A COMPREHENSIVE FRAMEWORK FOR THE ACCOMODATION OF EXERCISE IN PEOPLE WITH DEVELOPMENTAL DISABILITIES

by

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A THESIS

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The goal of this thesis is to create a framework for professionals in the fitness industry to accommodate people with special needs, specifically those with autism, Down syndrome, and cerebral palsy. My intent is to educate personal trainers and other fitness professionals on the need to differentiate and adapt their interactions and training protocols for people with developmental disabilities. This is expected to lead to a decline in the rate of obesity-related disease and causes of death in this population by making exercise more accessible. The annual cost of obesity is roughly $6.38 billion (Trogdon *et al.*, 2008). The framework of this thesis can be implemented to alleviate some of those health-related costs. The methods for this study involved searching key words including “special needs, developmental disability, or mental retardation” and cross-referencing these terms with words like “exercise, fitness, or workout” in information sources such as Web of Science, Sport Discus, and PubMed. The information from the articles retrieved was broken down into categories which provided data for different sections of this thesis.

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Introduction

Why Should People with Special Needs Exercise?

Exercise is an important aspect of maintaining good health for every individual. Obesity is an epidemic in America, that is in large part due to a lack of physical exercise. In the United States, an astounding40% of the general population is obese (Center for Health Statistics, 2017). Even more astounding is the reality that 67.1% of developmentally disabled Americans are obese(Melville *et al.*, 2008).That means that people with developmental disabilities are more than one and a half times as likely to be obese as their non-disabled counterparts. With a population of over two million developmentally disabled obese Americans, the need to encourage exercise among the special needs community is particularly important.

The high rate of overweight and obesity in people with developmental disabilities places them at a higher risk for secondary health problems (Emerson, 2005). These secondary health conditions include: coronary artery disease, stroke, hypertension, cancer, diabetes, respiratory illnesses, dental problems, and seizure disorders(Luckasson *et al.*, 2002). However, conditions associated with living a sedentary lifestyle, as is common in people with developmental disabilities, are usually reversible with the adoption of healthier life choices.

The prevalence of secondary health conditions often require medications as treatment. Many people who are affected by these types of disabilities are prescribed antipsychotics and antidepressants to manage their feelings and behaviors.These drugs block serotonin from reaching receptors in the hypothalamus of the brain, leading to an

increased appetite and eventual weight gain(Srinivasan *et al.,* 2014).The drugs may also inhibit leptin receptors in the hypothalamus, reducing satiety, causing weight gain via overeating(Srinivasan *et al.,* 2014). Furthermore, antipsychotic medications often cause **tardive dyskinesia**as a side effect, which is a movement disorder in which muscles, especially in the face, trunk, and limbs, move involuntarily. When severe enough, tardive dyskinesia can be a barrier to physical exercise(Cornett *et al.*, 2017).

The prevalence of obesity and obesity-related health conditions in the developmentally disabled population has reached epidemic proportions, and must be addressed. This thesis is intended to relay information to teach personal trainers considerations for crafting individualized exercise programs for people with special needs, whether those needs are cognitive or physical.This thesis will first examine the barriers to exercise for this population, then outline of the best practices for able-bodied individuals, and will finally develop guidelines for how to appropriately modify exercise for people with autism, Down syndrome, or cerebral palsy. Physical fitness is a part of any healthy lifestyle, as it can help regulate blood glucose, reduce blood pressure, improve cardiac and respiratory health, and improve self-esteem.As such,it is critically important that people with disabilities engage in regular exercise.

Barriers to Exercise

People with developmental disabilities are more likely than other populations to lead sedentary lifestyles due to a host of barriers, health-related and other(Weil *et al.*, 2002).Individuals in this population often choose to not exercise,citing a lack of social support from their friends, family, and caregivers.They often lack self-efficacy, or

struggle with insufficient physical accommodations, or experience difficulty with transportation to fitness facilities(van Schijndel-Speet *et al.*, 2014; Chow *et al.*, 2016). In addition, as a result of moderate-to-severe health conditions, people with special needs often believe they cannot improve their strength, flexibility, or overall health with exercise (Heller *et al.*, 2004).Many people from this population also do not believe that they can sweat hard or use weights and exercise machines correctly(van Schijndel-Speet *et al.*, 2014).

Individuals with severe physical disorders, those who are at risk of accidental self-harm, and those who have other serious medical conditions are most likely to avoid exercise out of fear that it might worsen their condition(s) (Chow *et al.*, 2016). Many health-related factors including a high probability of developing heart irregularities such as **ventricular septal defect**, **atrioventricullariscommunis**, **atrial septal defect**, **patent ductus arteriosus**. These condition, in addition to **pulmonary hypoplasia**, and **hypotonicity,** make athleticism unlikely in people with special needs, particularly those with Down syndrome (Pitetti *et al.*, 1992). The level of severity of a person's disability often dictates their activity level. Individuals are more likely to be able to choose to exercise when their conditions are milder, and when they live more independently. This is in contrast to individuals with more severe disabilities, who likely have no choice whether or not to exercise (Draheim *et al.*, 2002).

Most fitness facilities fail to provide an inviting, safe environment for those with special needs. As a result, these individuals are not provided with the attention they need to consistently utilize fitness equipment in a safe manner. This phenomenon may be partially due to lacking appropriate staff training. Fitness facilities must have

confidently educated staff to assist people with special needs, and make welcome these patrons. Aside from trainers, the two most important areas of a gym for people with special needs are customer serviceand the floor space surrounding machines and equipment. The customer service area should have a low enough desk for people with physical limitations to effectively communicate if seated. The aisles between training machines and equipment should be wide enough accommodate a wheelchair.Fitness machines should have attachments to adapt certain machines to be used by people with special needs(Tamse *et al.*, 2010). Placing equipment in easily accessiblespaces for those in wheelchairs may also reduce physical barriers to exercise. One of the primary functions of this thesis is to encourage the accommodation of individuals with special needs in fitness facilities.

Benefits of Exercise

When starting an exercise program with a client who has a developmental disability, it is essential that the caregiver understand the risks associated with a sedentary lifestyle, as well as the benefits of exercise. The client might lack sufficient mental capacity to understand these distinctions(Srinivasan *et al.*, 2014), and thus it is attendant on the caregiver to help communicate these risks with the client and to make choices that are best for the client's health. According to Tamar Heller and colleagues, regular exercise will have three major benefits for people with developmental disabilities. These benefits include (1) learning about the benefits of living a healthy lifestyle, (2) improving self-efficacy with regards to exercise, and (3) setting goals to improve their overall health(Heller *et al.*, 2004). Exercising in a safe environment with

personal trainers who are committed to teach people with disabilities creates opportunities for clients and their caretakers to learn how to make exercise enjoyable, as well as how to progress or regress movements to best suit their needs. Additionally, the implementation of exercise often leads to other healthy lifestyle changes. The improvements in their health conditions and in athletic abilities will increase their self-efficacy. Lastly, in teaching clients how to set attainable goals in their exercise programs, they will also learn how to set goals in other aspects of their lives.

