University of Wisconsin-La Crosse

Graduate Studies

Instructional Strategies for Teaching Aquatic Skills to Preschool and Elementary Aged Students with Down Syndrome

A Critical Analysis Project Submitted in Partial Fulfillment of the Requirements for the Master of Science in Exercise and Sport Science-Physical Education Teaching Adapted Physical Education Teaching Concentration

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ABSTRACT

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Aquatics is a common recreational physical activity with many unique benefits for all persons, especially those with Down syndrome (DS). It is important for persons with DS to develop aquatic skills to learn water safety, lifetime physical activity and fitness, develop independence, increase social skills, and increase movement competence. Minimal research has been done addressing aquatics for individuals with DS. There are also very few instructional resources for strategies to teach children and youth with DS and to make adaptations to general aquatics programs. The major purpose of this project was to identify instructional strategies to assist educational professionals, parents, and others in teaching aquatic skills to preschool and elementary-aged students with DS through multiple progressions and activities. This was accomplished through a review of teaching literature. Another purpose of this project was to assist educational professionals in developing an aquatics program in a school district or community. A third purpose was to combine and implement the first two purposes, providing instructional strategies to educators and assisting in building a program, into a video for educational professionals who work with students with DS. The video provides practical teaching techniques and progressions as well as specific modifications to use in an inclusion setting. Throughout the video viewers are introduced to DS, developing a program, transportation and logistics, developing curriculum, and assessment specific to students with DS and aquatics.

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CHAPTER I

INTRODUCTION

Down syndrome (DS) is a genetic disorder caused by either a full or partial extra pair of chromosome 21 (Dunn & Leitschuh, 2014). There are three types of DS: trisomy 21, translocation, and mosaicism, with Trisomy 21 being the most common at 95% of cases. Characteristics of DS can be seen in the psychomotor, cognitive, and affective domains.

There are many physical features common among persons with DS, such as almond shaped eyes and a flat nose. A small oral cavity with a protruding tongue is another noticeable characteristic. Children with DS tend to be shorter in stature, along with hypotonia (muscle laxity), and higher rates of obesity. Beyond the physical characteristics, persons with DS also have impairments in speech, physical fitness, and often have lower cognitive abilities. Down syndrome is classified as an intellectual disability (ID), meaning that their measure of intelligence is often one and a half standard deviations below the mean. Some other considerations for persons with DS include congenital heart defects or other heart problems, as well as a possibility for atlanto-axial instability (Winders, 1997). Atlanto-axial instability is misalignment of the first two cervical vertebrae; however, it is only present in about 17% of people with DS (Winders, 1997). Children with DS also show characteristics of stubbornness, rapid mood changes, and a need for routines (Dunn & Leitschuh, 2014). Persons with Down syndrome have physical, social, and mental characteristics that are distinguishable from typically developing peers.

Prevalence of Down Syndrome

Down syndrome is the most common chromosomal disorder in the U.S. with approximately 5,400 babies born each year with DS (Mikyong, Besser, Kucik, Chengxing, Siffel, & Correa, 2009). Within the Individuals with Disabilities Education Act (IDEA) special education law, DS would be considered part of the mental retardation category, now referred to as the intellectual disability category (Individuals with Disabilities Education Act, 2004). The prevalence of DS has been steadily increasing in the U.S. since 1957. Prevalence of DS dropped for a period of time from 1920-1940 due to the introduction of family planning and birth control in the U.S. As a result, the number of children overall decreased causing the number of children with DS to naturally decrease.

After 1940 the number of children, overall and the number of children with DS, began to increase again due to the increasing family size after World War II. Modern medicine in the 1950's increased the survival for persons with DS, drastically increasing their life expectancy and increasing the prevalence in the population (Graaf, Buckley, Dever, & Skotko, 2017). From 1979 through 2003 the prevalence of DS increased from 9.0 to 11.8 per every 10,000 live births, which is an increase of 31.1%, and has remained steady at 11.8 per every 10,000 live births from 2003 to the current date of 2017 (Mikyong et al., 2009).

Since the 1980s, women have begun waiting until into their later years to have children. The trend of later maternal age has also contributed to the higher number of babies born with DS as high maternal age and DS are linked, with older mothers having a five times higher prevalence, 38.6 per 10,000, compared to younger mothers, 7.8 per

10,000. Congenital heart disease is common in children born with DS and is evident in 40-60% of DS cases (Diogenes, Mourato, de Lima Filho, & Mattos, 2017). It is now mandated by federal law that children with DS must have any congenital heart defects repaired which also leads to higher life expectancy and a greater prevalence (Graaf et al., 2017).

The average overall prevalence of DS in the U.S. is 11.8 per 10,000 live births, however, prevalence differs in various regions. Prevalence was low in states such as Kentucky and Arkansas with the ratio being 8.0 per 10,000 in Kentucky and 9.7 per 10,000 in Arkansas. On the other hand, Utah and Florida had a DS prevalence as high as 13.7 per every 10,000 live births and Michigan with 13.0 per 10,000 live births (Graaf et al., 2017; Mikyong et al., 2009). Arizona is another state with a higher average prevalence, with 12.5 per 10,000 live births being diagnosed with DS. Due to interstate migration, Florida and Arizona have a 13% higher estimated population of DS. Persons with DS rarely migrated states after the age of 25 allowing the prevalence of persons with DS to remain steady. Arizona and Florida are the only states that show an increase due to migration as well as a higher prevalence of persons with DS who are of a Hispanic and Asian/Pacific Islander origin (Graaf et al., 2017).

Prevalence for persons with DS has also been broken down into categories of race and gender. Males were more commonly born with DS with a prevalence of 10.8 per 10,000, where females had a prevalence of 9.7 per 10,000. Four different races were tracked in the Mikyong et al. study: Non-Hispanic white, Non-Hispanic black, Hispanic, and Other. The lowest prevalence was Non-Hispanic blacks with a prevalence of only 7.3 per 10,000. Those who classified as their race being “Other” were also relatively low,

staying below the national average at 8.9 per 10,000. Non-Hispanic whites had the next highest prevalence with just below the national average at 10.2 per 10,000 and Hispanics had the highest prevalence of DS at 12.3 per 10,000 (Mikyong et al., 2009). In order to continue increasing the life expectance of persons with DS we must attempt to eliminate life expectancy reducing factors such as obesity caused by physical activity and sedentary lifestyles.

Sedentary Levels in Children and Youth with Down Syndrome

All young people should be engaging in 60 minutes or more of moderate to vigorous physical activity (MVPA) each day (World Health Organization, 2010). The majority of individuals with DS do not meet the recommended amount of MVPA per day, with only 42% of youth with DS meeting their 60 minutes a day (Shields, Dodd, & Abblitt, 2009). Youth with DS spend close to 9 hours each day participating in sedentary activities instead of engaging in MVPA. Not only do youth with DS spend more time in sedentary activities, but they also spend more sedentary time than same aged peers with an intellectual disability that are not classified as DS (Izquierdo-Gomez, Viega, Villagra, & Diaz-Cruz, 2015). Persons with DS who do participate in daily physical activity spend the majority of their activity time in low intensity physical activity and when they do spend time in MVPA it is usually in many short bouts lasting 2 to 4 minutes (Jobling & Cuskelly, 2006; Whitt-Glover, O'Neill, & Stettler, 2006; Slevin, Truesdale-Kennedy, McConkey, Livingstone, & Flemming, 2014; Kozub, Oh, & Rider, 2005). Due to low levels of MVPA in youth with DS, there is also a higher prevalence of obesity. Of all youth with DS, 25% of 3 to 10 year olds and 45.5% of 8 to 16 year olds are considered obese (Esposito, MacDonald, Hornyak, & Ulrich, 2012). Obesity is a rising epidemic in

many American youth overall and is even more of a health concern due to higher sedentary time and less time spent in MVPA for youth with DS.

Benefits of Physical Activity and Aquatics

Students with DS who are consistently physically active can attain many benefits in all three domains: psychomotor, cognitive, and affective. Beyond decreasing sedentary time, increasing MVPA, and decreasing obesity and the health risks that accompany it, persons with DS have also seen an improvement in musculoskeletal functioning (Davis, Zhang, & Hodson, 2011). Musculoskeletal function consists of muscular strength, muscular endurance, and flexibility. All components of musculoskeletal functioning are needed to maintain proper posture, functional movement, independence, and participation in active leisure pursuits. Increased physical activity results in improved musculoskeletal functioning and a greater ability to participate in active leisure pursuits that can improve overall health (Davis et al., 2011).

Along with the health benefits, physical activity can produce many cognitive and affective benefits. A key factor of physical activity for students with DS is MVPA as this can increase cognitive functioning and improve mood (Royal College of Psychiatrists, 2009). Exercise effects the dopamine and serotonin levels in the brain and increases the ability to concentrate, focus, and improve sleep. Physical activity can also stimulate neurotrophic factors that can help produce and grow new brain cells (Royal College of Psychiatrists, 2009). Improvements in reaction time, working memory, focus, and behaviors have also been seen as a result of MVPA (Alesi & Pepi, 2015).

Students who have higher levels of activity also perform better on tasks that require cognitive control: planning, organizing, abstract problem solving, working

memory, motor control, inhibitory control, and self-regulatory processes (Castelli, Hillman, Buck, & Erwin, 2007). Moderate to vigorous physical activity is also key to the affective domain for individuals with DS. On average, there are only 3.1 people within the social network of someone who has DS outside of their family one of which being a paid service provider. Only 42% of people with DS report having a friend (Amado, Stancliffe, McCarron, & McCallion, 2013). Physical activity can build a social network for individuals with disabilities (IWDs) through providing cultural awareness, community relationships, and psychological well-being. Self-confidence and self-esteem are important factors for IWDs and is increased through psychological well-being and a sense of self-worth through accomplishing tasks independently. One of the main causes of lack of physical activity for persons with DS is social isolation (Taheri, Perry, & Minnes, 2016). Being involved in a physical activity setting can increase social skills, relationships, and self-confidence.

Of all activities that individuals with DS participate in regularly, swimming is the most common with 69% of youth participating (Alesi, et al., 2015). Aquatics offers a unique sensory environment that cannot be achieved on land. Not only does the water elicit a motivating sensory response, but it also allows individuals with DS to move freely and independently (Newell & Valvano, 1998; Abouzeid, 2012). Because the water allows a person to move with gravity instead of against it, a person can move about without putting pressure on their joints to gain cardiovascular endurance as well as practice skills, such as jumping, that are more difficult on land (CDC, 2017). This is helpful for students with DS who have difficulty with some musculoskeletal activities. Aquatic programs are also seen to improve balance, posture, cardiovascular endurance, and respiratory

weakness. Because individuals with DS generally have heart disease and low levels of MVPA, it is important that they continue to increase cardiovascular endurance and respiratory function (Albert, 2010). The aquatics environment is ideal for persons with DS and shows a high prevalence in the population of children and youth with DS.

Prevalence of Aquatics

Aquatics are a commonly used health enhancing physical activity for leisure in the U.S. In 2009, there were an estimated 301 million swimming visits to aquatics facilities each year by persons 6 years or older. Swimming is the fourth most popular recreational activity in the U.S. for adults and the most popular recreational activity for children and teens (CDC, 2017). Beyond swimming in pools, aquatics can be experienced in lakes, rivers, oceans, and other bodies of water. Aquatics are also a popular activity in recreational settings such as summer camps, schools, and fitness centers. “With the abundance of swimming areas and opportunities in our society, families and individuals participate in aquatics activities for therapeutic reasons, fitness, and social benefits” (Krause, 2001). Swimming is integral for individuals because it not only benefits their physical health, but it also has a positive impact on their mental and affective health.

Need for the Project

Despite the daily recommended amount of 60 minutes of MVPA a day, IWD have lower levels of physical activity than the general population and do not often meet the daily recommended amount of MVPA. When compared with same aged peers, students with DS are far more sedentary, even when compared to same aged peers with an intellectual disability (Izquirerdo-Gomez, Veiga, Villagra, & Diaz-Cueto, 2015).

