The evidence. *Canadian Medical Association Journal, 174,* 801-809.

Weinberg, R.S., & Gould, D. (2003). *Foundations of sport and exercise psychology*. Champaign, IL: Human Kinetics.

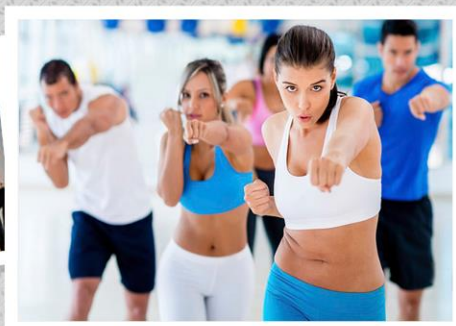
Ziegler, S. G. (1987). Effects of stimulus cueing on the acquisition of groundstrokes by beginning tennis players. *Journal of Applied Behavior Analysis*, *20*, 405-411.

Zinsser, N., Bunker, L., &Williams, J. M. (2006). Cognitive techniques for building confidence and enhancing performance. In J. M. Williams (Ed.), *Applied sport psychology: Personal growth to peak performance* (5th ed., pp. 349-381). New York, NY: McGraw-Hill.

APPENDICES

APPENDIX A: RECRUITMENT FLYER

GROUP EXERCISE


Do you want to become or stay active?

Come join us for an innovative and fun exercise activity!

We are currently conducting a research project to learn more about group exercise classes. If you are interested in participating in group fitness please take a slip below and contact Natalie Arreola at narreola09@mail.fresnostate.edu or (909) 721-8962

***Must be available twice a week**

***Must have no current injuries**

***Will be exposed to moderate and vigorous-intensity aerobic activity**

Weekly exercise sessions will be held in Sacramento, Ca

Natalie Arreola (909) 721-8962

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Natalie Arreola (909) 721-8962

APPENDIX B: INFORMED CONSENT

Informed Consent Form

Purpose

You are invited to participate in a study conducted by Natalie Arreola, a graduate student at California State University, Fresno, under the supervision of Dr. Marianne Jackson. The purpose of the study is to examine skill acquisition in a group exercise format. It is hoped that this examination will contribute to the further understanding the effects group exercise can have on an individual's performance over time.

Procedures

To participate, you must be between the ages 18-69. If you decide to participate, you will be asked to take the 2017 Physical Activity Readiness Questionnaire for Everyone [PAR-Q+], a pre-participation health screening, and the International Physical Activity Questionnaire (IPAQ) to identify if you have any injuries that may prevent you from participating in the study and your current activity level. If you are eligible to participate, you will then be exposed to another questionnaire identifying your current experience in a group exercise setting. You will then be provided with session times that specify the days and times for the exercise sessions.

Two exercise sessions will be conducted weekly in a large fitness room and will be video recorded. At the start of each exercise session, you will be provided with an HR Charge *Fitbit* with an assigned number. This will ensure that you use the same *Fitbit* throughout the entire experiment. A certified instructor will lead all exercise sessions and a researcher assistant will conduct video recording. Exercise sessions will be approximately 30 min and will consist of a warm-up,

cardio kickboxing routine, and a cool down. At the end of each exercise session, you will be given the Physical Activity Enjoyment Scale (PACE). The PACE and *Fitbit* will be collected as you exit the facility. You will also be given a final questionnaire at the end of the study regarding your overall experience.

You may be asked to meet with the instructor on an additional day at any point during the experiment and be provided with further instruction and or feedback. This may also include an additional questionnaire following the PACE.

You may terminate an exercise session at any given time. The estimated length of this study is 80 days. You may remove your consent and end your participation without consequences at any point in the study. If you are absent for a total of four scheduled sessions, you will be asked to stop participating in the study.

Benefits and Risks

The benefit of participating in this study is contributing to the extended research on increasing skill acquisition in group exercise settings. Participants may also benefit from participation in moderate and vigorous physical activity and increasing exercise. The benefits may include improved fitness, weight loss, muscle and bone strengthening.

There are risks associated with increasing physical activity and starting a new exercise routine. Participants may feel discomfort as heart rate, respiration rate, and body temperature increase when participating in the study activities. Participants may also experience discomfort associated with delayed onset muscle soreness (DOMS), which typically occurs 12-24 hours after exercise. In rare cases, participants may suffer a severe joint injury affecting mobility or even death. Risk to participants will be mitigated by prescreening participants and excluding high risk subjects, providing adequate supervision and monitoring participants at all

times during activities, engaging in a dynamic warm-up and appropriate cool-down during sessions, and providing participants with a brochure of information to explain what DOMS is and how to treat it effectively.

Your decision to participate in this study will have no effect on your future relations with California State University, Fresno.

Confidentiality

All information that is obtained and collected in this study and can be identified with you will be confidential. If you sign this document, only those involved in the study will have access to relevant information. All forms and data will be kept secured.

Question and Contact:

If you have any additional questions or concerns regarding this study, please contact either Dr. Marianne Jackson by phone (559) 278-2757; or email: majackson@csufresno.edu; or Natalie Arreola by phone: (909) 721-8962; or email: narreola09@mail.fresnostate.edu

Liability Waiver

I agree and consent to the following: I am voluntarily participating in the exercise/fitness program conducted by Natalie Arreola and Dr. Marianne Jackson for California State University, Fresno. I recognize that the program requires physical exertion that may be strenuous at times and may cause physical injury and I am fully aware of the risks mentioned in the above consent form.

I knowingly, voluntarily and expressly waive any claim I may have against Natalie Arreola, Dr. Marianne Jackson, and California State University, Fresno for injury or damages that I may sustain as a result of participating in the program.

I, _____forever release waive, discharge and covenant not to sue Natalie Arreola, Dr. Marianne Jackson, or California State University, Fresno for any injury.