Cardiovascular health can be improved though the adoption of a regular exercise routine. Joyner and Green (2009) share that exercise can be used to improve **endothelial function**, despite the presence of traditional risk factors, such as high blood pressure and high cholesterol. Sedentary individuals often have impaired endothelial function that results in poor functioning of the **baroreflex system**. This ultimately causes increased vascular stiffness and poor **heart rate variability**. Similarly, an increase in sympathetic outflow causes an increase in heart rate, blood pressure and vasoconstriction. Compounding high levels of outflow from the sympathetic nervous system and impaired endothelial function causes a severe reduction in the integrity of the cardiovascular system (Joyner & Green, 2009). The implementation of regular exercise can improve this relationship and improve overall cardiovascular health.

In addition to improved endothelial function and baseline sympathetic outflow, consistent exercise can lead to an increase in the expression of genes that lead to the production of **atrial natriuretic peptide** and **SERCA-2**. The increased expression of these genes reduces strain on the heart and increases **myocardialmyofilaments** sensitivity to calcium. Over time, this leads to **myocardial hypertrophy** and an

increase in contractile strength(Wisløff, 2002).Physical activity also increases the production of **lipoprotein lipase** (LPL). LPL is an enzyme that breaks down fat in the blood. The increase in LPL reduces **low-density lipoprotein** (LDL)(Wang & Xu, 2017). Moreover, aerobic exercise increases the production of **high-density lipoprotein**, which aids the process of **reverse cholesterol transport**(RCT). RCT shuttles LDL to the liver to be broken down (Lesna *et al.*, 2014). Reducing LDL leads to the reduction of blood pressure, hypertension, and risk of heart attack, thus improving cardiovascular health.While exercise can improve traditional risk factors for cardiovascular diseasethese risk factors are not as dramatically reduced as often believed, without the use of medications (Joyner & Green, 2009).

Engaging in a fitness routine also helps reduce body fat percentage and body weight (Maïano *et al.*, 2014). Completing low-intensity muscle contractions over a *sustained period of time* (endurance training) activates the enzymes adenosine monophosphate-activated protein kinase (**AMPK**) and calcium/calmodulin-dependent protein kinase (**CaMK)**, that ultimately lead to an increase in **mitochondrial biogenesis**. Mitochondrial biogenesis is the process by which mitochondrial mass increases. This process is stimulated by AMPK. With an increase in mitochondrial mass, fat can be metabolized more rapidly (Damirchi *et al.*, 2012). The swift metabolism of fat promotes weight loss. Losing weight aids in the reduction of falls, improves functional skills, maintains muscle tone and strength, encourages social skills and independent living, while helping clients improve their self-esteem and mental health (van Schijndel-Speet *et al.*, 2014).

Individuals with special needs experience social limitations that serve to disadvantage to their overall health(Luckasson *et al.*, 2002). Engaging in a fitness routine provides the client with an opportunity to interact with trainers, gym staff, and potentially other people with special needs in a group exercise setting. Practicing interpersonal skills and engaging in social activities further contribute to the health benefits of exercise(Draheim *et al.*, 2002). Most importantly, clients enjoy the social engagement with other people who are like them - those who have the same or similar disabilities.

Many individuals with developmental disabilities are employed in jobs that require a certain level of physical fitness. One study has demonstrated that the average person with special needs loses the ability to perform at the necessary level of physical fitness for employment around the age of 50(Fernhall, 1993). Exercise helps improve musculoskeletal fitness (Srinivasan *et al.*, 2014), balance, and trunk stability, which are required for many activities of daily life, including employment (Oviedo *et al.*, 2014). Exercise may improve job performance, by preventing a reduction in fitness levels in adults with special needs(Pitetti *et al.*, 1992), especially when the job has a higher demand for motor skills over intellectual skills(Croce, 1990).

The Able-Bodied Baseline

A typical training program for an able-bodied individual might include macro, meso, and micro cycles to manage time and reach goals. A **macro cycle** is the overallplan that includes all areas of training: strength, aerobic, flexibility, and

neuromuscular training. A **meso cycle** is a smaller training block that is goal-directed, and typically lasts for four to six weeks. At the end of the meso cycle, a new program will be craftedto continue progress towards the overall goal of the macro cycle.This is a time to incorporate new exercises, and discontinue old exercises.Lastly, the **micro cycle** is the weekly training plan that is adjusted with progressions as the individual's exercise capacity increases(Helms *et al.*, 2018). Using a training periodization such as this will prevent a client from experiencing a plateau in progress, and will facilitate new and interesting workouts.

Aerobic Training

Aerobic activity is recommended to improve cardiovascular and respiratory health. Aerobic exercise should be performed three to five times weekly to experience health improvements. Aerobic exercise should be conducted for a minimum of 10 minutes in each section(World Health Organization, 2015). Exercising for less than ten minutes is not beneficial to an exercise program or to a client's overall health(American College Of Sports Medicine., 2010). This is because it takes approximately three minutes to reach **steady state**, and a few additional minutes to reach a level of activity that improves ventilatory capacity.With this in mind, exercise conducted in the form of high intensity interval training may be done in lesser volumes while still achieving the same result as other steady state exercises (Sultana *et al.*, 2019).

Depending on the fitness level of the client, the duration of aerobic exercise can be increased throughout a program. The client's fitness level can be determined with a YMCA test, or other similar measure. The YMCA test is outlined below.

When beginning an aerobic-centered program for a client, start by estimating their aerobic capacity. This can be most easily done with a YMCA cycling test, or with simple heart rate maximum calculations, which Equation1 displays(American College Of Sports Medicine., 2010). These methods are submaximal, which helps the client feel more comfortable and willing to return to exercise in the future.

To estimate a client's maximum heart rate, begin calculating a client's heart rate range by subtracting their age from 220 to find their maximum heart rate. This is shown in Equation 1below. Next, subtract the client's resting heart rate from the maximum value previously calculated. This number is called the heart rate reserve. This calculation are shown in Equation 3 below.

$$Heart\ Rate\ Maximum = 220 - age \quad (1)$$

$$Heart\ Rate\ Reserve = Heart\ Rate\ Maximum - Resting\ Heart\ Rate \quad (2)$$

Calculate the heart rate values using the equations above before beginning the YMCA cycling test. The YMCA cycling test is outlined in Table 1.

Table 1. YMCA cycling test protocol

1st Stage	150 kgm/min (0.5 kg)			
	HR: <80	HR: 80-89	HR: 90-100	HR: > 100
2nd Stage	2.5 kg at 50 rpm	2.0 kg at 50 rpm	1.5 kg at 50 rpm	1 kg at 50 rpm
3rd Stage	3 kg at 50 rpm	2.5 kg at 50 rpm	2 kg at 50 rpm	1.5 kg at 50 rpm
4th Stage	3.5 kg at 50 rpm	3 kg at 50 rpm	2.5 kg at 50 rpm	2 kg at 50 rpm

This table can be used with the above equations to calculate an individual's exercise capacity. HR units: beats per minute; rpm = revolutions per minute

Start the cyclingtest with the first stage for a duration of at least three minutes. Continue the stage until the client's heart rate does not increase by more than 5 beats per minute, indicating that the client has reached a steady state. Continue through the stages using the client's heart rate at the end of the previous trial. Terminate the test

once the client has reached 85% of their age-predicted heart rate maximum or 70% of their heart rate reserve. Allow the client to cool down, and observe for any physiologic changes that may indicate a medical emergency (Kaminsky, 2014).

Table 2 below lists levels of physical activity with appropriate corresponding heart rate levels (American College Of Sports Medicine., 2010). Helping clients maintain their heart rate in their target zone can increase motivation to participate in the exercise program.