Aquatics offers an environment that provides opportunities to gain independence through movement with the assistance of the buoyance of the water. Minimal research has been done in the past in regards to DS and aquatics. Few resources have been produced to teach educational professionals how to create an adapted aquatics program and what curriculum content should be included for students with DS. The American Red Cross (2014) and the National YMCA (2016) have produced instructional guides to teach aquatic professionals how to teach aquatic skills to the general populations. Monica Lepore (2006) has produced a DVD and authored publications about adapted aquatics programs for all students with disabilities, including short segments specific to DS. However, there are no instructional videos that focus on specific skills and adaptations needed for students with DS. Aquatics is a common recreational and fitness activity for persons with DS and the video produced in this project provides teachers, administrators, and other educational professionals with the specific adaptations and accommodations needed for students with DS.

Purpose of the Project

The purpose of this project was to develop a video to provide instructional strategies to teachers and other educational professionals who work with a preschool or elementary aged child with DS in an aquatic environment. It also provides recommendations for developing and implementing an adapted aquatics program in a school or district. With minimal instructional materials available specific to preschool and elementary aged students with DS, additional resources are necessary for individuals teaching in an aquatic setting and are unsure what adaptations need to be made.

This project was intended primarily for teachers, however, many audiences can benefit from the information. Other professionals that can benefit include paraprofessionals, parents working with their young students on swimming in a recreational setting, adapted physical education teachers starting an adapted aquatics program, undergraduate and graduate students, and school administrators who are beginning the process of implementing an adapted aquatics program. This project includes an instructional video on teaching progressions, activities, and adaptations for young students with DS, sample assessment documents, and information on creating and implementing an adapted aquatics program.

Definition of Terms

The following terms were used throughout the project. Definitions are provided to help clarify what is discussed in the project.

Down Syndrome (DS): A genetic disorder where an individual has a full or partial extra copy of chromosome 21, leading to a variety of physical and cognitive characteristics (National Down Syndrome Society, 2017).

Adapted Aquatics: A program serving individuals with disabilities using swimming, aquatic recreational activities, and water safety to promote health and rehabilitation. Adapted aquatics encompasses aspects such as learning strokes and how to be safe in the water, but exclude hydrotherapy, aquatic therapy, and therapeutic water exercise (Lepore, Gayle, & Stevens, 2007).

Summary

When compared to their same aged typically developing peers, students with DS are less likely to be physically active, increasing their chance of becoming overweight or

obese (Izquirerdo-Gomez et al., 2015). Physical activity settings provide an environment for persons with DS to develop physical as well as cognitive and social skills. Aquatics is a very common physical activity for youth with DS and has many benefits, including sensory motivators and buoyancy (Newell & Valvano, 1998). However, there are few resources available to teach students with DS aquatic skills. Some resources exist, however, they are focused on the general population or discuss DS for a short period of time. This project provides a comprehensive resource about instructional strategies for teaching young children with DS in an aquatic environment and how to develop and implement an adapted aquatics program. The video is intended to improve the quality of aquatic instruction for students with disabilities, focusing on those with DS.

CHAPTER II

Review of Related Literature

Introduction

Much research on Down syndrome (DS) has examined the implications and benefits of physical activity and some has focused on aquatics specifically. This chapter discusses a brief history of previous research in aquatics and DS, along with an explanation of the prevalence of aquatics in the U.S. and a discussion of the prevalence of DS. The benefits of moderate to vigorous physical activity (MVPA) for individuals with DS will also be discussed including the psychomotor, cognitive, and affective benefits. There are many barriers that prevent persons with DS from receiving their recommended amount of MVPA each day. Barriers will be discussed in depth, followed by the benefits of aquatics as a source of MVPA for individuals with DS. Safety considerations will also be discussed in regards to atlantoaxial instability and its relation to students with DS participating in aquatics. Lastly, practical implications regarding instructional strategies for students with DS in aquatics will be discussed.

Research on Aquatics for Children and Youth with Down Syndrome

There is currently research in the field of adapted aquatics. A variety of disabilities are focused on in the research, however, most of the research focuses on persons with autism spectrum disorders. Some research exists on persons with intellectual disability and aquatics, however, only a small number of research studies are specific to DS even though it includes intellectual disability. Of the available research focusing on DS and aquatics, the majority focuses on the health benefits of aquatics, with little research on teaching strategies for students with DS. To date, there is no extensive

research on how to teach individuals with DS aquatic skills. Teaching individuals with DS aquatic skills is mentioned briefly in other practical implication studies, however, there are few specific to DS.

Benefits of Physical Activity for Children and Youth with Down Syndrome

Psychomotor Benefits

Individuals with DS tend to spend more time participating in sedentary activities than typically developing children at the same age. Sedentary behavior is defined as "any waking behavior with an energy expenditure of less than one and a half metabolic energy of task (METs) in a seated or reclined position" (Izquierdo-Gomez, Viega, Villagra, & Diaz-Cruz, 2015). Youth with DS not only spend more time doing sedentary activities than their same aged peers without disabilities, but they also have more sedentary time compared to others with intellectual disabilities. In order to study the physical activity levels of youth with DS Izquierdo-Gomez et al., (2015) placed accelerometers on youth with DS for seven consecutive days to measure the amount of time they spent doing sedentary activities as well as measured total television viewing time per day. The study found that males with DS spent 578 ± 68 minutes per day doing sedentary activities with 93 ± 64 of those minutes watching television. Females were only slightly lower with 576 ± 66 and 88 ± 60 minutes being spent doing sedentary activities and watching TV, respectively.

Another category the study measured was the amount of sedentary time of youth with DS who were of a normal weight versus overweight or obese. Youth that were overweight or obese spend 583 ± 67 minutes in sedentary activities. Those within a normal weight had a lower average of sedentary time; however, it was still high at

571 ± 70 minutes. Being the first or second child also had an impact on the total number of minutes in sedentary time. Participants who were the first or second child had a sedentary time of 594 ± 67 minutes in sedentary time per day compared to the 566 ± 68 minutes of children who were a birth order besides the first or second child. Overall, youth with DS spend close to 9 hours a day doing sedentary activities instead of engaging in MVPA (Izquierdo-Gomez et al., 2015).

Because youth with DS spend the majority of their day doing sedentary activities, they have lower physical activity time and increased body mass. Lower activity time leads to a higher body mass index (BMI) seen in the DS population when compared to typically developing peers (Whitt-Glover, O'Neill, & Stettler, 2006). Body mass index is calculated by taking the person's weight, in kilograms, and dividing it by the height squared, in centimeters (Winnick & Short, 1999). When calculating BMI, any scores between the 85^{th} and 95^{th} percentile classify as overweight, and any score above the 95^{th} percentile indicates obesity. Scores in the obese range put children at a greater risk for type two diabetes, cardiovascular disease, high blood pressure, joint problems, and mortality (Winnick & Short, 2014; Rimmer, Rowland, & Yamaki, 2007). High rates of youth who are overweight and obese in America is a growing epidemic, however, the rate of youth with DS who are overweight and obese is significantly higher than the general population. Of all 3 to 10 year olds with DS, 25% are considered obese (Hill, Parks, Zemel, Shults, Stallings, & Stettler, 2013). As students with DS age, the prevalence of obesity increases to 45.5% of 8 to 16 year olds with DS being obese (Esposito, MacDonald, Hornyak, & Ulrich, 2012). It is important to note that because of the short stature that is a characteristic of DS, BMI may not be completely accurate (Pitetti,

Baynard, & Agiovlasitis, 2013). BMI was also found to be higher in males compared to females. Boys ages 8 to 11 had a 46.2% prevalence for being overweight or obese, where girls in the same age range had a 38.9% prevalence for being overweight or obese (Esposito et al., 2012).

Moderate to vigorous physical activity (MVPA) has countless physical benefits for all youth, especially youth with DS. However, a large amount of individuals with DS do not meet the 60 minutes of MVPA per day recommendation (Chief Medical Officer, 2011). When persons with DS are engaged in physical activity, they spend the majority of their time in low intensity physical activity (Jobling & Cuskelly, 2006; Whitt-Glover et al, 2006; Slevin, Truesdale-Kennedy, McConkey, Linvingstone & Fleming, 2014). Physical improvements from MVPA can be seen in cardiovascular and respiratory muscle function, coronary artery disease, weight control, improved balance, and improved endurance (Alesi & Pepi, 2015). It is very common for persons with DS to gain weight during adolescence and be overweight or obese throughout adulthood as a result of chronic health problems associated with the condition. These health problems include: underactive thyroid gland, low basal metabolic rate, decreased muscle strength, muscle hypotonicity, joint hypermobility, ligamentous laity, and obesity (Jobling & Cuskelly. 2006; Ara, Moreno, Leiva, Gutin, & Casajus, 2007).

Many studies that measured the levels of MVPA performed by youth with an intellectual disability (ID). All young people should be engaging in 60 minutes of moderate to vigorous physical activity each day (Centers for Disease Control, 2017). One study found that physical activity levels from children with an ID were lower on weekends, after school, and during recess then their typically developing peers (Foley,

Bryan, & McCubbin, 2008). When students with DS were participating in MVPA their mean daily time was 104.5 ± 35.4 minutes with only 42% of the students reaching the recommended 60 minutes daily (Shields, Dodd, & Abblitt, 2009). Children with ID were also engaging in many bouts of MVPA per day, however, each bout was only lasting between 2 and 4 minutes (Kozub, Oh, & Rider, 2005). Within their chosen physical activities, children with DS had limited diversity and intensity of participation. Children with DS, who scored higher in the cognitive range, engaged more in MVPA and found enjoyment, however, all students with DS were involved in more informal and recreational activities than formal activities such as team sports (Wuang & Su, 2012).

One activity that was found to increase activity levels for youth with DS was riding a bike. After pre-intervention, children who knew how to ride a bike were less sedentary and spent more time in MVPA a year later (Ulrich, Burghardt, Lloyd, Tiernan, & Hornyak, 2011). Activity levels were measured using an accelerometer that was found to have higher validity when placed on the hip rather than the wrist of the participant (Hinkson & Curtis, 2013). The System for Observing Fitness Instruction Time (SOFIT) was used to distinguish correlations between the tool and heart rate during physical education and recess. During physical education, the correlation was high, $r = 0.81$, and moderate at recess, $r = 0.69$, however, MVPA was still lower than their typically developing peers (Faison-Hodge & Porretta, 2004).

In another study, a 10-week fitness program was implemented with a total of 15 hours of instruction with the goal being to improve musculoskeletal function. Musculoskeletal function consists of three categories: muscular strength, muscular endurance, and flexibility. A characteristic of DS is hypotonia, meaning children with DS

have low muscle tone and limited strength. It is important to improve their musculoskeletal functioning because, “all three components of musculoskeletal functioning are necessary to maintain proper posture, independence, and participation in active leisure pursuits” (Davis et al., 2011). After the 10 week program, muscular strength and endurance improved in the participants. The number of modified curl ups, measuring muscular strength, increased from 7.66 ± 6.44 to 13.26 ± 10.91, with 27 of the 34 participants improving their scores. Isometric push-ups, measuring muscular strength by amount of time held, also increased significantly, from 17.68 ± 14.33 to 25.43 ± 23.74 with 26 out of the 34 participants showing improvement (Collins & Staples, 2017). Increased physical activity results in improved musculoskeletal functioning and a greater ability to participate in active leisure pursuits that can improve overall health.

Cognitive Benefits

Physical activity has some overall benefits, many of which are cognitive. The mind functions better when the body is healthy and active. Physical activity can reduce anxiety and depression in the general public. For individuals with DS, physical activity can help in the same way, however, a key factor is that physical activity can increase cognitive functioning and improve mood. The ability to concentrate and focus as well as the ability to sleep better are directly related to physical activity. Exercise has a direct effect on the dopamine and serotonin levels in the brain, positively affecting mood and thinking. Moderate physical activity can also stimulate neurotrophic factors that help new brain cells grow and develop (Royal College of Psychiatrists, 2009).