Statement of Consent

I have read this form and the research study has been explained to me. I have also read the above waiver and release of liability and fully understand it contents. I voluntarily agree to the terms and conditions stated above.

I have been given the opportunity to ask questions and my questions have been answered. If I have additional questions, I have been told whom to contact. I agree to participate in the research study described above, understand that I may withdraw at any time, and will receive a copy of this consent form.

Name of Participant (Please Print): _____ Age:_____

Signature of Participant: _____ Date:_____

Signature of Researcher: _____ Date: _____

APPENDIX C: PRESCREENING QUESTIONNAIRES

2017 PAR-Q+

The Physical Activity Readiness Questionnaire for Everyone

The health benefits of regular physical activity are clear; more people should engage in physical activity every day of the week. Participating in physical activity is very safe for MOST people. This questionnaire will tell you whether it is necessary for you to seek further advice from your doctor OR a qualified exercise professional before becoming more physically active.

GENERAL HEALTH QUESTIONS

Please read the 7 questions below carefully and answer each one honestly: check YES or NO.	**YES**	**NO**
1) Has your doctor ever said that you have a heart condition ☐ OR high blood pressure ☐?	☐	☐
2) Do you feel pain in your chest at rest, during your daily activities of living, **OR** when you do physical activity?	☐	☐
3) Do you lose balance because of dizziness **OR** have you lost consciousness in the last 12 months? Please answer **NO** if your dizziness was associated with over-breathing (including during vigorous exercise).	☐	☐
4) Have you ever been diagnosed with another chronic medical condition (other than heart disease or high blood pressure)? **PLEASE LIST CONDITION(S) HERE:** _____	☐	☐
5) Are you currently taking prescribed medications for a chronic medical condition? **PLEASE LIST CONDITION(S) AND MEDICATIONS HERE:** _____	☐	☐
6) Do you currently have (or have had within the past 12 months) a bone, joint, or soft tissue (muscle, ligament, or tendon) problem that could be made worse by becoming more physically active? Please answer **NO** if you had a problem in the past, but it ***does not limit your current ability*** to be physically active. **PLEASE LIST CONDITION(S) HERE:** _____	☐	☐
7) Has your doctor ever said that you should only do medically supervised physical activity?	☐	☐

If you answered NO to all of the questions above, you are cleared for physical activity.
Go to Page 4 to sign the PARTICIPANT DECLARATION. You do not need to complete Pages 2 and 3.

- Start becoming much more physically active – start slowly and build up gradually.
- Follow International Physical Activity Guidelines for your age (www.who.int/dietphysicalactivity/en/).
- You may take part in a health and fitness appraisal.
- If you are over the age of 45 yr and **NOT** accustomed to regular vigorous to maximal effort exercise, consult a qualified exercise professional before engaging in this intensity of exercise.
- If you have any further questions, contact a qualified exercise professional.

If you answered YES to one or more of the questions above, COMPLETE PAGES 2 AND 3.

Delay becoming more active if:

- You have a temporary illness such as a cold or fever; it is best to wait until you feel better.
- You are pregnant - talk to your health care practitioner, your physician, a qualified exercise professional, and/or complete the ePARmed-X+ at **www.eparmedx.com** before becoming more physically active.
- Your health changes - answer the questions on Pages 2 and 3 of this document and/or talk to your doctor or a qualified exercise professional before continuing with any physical activity program.

2017 PAR-Q+

FOLLOW-UP QUESTIONS ABOUT YOUR MEDICAL CONDITION(S)

1. Do you have Arthritis, Osteoporosis, or Back Problems?

If the above condition(s) is/are present, answer questions 1a-1c — If **NO** ☐ go to question 2

1a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐	NO ☐
1b.	Do you have joint problems causing pain, a recent fracture or fracture caused by osteoporosis or cancer, displaced vertebra (e.g., spondylolisthesis), and/or spondylolysis/pars defect (a crack in the bony ring on the back of the spinal column)?	YES ☐	NO ☐
1c.	Have you had steroid injections or taken steroid tablets regularly for more than 3 months?	YES ☐	NO ☐

2. Do you currently have Cancer of any kind?

If the above condition(s) is/are present, answer questions 2a-2b — If **NO** ☐ go to question 3

2a.	Does your cancer diagnosis include any of the following types: lung/bronchogenic, multiple myeloma (cancer of plasma cells), head, and/or neck?	YES ☐	NO ☐
2b.	Are you currently receiving cancer therapy (such as chemotheraphy or radiotherapy)?	YES ☐	NO ☐

3. Do you have a Heart or Cardiovascular Condition? *This includes Coronary Artery Disease, Heart Failure, Diagnosed Abnormality of Heart Rhythm*

If the above condition(s) is/are present, answer questions 3a-3d — If **NO** ☐ go to question 4

3a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐	NO ☐
3b.	Do you have an irregular heart beat that requires medical management? (e.g., atrial fibrillation, premature ventricular contraction)	YES ☐	NO ☐
3c.	Do you have chronic heart failure?	YES ☐	NO ☐
3d.	Do you have diagnosed coronary artery (cardiovascular) disease and have not participated in regular physical activity in the last 2 months?	YES ☐	NO ☐

4. Do you have High Blood Pressure?

If the above condition(s) is/are present, answer questions 4a-4b — If **NO** ☐ go to question 5

4a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐	NO ☐
4b.	Do you have a resting blood pressure equal to or greater than 160/90 mmHg with or without medication? (Answer **YES** if you do not know your resting blood pressure)	YES ☐	NO ☐

5. Do you have any Metabolic Conditions? *This includes Type 1 Diabetes, Type 2 Diabetes, Pre-Diabetes*

If the above condition(s) is/are present, answer questions 5a-5e — If **NO** ☐ go to question 6