Table 2. Activity level and corresponding target heart rate zone

Activity Level	Percent Heart Rate Max
Very Light	<50
Light	50-63
Moderate	64-76
Hard (vigorous)	77-93
Very Hard	94
Maximal	100

This table displays heart rate zones that correspond with differing intensities of exercise.

The intensity of the aerobic activity should be gradually increased as the client becomes more comfortable with the program (Rimmer, 1992).

Strength Training

When creating a strength training program, it is important to consider the client's goals. Does the client want to increase strength, muscle size, or both? To increase muscle strength and size, 8 -12 repetitions should be completed, while an increase muscle endurance requires 15 to 25 repetitions (American College Of Sports Medicine., 2010).

In addition to the repetition scheme, it is important to work all major muscle groups in the body. This includes the arms, chest, trunk, hip, and legs. Opposing muscle groups should be exercised during the same workout session to avoid injuries from muscle imbalance.

Progression through a program should occur when the client can complete the higher end of their repetition range without too much effort. This means adding weight or increasing the number of sets or repetitions prescribed. When adding weight, add 5 to 10 lbs. and have the client test the weight until a more suitable load is found. Be careful to not overload an exercise, as too much of an increase in weight will likely cause an injury.

Flexibility

Stretching is recommended for at least 10 minutes, two or three days per week to improve mobility and reduce stiffness(American College Of Sports Medicine, 2010). Stretches should be held for up to one minute, and should not pull the muscles to a point ofdiscomfort. Static stretching should be avoided in warm ups and during exercise to avoid injuries when loading the muscles. Alternately, dynamic stretching can safely be part of a healthy warm up(Sands *et al.*, 2012).

Neuromuscular Training

A program with focus on neuromuscular activity will centeraround balance. Pilates, yoga, and other low impact activities are forms of neuromuscular training. Neuromuscular training should be completed up to three times per week to improve balance (American College Of Sports Medicine., 2010). Resistance bands and light

weights are useful tools in neuromuscular training, as they will not place undue stress on the body.

Cross-Training

Resistance training leads to adaptations in muscle size, strength, and power, that are controlled by the protein kinase B (**AKT**) and mammalian target of rapamycin (**mTOR**) signaling pathways. Alternately, completing low-intensity muscle contractions over a *sustained period of time* (endurance training) activates the enzymes adenosine monophosphate-activated protein kinase (AMPK) and calcium/calmodulin-dependent protein kinase (CaMK**)**, that ultimately lead to mitochondrial biogenesis. The activation of AMPK inhibits the mTOR pathway, hindering **hypertrophic** gains from resistance training by increasing protein degradation (Geoff, 2017). More simply, combining resistance and endurance training can have negativelyimpact strength gains made towards a resistance-related goal. With endurance training, AMPK is activated in response to stresses that deplete ATP (cell's source of energy) stores, which are needed for protein synthesis. AMPK also activates tuberius sclerosis complex 1/2 (**TSC 1/2**), which **inhibits** mTOR from linking proteins.

In endurance training, the AMPK pathway is activated in response to stress that depletes ATP (the cell's source of energy) stores, which are needed for protein synthesis. Thus, if a cell is depleted energetically, it will be unable to undergo protein synthesis. Combining resistance training with endurance training during the same workout will not negatively impact endurance adaptations made during the program. However, the combination negatively impacts strength gains when endurance and resistance training are conducted in the same workout(Wang *et al.*, 2011). This effect is

summarized in Figure 1 below.To avoid this cross-talk effect, it is recommended that resistance and endurance training be conducted on different days.

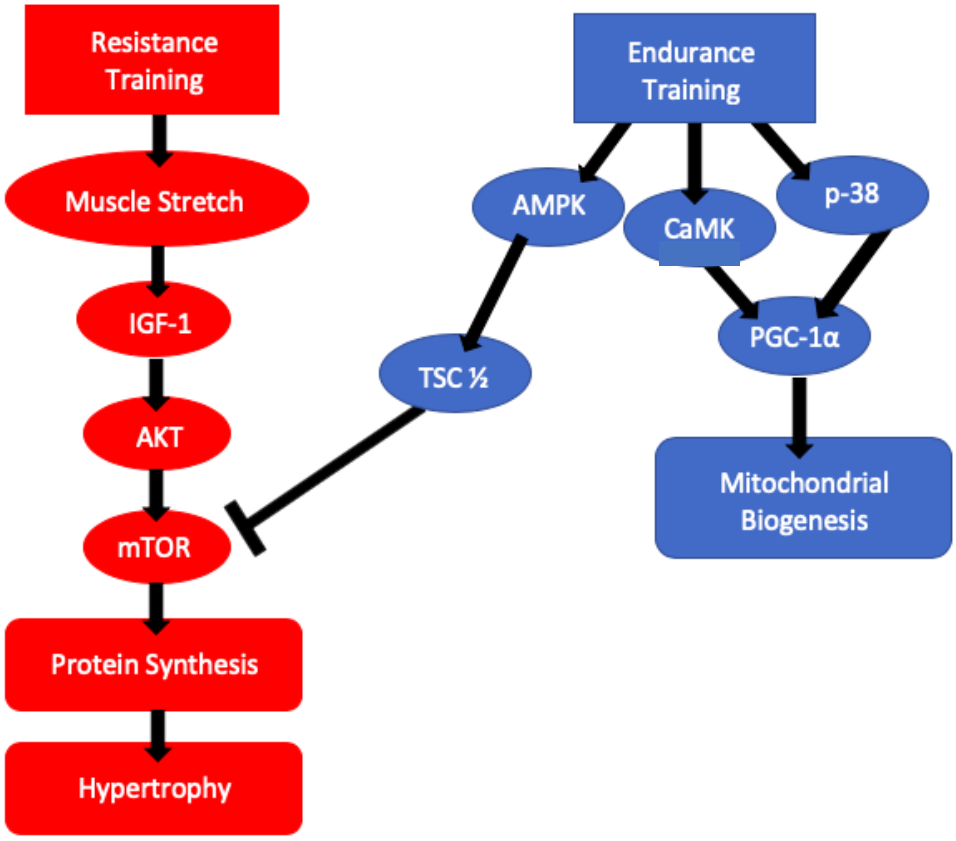


Figure 1. Cross-talk between pathways active during exercise. This diagram shows the interference between biochemical pathways involved in resistance and endurance training. IGF-1 = intrinsic growth factor 1; AKT = Protein kinase B; mTOR = Mammalian target of rapamycin; AMPK = adenosine monophosphate-activated protein kinase; CaMK = Calcium/calmodulin-dependent protein kinase; p-38 = Mitogen-activated protein kinase; PGC-1α = Proliferator-activated receptor- γ coactivator-1α; TSC ½ = Tuberius sclerosis complex ½

Fatigue and Deloading

Fatigue is a weakness or tiredness caused by stress, health conditions, and physical exertion. As a client continues to train, the capacity for fatigue should increase. However, feelings of fatigue may be exacerbated by stress, medical conditions, poor nutrition, lack of sleep, stress and anxiety, or other factors (Helms *et al.*, 2018). People with developmental disabilities tend to have less muscle mass. Having less muscle mass

leads to a reduced number of blood vessels to transport oxygen to working tissues. The muscles used during moderate exercise require oxygen to function. When oxygen delivery or availability does not meet the body's demand for oxygen, the muscles cannot operate at a maximum level of aerobic efficiency, forcing the muscles to switch to anaerobic respiration. This result will causean individual to feel exhausted. Leading a sedentary lifestyle can significantly reduce capillary density, exacerbating this effect(Laughlin & Roseguini, 2008).