Students with DS who are more physically active also have general improvements in reaction time and working memory. Parents of students with DS reported that they

preferred their child be involved in team sports because their child showed a decrease in stubbornness and an increase in their ability to focus attention. Both stubbornness and lack of focus are common characteristics of students with DS, while participating (Alesi et al., 2015).

Improving physical activity for students with DS can have a direct and positive effect in their academic work. A cross-sectional association between differing levels of cardiovascular fitness and levels of cognitive function have been seen in students (Hillman, Pontifex, Rane, Castelli, Hall, & Kramer, 2009; Hillman, Buck, Themanson, Pontifex, & Castelli, 2009; Hillman, Castelli, & Buck, 2005). Children who have higher levels of fitness also perform better on tasks that require high cognitive control and attention. These tasks include: planning, organizing, abstract problem-solving, working memory, motor control, inhibitory control, and other self-regulatory processes (Castelli, Hillman, Buck, & Erwin, 2007). There was no impact on scores of standardized test scores, however, students did see increases in overall grades when they had high levels of physical activity. The amount of physical activity achieved in physical education was not high enough to effect cognition due to limited class times and minimal time spent in moderate to vigorous physical activity, however, students who recorded high levels of physical activity outside of school had increased cognition. It is also important to note that levels of cognition did not change in a year but showed an increase over a long period of time with constant physical activity. Students who performed 40 minutes of aerobic exercise 5 times per week over a duration of over a year scored significantly higher on the Planning Scale of the Cognitive Assessment System (Donnelly & Lambourne, 2011). The correlation between BMI and academic achievement provides the

opportunity to use physical activity to improve not only a students' overall heath, but their cognition as well.

Affective Benefits

Beyond the psychomotor and cognitive benefits, there are many benefits to physical activity within the affective domain. Researchers found that the average social network of individuals with a developmental disability (DD), a category which those with DS fall under, is limited. On average there are only 3.1 people within the social network of someone with DD. Of the 3.1 people that are in the social network, at least one of them is a paid service provider (Amado, Stancliffe, McCarron, & McCallion, 2013). Out of 400 individuals with DD, only 42% had a friend outside of their family. After interviewing 52 adolescents with DD about friendships, researchers found that 81% of participants wanted to have more friends and 65% wanted to have the opportunity to develop a best friend relationship. In general, participants felt as though they were socially isolated and needed to meet more people. When asked about school friends the majority of typically developing students had six or more school friends and several friends outside of school. Students with an ID had no friends outside of school and 20% of the group did not have any friends at school either (Taheri, Perry, & Minnes, 2016). Physical activity provides opportunities for social interactions and networks for persons with a DD to create friendships and develop social skills. By building these networks and skills, kids with DS have the ability to boost self-esteem.

Many restrictions are found for individuals with disabilities (IWD), especially those with DDs, such as DS, within the school setting in regards to physical activity. Participation in physical activities, that also offer a social aspect, help promote emotional

and social well-being for children with and without disabilities. For children with disabilities, having skills and knowledge of how to be physically active can translate to the community and provide cultural awareness, community relationships, and psychological well-being. Psychological well-being includes increased levels of confidence and self-esteem, which are important factors for people with disabilities to continue with physical activity as well as build self-worth levels that help their daily living overall and improve independence. Poor health and social isolation are links that have been evident between lack of physical activity participation and IWDs (Taheri et al., 2016). In order to ensure the physical health of IWDs as well as promote social skills and social growth, recreational activities for these populations need to be abundant and integrated with typically developing individuals.

It is important for the individual with DS to have a team for emotional supports. "Emotional support is an important factor in this category because it stimulates the sense of competence and mastery motivation to cope with challenging physical tasks" (Badia, Orgaz, Verdugo, Ullan, & Martinez, 2011). When parents were asked what activities they preferred their child with DS be involved in, parents preferred team sports. They chose team sports because it gave their child the opportunity to socialize and create meaningful relationships with peers. One parent stated, "My child has developed a more positive self-image through skill acquisition and rewarding experiences more appropriate for her" regarding physical activity. Another parent explained, "sport allows social interactions that help my child to make friends and to be like his peers". Participating in regular physical activity decreases low self-efficacy toward physical skill tasks and the fear of

humiliation, it also supports the self-determination and autonomy needed to be independent and have a career (Alesi & Pepi., 2015).

Barriers for Achieving Physical Activity for Individuals with Down Syndrome

Three main barriers were identified by Alesi and Pepi (2015) in regards to students with DS not achieving the recommended 60 minutes of MVPA per day: lack of adapted physical activity instructors, DS characteristics, and parental worries. Many parents voiced frustration that there are not enough adapted physical activity programs or enough inclusion programs that would accommodate their student with DS (Alesi & Pepi, 2015). A second barrier to MVPA is DS characteristics such as gross motor deficiencies, hypotonicity, weight, heart disease, coordination difficulties, cognitive impairments, and communication difficulties. One mother stated, "gross motor dysfunctions restrained my child from doing some exercises and being regularly included in sport teams" (Alesi & Pepi, 2015). Limited cognitive abilities and communication are barriers that can lead students with DS to be less successful in team sports. Students with DS are generally more successful in activities that are individually focused and require minimal communication, such as bowling or swimming. The third barrier, parental worry, is caused by the other two barriers. Parents want their child to be included, make friends, improve self-esteem, and gain social skills through physical activity, however, sometimes their overarching worry can prevent physical activity (Alesi & Pepi, 2015).

Three main facilitators have also been identified to help offset the barriers or to increase physical activity, the first facilitator being family. Children with DS are more likely to participate in physical activity if their parents or siblings participate with them. Having a positive role model within the family that participates in MVPA regularly

increases motivation. Another facilitator is instructors who are experts in adapted physical activity. In order to have more success doing MVPA and to pursue physical activity for a lifetime, students need more qualified adapted physical education specialists. The last facilitator of MVPA for students with DS is the characteristics of MVPA. Using activities that are within the optimal zone of development for the student so they are challenging but attainable as well as enjoyable will help persons with DS to continue with a desired physical activity over a long period of time and in turn increase overall health (Alesi & Pepi, 2015).

Benefits of Aquatics for Persons with Down Syndrome

According to Alesi and Pepi (2015), of individuals with DS who participate in habitual physical activity, swimming is the most practiced with 69% of youth with DS participating. Aquatics were practiced consistently by individuals with DS aged 7 to 14 and practiced previously by individuals who are now aged 16 through 27 (Alesi & Pepi, 2015). Beyond the benefits aquatics offers as a result of being MVPA, it also offers some unique advantages. Water produces a different sensory environment than land. Down syndrome is a developmental disorder, and a common characteristic of all developmental disorders is heightened sensory needs. Individuals with DS seek activities that appeal to the senses as they receive increased feedback from their environment. Movement in the water can elicit a sensory response that can increase motivation (Newell & Valvano, 1998). The buoyancy of the water allows individuals to move freely in the water and move about independently (Abouzeid, 2012). Swimming has an effect on all three domains of learning and can improve agility, cardiorespiratory fitness, behaviors, self-esteem, and positive self-image (Alesi & Pepi, 2015). Aquatics allows persons to exercise

using gravity to their advantage rather than fighting against it as well as take the pressure off their joints in order to build cardiorespiratory strength (CDC, 2017). According to the national death registry, pneumonia and other respiratory infections are the leading cause of death for youth with DS at 33.1% of deaths and congenital heart defects are the second leading cause for death at 12.8% (Bittles, Bower, Hussain, & Glasson, 2006). Aquatics have the ability to increase strength and function in the respiratory and cardiovascular systems through endurance increases and diminish the probability of respiratory infection (Hakim, Ross, Runco, & Kane, 2017).

Persons with IDs were found to have greater difficulties with balance and gait capacity than age matched peers (Enkelaar, Smulders, van Schrojenstein Lantman-de Valk, Geurts, & Weerdensteyn, 2012). Aquatic programs are seen to help improve poor balance, posture, and cardiovascular endurance (Albert, 2010). In Hakim et al., (2017) study participants with an ID underwent an 8 week aquatic exercise program twice weekly for an hour each session. Before the aquatic exercise program began, all participants were given pretests in many areas of fitness. Pretests included resting heart rate and blood pressure, a 6 minute walk test to measure cardiovascular endurance, a 10 minute timed walk to measure gait velocity, a timed up and go test to measure balance and mobility, a 30 second chair stand to measure lower extremity strength, a static plank test for abdominal strength, and a dominant handgrip test. Throughout the exercise program, there were no adverse outcomes or events suggesting that the aquatic program was safe for participants. In all the measured areas, improvements were seen. However, in the scores for the 6 minute walk test, 30 second chair stand, and static plank test there was statistically significant improvement. The average distance for the 6 minute walk

increased by 26.54 meters during the exercise program. Participants were also increased their chair stands by a repetition of 1.30 from pre to posttest and increase their static plank test by 5.98 seconds. These results show an increase of endurance, balance/mobility, and core body strength in individuals with an ID as a result of an aquatic exercise program (Hakim et al., 2017).

Benefits of Aquatics for all Persons with Disabilities

Aquatics has benefits for many persons with disabilities, not just those with DS. Adapted aquatics can build venous return in all persons and is beneficial for people with reduced mobility in the lower body (Gomez, Miguel, & Fernandez-Rio, 2000). Pehoiu, Moaca, and Stanescu (2015) performed a study on 12 students with a disability between the ages of 7 and 19 years to determine if aquatics could help cardiovascular functioning. Students in the study had a range of disabilities including: DS, autism, ADHD, tetraparesis, paraperesis, spastic hemiplegia, double thoraco-lumbar scoliosis, and stern block. The study was divided into 3 macrocycles. The first used water adjustment and basic aquatic skills such as floating and breathing. The next cycle worked on mixed aerobic resistance using a large number of exercises and repetitions. The last macrocycle increased intensity, shortened breaks, and increased execution speeds. Findings included an increase of vital capacity of 20-30% on average over the time span of 6 months, as well as improved cardiovascular parameters such as decreased heart rate at rest (Pehoiu et al., 2015).

Cerebral palsy (CP) is another disability that can benefit from aquatics. Kelly and Darrah (2005) researched the benefits of aquatic exercise programs for persons with CP as well as exercises and skills. They found that the buoyancy of water decreases the

influence of gravity and provides postural support. The study also revealed improvements in motor functioning in the pool due to the reduced levels of joint loading and impact. Aquatics provides an environment that can help support unstable joints commonly associated with CP. Kelly and Darrah (2005) noted that the proper intensity, duration, and frequency needed to be implemented to derive benefits in fitness. There also needs to be some discretion as to whether a group or individual environment is the most beneficial and if a pool is suitable and safe for that specific student. Some skills that can be increased through aquatics for students with CP include: lap swimming, jumping skills, propulsive running, and kicking (Kelly & Darrah, 2005). Due to the properties of the water, aquatics can greatly benefit students with CP.

Autism spectrum disorder (ASD) is another disability that can be positively affected by aquatics. Drowning is the number one cause of accidental deaths in children with ASD (Alaniz, Rosenberg, Beard, & Rosario, 2017). Because of the risk of accidental drowning, Alaiz et al looked at the practicality of teaching water safety skills to students with mild to severe ASD. The study was conducted with 7 participants aged 3-7 years old. They found that students were able to improve water safety skills through group aquatic interventions. Skills that were improved upon were breath control, propulsion, and changing positions while swimming. All movement skills taught were established to prevent drowning. All 7 students showed improvement in all of the skills implemented into the program (Alaiz et al, 2017).