5a.	Do you often have difficulty controlling your blood sugar levels with foods, medications, or other physician-prescribed therapies?	YES ☐	NO ☐
5b.	Do you often suffer from signs and symptoms of low blood sugar (hypoglycemia) following exercise and/or during activities of daily living? Signs of hypoglycemia may include shakiness, nervousness, unusual irritability, abnormal sweating, dizziness or light-headedness, mental confusion, difficulty speaking, weakness, or sleepiness.	YES ☐	NO ☐
5c.	Do you have any signs or symptoms of diabetes complications such as heart or vascular disease and/or complications affecting your eyes, kidneys, **OR** the sensation in your toes and feet?	YES ☐	NO ☐
5d.	Do you have other metabolic conditions (such as current pregnancy-related diabetes, chronic kidney disease, or liver problems)?	YES ☐	NO ☐
5e.	Are you planning to engage in what for you is unusually high (or vigorous) intensity exercise in the near future?	YES ☐	NO ☐

2017 PAR-Q+

6. Do you have any Mental Health Problems or Learning Difficulties? *This includes Alzheimer's, Dementia, Depression, Anxiety Disorder, Eating Disorder, Psychotic Disorder, Intellectual Disability, Down Syndrome*

If the above condition(s) is/are present, answer questions 6a-6b — If **NO** ☐ go to question 7

6a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
6b.	Do you have Down Syndrome **AND** back problems affecting nerves or muscles?	YES ☐ NO ☐

7. Do you have a Respiratory Disease? *This includes Chronic Obstructive Pulmonary Disease, Asthma, Pulmonary High Blood Pressure*

If the above condition(s) is/are present, answer questions 7a-7d — If **NO** ☐ go to question 8

7a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
7b.	Has your doctor ever said your blood oxygen level is low at rest or during exercise and/or that you require supplemental oxygen therapy?	YES ☐ NO ☐
7c.	If asthmatic, do you currently have symptoms of chest tightness, wheezing, laboured breathing, consistent cough (more than 2 days/week), or have you used your rescue medication more than twice in the last week?	YES ☐ NO ☐
7d.	Has your doctor ever said you have high blood pressure in the blood vessels of your lungs?	YES ☐ NO ☐

8. Do you have a Spinal Cord Injury? *This includes Tetraplegia and Paraplegia*

If the above condition(s) is/are present, answer questions 8a-8c — If **NO** ☐ go to question 9

8a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
8b.	Do you commonly exhibit low resting blood pressure significant enough to cause dizziness, light-headedness, and/or fainting?	YES ☐ NO ☐
8c.	Has your physician indicated that you exhibit sudden bouts of high blood pressure (known as Autonomic Dysreflexia)?	YES ☐ NO ☐

9. Have you had a Stroke? *This includes Transient Ischemic Attack (TIA) or Cerebrovascular Event*

If the above condition(s) is/are present, answer questions 9a-9c — If **NO** ☐ go to question 10

9a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
9b.	Do you have any impairment in walking or mobility?	YES ☐ NO ☐
9c.	Have you experienced a stroke or impairment in nerves or muscles in the past 6 months?	YES ☐ NO ☐

10. Do you have any other medical condition not listed above or do you have two or more medical conditions?

If you have other medical conditions, answer questions 10a-10c — If **NO** ☐ read the Page 4 recommendations

10a.	Have you experienced a blackout, fainted, or lost consciousness as a result of a head injury within the last 12 months **OR** have you had a diagnosed concussion within the last 12 months?	YES ☐ NO ☐
10b.	Do you have a medical condition that is not listed (such as epilepsy, neurological conditions, kidney problems)?	YES ☐ NO ☐
10c.	Do you currently live with two or more medical conditions?	YES ☐ NO ☐

PLEASE LIST YOUR MEDICAL CONDITION(S) AND ANY RELATED MEDICATIONS HERE: _____

GO to Page 4 for recommendations about your current medical condition(s) and sign the PARTICIPANT DECLARATION.

2017 PAR-Q+

If you answered NO to all of the follow-up questions about your medical condition, you are ready to become more physically active - sign the PARTICIPANT DECLARATION below:

- It is advised that you consult a qualified exercise professional to help you develop a safe and effective physical activity plan to meet your health needs.
- You are encouraged to start slowly and build up gradually - 20 to 60 minutes of low to moderate intensity exercise, 3-5 days per week including aerobic and muscle strengthening exercises.
- As you progress, you should aim to accumulate 150 minutes or more of moderate intensity physical activity per week.
- If you are over the age of 45 yr and **NOT** accustomed to regular vigorous to maximal effort exercise, consult a qualified exercise professional before engaging in this intensity of exercise.

If you answered **YES** to **one or more of the follow-up questions** about your medical condition:

You should seek further information before becoming more physically active or engaging in a fitness appraisal. You should complete the specially designed online screening and exercise recommendations program - the **ePARmed-X+ at www.eparmedx.com** and/or visit a qualified exercise professional to work through the ePARmed-X+ and for further information.

Delay becoming more active if:

- You have a temporary illness such as a cold or fever; it is best to wait until you feel better.
- You are pregnant - talk to your health care practitioner, your physician, a qualified exercise professional, and/or complete the ePARmed-X+ **at www.eparmedx.com** before becoming more physically active.
- Your health changes - talk to your doctor or qualified exercise professional before continuing with any physical activity program.

- You are encouraged to photocopy the PAR-Q+. You must use the entire questionnaire and NO changes are permitted.
- The authors, the PAR-Q+ Collaboration, partner organizations, and their agents assume no liability for persons who undertake physical activity and/or make use of the PAR-Q+ or ePARmed-X+. If in doubt after completing the questionnaire, consult your doctor prior to physical activity.