When starting a program with a new client, a trainer must be flexible when creating a program. That is when a client is feeling fatigued or stressed, they should complete an easier workout. Forcing a client to work hard without regard to potential fatigue, may minimize progress, and can impede motivation and self-efficacy. Clients can quickly lose their desire to exercise if the workouts are too strenuous. When progress plateaus and a client struggles with a workout, a deload should be incorporated. Deloading is when the number of sets and/or repetitions of a training program is/are reduced to allow the body to recover from fatigue. In a newer client a trainer should reduce the training volume or intensity of the session by about 10%. Each deload should last about a week. Adding a deload into a workout will allow the client to make progress at a faster rate. Furthermore, incorporating a deload into a program helps limit the potential of injury. Fatigue can cause soft tissue injuries, particularly when technique is compromised due to exhaustion. To prevent earlier onset of fatigue, spread a desired training volume over multiple workouts (Helms *et al.*, 2018).

Part I: Disability Information and Considerations

Cognitive Disabilities

Autism Spectrum Disorders

Autism is a developmental disorder in which communication skills are impaired. People with autism spectrum disorders have trouble with **social reciprocity**, including both verbal and nonverbal communication delays. This makes eye contact and group activities challenging for these individuals. Additionally, sensory issues are extremely common in people with autism spectrum disorders. Troubles with auditory, tactile, and visual sensations are most common. An individual with autism may react with either hyper- or hypo- responsiveness to stimuli experienced with these senses (Srinivasan *et al.*, 2014). This means a person with autism will either over-react to a stimulus, or will not react much at all. This becomes a problem when over-reactions to certain stimuli causes behavioral tantrums. For this reason, it is crucial for fitness professionals and other providers to consult with the client's caregiver to be made aware of the client's sensitivities.

Obesity in people with autism spectrum disorders is likely due to five primary factors: (1) low physical activity, (2) poor nutrition, (3) prescription medication use, (4) **metabolic abnormalities**, and (5) lack of knowledge or awareness about their physical health (Srinivasan *et al.*, 2014). People with autism spectrum disorders are often sedentary due to an inability to remain focused for extended periods of time. The inability to focus can lead to behavioral problems that make exercising in a public facility a challenge. It may present dietary challenges if a person with autism is picky

and throws tantrums when given nonpreferred food. Medications to treat anxiety and depression are often prescribed to persons with autism. Physicians use these types of medications to reduce incidences of aggression and self-harm, which can be common in people with autism. These medications often cause weight gain. Most importantly, people with autism spectrum disorders may not comprehend the importance of living a healthy lifestyle. Since clients must be able to consent to participating in an exercise program, it is important to ensure that the program includes activities that the individual enjoys. Personal trainers and caregivers should together try to help clients with autism understand why it is important to make healthy choices, and do so with patience and enthusiasm.

Utilizing visual supports is imperative when training clients with autism. Visual supports are tools like colorful posters with photos that personal trainers can use to communicate with their clients. Allowing clients to feel a sense of independence helps them remain calm and cooperative throughout their workout. The visual component will give them the structure they need to work toward success. In light of their sensory problems, it is also essential to avoid touching clients with autism. Some clients may have trouble touching certain exercise equipment. Sound is another problem for many people with autism. To avoid loud sounds, conduct the workout for a client with autism in an area isolated from other gym patrons. In addition to avoiding loud sounds that may overwhelm the client, this will also help to block out other social stresses and allow the trainer to build stronger rapport with the client and caregiver. Shielding the client from potential triggers will also place the client at ease and increase the likelihood of achieving their fitness goals.

Down Syndrome

Down syndrome occurs as a result of partial or complete **trisomy**, where there are three chromosomes instead of two on the 21st pair of chromosomes. People with Down syndrome have physiological differences that disadvantage and prevent them from participating in certain physical activities. One pathological difference is the unnatural utilization of substrates such as carbohydrates and fats(Fernhall, 1993). Many of the genes on the affected chromosomes code for metabolic enzymes. When trisomy occurs, there can be an overexpression of metabolic enzymes, creating metabolic disturbances (Patterson, 2009). As a result, people with Down syndrome tend to carry more body fat than able-bodied people. Individuals with Down syndrome also commonly have **hypothyroidism**, causing their**basal metabolic rate**, to further decline, contributing to a higher body fat percentage (McElduff, 1995). Another physiological abnormality experienced by people with Down syndrome is their brains' sympathetic response to physical activity. People with Down syndrome have trouble converting **dopamine** into **norepinephrine** which results in a lower than normal heart rate, especially during exercise (Pitetti *et al.*, 1992).

The majority of people with Down syndrome have poor muscle tone and an inability to produce high muscle force. For this reason, it may be beneficial to put a client with Down syndrome on a mild hypertrophic program to help increase muscle tone and force output. This means using more repetitions per set, with shorter breaks between sets. Low arches or flat feet are also characteristic of this condition, causing problems with balance and agility (Ulrich *et al.*, 2004) andrestricting the complexity of

aerobic exercise programming. Down syndrome is commonly correlated with having shorter than normal arms and legs (Fernhall, 1993), making certain movements more challenging than others, and further contributing to difficulties with balance. Individuals with Down syndrome experience additional trouble with balance due to a high degree of **joint laxity**(Ulrich *et al.*, 2004). This makes their joints susceptible to injuries including strains and sprains. It is important to build strength in muscles that support joints to avoid injury in individuals with Down syndrome.

Down syndrome is one developmental disability in which individuals tend to have problems with **motor control**(Patterson, 2009). This means that people with Down syndrome often have trouble achieving desired movement patterns. Personal trainers should encourage clients with Down syndrome to practice different movements and exercises until they can train their bodies to move properly. This should involve breaking movements down into sub components, practicing lifting techniques with little or no weight, and/or incorporating resistance bands for variable loading to avoid injuries while training different movement patterns.

People with Down syndrome generally have good social skills and positive disposition throughout childhood and early adulthood. Their good social skills make people with Down syndrome popular participants in group activities. With age, many people with Down syndrome develop depression. Participating in group activities and offering a safe environment can help mitigate the effects of depression in people with Down syndrome. Although individuals with Down syndrome tend to have good social skills, they commonly have trouble with verbal proficiency. When communicating with

people with Down syndrome, visual supports can help minimize confusion (Luckasson *et al.*, 2002).

Physical Disability

Cerebral Palsy

Cerebral Palsy (CP) results from complications during pregnancy and/or birth, or from brain damage.Of all motor-manifested developmental disabilities in children, CP occurs most often. While CP effects children of all genders and ethnicities, males are affected most frequently. CP mainly affects posture, balance, and ability to control movements(Center for Disease Control, n.d.). There are two forms of CP: spastic and athetoid. In spastic CP, an individual will experience a general increase in muscle tone of upper extremity flexors, and lower extremity extensors(American College Of Sports Medicine., 2010). This leads to a weakness in antagonist muscles, that should be an area of focus while training. Spasticity can be improved with an increase in body temperature, stretching, and good body positioning. Alternately, athetoid CP involves involuntary movement of the limbs. Because of the involuntary movements, using exercise machines, as opposed to free weights, can prevent injury (American College Of Sports Medicine., 2010).