Beyond physical aquatic skills, there is some research on increasing social skills in students with ASD through an aquatic setting. Pan, 2010 performed a to examine the effectiveness of a water exercise swimming program on aquatic and social skills of

students with ASD. Students were broken into 2 groups. Group A received the water exercise program first then 10 weeks of a general aquatics class following, both with social skills intertwined. Group B received general aquatics class first for 10 weeks, and then received the water exercise program. Assessments were taken 3 times, a baseline at the beginning, after the first 10 weeks, and at the end of the program. There was no difference between groups at the beginning of the study. After the first 10 weeks Group A, which received the water exercise program, had significantly higher aquatic skills than Group B, which received a standard aquatics class. Group B then showed significant improvement between the midline assessment and the final assessment after receiving their water exercise swimming program. As far as social behavior, there was once again no difference between groups at the beginning of the study. At the end of the study both groups had significantly lower scores on hostile/irritable behaviors, defiant/disruptive behaviors, and anti-social behaviors (Pan, 2010). This study shows that when deliberately taught through a water exercise swimming program students with ASD can gain valuable aquatics and social skills.

Teaching Literature

Much research has been done in the benefits of MVPA and DS and some research exists on the specific benefits of aquatics and DS. However, there is little information on practical teaching strategies for students with DS. An important individual in regards to teaching strategies in aquatics for students with disabilities is Monica Lepore. Her DVD, Introduction to Adapted Aquatics, provides a wide variety of instructional strategies and adapted equipment to be successful in adapted aquatics for students with a variety of disabilities. One section talks specifically about students with DS and needs they have,

including some important areas in adapted aquatics. Many disabilities are discussed throughout the DVD and although DS is not the only topic, teaching strategies still apply.

The National YMCA (2014) and the American Red Cross (2016) have published lengthy documents with in depth teaching strategies in aquatics. The teaching materials cover aquatic skills from ages 6 months to adult hood and include everything from water adjustment to swimming for fitness. The National YMCA (2014) includes lesson plans with safety topics for each level of their program. However, there are no instructional strategies for students with disabilities, and the entire manual is developed for typically developing students. Much like the YMCA, the American Red Cross Water Safety Instructor Manual (2016) includes teaching tools for each level including safety topics, but does not have instructional strategies for students with disabilities. However, it does include a section on characteristics of disabilities and benefits of aquatics for persons with disabilities. There is also a table that briefly describes safety implications of each disability giving an overview to an instructor.

Some instructional information exists for aquatics for children with other developmental disabilities, such as autism spectrum disorders. Lee and Porretta (2013) provide specific exercises and activities to do in an aquatics environment that use the turbulence, resistance, and buoyancy of the water to assist the student in fundamental locomotor movements and object control skills. There are two separate tables provided that work on a skill including descriptions and variations of the task. Locomotor skills discussed include walking, lunges, knee high walking, hopping, leaping, and frog jumps. For example, frog jumps are described by “jump with knees going out to the sides, place hands between knees like a frog” with variations of jumping over an object, jump for

height, and jump for distance (Lee & Porretta, 2013). Beyond locomotor skills there is also a table for activities to develop object control skills. Skills included are throwing, catching, striking, and kicking. Much like for locomotor skills, instructional strategies are provided with a description and variations of the task. These practical implications were developed for students with autism spectrum disorders, however, the strategies and activities can be transferred to students with DS.

Chapter III

Critical Analysis

Introduction

Aquatics is extremely beneficial for preschool and elementary aged students with Down syndrome (DS), not only for learning to swim, but also for recreation, life time fitness, and other benefits that translate to land. This chapter summarizes a variety of teaching strategies, a description of the project video, resources, and recommendations for future research and projects. Teaching strategies include: appropriate duration of aquatics lessons, pool temperature, visual supports and demonstrations, equipment use, and safety specific to children with DS in aquatics. Resources provided include books, journal articles, websites, and technology, such as iPad applications that can be used to assist instructors when teaching adapted aquatics. Resources include specific information on DS, teaching resources for aquatics for students with DS, as well as teaching strategies for other disabilities. Adapted physical education teachers, general physical education teachers, paraprofessionals, recreational swimming instructors, and families can use these resources, as well as the video, to provide quality and specific aquatics instruction to a child who has DS. Lastly, there are recommendations for future research related to this topic as well as recommendations for future critical analysis projects.

Teaching Strategies

Duration of the Lessons

There has been much research about the ideal duration of a swim lesson for the student to gain the most benefit. The American Red Cross Scientific Advisory Committee (2012) recommends that swimming lessons for children and youth should be between 30

and 45 minutes. Swim America © (2007), a learn to swim organization at the national level, stated that swimming lessons should be limited to 20-40 minutes. Their reasoning for this time frame is to avoid participants becoming overwhelmed, losing focus, or getting cold (Swim America, 2007). A third national swimming association, Swimming Teachers Association (2008), suggests that a traditional swimming lesson should not last more than 45 minutes. Once again, this time suggestion is due to the students losing focus or getting cold.

However, there is also research that supports learn to swim lessons with a longer duration for students with disabilities. Some research suggests having swim lessons for 60 or more minutes for persons with disabilities to allow them time to adjust mentally and emotionally to the environment and gain comfortability with the lesson. A longer lesson would also allow the students time to prepare to transition at the end of the lesson and allow more time for learning (Hall, 2013). Lepore and colleagues (2007) discussed the duration of lessons depending on the temperature of the water as well as the degree and type of exercise. If the exercises are vigorous and include tasks such as swimming laps or treading water, more energy is expended, and the pool can be slightly colder because the body will produce more heat.

When working on stationary skills such as floating, the body will cool down faster and the pool needs to be warmer or the lessons need to be kept shorter. When working with young students, it is suggested to keep lessons short and the pool at or around 82 degrees Fahrenheit (Lepore et al, 2007). When working with students with special needs, it is important to vary the activities and increase the length of the lesson to allow the

student time to become comfortable and become adjusted to the water (Lepore et al, 2007).

Hall (2013) conducted a study in which he provided swimming lessons to students with disabilities, most of which had autism spectrum disorder, for 60-minute periods of time. Hall's study found a great deal of success with increasing instruction time from the recommended 45 minutes to 60 minutes. One parent in the study stated, "sometimes with my boys it takes 15 minutes just to be comfortable in the surroundings". Another parent observed, "I noticed all the kids seemed to relax and get more comfortable about 20 minutes into the lesson . . . they take longer to warm up than other kids might. So when the sessions only last 30 minutes or so, they seem to end just when a child is getting comfortable. I think the extra-long time is very beneficial" (Hall, 2013). Because of his findings, Hall (2013) recommends longer lessons for students with disabilities to allow them that time to mentally and emotionally adjust before they are comfortable and available to learn. The extended time also allows for additional time and a smoother transition between activities and out of the pool at the end of a lesson (Hall, 2013). Previous research states keeping swimming lessons under 45 minutes due to the chilling effects of the water, however, current research recommends having swimming lessons last 60 minutes for students with disabilities to allow them time to mentally and emotionally adapt to their surroundings and be available to learn.

Pool Temperature

Previous research which recommends keeping swimming lessons under 45 minutes is mostly grounded in the chilling factor of the water (Swimming Teachers Association, 2008). In order to achieve 60 minute long lessons that are recommended by

Hall (2013) for students with disabilities, pool temperature must be monitored closely. Pools used primarily for competitive swimming are kept between 75-78 degrees Fahrenheit. On the other hand, a pool that is used for therapeutic purposes is usually kept at or around 82 degrees Fahrenheit (Lepore et al., 2007). Lepore et al., (2007) also reported that the recommended temperature of a pool for persons with disabilities ranges from 83 to 96 degrees. Water conducts heat away from the body 20 to 25 times faster than air (Professional Association of Diving Instructors, 2003). When students are chilled, swimming lessons can lead to discomfort and limit the time spent learning as well as the enjoyment of the lesson (American Red Cross Scientific Advisory Council, 2012). One recommendation Hall (2013) has for combating low pool temperature that cannot be raised to ideal temperature is wetsuits. Wetsuits will slow the cooling rate of water, provide insulation, and slow down heat loss (Williams & Acott, 2003). Wetsuits also provide additional buoyancy in the water allowing for additional support in swimming skills like floating. The use of wetsuits will allow students with disabilities to stay warmer in the pool, especially pools kept at a temperature for competitive swimming, and allow them to stay in the pool longer to reach their recommended 60 minutes of instruction (Hall, 2013).

Visual Supports and Demonstrations

Persons with DS are generally visual learners, and need ample visual support in order to understand and perform a task (National Down Syndrome Society, 2017). Visual supports can be used in a variety of styles, it is important to find out what creates success for that student and work with that type of visual support. Some examples of visual supports include pictures of the skill or activity, videos of someone performing the skill,

visual numbers for a countdown, or a live demonstration. When working in an aquatic setting it is important to provide visual supports, not just in the pool, but also on the pool deck and in locker rooms so students see and understand the rules and how they are supposed to act. Once again this can be through pictures, video models, or demonstrations (Lepore et al, 2007).

One type of demonstration or visual support that can be helpful to students with disabilities, including young children with DS, is social stories. Social stories are stories that teach children how to negotiate specific social situations they may frequently encounter. Social stories are useful when students are in a new situation, such as being at the pool (More, 2012). For students who are new to the pool, or do not know how to act in an aquatic environment, a social story can be helpful for adjusting them to the situation and helping them know what will happen and how to appropriately act (Reynhout & Carter, 2006). Social stories can be used in a variety of ways for students with disabilities in aquatics. Some examples of this are changing in the locker room, the rules of the pool, getting in the pool, swimming, and getting out of the pool. Social stories can help students be ready for an environment they are not familiar or comfortable with and teach them in a story format that will capture their attention.

Once in the pool, demonstrations are vital to assisting the learner. It is important to remember that children with DS need visual demonstrations, but it is also important to realize that the demonstrations may have to be repeated multiple times in a row, or frequently over time. When giving a demonstration be sure that the teacher is in a position to be seen and the student can adequately see the demonstration. Use verbal cues during the demonstration so the student can start pairing cue words with the physical skill

they are performing. Demonstrate from multiple angles and at multiple speeds so students can see how the full skill looks or the part of the skill if the skill is being taught in a part method (Winnick, 2017). Overall, visual cues and demonstrations are vital for preschool and elementary aged students with DS when learning new skills. Beyond visual supports, choosing supportive and motivating equipment will help students find success.

Equipment

Lack of motivation and stubbornness are other common characteristics of children with DS (National Down Syndrome Society, 2017). One way to increase motivation of students while increasing active participation and skill development is to use equipment for motivation and support. For students who need water adjustment, many different pieces of equipment can be used. Any equipment that pours water over a child can be used. These can range from buckets, to toy watering cans, to pool toys. Motivational equipment can be as simple as using a kickboard in their favorite color or with a favorite movie character, such as Nemo or Cinderella. For some students, motivation can be as simple as a pair of goggles. Goggles can also increase comfort doing skills like the front float or front crawl. It is important to use equipment as a motivator to keep students engaged and enjoying the lesson.

Using rubber ducks or other floating toys in the pool can also provide motivation for students when they are swimming. Rubber ducks can be used as a visual support, showing students how many more trials of a skill a student needs to do or how much longer they need to float as the teacher takes ducks away. Beyond just motivation, equipment can serve as support for the student. Common support equipment includes lifejackets, noodles, aqua joggers, and kick boards. Such supports allow students to usea

buoyancy and find more success, therefore enjoying an activity more and participating for longer periods of time instead of getting frustrated with the skill.

One piece of equipment that is not a common in adapted aquatics but can provide assistance with motivation, support, and demonstrations is a floating mat. Floating mats allow children to feel secure in the water as well as allow them to practice skills with a high amount of independence (Vize, 2011). Floating mats provide support for the trunk and head, provide safety, and also provide freedom of movement to practice skills in the proper body position (NCHPAD, 2011). When students are first learning strokes or swimming skills, a floating mat allows them to be in the water in the correct body position, while working on a single part of a skill. For example, when learning breath control, students can lay flat on their stomach with just their head off the mat and practice rhythmic breathing while their body is in a prone position and they are safe and secure. Floating mats also allow students to practice full skills, such as the front crawl, where they can experience what the skill will feel like in the water without the frustration, sinking, or slow propulsion (Hall, 2013).