PARTICIPANT DECLARATION

- All persons who have completed the PAR-Q+ please read and sign the declaration below.
- If you are less than the legal age required for consent or require the assent of a care provider, your parent, guardian or care provider must also sign this form.

I, the undersigned, have read, understood to my full satisfaction and completed this questionnaire. I acknowledge that this physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if my condition changes. I also acknowledge that a Trustee (such as my employer, community/fitness centre, health care provider, or other designate) may retain a copy of this form for their records. In these instances, the Trustee will be required to adhere to local, national, and international guidelines regarding the storage of personal health information ensuring that the Trustee maintains the privacy of the information and does not misuse or wrongfully disclose such information.

NAME _____ DATE _____

SIGNATURE _____ WITNESS _____

SIGNATURE OF PARENT/GUARDIAN/CARE PROVIDER _____

For more information, please contact
www.eparmedx.com
Email: eparmedx@gmail.com

Citation for PAR-Q+
Warburton DER, Jamnik VK, Bredin SSD, and Gledhill N on behalf of the PAR-Q+ Collaboration. The Physical Activity Readiness Questionnaire for Everyone (PAR-Q+) and Electronic Physical Activity Readiness Medical Examination (ePARmed-X+). Health & Fitness Journal of Canada 4(2):3-23, 2011.

The PAR-Q+ was created using the evidence-based AGREE process (1) by the PAR-Q+ Collaboration chaired by Dr. Darren E. R. Warburton with Dr. Norman Gledhill, Dr. Veronica Jamnik, and Dr. Donald C. McKenzie (2). Production of this document has been made possible through financial contributions from the Public Health Agency of Canada and the BC Ministry of Health Services. The views expressed herein do not necessarily represent the views of the Public Health Agency of Canada or the BC Ministry of Health Services.

Key References

1. Jamnik VK, Warburton DER, Makarski J, McKenzie DC, Shephard RJ, Stone J, and Gledhill N. Enhancing the effectiveness of clearance for physical activity participation; background and overall process. APNM 36(S1):S3-S13, 2011.
2. Warburton DER, Gledhill N, Jamnik VK, Bredin SSD, McKenzie DC, Stone J, Charlesworth S, and Shephard RJ. Evidence-based risk assessment and recommendations for physical activity clearance; Consensus Document. APNM 36(S1):S266-s298, 2011.
3. Chisholm DM, Collis ML, Kulak LL, Davenport W, and Gruber N. Physical activity readiness. British Columbia Medical Journal. 1975;17:375-378.
4. Thomas S, Reading J, and Shephard RJ. Revision of the Physical Activity Readiness Questionnaire (PAR-Q). Canadian Journal of Sport Science 1992;17:4 338-345.

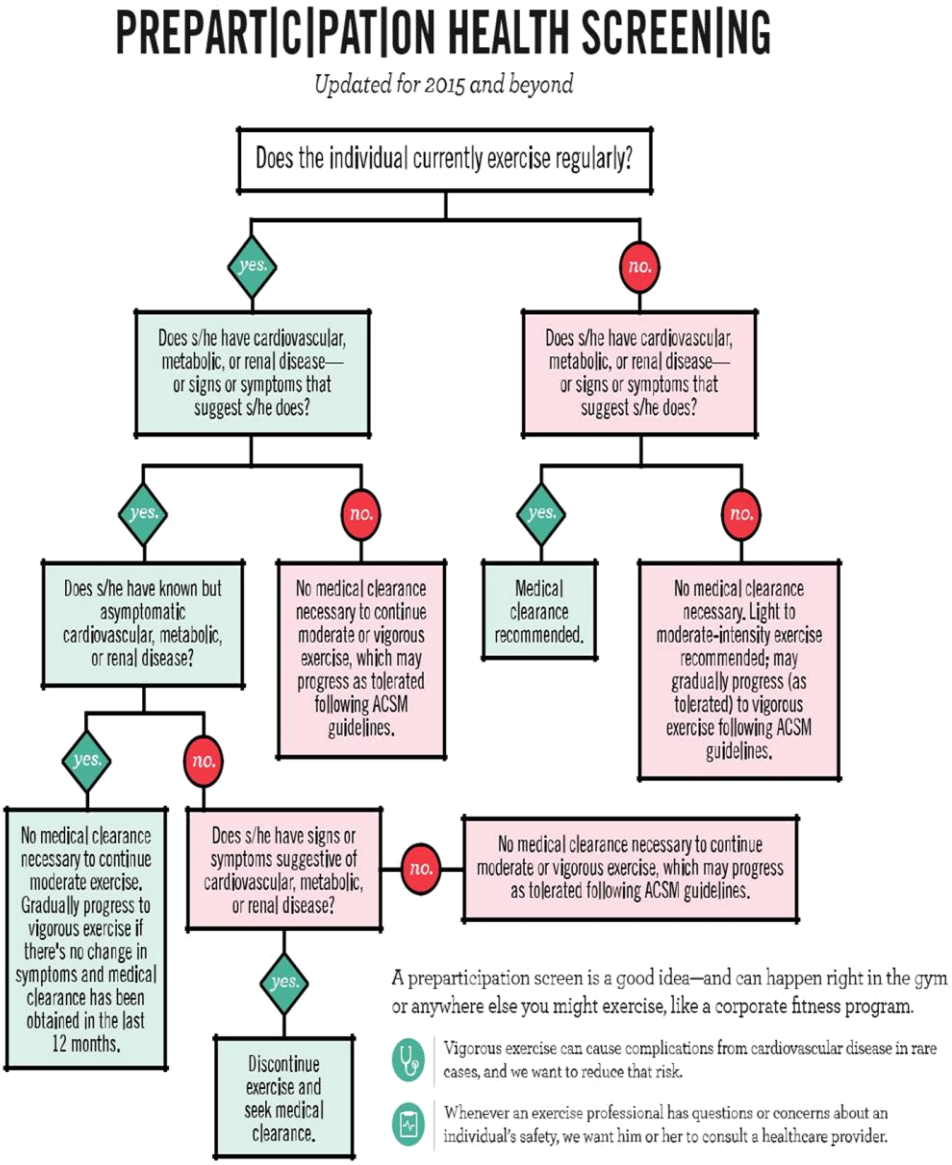
OSHF Ontario Society for Health and Fitness

01-01-2017

Preparticipation Health Screening

Please read the questions carefully and answer each one honestly: answer YES or NO.