Most people with CP are ambulatory, but crutches or other mobility devices are often needed. Cerebral Palsy is often accompanied by other medical conditions such as epilepsy or autism (Center for Disease Control, n.d.). Furthermore, as people with CP age, much like the general public, they experience greater risk for cardiovascular disease and other age-related conditions. In people with CP, exercise can minimize the

effects of aging and other restrictions associated with the condition, such as pain, fatigue, and spasticity (Nieuwenhuijsen *et al.*, 2011).

Fatigue is commonly experienced by people with CP, especially during and after exercise. An individual with CP may present with moderate-to-severe fatigue when they have an imbalance in the physical fitness level required by their lifestyle and their actual fitness level. People with CP also tend to have less active muscle tissue as a result of **muscle contractures**. Muscle contractures are a permanent thinning and shortening of muscle fibers caused by the continual muscle contraction associated with cerebral palsy(Mathewson & Lieber, 2015).As mentioned in the discussion of Fatigue and Deloading above, having less muscle leads to a reduced number of blood vessels that carry oxygen to working tissues, resulting in the individual feeling exhausted. The thin and short muscle fibers associated with CP lead to an earlier onset of fatigue and exhaustion as oxygen is rapidly depleted. Moreover,jerky movements seen in people with CP lead to an increased caloric need to maintain the body's energy output for tasks of daily living. In people with CP, this increase in energy demand makes being physically active in adulthood much more of a challenge, and leads to constant fatigue. This feeling of fatigue can evolve into pain and **osteoporosis** in the absence of regular strength-focused exercise.

In addition to the aforementioned symptoms, CP causes muscle weakness and **spasticity**, or continuous muscle contractions, which creates difficulty for people with this disability to establish a consistent fitness routine. Likewise, the movement problems associated with CP often prevent affected people from developing their cardiovascular fitness levels effectively. Strength training can be extremely beneficial

for improving muscle strength in people with CP.Clients with CP can be trained to lift weights in essentially the same way as people without disabilities, particularly in terms of weight progression. This means adding about 5 pounds to an exercise with each progression, while maintaining the same number of sets and repetitions programmed for a desired goal. Cerebral Palsy causes both **agonist** and **antagonist** muscle groups to contract simultaneously, rendering difficulty in producing large amounts of force while moving. This will immobilize the joint or make movements difficult because the agonist muscle group must overcome the force generated by the antagonist muscle group. Weight-lifting can increase muscle force production, improving strength, and ultimately benefitting functional skills. Not only does strength training increase a client's capacity for preforming functional skills, but it also aids in improving their self-image and self-efficacy. Aerobic exercise is also important for people with CP, especially to combat fatigue. Engaging in regular cardio-based exercise will increase the time until the client feels fatigued during exercise. The best cardio-based exercise for people with CP includes biking, swimming, and walking.

When programming for clients with CP, it is important to observe and document irregular movement patterns that waste energy or that may cause injury.This can be achieved by creating a program that targets the correction of the observed movement irregularities. Exercises that focus on areas of the body that may already be functioning well should also be implemented into a program, from the beginning to maintain correct function. This will help build confidence and rapport with the client until they are comfortable to progress their program to correct movement deficiencies. A program for a person with CP should incorporate cardio to increase **stamina**. For those who can

walk with assertive devices, but also use a wheelchair, portions of their program should encourage them to get out of the wheelchair, if doing so can be accomplished safely. Encourage caregivers and/or families of people with CP to engage in physical activity with the client outside of the gym (Fowler *et al.*, 2007).

Part II: Proposed Training Model

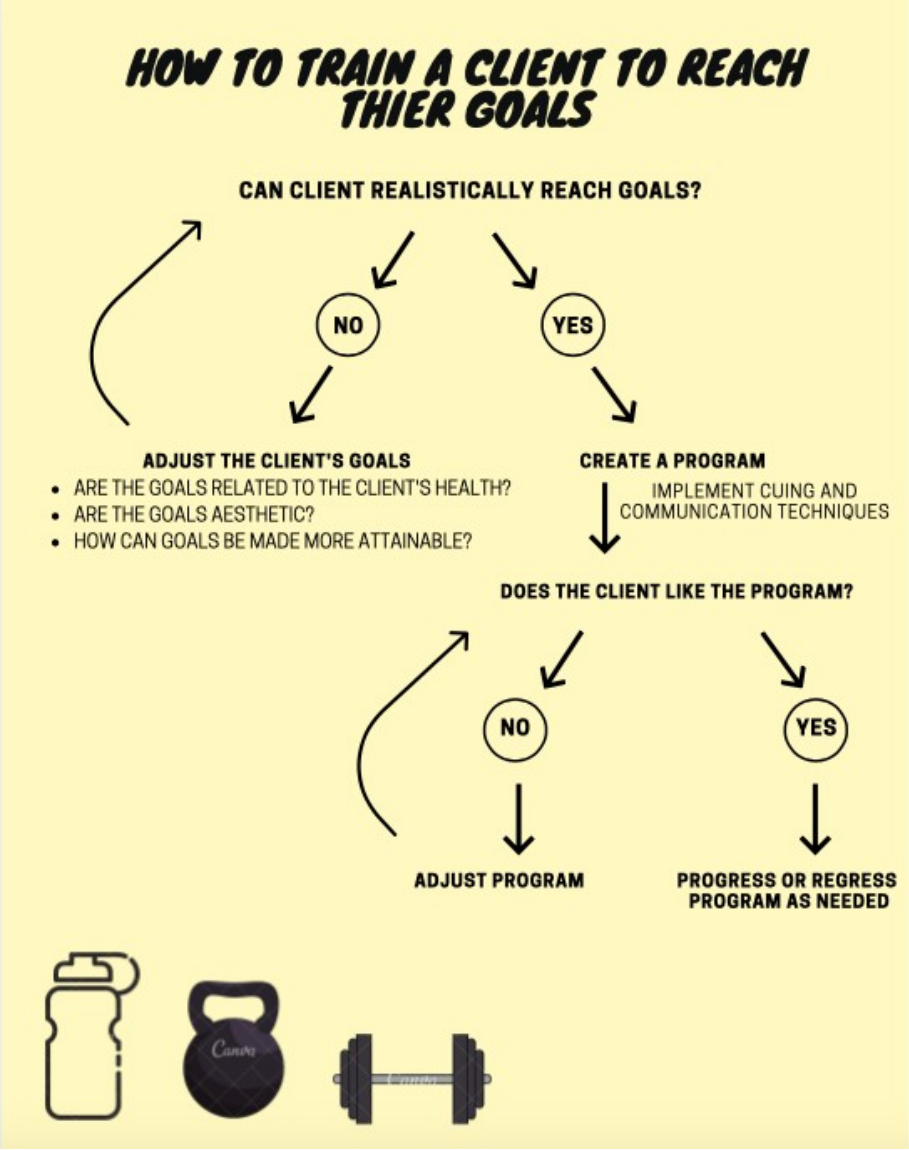


Figure 2. Creating an exercise program flow chart.This chart shows the cycle of steps required for the creation of an exercise program.