Another key aspect of the floating mat is to use this equipment for demonstration purposes. Many times when demonstrating in a pool, the demonstrator has to show the skill from the pool deck, or from in the water. From the deck, the demonstrator's body position and movements are not always exact to what the skill looks like in the water. When demonstrating in the water, students cannot always see the entire body or how it is moving. A floating mat allows the demonstrator to stay in the pool and demonstrate in a way that the skill is true to how it will look without the mat, as well as put the demonstrator in a position that all students can see the skill completely and the

demonstration is not partially covered by the water (Hall, 2013). Floating mats are a novelty for young children and can also provide a motivation factor. Overall, equipment use for motivation and support with skills is imperative for the success of teaching aquatics to children with DS.

Safety Considerations Regarding Atlantoaxial Instability

Atlantoaxial instability (AI) is the "ligamentous laxity of the transverse ligaments that ordinarily hold the odontoid process close to the anterior arch of the atlas" (Pueschel & Scola, 1987). Of the recorded population of youth with DS, 14.6% of individuals had AI. Only 1.5% of those with the instability exhibited symptoms where 13.1% were asymptomatic (Pueschel, 1988). Some symptoms include: discomfort in the head or neck, unusual position of the head, and gait abnormalities. Because the majority of individuals with AI are asymptomatic, x-rays are required to make a diagnosis. X-rays were taken in three different head positions: flexion, neutral, and extension because not everyone's diagnosis was able to be made based on one of these positions. The atlanto-dense intervals were significantly greater in flexion in comparison with the other two positions, however, there was instability diagnosed in all three positions for differing individuals. Only 14.6% of individuals with DS have AI, however, there are safety implications aquatics for those with AI in order to prevent injury (Pueschel et al.,1987).

Due to the laxity in the atlantoaxial joint, many sport and recreational associations have adopted strict screening guidelines for individuals with DS to ensure their safety. One association that has adopted strict guidelines is the Special Olympics (SO). Within SO, over the past 20 years, no individual with DS has suffered an injury due to AI (Special Olympics of Wisconsin, 2013). All individuals with DS are restricted from

participation in any SO event until they have been examined, including x-rays, by a physician who has been briefed in the condition. A written report of the examination with a signature by the physician stating that the individual does not have AI must be turned into the SO (Special Olympics of Wisconsin, 2013). Athletes who have AI are permitted to participate in SO but they may not participate in activities that may result in hyper-extension, extreme flexion, of pressure on the neck or spine. In aquatics this means that persons with AI are not permitted to participate in diving, the butterfly stroke, or use a diving start (Special Olympics of Illinois, 2005). It is important to know if a student has AI before being physically active and what activities can present potential a danger in order to keep the individual safe from serious injury.

Description of the Video

The video produced in this project is titled *Instructional Strategies for Teaching Aquatics Skills to Preschool and Elementary Aged Students with Down Syndrome.* This in-depth instructional video provides an overview of the characteristics of DS, why aquatics is beneficial to children with DS, specific instructional activities and progressions in aquatics that are appropriate to the age group and to DS, how to create and implement an adapted aquatics program, and how to assess in adapted aquatics. See appendix A for sample assessments. Specific instructional strategies focus on aquatic skills best fit for preschoolers and elementary aged students including: water acclimation, pool entry and exit, breathe control, floating, flutter kicking, and beginning the front crawl. For the full script, see Appendix B.

All documents and topics included in the video are intended to assist professionals in teaching aquatics to preschool and elementary aged students with DS. Persons that can

benefit from the content of this video include: adapted physical education teachers, general physical education teachers, paraprofessionals, parents/families, and recreational teachers such as YMCA swimming lesson instructors. Administrators can also benefit from the section of the video explaining implementing an adapted aquatics program. The video provides an overview and sample of adapted aquatics that can be used as the starting point for any adapted aquatics program. Programs should then be expanded beyond this video to meet the teaching styles and the needs of the participants of the program involved. The video, this complete document, and sample documents for the building an adapted aquatics program can be found at the University of Wisconsin-La Crosse Center on Disability Health and Adapted Physical education website.

Resources

Many resources were used when creating this graduate project, and many resources are beneficial for persons who are looking for additional information on DS and aquatics. Below are a variety of books, journal articles, websites, and technology that are useful in teaching aquatics to children with DS. They provide information about DS and aquatics as well as provide specific strategies to assist with teaching aquatic skills.

Books and Video

Lepore, M., Gayle, W., & Stevens, S., (2007*). Adapted aquatics programming: A professional guide*. Champaign, IL. Human Kinetics.

Adapted Aquatics Programming: A Professional Guide is a textbook that provides and in-depth description of a variety of topics involved with adapted aquatics. It provides general information such as teaching models in adapted aquatics, instructional planning for individuals, equipment and facilities, and instructional strategies. This text includes specific aquatics tips on a variety of different disabilities including DS. Chapter 9 includes specific information about atlanto-axial instability and aquatics activities that are safe and effective for children with the condition. This textbook is a great place for educators to look for a general overview of adapted aquatics as well as specific instructional strategies in the pool.

Winnick, J. & Porretta, D., (2017). *Adapted physical education and sport* (6th edition). Champaign, IL. Human Kinetics.

Adapted Physical Education and Sport is a textbook that provides general information about many disabilities and physical education. Because a variety of topics are covered, the content is not specific in categories such as DS or aquatics. However, this text is a starting point for general information for people who are unfamiliar with DS and/or aquatics. Information about DS is general, including characteristics, learning styles, and instructional strategies to help students with DS succeed in physical activity. A chapter is also included on aquatics but gives a brief overview of what adapted aquatics is and how it is beneficial to students with disabilities. Once again, this is a great text for a brief overview of DS or adapted aquatics for people looking for quick general information before researching further.

Lepore, M. (2006). Introduction to adapted aquatics. DVD. Oceano, CA: Sprint Aquatics.

This film created and narrated by Monica Lepore provides a general overview of adapted aquatics. It provides considerations specific to multiple disabilities in aquatics, including a brief section on Down syndrome. This film also provides activities and equipment needed to work on specific skills such as breath control and kicking.

Journal Articles

Grosse, S. (2015). Take your poly equipment into the pool! *Palaestra, 29(1),* 11-12.

Take Your Poly Equipment into the Pool is a journal article that discusses the use of poly spots in an aquatic setting as well as games and activities that can be done with poly spots. As previously discussed, children with DS are visual learners and thrive off visual supports such as poly spots. Therefore, this article is useful because it considers the visual learning style of students with DS and incorporates equipment and activities to help improve their aquatic skills. The article includes four activities that can be done in the pool that will improve skills like breath control and submerging with motivating equipment. Overall, this article is useful because of its equipment and activity suggestions that include visual supports that are essential for teaching students with DS.

Block, M. & Conatser, P. (2013). Adapted aquatics and inclusion, *Journal of Physical Education, Recreation & Dance, 73(5), 31-34,* DOI: 10.1080/07303084.2002.10607806

Adapted Aquatics and Inclusion provides an overview for general education teachers who may have a student with a disability in their aquatic setting. It includes collaboration, determining goals, placement, adapting the environment, and managing information. It also includes a table that shows the difference between activities in the general aquatics setting versus the inclusive aquatics setting. This article can be useful for

a general physical education teacher or a paraprofessional who is working with a student with DS in their inclusive aquatics class.

Websites

American Red Cross. (2017). Longfellow's Whale Tales for aquatic safety. Retrieved March 14, 2018, from https://www.redcross.org/take-a-class/teach-water-safety/whale-tales-resources

Longfellow's Whale Tales uses a whale that captures the attention of young students to teach simple water safety cues. An example is "reach or throw, don't go". This is catchy, and the whale provides motivation for young children while teaching basic water safety skills. The short cues that are easy to remember can help all preschoolers, especially those with DS be safe around water. Incorporating Longfellow's Whale Tales into an aquatics program can help ensure safety of children when they swim with their class as well as outside of school.

Conatser, P., (n.d.). Adapted Aquatics Organization. Retrieved March 14, 2018, from http://www.adaptedaquatics.org/

Adapted Aquatics Organization is a website put together that combines a variety of resources. It has a tab that provides multiple games and activities broken down into what skills the instructor is working with the student on. All activities are for adapted aquatics in general, but teachers can use the activities and adapt them to meet their student's individual needs. This website also has links to a variety of other websites that sell adapted aquatics equipment. That is helpful for adapted aquatics instructors who are starting a program, or already have a running program and need more or new equipment. Overall, this website provides an overview of a variety of adapted aquatics activities and adapted aquatics equipment.

National Down Syndrome Society. (2017). What is Down Syndrome. Retrieved November 27, 2017, from http://www.ndss.org/about-down-syndrome/down-syndrome/

The National Down Syndrome Society is a national organization that advocates for, provides resources, and shares news about Down syndrome. There is no information on this site specifically about aquatics, however, it is a great resource for parents and teachers who work with a student who has DS. It explains what DS is and provides supports and resources in a variety of environments. This website is a great place to look when looking for general information about DS or when looking for support, advice, or advocacy for DS.

Technology

Geslak, D. (2017). "Exercise Buddy Pro" [iPad Application]. United States of America: Exercise Buddy. http://www.exercisebuddy.com/

Exercise Buddy and Exercise Buddy Pro were created to assist students with Autism in exercise. It is an app that can be used on an iPad that allows the student to work through start finish boards, circuits, and first then boards with a wide variety of skills that can be inputted. Aquatics skills are included on the app and a teacher or paraprofessional could create an aquatics lesson on the app and still utilize the apps features from the pool deck. Exercise Buddy and Exercise Buddy Pro also provide pictures and videos for each skill, allowing the students to have that visual demonstration on the app and in the water.

Lepore, M., Columna, L., & Litzner, L. (2015). *Assessments and activities for teaching swimming*. Champaign, IL: Human Kinetics.

Assessments and Activities for Teaching Swimming is a textbook that provides multiple skills progressions, activities, and sample assessments for adapted aquatics. The text breaks down aquatic stages into six levels based on student skill. It also provides over one hundred activities to work on a variety of skills. The authors provided a table at the beginning of the book that allows teachers to find an activity in the book quickly based on skill and level of their swimmer. All activities include equipment needed, preparation, student formation, instructor directions, student directions, and pictures of the activity. At the beginning of each chapter there are also sample assessments included that are appropriate for the level discussed in the chapter. This book is useful to all people teaching adapted aquatics.

Recommendations for Future Research

Research Recommendations

The development of this graduate project has created several research questions for future study. More research can be done in the field of aquatics for persons with Down syndrome as well as for other persons with disabilities. The need for research in the field of adapted physical education, especially in the benefits of aquatics continues. The following are research questions that could be studied.

1. What are the most effective strategies and important skills to teach survival swimming skills to youth with autism spectrum disorder?

2. What are the effects of aquatics on the gait, balance, and core strength of students with disabilities?
3. What are the effects of aquatics exercise on locomotor and object control skills in children and youth with Down syndrome?
4. What are the effects of children with disabilities acquiring aquatic skills and comfortability and family physical activity in a recreational setting?
5. What are the effects of aquatic skills in youth with disabilities and increased communication skills?

Critical Analysis Project Recommendations

In addition to future research, there is a need for further critical analysis projects in the field of adapted aquatics. Many practical and descriptive projects in aquatics can provide general physical educators, adapted physical educators, paraprofessionals, and recreational professionals with quality instruction to students with disabilities in aquatics. Future critical analysis projects could include:

1. Instructional strategies for teaching aquatic skills to secondary students with Down syndrome.
2. Creating and implementing an adapted aquatics program in a school or recreational setting.
3. Instructional strategies for teaching aquatic skills to children and youth with autism spectrum disorders.
4. Instructional strategies for teaching survival swimming skills to children and youth with autism spectrum disorders.

5. Instructional strategies for teaching swimming for cardiovascular fitness in secondary students and adults with disabilities.