	Questions	Yes	No
1.	Do you currently exercise regularly?		
2.	Do you have cardiovascular, metabolic, or renal disease- or signs or symptoms that suggest you do?		
3.	Do you know that you do have asymptomatic, cardiovascular, metabolic or renal disease?		



INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

- During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

  _____ **days per week**

  ☐ No vigorous physical activities → ***Skip to question 3***

➔ How much time did you usually spend doing **vigorous** physical activities on one of those days?

  _____ **hours per day**

  _____ **minutes per day**

  ☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

   _____ **days per week**

   ☐ No moderate physical activities → ***Skip to question 5***

2. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

1. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking → ***Skip to question 7***

1. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

This is the end of the questionnaire, thank you for participating.

SHORT LAST DAYS SELF-ADMINISTERED version of the IPAQ. Revised August 2002.

Source: Booth, M.L. (2000). *Assessment of Physical Activity: An International Perspective*. Research Quarterly for Exercise and Sport, 71 (2): s114-20.

Group Exercise Experience Form

History of Group Exercise

1. Do you have any previous experience participating in group exercise formats (e.g., Pilates, Cardio Kickboxing, Zumba, etc.)? If so, specify how often and how long.

☐ Yes ☐ No

_____

2. Do you have any experience in participating in dance routines (e.g., cheerleading)? If so, specify how often and how long.

☐ Yes ☐ No

_____

If you answered yes to questions 1 or 2:

3. During the exercise or dance routine, what techniques do you use when learning the moves?

_____

APPENDIX D: DEPENDENT VARIABLE DATA SHEET

Data Sheet Pre and Post intervention

Season # _____ Season Total: _____
Date: _____
Participant: _____

Repeater		
Punches		
Repeater		
Punches		
Repeater		
Kicks		
Repeater		
Kicks		
Repeater		
Form		
Repeater		
Form		
Repeater		
Total		%

Season # _____ Season Total: _____
Date: _____
Participant: _____

Repeater		
Punches		
Repeater		
Punches		
Repeater		
Kicks		
Repeater		
Kicks		
Repeater		
Form		
Repeater		
Form		
Repeater		
Total		%

APPENDIX E: PHYSICAL ACTIVITY ENJOYMENT SCALE

Appendix E
Physical Activity Enjoyment Scale

Please rate how you feel *at the moment* about the physical activity you have been doing.

I enjoy it	1	2	3	4	5	6	7	I hate it
I feel bored	1	2	3	4	5	6	7	I feel interested
I dislike it	1	2	3	4	5	6	7	I like it
I find it pleasurable	1	2	3	4	5	6	7	I find it unpleasurable
I am very absorbed in this activity	1	2	3	4	5	6	7	I am not at all absorbed in this activity
It's no fun at all	1	2	3	4	5	6	7	It's a lot of fun
I find it energizing	1	2	3	4	5	6	7	I find it tiring
It makes me depressed	1	2	3	4	5	6	7	It makes me happy
It's very pleasant	1	2	3	4	5	6	7	It's very unpleasant
I feel good physically while doing it	1	2	3	4	5	6	7	I feel bad physically while doing it
It's very invigorating	1	2	3	4	5	6	7	It's not at all invigorating
I am very frustrated by it	1	2	3	4	5	6	7	I am not frustrated by it

Appendix (cont.)

It's very gratifying	1	2	3	4	5	6	7	It's not at all gratifying
It's very exhilarating	1	2	3	4	5	6	7	It's not al all exhilarating
It's not at all stimulating	1	2	3	4	5	6	7	It's very stimulating
It gives me a strong sense of accomplishment	1	2	3	4	5	6	7	It does not give me any sense of accomplishment at all
It's very refreshing	1	2	3	4	5	6	7	It's not at all refreshing
I felt as though I would rather be doing something else	1	2	3	4	5	6	7	I felt as though there was nothing else I would rather be doing

* Item is reversed scored (i.e., 1 = 7, 2 = 6, 3 = 5, 4 = 4, 5 = 3, 6 = 2, 7 = 1).

Source: Moore, J. B., Yin, Z., Hanes, J., Duda, J., Gutin, B., & Barbeau, P. (2009). Measuring enjoyment of physical activity in children: validation of the Physical Activity Enjoyment Scale. *Journal of Applied Sport Psychology*, *21*, S116-S129.