Creating an Exercise Program

For clients with developmental disabilities or other special needs, it is important to not plan a full session of assessments.Too many assessments in one session can be hard on the client's mind and body and can undermine the ability to build rapport with

the client. Trying to fit too many assessments into one session can also deter clients from wanting to participate in future sessions out of fear of being over-fatigued (Bryant *et al.,* n.d.). It may be more beneficial to conduct a mild-to-moderately difficult workout that allows for movement screens, instead of focusing solely on assessments. Working assessments into two to four workouts will increase client participation and reduce boredom from assessments.It is with the discretion of the trainer to choose what assessments to conduct during initial training sessions. Recall that people with special needs tend to have poor core strength and stamina for aerobic activity (Fernhall, 1993). To avoid injury, familiarize the client with the training equipment and technique during approximately the first two weeks of a new training program. Encourage clients to communicate when an exercise is painful or uncomfortable (Heller *et al.,* 2004). Doing these few things to commence a new program will ensure safety and comfort for the client.

The World Health Organization suggests that adults should engage in a minimum of 150 minutes of moderate-intensity exercise *or* in a minimum of 75 minutes of high-intensity exercise each week. To maximize health benefits associated with exercise, 300 minutes of moderate-intensity exercise, *or* 150 minutes of high-intensity exercise should be conducted weekly(World Health Organization, 2015). This goal may be unlikely for someone with special needs, particularlyat the start of an exercise program. These suggestions apply equally to the developmentally disabled population as to the general population. As with able-bodied individuals, a good exercise program for a person with a developmental disability should include **aerobic**, **resistance**, **flexibility**, and **neuromuscular training**(Srinivasan *et al.,* 2014). This means that some

form of cardio, strength training, stretching, and activities to test coordination should be included to complete a program for an individual with special needs. Programs should also include activities that are fun and interesting for the client (Oviedo *et al.*, 2014), as well as exercises that help the client work toward their goals.

Aerobic Exercise

Walking and cycling are the most commonly documented forms of aerobic exercise among people with special needs (Draheim *et al.*, 2002). Other activities including dancing and **circuit training** are also effective for this population. In circuit training, each exercise can be performed for one to two minutes, with up to a minute of rest in-between exercises (Rimmer, 1992). Jogging also improves cardiovascular fitness and work performance in people with developmental disabilities (Beasley, 1982). However, jogging tends to be more vigorous and has greater impact on joints, and is often enjoyed less than other activities.

People with special needs should engage in aerobic exercise at a maximum of30 minutes at the start of a new program. It isimportant to note that some people with developmental disabilities, especially Down syndrome, experience **chronotropic incompetence**. This occurs when a person's maximal heart rate falls below an expected value (Rimmer, 1992). Chronotropic incompetence renders heart rate measurements less effective indicators of work capacity. For individuals that experience challenges using heart rate as an effective indicator of aerobic capacity, it may be more beneficial to use ratings of perceived exertion to gauge the intensity of a client's workout.

Resistance Training

Contrary to popular belief, strength training is safe for people with developmental disabilities. People with conditions such as Down syndrome andCerebral Palsy may benefit more from resistance training than they will from cardio-based activities. Both Down syndrome and Cerebral Palsy are characterized by poor muscle tone and strength. Working to strengthen muscles may alleviate common symptoms associated with these conditions. While some conditions benefit more from resistance training than cardio, resistance training benefits individuals with all developmental disabilities because it helps increase strength, balance, and flexibility (Chow *et al.*, 2016). It also improves work performance and the ability to live independently (Fernhall, 1993). Strength training of major muscle groups should be done at least two days per week (World Health Organization, 2015) to achieve improvements in strength and muscle tone. To maximize safety, a personal trainer should be personally present any time weights are used (Hovart & Smail, 2009; Tamse *et al.*, 2010).

When administering resistance training to an individual with special needs, first start with bodyweight exercises, or exercises using light weights (Chow *et al.*, 2016). The use of power assisted machines (Bossink *et al.*, 2017), resistance bands, and other modification devices can help clients commence an exercise program at a level that coincides with the severity of their disability and fitness level. Gradually increase the intensity of the exercises with repetitions and weight as the client becomes more comfortable with the program (Rimmer, 1992).

Programming Summary and Examples

Table 3. Safe common exercises for select developmental disabilities

Type of Exercise	Autism	Down syndrome	Cerebral Palsy
Strength	Bodyweight movements	Squats	Yoga
	Squats	Rowing variations	Push ups
	Pushups	Chest press	Squats
	Resistance bands	Bicep curls	Deadlifts
	Lateral walks	Overhead press	Weight machines
	Hip bridges	Hip bridges	Unilateral arm lifts
Aerobic	Jogging	Cycling	Swimming
	Rowing	Dancing	Walking
	Swimming	Treadmill	Dancing

This table lists safe exercises, both strength- and endurance-related, that can be conducted for specific developmental disabilities.

Without Physical Limitations

Table 4. Example Strength Workout for Individual Without Physical Limitations

Type of Exercise	Example
Resistance 1	Box Squat
Resistance 2	Floor Chest Press
Superset 1	Banded Hip Bridge
Superset 2	TRX Rows
Circuit	Sit to Stand
	Down and Backs
	Medicine Ball Slams

Cardio: 30 minutes on arm cycle or seated rowing. Cardio and strength training to be done on alternating days.

Wheelchair Bound/Physically Disabled

Table 5. Example Strength Workout for Physically Disabled Individual

Type of Exercise	Example

Resistance 1	Overhead Press
Resistance 2	Resisted Lat Push Down
Superset 1	Tricep Pull Down
Superset 2	Bicep Curls
Circuit	Battle Rope Waves Contralateral Reaches Palm Press w/ Breathing
Cardio: 30 minutes on arm cycle or seated rowing. Cardio and strength training to be done on alternating days.	

Cooperative High Intensity Interval Training

Table 6. Example Cooperative High Intensity Interval Training Workout

	Example		Example
Interval 1	Squat w/ OH Press Jumping Jacks Renegade Rows	Interval 5	Jump Rope Plank Jacks High Knees
Interval 2	Sit to Stand/Burpees Mountain Climbers March/Box Step-Up Star Jumps	Interval 6	Spiderman Plank Charleston Kicks Pulse Squats Banded Lateral Walk
Interval 3	Banded Bicep Curls Banded Lateral Raise Knee/Incline Push Up Tricep Dips	Interval 7	Football Rumble Squat Jacks Overhead Press Skiers
Interval 4	Inch Worms Squat Jumps Lunges Repeater Knee Tuck	Interval 8	Toe Touches Hollow Body Hold Plank Hold Deadbugs
Each exercise should be completed for 20 – 60 seconds, allowing for 10-30 seconds of rest between each exercise. Each exercise can be progressed or regressed to fit the client's needs			

Movement Deficiencies

Balance

The primary sensory systems of the body, including sight and touch, may be at least somewhat compromised in individuals who have special needs, which may increase the likelihood of a fall. Furthermore, people with autism spectrum disorders and Down syndrometend to experience poor hand-eye coordination and trouble

balancing, both **statically** and **dynamically**(Srinivasan *et al.*, 2014). This means it is also more likely that a client may fall during their session. As a precaution, ensure that the client feels stable before asking them to perform any exercises where health deficiencies may impair balance. Incorporating neuromuscular training, like yoga and Pilates, may improve balance(Donahoe-Fillmore & Grant, 2019).