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APPENDIX A
ASSESSMENT TOOLS

Water Adjustment Rubric (from face in water to rhythmic breathing)

Students Name: _____Teacher: _____ Date: _____

Skills/Behaviors	**2**	**1**	**0**	**Teacher Comments About Performance**
1. Blows bubbles in water with just chin and mouth in water (without swallowing water). (See Picture 1)				
2. Places right cheek and ear in water for 5 seconds.				
3. Places left cheek and ear in water for 5 seconds.				
4. Places back of head (including both ears) in water for 5 seconds. (See Picture 2)				
5. Takes a deep breath, places face in water, including ears and blows out bubbles slowly for 2-3 seconds. (See Picture 3)				
6. Takes a deep breath, dunks entire head under water and comes back to above surface and breaths in.				
7. Takes a deep breath, dunks entire head under water, blows bubbles slowly, bobs to surface and takes a deep breath, re-enters under water and repeats _____ times.				
8. From standing position, puts face in water, rotates ear to ear, taking a breath each time their mouth leaves the water, blowing bubbles when under water. (See Picture 4)				

Rubric Assessment Scale

2: Performs skill/task independently (after given verbal directions and demonstrations)

1: Performs skill/task with minimal physical assistance (after given verbal directions and demonstrations)

0: Unable to perform skill/task (needs maximum physical assistance)

Student Goals

1.)_____
2.)_____

Flutter Kick Rubric

Students Name: _____Teacher: _____ Date: _____

Skills/Behaviors	2	1	0	Teacher Comments About Performance
1. Gets in water next to wall				
2. Puts hands on wall and grabs independently				
3. Brings legs up to surface straight behind body				
4. Flutter kicks while on front, kicking from the hips and not just kicking from the knees				
5. Rhythmically kicks for at least 10 seconds alternating legs				

Rubric Assessment Scale

2: Performs skill/task independently (after given verbal directions and demonstrations)

1: Performs skill/task with minimal physical assistance (after given verbal directions and demonstrations)

0: Unable to perform skill/task (needs maximum physical assistance)

Student Goals

1.)_____
_____
_____

2.)_____
_____
_____

Back Crawl Rubric

Students Name: _____Teacher: _____ Date: _____

Skills/Behavior:	4	3	2	1	Teacher Comments on Performance:
1. Gets in water and faces wall.					
2. Puts hands on wall and puts feet up on wall (in ready to push off position) (See Picture 1)					
3. Brings head back and pushes off in a streamline position, legs straight, hands together with one on top of the other overhead and in a gliding position. (See Picture 2)					
4. Keeps chin up and head in a straight line with back, keeping eyes looking at ceiling.					
5. Moves arms in a circular motion, starting at their hips, moving one at a time in a circle, above their head with cupped hands, fingers entering water above their head, and pulling hand back to their hip while the other hand starts its circle. (See Picture 3)					
6. Flutter kicks from the hips, keeping toes pointed and not kicking through the knees (See Picture 4).					
7. Combines the skills into one continuous stroke, and swims _____ feet.					

Rubric Assessment Scale

2: Performs skill/task independently (after given verbal directions and demonstrations)

1: Performs skill/task with minimal physical assistance (after given verbal directions and demonstrations)

0: Unable to perform skill/task (needs maximum physical assistance)

Student Goals

1.)_____
2.)_____

Front Float Skills Assessment Rubric

Student: _____ Teacher: _____ Date: _____

Skills/Behavior:	2	1	0	Teacher Comments on Performance:
1. Stands in water and bends top half of body onto water. (See Picture #2)				
1. Holds arms above head and on surface of water with face in water (See Picture #1)				
1. Keeps face in water while rest of body is level (See Picture #1)				
1. Holds legs straight and on surface of water (See Picture #1)				
1. Remains relaxed and floats for _____ seconds				

Rubric Assessment Scale:
2 = Performs skill/task independently (after given verbal directions and demonstration)
1 = Performs skill/task with minimal physical assistance (after given verbal directions and demonstration)
0 = Unable to perform skill/task (needs maximum physical assistance)

Student Goals
1._____
_____
_____

2._____
_____
_____

Back Float Skills Assessment Rubric

Student: _____ Teacher: _____ Date: _____

Skills/Behavior:	**4**	**3**	**2**	**1**	**Teacher Comments on Performance:**
1. Stands in water and leans back with arms out then kicks feet up. (See Picture #2)					
1. Holds arms out to side and on surface of water while floating on back (See Picture #1)					
1. Keeps back of head in water with eyes looking at ceiling (See Picture #1)					
1. Holds legs straight and on top of surface of water (See Picture #1)					
1. Holds stomach up, keeping whole body level (See Picture #1)					
1. Remains relaxed and floats for _____ seconds					

Rubric Assessment Scale:
2 = Performs skill/task independently (after given verbal directions and demonstration)
1 = Performs skill/task with minimal physical assistance (after given verbal directions and demonstration)
0 = Unable to perform skill/task (needs maximum physical assistance)

Student Goals
1._____

2._____

Aquatics: Jumping Feet First Into Water Assessment Rubric

Student's Name: _____ Date: _____ Teacher: _____

Skills/Behaviors	2	1	0	Teacher Comments About Performance
1. Walks to pool edge and waits for teacher's directions (Refer to figure 1.1)				
2. Locates appropriate depth for jumping feet first. (Minimum depth for jumping is 6 ft) (Refer to figure 1.2)				
3. Jumps feet first into water (Refer to figure 1.3).				
4. Surfaces after jump and swims over to ladder or side of pool.				
5. Jumps at least 3 feet from the pool into hula hoop.				
6. Jumps feet first and retrieves object at bottom of pool (Refer to figure 1.4).				

Rubric Assessment Scale:

2 = Performs skill/task independently (after given verbal directions and demonstration)
1 = Performs skill/task with minimal physical assistance (after given verbal directions and demonstration)
0 = Unable to perform skill/task (needs maximum physical assistance)
Goals:

1. _____
2. _____

Aquatics: Diving Assessment Rubric

Student's Name: _____ Date: _____ Teacher: _____

Skills/Behaviors	**2**	**1**	**0**	**Teacher Comments About Performance**
Diving:				
1. Walks to pool edge and waits for teacher's directions (Refer to figure 1.1).				
2. Locates appropriate depth for diving. (Minimum depth for diving is 9 ft)				
3. Dives from seated position with arms above head and hands together with feet starting in gutter (Refer to figure 1.2)				
4. Dives from a squatted position with arms above head and hands together (Refer to figure 1.3).				
5. Approaches and dives headfirst into pool rolling off peanut roller.				
6. Dives from standing with slow forward lean into water. (Slight bend in knees) Hands above head and together (Refer to figure 1.4).				
6. Dives from standing with no bend in knees. Hands above head and together.				
7. Dives from standing with forceful leg spring push off. Hands above head together.				
8. Dives from standing through hoop placed 3' from side of pool. Arms extended and hands together.				

9. Dives from standing at end of low board with arms extended and hands together.				
10. Surfaces after dive and swims over to ladder or side of pool.				

Rubric Assessment Scale:

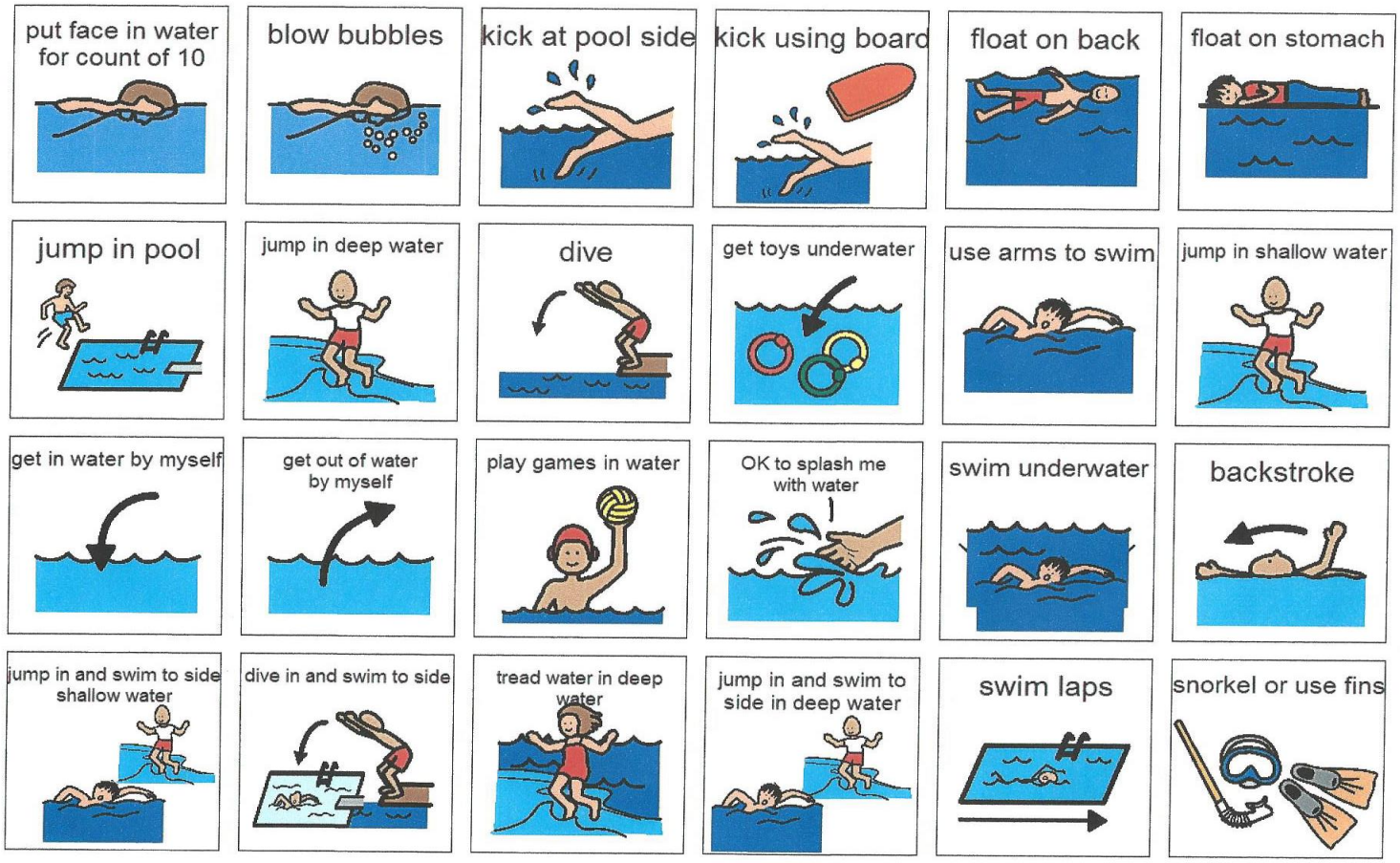
2 = Performs skill/task independently (after given verbal directions and demonstration)
1 = Performs skill/task with minimal physical assistance (after given verbal directions and demonstration)
0 = Unable to perform skill/task (needs maximum physical assistance)
Goals:

1. _____

2. _____

Name: _____ **Date:** _____

Circle what you can do in the water.