APPENDIX F: INTERVENTION DATA SHEET

Appendix F

Date: _____ Participant: _____

Echoic and Tact Component Training

Echoic Training										
Sections	**Trials**									
Repeater										
1. Right: Jab, Cross, Jab, Knee, 4 Uppercuts Left Jab, Cross Knee, 4 Uppercuts										
Punches										
2. Right: Jab 3, 2, 1, 12, 12, 1, 2, 3, o'clock Switch Left Jab 9, 10, 11, 12, 11, 10, 9										
3. Right: Jab/Cross @ 3, 2, 1, 12, 12, 1, 2, 3 o'clock Left Jab/Cross @ 9, 10, 11, 12, 11, 10, 9 o'clock										
4. Right: Jab/Cross/Slip-Slip @ 3, 2, 1, 12, 12, 1, 2, 3 o'clock Jab/ Cross/Slip-Slip @ 9, 10, 11, 12, 1,, 10, 9 o'clock										
Kicks										
5. To Tempo: Right Hammer, Left Hammer, Right: Hammer, Left Roundhouse Kick X 4										
6. Right: Hammer Punch, L-Roundhouse X 8										
Form										
7. Right: low jab, High Jab, Low Jab, High Jab, double punch, double punch Right Low jab, high lab, low jab, high jab, low kick, high kick										

Tact Training										
Moves	**Trials**									
Repeater										
Right and Left Jabs										
Right and Left Uppercut										
Right and Left Crosses										
Right and Left Knee										
Punches										
Back and Forward Slip-Slip										
Right and Left Jabs										
Right and Left Crosses										
Kicks										
Right and Left High Roundhouse Kicks										
Right and Left Knees										
Right and Left Low Roundhouse Kicks										
Form										
Double Punches										
Low Jab										
High Kick										
High Jab										
Low Kick										

Joint Control Training										
Sections	**Trials**									
Repeater										
1. Right: Jab, Cross, Jab, Knee, 4 Uppercuts Left Jab, Cross Knee, 4 Uppercuts										
Punches										
2. Right: Jab 3, 2, 1, 12, 12, 1, 2, 3, o'clock Switch Left Jab 9, 10, 11, 12, 11, 10, 9										
3. Right: Jab/Cross @ 3, 2, 1, 12, 12, 1, 2, 3 o'clock Left Jab/Cross @ 9, 10, 11, 12, 11, 10, 9										
4. Right: Jab/Cross/Slip-Slip @ 3, 2, 1, 12, 12, 1, 2, 3 o'clock Jab/ Cross/Slip-Slip @ 9, 10, 11, 12, 1,, 10, 9										
Kicks										
5. To Tempo: Right Hammer, Left Hammer, Right: Hammer, Left Roundhouse Kick X 4										
6. Right: Hammer Punch, L-Roundhouse X 8										
Form										
7. Right: low jab, High Jab, Low Jab, High Jab, double punch, double punch Right Low jab, high lab, low jab, high jab, low kick, high kick										

APPENDIX G: POST-INTERVENTION QUESTIONNAIRE

Appendix G
Post Intervention Questionnaire

Name: _____

Date: _____

Session #: _____

Did you use the joint control strategy (self talk) during the cardio boxing section?	Yes	No	Certain parts, not the entire routine
Did you find that the sequences were easier to follow after the joint control training?	Yes	No	N/A Did not use the strategy
If you did not use the strategy, was it because it was distracting?	Yes	No	
If you did not use the strategy, was it because you forgot?	Yes	No	

Comments: _____

APPENDIX H: SOCIAL VALIDITY

Appendix H

Joint Control Social Validity Questionnaire

Directions: Rate how strongly you agree with the statement from weakest (1) to strongest (5).

Question 1: The study did not require too much time or effort to participate in.

5	4	3	2	1
Strongly Agree	Somewhat Agree	Neutral	Somewhat Disagree	Strongly Disagree

Question 2: The joint control procedure was easily implemented in the cardio kickboxing sections during the exercise sessions.

5	4	3	2	1
Strongly Agree	Somewhat Agree	Neutral	Somewhat Disagree	Strongly Disagree

Question 3: I would continue using the joint control procedure in other exercise activities that require sequences of movements.

5	4	3	2	1
Strongly Agree	Somewhat Agree	Neutral	Somewhat Disagree	Strongly Disagree

Question 4: I noticed changes in accurate performance after implementing the joint control procedure.

5	4	3	2	1
Strongly Agree	Somewhat Agree	Neutral	Somewhat Disagree	Strongly Disagree

Question 5: I enjoyed participating in this study.

5	4	3	2	1
Strongly Agree	Somewhat Agree	Neutral	Somewhat Disagree	Strongly Disagree

Question 6: This study was effective in increasing my physical activity levels.

5	4	3	2	1
Strongly Agree	Somewhat Agree	Neutral	Somewhat Disagree	Strongly Disagree

Question 7: I would recommend this study to others.

5	4	3	2	1
Strongly Agree	Somewhat Agree	Neutral	Somewhat Disagree	Strongly Disagree

Additional Comments: _____

APPENDIX I: PROCEDURAL INTEGRITY

Appendix I
Procedural Integrity Data Collection Data Sheet

Date:

Total Number Correct _______/ Total Number _______ X 100 = _________________

Date:

Total Number Correct _______/ Total Number _______ X 100 = _________________

Date:

Total Number Correct _______/ Total Number _______ X 100 = _________________

Date:

Total Number Correct _______/ Total Number _______ X 100 = _________________

Date:

Total Number Correct _______/ Total Number _______ X 100 = _________________

Date:

Total Number Correct _______/ Total Number _______ X 100 = _________________

Date:

Total Number Correct _______/ Total Number _______ X 100 = _________________

Date:

Total Number Correct _______/ Total Number _______ X 100 = _________________

Date:

Total Number Correct _______/ Total Number _______ X 100 = _________________

Date:

Total Number Correct _______/ Total Number _______ X 100 = _________________

Date:

Total Number Correct _______/ Total Number _______ X 100 = _________________

APPENDIX J: SECONDARY PARTICIPANTS PERCENTAGE OF CORRECT MOVES

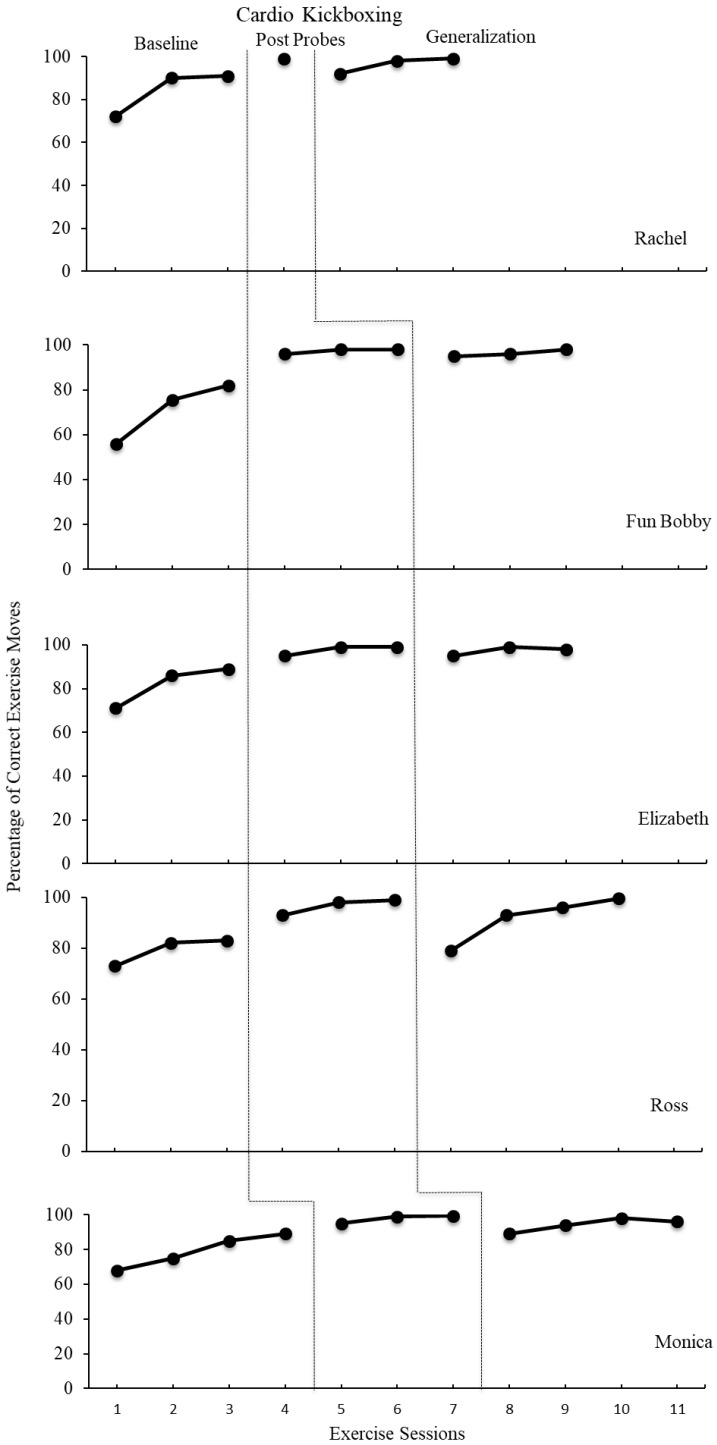


Figure 6. Percentage of correct exercise moves for all secondary participants.

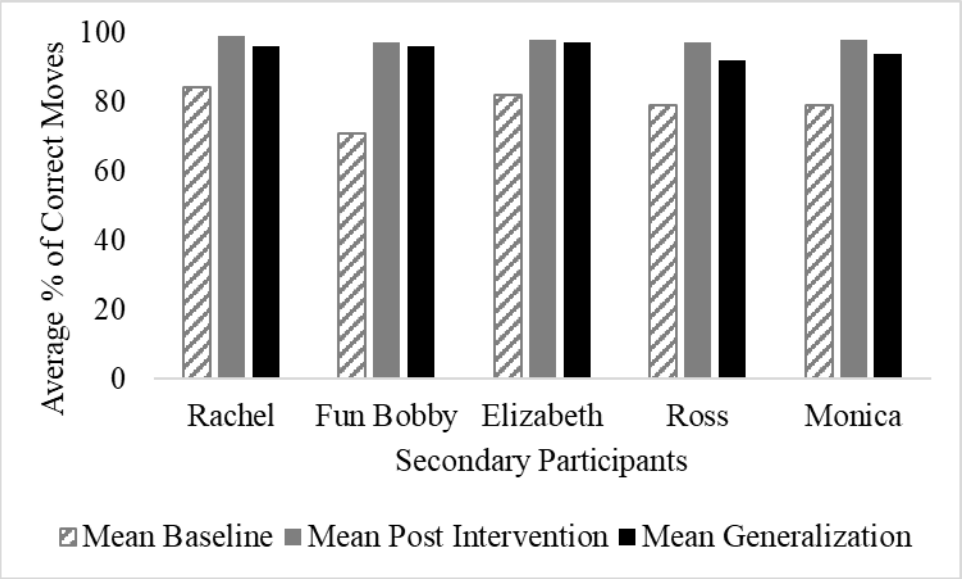


Figure 7. Average percentage of correct moves for each participant during per phase (baseline, post-intervention, generalization).