Wheelchairs

In individuals limited to wheelchairs, who also have developmental disabilities, leading a sedentary lifestyle makes it more likely that they will develop additional functional or physiological handicaps associated with nonuse. For this reason, and to avoid the onset of other preventable cardiovascular and metabolic diseases, it is important to encourage those who are wheelchair-bound to engage in regular exercise. Important exercises for people dependent on a wheelchair include exercises that expand the chest and lungs, mobilize the trunk and arms, and promote deep abdominal breathing. Elastic bands have been found to be especially effective in improving overall fitness in people with developmental disabilities who are wheelchair-bound (Chen *et al.*, 2016). Notably, many people who are wheelchair-bound lack back and abdominal strength and stability. As such, focusing on strengthening these areas may be beneficial. Most fitness facilities do not offer many, if any, pieces of adaptable fitness equipment, but should. While it is not mandated by law, owners or managers of facilities used to train individuals who use wheelchairs should consider buying adaptive equipment. To avoid injury, exercise equipment must be capable of access from a wheelchair(Dolbow & Figoni, 2015).

Facility Accommodations

The Americans with Disabilities Act of 1990 mandates that people with disabilities are to be accommodated and provided with the opportunity to experience any services that a business may provide (Dolbow & Figoni, 2015).Stairs and curbs prevent people bound to wheelchairs from reaching and using fitness facilities (Dolbow & Figoni, 2015). Doors that do not open automatically prevent those who are reliant on wheelchairs from entering fitness facilities because the doors may be too heavy, or require too much grip strength to turn a knob (Dolbow & Figoni, 2015). Hallways must be wide enough for a wheelchair to easily navigate ingress and egress, while service desks and water fountains should be lowered (Dolbow & Figoni, 2015). Moreover, exercising from a wheelchair requires adaptable equipment to counteract any physical impairments an individual might face(Dolbow & Figoni, 2015). This means placing equipment at an appropriate height and using weights that can be accessed from a sitting position.

Part III: Goal Setting and Training Techniques

Goal Setting

It is critical to set goals to help clients achieve success with their programs. Setting goals for people with developmental disabilities and other special needs is essentially the same as setting goals for non-disabled people. Setting a few goals for a healthy lifestyle will increase clients' motivation and self-efficacy. To maximize the benefits associated with goal setting, a few basic rules should be followed.

First, it is important to remember to set a realistic number of achievable goals. Each training period (up to about 12 weeks) should set no more than 3-5 achievable goals. This ensures that exercises can be programmed for specific goals to keep the client motivated.

Second, positive goals should be the main focus. That is, goals should focus on reinforcement of a desired behavior instead of eliminating an undesired behavior. For instance, a negative goal could be to stop spending as much time sitting in front of the TV. This could be reconstructed into a positive goal, saying spend more time walking outside.

Finally, clients should have both short-term and long-term goals. Short-term goals may be changed every four to six weeks, while long-term goals should be used for up to six months. Having short-term goals will help maintain client motivation as they work toward and achieve these goals throughout their program. Long-term goals keep clients focused on a larger achievement. Remember to regularly confirm client progress toward goals.Regular follow-ups will improve self-efficacy and motivation as the client

realizes the improvement in athletic abilities and overall health. By setting goals based on the S.M.A.R.T. parameters laid out below, clients are more likely to achieve their goals (Doran *et al.*, 1981). The acronym S.M.A.R.T. stands for specific, measurable, attainable, realistic, and time-bound.

Table 7. S.M.A.R.T. Goal Guidelines

Specific	What will be done?
Measurable	How will the goal be evaluated?
Assignable/Attainable	Is the goal within your scope? Is it possible to achieve the goal in the time allowed?
Realistic	Does this goal improve overall health for the client? Does this goal make sense with regard to exercise?
Time-Bound	When should the goal be reached? Is there a specific timeframe?

The S.M.A.R.T. goal-setting principle comes from Doran *et al.* (2018), and their model for successful business management.

Visual Supports

Visual supports include pictures, symbols, objects, words, and more.A 2004 study regarding communication with picture exchangeconcluded that education is improved through the use of visual supports (Ganz & Simpson, 2004). Not surprisingly,pictograms can be useful for communicating effectively with people with developmental disabilities when creating a training program(van Schijndel-Speet *et al.*, 2014). Visual supports are more permanent fixtures than spoken words, making them easier to remember (Pate, 2019) and better at attracting and holding a client's attention. The use of visual supports in an exercise program also helps clients express their thoughts and causes abstract concepts to be more easily understood (Rao & Gagie, 2006). Basically, using images helps people with special needs know what to do and

when to do it. This provides the client a sense of independence and helps limit undesirable behaviors (Hodgdon, 2011). Both personal trainers and clients will benefit from the use of visual supports.

Visual supports may be incorporated into schedules, choice menus, maps, progress charts, and lists of rules to be followed. The use of visual supports on progress trackers acts as a form of positive reinforcement. Progress trackers allow clients to envision the progress they are making, and eventually allow greater self-reliance. Rule reminder boards provide visual reminders of behavior expectations and prohibited activities. For example, to promote sharing and taking turns, use images that symbolize these actions on the rule reminder board (Pate, 2019).**Choice menus** display exercise options to help clients choose their preferred exercises. Choice menus also help clients have a sense of control in their exercise environment, fostering a sense of overall independence that is beneficial to their mental health(Pate, 2019). Using choice menus will likely increase client participation, as the client is involved in planning the workout. When creating a choice menu, it is important to show only activities that are aligned with the client's program and goals.

When creating a system of visual supports, first determine the desired behavior or skill and what images can be used to guide a client toward these behaviors or skills. After brainstorming ideas, consider what the client will and will not be able to comprehend, and organize the visual materials. Lastly, teach clients how to consistently use the visual supports created for themto achieve the best results (Pate, 2019). Some examples of visual supports are located in the Appendix.

In addition to the use of pictograms, clients with special needs benefit from the use of heart rate monitors (Croce, 1990), that are included in many athletic watches. When a client has access to an athletic watch that has a heart rate monitor, the client can be taught to track their heart rate zone. This starts with calculating desired heart rate ranges for different levels of exercise intensity, based on the client's resting heart rate. The equations for these calculations are listed in the Able-Bodied Baseline section of the Introduction of this thesis.

Positive Reinforcement

Self-efficacy in people with developmental disabilities can be drastically improved throughout an exercise program when the same staff members are consistently involved in their weekly training. Seeing familiar faces helps increase cooperation, comfort, and progress for the client and their trainer(s). This success is heightened when the trainers and other staff members are enthusiastic and positive. Those with autism work best in one-on-one settings. This is due to sensory sensitivities and behavioral concerns. Individuals with other disabilities, like Down syndrome, may train better in group settings and take comfort in being surrounded by people who have similar conditions and physical features (Croce, 1990). When working in a group setting, it may be appropriate for clients to share their physical limitations (if they are comfortable sharing) with one another, as to avoid embarrassing any of the participants (Wright *et al.*, 2019).

Trying to conduct an exercise program for individuals with developmental disabilities that does not implement positive reinforcement is likely to be unsuccessful

or more challenging for the personal trainer (Rimmer, 1992). Individuals with developmental impairments thrive on feedback throughout a training session with the use of verbal instructions and/or visual cues (Srinivasan *et al.*, 2014). Additionally, people with special needs develop confidence in their athletic abilities whenproper communication techniques are used, including positive feedback, and pictures and videos of the client properly performing exercises (Heller *et al.*, 2004).