APPENDIX B
VIDEO SCRIPT

Time	Content and Script	Video
0:00-0:13	**Instructional Strategies for Teaching Aquatic Skills to Preschool and Elementary Aged Students with Down syndrome.**	Clip of Greta talking and listening to the fish with title on screen.
0:13-0:39	Hello, my name is Brittany Thomfohrda and I am a graduate student in adapted physical education at the University of Wisconsin-La Crosse. What you just saw was 3 preschool and elementary aged students with Down syndrome who were actively engaged in an aquatics lesson appropriate for their skill level and unique needs. The purpose of this video is to provide instructional strategies for teaching aquatic skills to preschool and elementary aged students with Down syndrome.	Scene of me sitting in a professional environment
0:39-1:20	Due to some of the unique characteristics of Down syndrome, a variety of aquatic skill progressions, activities, and teaching equipment will be discussed. This video will also discuss how to build an adapted aquatics program along with how to train and use paraprofessionals and other assistants within an aquatic setting. The target audience for this video includes general and adapted physical education teachers, aquatic professionals, special education administrators, related service personnel, paraprofessionals, parents, and caregivers.	Several streaming still pictures of students with Down syndrome participating in swimming activities.
1:20-1:57	This video is divided into 5 chapters, Chapter I presents information on the characteristics of Down syndrome as well as the prevalence of both Down syndrome and aquatics in the United States. Chapter II explains the benefits of physical activity and aquatics for persons with Down syndrome as well as safety concerns. Chapter III presents teaching strategies for aquatic skills for students with Down syndrome while presenting and explaining	Text on screen of each chapter title/description.

	equipment needed in an adapted aquatics program. Chapter IV discusses the logistics of creating and implementing an adapted aquatics program. Lastly, Chapter V covers assessment for an aquatics program and how aquatic assessments can be integrated in IEP's.	
1:57-1:57	**Characteristics of Down syndrome**	Title on screen
1:57-4:38	Down syndrome is a chromosomal disorder that is caused by a full or partial extra pair of chromosome 21. Down syndrome falls under the Individuals with Disability Act (IDEA) as an Intellectual Disability. It can also be classified under a Developmental Disability due to their sensory needs and the fact that they are developmentally 2 years behind their same aged peers. There are 3 types of Down syndrome: trisomy 21, translocation, and mosaicism. Trisomy 21 is the most common with 95% of persons with Down syndrome having Trisomy 21. There are many physical features that are evident in the majority of persons with Down syndrome. These include almond shaped eyes, a flat nose, small oral cavities with protruding tongues, low muscle mass, higher levels of obesity, and a short stature. Because of the small oral cavity and protruding tongues persons with Down syndrome may have speech impairments. Down syndrome is classified as an Intellectual Disability meaning persons with Down syndrome have lower cognitive function than their same aged peers. Some important factors to be cognizant of are the congenital heart defects and atlanto-axial instability. Both will be discussed further in the safety portion of this video. Persons with Down syndrome tend to show characteristics of stubbornness, rapid mood changes, a need for routines, and are visual learners. According to Mikyong and colleagues, Down syndrome is the most common chromosomal disorder in the United states with approximately 5,400 babies born each year with Down syndrome. Since 1957 the prevalence of Down syndrome has been steadily increasing due to modern medicine and the governmental mandate for all congenital	Video of me in a professional setting Pictures of children with Down syndrome on screen as an example of each of the physical characteristics Clip of teacher giving a visual demonstration to one of the students Pictures of students with Down syndrome

	heart defects being required to be repaired in children with Down syndrome within the past decade. On average, 10.8 per every 10,000 babies born with Down syndrome are male and 9.7 per every 10,000 babies are female showing a slightly higher prevalence for males to be born with Down syndrome than females. Because of the risk of higher obesity levels, students with Down syndrome need physical activity in order to maintain a healthy weight. An in depth look at the benefits of physical activity, aquatics specifically, will be discussed more in this video. Of the children with Down syndrome who do participate in physical activity, swimming is the most common for those under the age of 14. According to Alesi and colleagues, 69% of consistently active youth with Down syndrome participate in some form of aquatics activity, anything from lessons, to recreational swimming, to Special Olympics.	Clips of students with Down syndrome running, in a strength center, or participating in sports.
4:38-6:24	**Benefits and Safety Considerations** As previously mentioned children with Down syndrome have a higher prevalence of obesity compared to their same aged peers. Because of this, it is important they get the recommended value of moderate to vigorous physical activity daily. The CDC recommends youth get 60 minutes of moderate to vigorous physical activity each day. There are many physical benefits for children with Down syndrome getting their recommended level of physical activity. There are also many benefits of aquatics as a physical activity. Water elicits a sensory environment that can increase motivation for students with disabilities as they tend to need more motivation when performing physical activity. Because Down syndrome is also classified as a Developmental Disorder, a common characteristic is the want or need for sensory stimulation. Students with DS have heightened sensory needs and seek sensory stimulation for motivation. Aquatics can provide such stimulation. The	Title on screen Video of me in a professional setting Videos of youth with Down syndrome in pool doing water adjustment with buckets

	buoyancy of the water also allows students to work with gravity instead of against it. This effect allows them to move around more freely in the water and gain independence in movement. Beyond moving more freely, aquatics allows pressure to be taken off their joints and build cardiovascular endurance which is key for students with Down syndrome. Aquatics also has the ability to increase balance and posture. This is important for students with disabilities due to the greater difficulties with balance, gait capacities, muscle tone, and core strength Alesi and colleagues also found that increased motivation and independent moving in the water also has the ability to build confidence. Increased confidence can also increase self-esteem, a common struggle for persons with Down syndrome.	Video of multiple youth with DS swimming together.
6:24-7:39	Interview with Parent about benefits	Jenny Levendoski
7:39-9:11	**Safety Considerations**	Subtitle on screen
	Due to the commonality of congenital heart defects and the possibility of atlanto-axial instability in children with Down syndrome, there are a few safety considerations. It is now federally mandated that all congenital heart defects are corrected, however, it is still important to be aware of any safety considerations associated, although accommodations most likely will not need to be made for this health issue. Another important health issue to note is a child with atlanto-axial instability. Pueschel and Scola define atlanto-axial instability as "ligamentous laxity of the transverse ligaments that ordinarily hold the odontoid process close to the anterior arch of the atlas." This essential means that their 1st and 2nd vertebrae are loosely connected and have the ability to dislocate easier than most others. Only 14.1% of persons with Down syndrome have this instability, however, 13.1% do not show symptoms. Because of the laxity and possibility of dislocation, the Special Olympics has a strict screening guideline in aquatics for persons with Down syndrome to make sure they do not have	Pics or videos of students with DS Words on screen of definition Pic of atlanto-axial instability Picture of the S.O. page on atlanto axial

	atlanto-axial instability. This process includes submitting x-rays. Those that do need a doctor's signature and are not allowed to participate in diving or the butterfly stroke due to the strain placed on the neck in those activities. It is important to know if your student with Down syndrome has atlanto-axial instability and if you are unsure, do not have them participate in diving or the butterfly stroke.	instability restrictions Image of diving and the butterfly stroke
9:11-9:30	**Teaching Aquatic Skills** As previously described, aquatics has many health benefits for youth with Down syndrome. I am going to show you some of the main skills to work on with preschool and elementary aged students with Down syndrome, including skill progressions, equipment, and equipment modifications and any unique considerations.	Title on Screen Video of student with DS swimming
9:30-10:53	**Water Acclimation** For some students, especially those at the preschool level or those who are unfamiliar with the water, getting adjusted and comfortable in the water can be the greatest challenge. For some students water acclimation can be as basic as using a small bucket or watering can to pour water over your head and the student's head. You may even have to start by pouring water over their legs, hands, and arms to gain comfortability. If the student has a favorite toy that squirts out water, that can be used as well. Once students are comfortable being in the pool, one activity you can do that gets students acclimated to the water each day before the lesson, which also serves as pre-teaching for other aquatic skills, is to create fun flashcards that have acclimation exercises on them. You can simply print out flashcards with pictures on them and then seal them in Ziploc bags or laminate them so they can go in the water. Flashcards can include a flower meaning water the flowers (themselves) with a bucket or watering can, a fish signifying blow bubbles like a fish, a frog meaning balance a frog	Subtitle on screen over pic of student sitting on edge of pool Video of Ethan and Greta using watering can Video of Ethan doing flashcard activity. Hold up flashcards to camera so viewer can see what the card looks like and have Ethan doing each skill on the card.

	toy on one ear as the other one is in the water (this is a lead up to rhythmic breathing), a sting ray meaning to lay flat and float, and a shark telling them to dunk their head underwater, if they are comfortable with that skill, and put a hand on their head as a fin pretending to be a shark. All activities can be done with assistance if necessary.	
10:53-16:05	**Pool Entry and Exit** An important skill to work on is safely entering and exiting the pool. In this video I will demonstrate using a ladder, sliding in, and jumping in safely. The first step of the progression is using a ladder to climb in. It is important to make sure you are in the pool first and ready to assist the student if they need help. By getting in the pool first, you are also able to provide a visual demonstration to appeal to the students' visual learning needs. After you are in, have the student hold on to the ladder with both hands then climb into the pool backwards taking one step at a time in order to ensure safety. Using a ladder also allows the student to climb into the pool slowly and at their own pace. This is important if the student is still uncomfortable in the water. The next progression in getting into the pool is sliding in from the pool edge. If the student is not yet ready to jump in, but wants to get in quicker than the stairs, sliding in is an option. Once again, you should get in first and provide a visual demonstration of how you want the student to enter the pool. To start they should be sitting with their bottom on the edge of the pool facing the water. When they are ready the student should twist so both hands are gripping the side of the pool on the same side of their body. They can then slowly lift their bottom off the pool deck and twist so their body is in the pool and they are facing the wall. During this entire transfer from the deck to the pool the student's hands should maintain contact with the side of the pool with a teacher close by for assistance. The last progression is jumping into the pool. There are many levels to jumping in and you should progress as your student feels comfortable. Many students won't feel ready to jump in independently	Subtitle on screen over a picture of a student jumping in Eliza entering the pool using a ladder with me assisting from the pool so viewers can see her legs hit each rung Sammy sliding into the pool Sammy Jumping into the pool for levels 1 and 2

	right away. It is important that students know the safety of jumping. They need to jump away from the wall, feet first, and facing the pool. • Level 1: When a student first begins jumping in they may be more comfortable with assistance. At this level offer your hands for them to hold while they jump. As they gain comfortability you can move backward so they are jumping into your arms and you are catching them instead of them having contact with you at all times. • Level 2: Now that your student is comfortable jumping in to you or whoever is working with them, you can start progressing to help them gain independence and eventually jump in independently. For this next progression you will need a noodle. Be sure to have a motivational toy or activity for the student, especially if they are slightly frightened of the activity or it is not one of their favorites. Sammy is motivated by dumping or squirting water with a toy so I am sure to have her favorite purple whale or a watering can for her to dump water in between jumps or when she needs motivation. Much like you did with level 1, start with the noodle in the water between you and your student. Your student may still want to grab onto your hands or shoulders. The key is to get them used to landing with their feet in the water and so the noodle lands under their arms to provide flotation assistance. As they get used to the feeling of landing with their arms over the noodle you can back yourself away from the noodle. Be sure to gauge how far they jump so the noodle is in the correct spot. As you slowly back up you are still there for support but they are jumping and landing on the noodle on their own. The last step of this progression is jumping onto the noodle and kicking back to the wall completely independently. Another modification or piece of equipment you could use would be a child's aqua jogger so they stay at the top	

	of the water once they jump in and feel secure. • Level 3: Now that your student is comfortable jumping independently onto a noodle, they can progress to level 3. If they are not a strong enough swimmer to swim back to the edge of the pool, then I recommend having them stay at the highest progression of level 2 or using an aqua jogger to provide assistance. If they are a strong enough swimmer, like Eliza, they can jump in independently as long as they follow the rules: jump out, jump feet first, and face the pool. At this stage they can begin to jump over objects such as a noodle or into a hula hoop or you can play games that incorporate jumping in such as Chop Chop Timber. One of my favorite games to play for jumping in is Chop Chop Timber. Students enjoy this game and you get some fun creative answers. It is also easy to play with students at different skill levels. Students who need one on one assistance can have a teacher with them to catch them or can slide into the pool, such as Ethan. Sammy is using a noodle to assist her floatation and Eliza is jumping independently. To play Chop Chop Timber, the student begins by sitting on the edge of the pool and act as a seed. When you splash them with water they seed is nourished and can grow into a big tree. The student stands up as big as they can like a tree. At this point you can ask them what kind of tree they are. Allow their creativity to run free, they can be whatever kind of tree they can imagine. Then you tap on their leg once or twice like you are chopping the tree down. When they are chopped down they get to jump into the pool following the safety rules: jump out, feet first, and forward. Have students swim to the ladder and climb out of the pool holding onto the sides and taking one step at a time. Once they are out of the pool they can walk back to their spots and you can play again. Due to the safety issues previously talked about in this video and the students' young age I will not cover any diving progressions.	Eliza jumping independently onto noodle & Eliza jumping for level 3 Ethan, Sammy, and Eliza playing Chop Chop Timber with other adults in the pool to assist them