APPENDIX K: SECONDARY PARTICIPANTS' HEART RATE

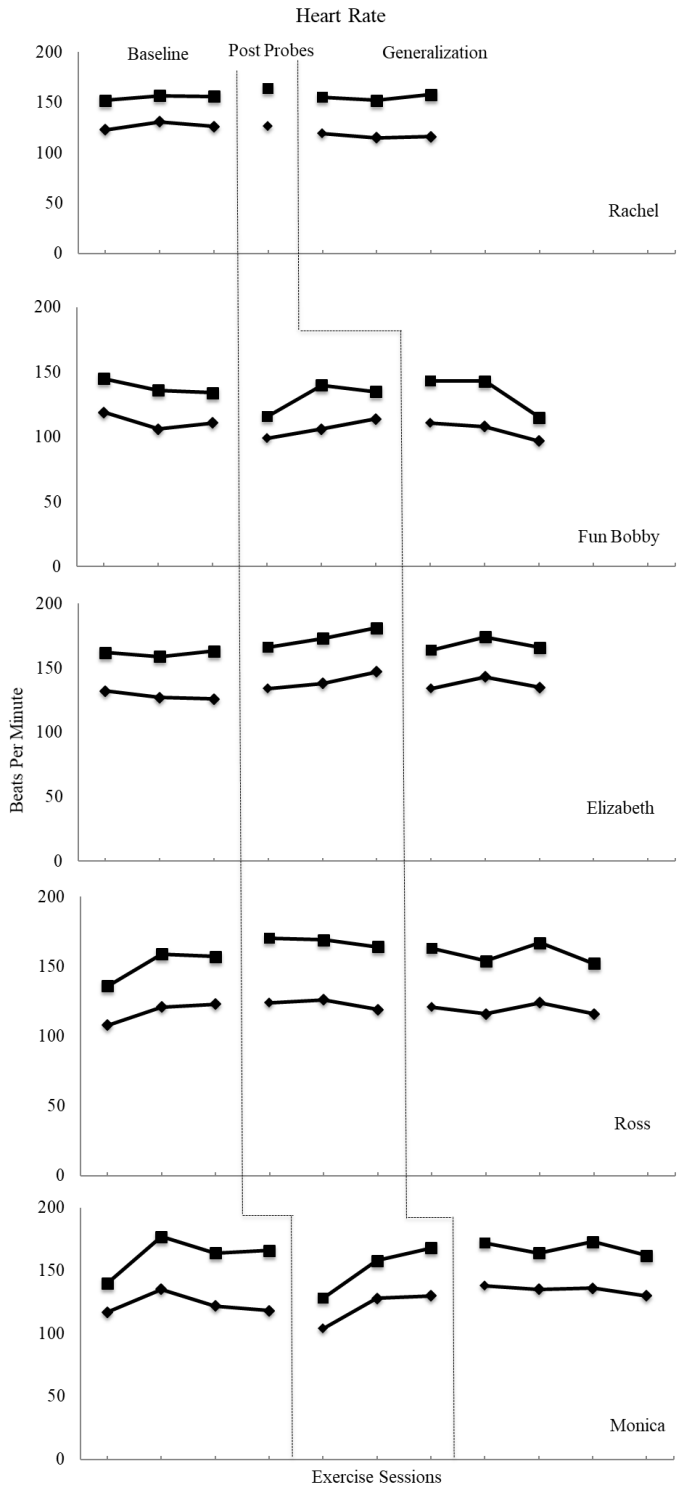


Figure 8. Maximum (■) and average (♦) heart rate measures for all secondary participants.

APPENDIX L: SECONDARY PARTICIPANTS' ENJOYMENT

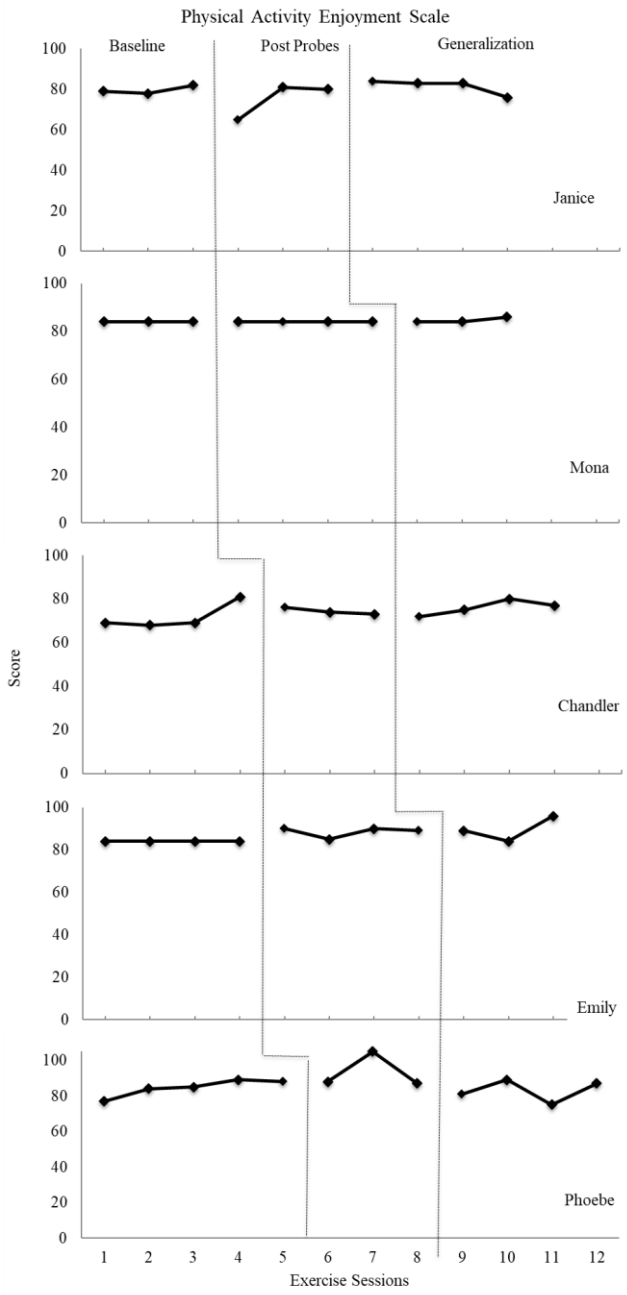


Figure 9. Physical Activity Enjoyment scores for secondary participants.