Personal trainers may create charts with personalized categories for their client's program that tracks the client's progress. Rewards and prizes can be offered at different stages of progress to encourage further progress (Combs & Jansma, 1990). **Verbal reinforcement** and a **token economy** system are often useful motivators (Rimmer, 1992; Alstot, 2012). Tokens can be earned based on performance and then returned in exchange for a healthy reward. Adults with special needs often have limited resources to treat themselves and cherish rewards for their progress during an exercise program (Rimmer, 1992). Holding an award ceremony at the end of a training block helps reinforce client performance and self-efficacy, especially when working in a group setting (Heller *et al.*, 2004).

Conclusion

People with developmental disabilities have historically been a sedentary population. In the United States, twice as many developmentally disabled individuals are obese, as compared to their nondisabled counterparts (Center for Health Statistics, 2017; Melville *et al.*, 2008). Obesity caused by living a sedentary lifestyle commonly causes secondary health conditions, including coronary artery disease, stroke, hypertension, cancer, diabetes, respiratory illnesses, dental problems, and seizure disorders (Luckasson *et al.*, 2002).Moreover, in the past several years the cost of managing obesity-related health conditions has risen to approximately $6.38 billion (Trogdon *et al.*, 2008). The astounding costs associated with treating obesity-related conditions, and the prevalence of obesity and secondary conditions themselves exhibit the dire need for exercise in the developmentally disabled population.

Physical activity in people with special needs has been dissuaded for a number of reasons. These include a lack of fitness facility accommodation, a lack of self-efficacy, and the prevalence of disability-related health conditions. This thesis aims to support the reconstruction of exercise-related hinderances to improve the health of people with developmental disabilities. In regards to exercise, the experiences of people with special needs can be improved through the use of visual supports and positive reinforcement, proper goal setting, training and facility accommodations, and the consideration of individual disabilities. With attention to these aspects of physical training, exercise can be made more enjoyable and successful for people with developmental disabilities.

Glossary

Aerobic Exercise: Low-to-high intensity exercise that is maintained over a period of time, and relies on aerobic metabolism (the presence of oxygen)

Agonist Muscle: Muscle(s) that contract while the antagonist muscle relaxes

AKT: Protein Kinase B

AMPK: Adenosine monophosphate-activated protein kinase

Antagonist Muscle: Muscle(s) that oppose(s) the movement of another muscle

Atrial Natriuretic Peptide: A hormone secreted by the atria of the heart that increases sodium excretion by the kidneys

Atrial Septal Defect: A heart condition characterized by a hole the walls separating the two upper chambers of the heart

AtrioventricularisCommunis: A heart condition in which the chambers of the heart are partitioned incorrectly

Baroreflex System: A homeostatic mechanism of the body that senses and reacts to changes in blood pressure

Basal Metabolic Rate: The rate at which the body uses energy while at rest

CaMK: Calcium/Calmodulin-dependent protein kinase

Choice Menu: A list of options a person with special needs can chose from to feel a sense of control or independence

Chronotropic Incompetence: When a person's heart rate falls below normal values

Circuit Training: A group of high intensity exercises that are cycled over a period of time

Dopamine: A blood chemical that is converted into norepinephrine and epinephrine (adrenaline)

Dynamic: An activity that causes joint movement through a wide range of motion

Endothelial Function:The ability of the smooth muscle inside of blood vessels to constrict and dilate

Flexibility: Stretching muscles to allow for a better range of motion

Heart Rate Variability: Variation in the interval between heart beats

High-density Lipoprotein:Proteins that transport fat through the blood to the liver to be broken down

Hypertrophy: The enlargement of muscle cells

Hypothyroidism: When the thyroid gland does not produce and release sufficient levels of hormones, if any

Hypotonicity: Lacking muscle tone or tension

Inhibits: Prevents; does not allow

Joint Laxity: Loose ligaments

Lipoprotein Lipase: An enzyme that breaks down fat in the blood

Low-density Lipoprotein: Proteins that transport fat through the blood from the liver to body tissues

Macro Cycle: A big picture training cycle lasting a few months to a year

Meso Cycle: A training period of four to six weeks

Metabolic Abnormality: A problem with the way that carbohydrates, fats, and proteins are broken down in the body

Micro Cycle: A weekly training plan

Mitochondrial Biogenesis: A pathway in which cells increase mitochondrial mass, and thus the ability to provide energy

Motor Control: The brain's control over body movements

mTOR: Mammalian target of rapamycin

Muscle Contracture: Permanent shortening of muscles

Myofilaments:Filaments of muscle cells that together construct the muscle

Neuromuscular Training: The trained response of a muscle in response to stability and efficient movement

Norepinephrine: A hormone released from the adrenal gland that raises blood pressure, heart rate, and ventilatory rate

Osteoporosis: A condition in which bones become weak; causes pain and discomfort

Patent Ductus Arteriosus: A heart condition characterized by an opening in two blood vessels attached to the heart

Positive Reinforcement: Offering a positive stimulus to encourage reoccurring behaviors

Pulmonary Hypoplasia: The underdevelopment of the lungs

Resistance Exercise: Strength training, weight lifting, etc.

Reverse Cholesterol Transport: Shuttles low-density lipoprotein to the liver to be broken down

SERCA-2: A pump inside of a muscle cell that transports calcium

Social Reciprocity: The ability to engage in social activity

Spasticity: Continuous muscle contraction

Stamina: The ability to engage in exercise over a long period of time

Static: Staying in one position for a period of time

Steady State: When heart rate and breathing evens to a steady level as the body finds balance between the energy needed for ATP (cell energy) production and for working muscles

Tardive Dyskinesia: A movement disorder in which muscles of the face, trunk, and limbs move involuntarily

Token Economy System: Using coins or tokens that can be used to purchase a prize or reward

TSC 1/2: A protein that degrades tissues

Trisomy: Where there are three chromosomes instead of two on the 21st pair of chromosomes

Ventricular Septal Defect: A heart condition caused by an abnormal connection of the lower chambers of the heart

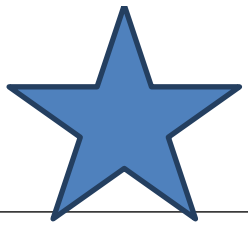
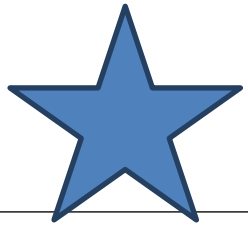
Verbal Reinforcement: When language is used to reinforce behavior

Appendix

Example Visual Supports

Progress Tracker

I Can Do It!

Workout	Workout	Workout	Workou
			

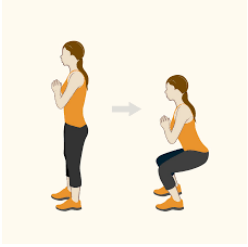
I'm Working Towards:_____

Choice Menu

Workout Choices

Strength:

istokphoto.com



Oprah.com

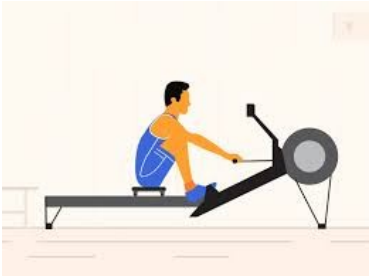
123rf.com

istokphoto.com

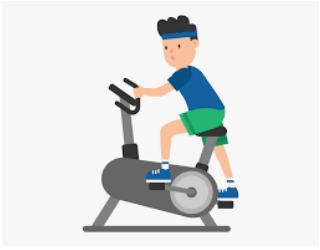
-

Aerobic:

vectorstock.com



dribble.com



clipartwiki.com

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