16:05-20:39	**Breath Control** Once a student is acclimated and comfortable in the water, breath control can be developed through many simple fun activities that can progress into breathing as complex as rhythmic breathing. There are 3 levels of breath control progressions. Level 1 is simply blowing bubbles. There are many activities that can be used to practice blowing bubbles. For all activities first have the student look at how your mouth is shaped and give a visual demonstration of the activity. Be sure the student is facing you so they have a continuous visual demonstration of how their mouth should be shaped. • Activity 1 is blowing through a straw. Have a straw for the student and yourself. Put one end of the straw in your mouth and the other in the pool and blow causing bubbles to form underwater. • Another activity is putting ping pong balls flat on your hand and blowing them off your hand into the water. Students can also blow a ping pong ball in the water, either in free space or from a starting spot to a finishing spot. • If you have money available in your budget there are also space shuttle type toys that are two different colors on the sides. When you put them in the pool and blow on them they flip sides to the other color. • The last activity I have for bubble blowing is one that also integrates kicking either independently or with assistance. This activity came from Monica Lapore's film "Introduction to Adapted Aquatics". You will need 3 different colored ping pong balls and 3 different colored floating hoops that correspond with the colors of the ping pong balls. Students blow the colored ping pong balls into their matching colored hoop sorting colors and flutter kicking from one hoop to the next. Depending on the students skill level you could provide them with a	Subtitle on screen Video of student doing activities

	noodle, aqua jogger, or physical assistance when flutter kicking.	
	After your student has a grasp on blowing bubbles and is comfortable putting their face in the water you can move onto submersion. At first, some students may not be comfortable submerging completely and that is ok. Try to get them to go under water up to their nose, then their eyes, then forehead, then the top of their head. Progress as the student feels comfortable, challenge them to move to the next step, however, do not push them too far so they develop a fear of the water. One activity that can be done with either an individual or an entire class is bobbing for rings and placing them on cones. For students who are uncomfortable going all the way underwater, you can hold the ring underwater to the point they are comfortable submerging or place the ring on a tot dock. Students who are comfortable going all the way underwater and who need a challenge can have the ring on the bottom of the pool in the shallow end. They can retrieve it then place it on the cone. Two more submersion games that are fun for young children such as preschoolers and early elementary aged students are Dig for a Bone and Underwater Band. Both games came from the YMCA's swimming lesson skill and topic library. Once again you will need to give a visual demonstration to accommodate to the visual learning characteristic of students with Down syndrome. Dig for a Bone has students pretend to be a dog and "dig" in the water to bury their favorite bone at the bottom of the pool or however far they can go. Underwater band has students stay closer to the surface of the water but still requires them to submerge partially or fully. Students pick a favorite instrument. You may have to offer suggestions due to their young age; such as a trumpet or a trombone. They then go underwater and play their instrument. Be sure they are blowing bubbles while they are underwater.	Video of Eliza bobbing underwater through the stages of their head Video of all 3 students doing activity, each with the supports they need Video of Eliza retrieving ring of tot dock with assistance Video of Eliza doing Dig for a Bone Video of one of the students doing Underwater band
	The last and highest level of breathing is rhythmic breathing. Rhythmic breathing is needed to efficiently swim the front crawl as students'	Picture of student laying with their ear in the water

	progress in their swimming ability; however, in this video we will cover lower level progressions due to the focus age of preschool and elementary aged students and will not introduce the front crawl arms in conjunction with rhythmic breathing. • The first stage of breathing after comfortability submerging and bubble blowing can be started at a very young age. One activity to build students' creativity and rhythmic breathing is called Talk to the Fish, Listen to the Fish. Explain to students that they have a fish friend underwater and you want to know more about it. Students hold their hands on the wall and you can ask them a question such as "what is your fish's favorite color?" They ask the question by blowing bubbles to talk to their fish. Be sure to give a visual demonstration. Then they have to tip their head to one side so one of their ears is in the water to listen to their fish. Allow them to tell you their answer to keep it interactive and fun for them. Students love to talk about their fish friend. Ask another question. This time have them listen with their other ear. Keep alternating ears so they get used to the motion of alternating for rhythmic breathing and both ears are comfortable in the water. • Each of the progressions from here, can continue using the cues "talk to the fish and listen to the fish" to help students visualize how they need to blow bubbles and turn their heads to breathe. The first progression is to have students hold onto the wall and lay on their stomachs to practice their breathing. If they do not have the muscle strength to hold their legs up you can either put a noodle under their legs or have someone hold their legs up to assist them. Most students with Down syndrome will not have enough abdominal strength to keep themselves up without kicking because of the low muscle tone that is associated with Down syndrome. • Once the student is able to perform the breathing efficiently you can start pairing	Video of one of the students doing talk to the fish, listen to the fish Video of Eliza holding onto the pool edge practicing breathing Video of Eliza doing each of the

	breathing with kicking. This will get increasingly difficult due to the combination of tasks. Start with them kicking and holding onto the wall. As the kick and breathing combination is efficient move to kicking with a kickboard across the pool while performing the breathing.	stages of kicking and breathing
20:39-21:40	**Back Float** One skill that can take time to get students comfortable, but is essential to swimming success and safety is being on their back. The first aspect of comfortability on back is learning the support positions on back. All students will need support on their back in one of the various positions as they learn the back float and find their buoyancy in the water. Once again, be sure to give a visual demonstration of all activities. One key aspect of floating is having the student keep their head back with their ears in the water, looking up at the ceiling with a flat stomach and their arms out like a starfish. You can use a rubber duck or a student's favorite toy and place it on their forehead or on their chest with the goal to balance it there. This will keep their focus and help them lay still while you float as well as provide motivation. Be sure to tell them before they start floating how long they will be doing the skill and then count down out loud. That way they always know how long they have left. The next progression is to have the student practice their back float, and try to balance a rubber duck or other motivating toy either on their stomach or their forehead. For students that are working on developing independence you can have them front hug a kickboard to provide assistance or place a noodle under their lower back as a support instead of a teacher. Once your student is comfortable being on their back and can lie flat with their head back in the water you can begin the flutter kick on their back. I suggest starting in the hip support position. This	Subtitle on screen over image of student back floating Video of one of the students floating with a duck balanced Video of Eliza balancing a duck while floating

	will allow the student to be stationary with you assisting them. Because they are preschool and elementary aged they are most likely small enough that you can use physical brailling to move their legs up and down keeping their knees straight in a proper flutter kick. Once they can independently flutter kick in the hip support position, move into the back support position so they get the feel of their head being in the water while kicking and still have support. If you need you can also put a noodle under their arms when they are in this position for additional support. When they are ready begin kicking independently have the student lay on their back and hug a kickboard, I tell them to hug it like it's their favorite stuffed animal, and kick. Be sure to stay near them in case they lose their grip. If your student is too small or cannot grip a kickboard you could put an aqua-jogger on them or support them with a noodle so all they have to focus on is kicking. If you have access to water weights older students can also hold onto those to help with buoyancy.	Video of Ethan kicking in hip support position Video of Sammy kicking in back support position Video of Eliza kicking on her back
21:40-22:32	**Flutter Kicking on Front** Flutter kicking on the stomach will follow the same progressions as flutter kicking on the back that was just demonstrated. Most students will not be able to flutter kick on their stomachs independently at first. It is important to make sure the student is laying in the prone position with their body at the top of the water and that they are kicking from their hips. This positioning will help them as they progress into swimming strokes. Once they are comfortable there you can move them to independent kicking. Have the student lay with a noodle under their arms and kick alongside you or in a chasing manner with the student swimming towards you trying to catch you. If they become efficient have the students switch to holding a kickboard with their arms extended. If you can, use kickboards with hand slots cut out so the student can place their hands in them and don't have to hold onto the kick board continuously. For a student who has mastered kicking on their front at a young elementary age, use the kickboard and	Subtitle on screen over image of student kicking on front Video of Sammy kicking in a support position. Video of Eliza doing independent kicking with a noodle and a kickboard.

	combine kicking with rhythmic breathing that was discussed in the breath control section.	
22:32-24:23	**Front Crawl** As students get comfortable kicking on their front and are able to kick in the prone position it is important to get them used to moving their arms in a beginning progression to the front crawl. There are five levels of front crawl arms, however, since this video focuses only on preschool and elementary aged students, I am only going to explain the first 3 levels in depth and I will list the last 2 levels. • Level 1: Once the student is able kick fluently in the prone position place a noodle under the student's arm pits or have them wear a child's aqua jogger either in the standard manner or flip it upside down to keep their hips up, if they cannot propel themselves forward independently. At this level have the students focus on flutter kicking while also moving their arms at the same time. At this level the goal is to simply get their arms and legs moving at the same time. • Level 2: Once students are able to continuously move their arms and flutter kick at the same time, their arm stroke can be refined. The cue words I like to use are "ice cream scoopers". This gives the child and visual image. You will also need to demonstrate to them that an ice cream scooper is their hands cupped together in the shape of a scoop. Children typically start their scoopers very close to their body, appearing as though they are doggy paddling. As they consistently use the ice cream scooper hand shape provide reminders and demonstrations to reach out farther and use long arms. I like to tell students to "reach as far as they can to scoop as much ice cream as they can" to work on reaching out. During ice cream scooping activities I like to ask children questions like, "what's your favorite flavor of ice	Title on screen Video of student swimming front crawl Video of Sammy doing Level 1 & 2 Show student with aqua jogger on both way

	cream" or "do you like sprinkles" so they are motivated and can connect the skill to something they like. • Level 3: After students are able to flutter kick in the prone position while simultaneously doing ice cream scoopers and reaching out with long arms they can move to the next progression. Students can either use a noodle in their hands, or a long dumbbell, or a kickboard. Arms should be outstretched while the student flutter kicks in the prone position from the hips. Keeping one hand on the kickboard, or other equipment, the student should reach one arm in a large circle with an "ice cream scooper" hand and catch back onto the kick board. Continue alternating arms. Be sure you demonstrate this skill first so the student knows what is expected of them. • Level 4 & 5: Due to the advanced nature of these skills I will not cover them in depth in this video. If your student has mastered level 3, the next step is to incorporate breathing. Start with bubble blowing, then move to rhythmic breathing while still holding the kick board. In level 5, the kickboard should be removed and the student performs the front crawl independently, beginning with their head out of the water then with rhythmic breathing. Because this video focuses specifically on preschool and elementary aged students with Down syndrome I am not going to cover any advanced skills. A characteristic of students with Down syndrome is that they are a year and a half to two years behind their same aged peers, shorter in stature, and have low muscle tone. Because of this and because they may have had little to no previous aquatic experience, progressions and skills in this video will not pass an intermediate level for an elementary aged child.	Video of Eliza doing level 3 Video of adult doing levels 4 & 5 Video of student swimming
24:23-27:28	**Building a Program**	Title on screen

	The first step to building an adapted aquatics program for a school that doesn't have one is to gain interest and support. It is important to talk to parents to see if there is interest in aquatics for their children. Next, you must discuss the feasibility of a program with administrators. If it is feasible to start a program, logistics must be figured out. Talk to special education teachers as well as classroom teachers to determine what days, times and how often scheduling allows to do aquatics. Keep in mind that you may need to travel off campus if your building doesn't have a pool and travel time needs to be calculated into the logistics. Also be sure to talk to Physical Therapists about the benefits of an aquatic program for certain students. Once feasibility and logistics are doable, you need to write a proposal. When writing a proposal, be sure it includes the following aspects: • identify and justify the need for the program • why the program would benefit your students with disabilities • why should students with disabilities be offered this program that is not offered for typically developing peers • goals and outcomes of the program • ages/grades of the students • amount of students that will be attending • outline of the cost (bussing, equipment, renting the facility, etc.) • community support (high school peer buddies, community volunteers, etc.) • support staff needed to assist and their roles during aquatic sessions (special education teachers, paraprofessionals) Step 2 is finding a facility to use. Not all school districts or school buildings have the luxury of having a pool on campus. Because of this the APE teacher would need to collaborate with a community facility that is accessible for the program. Some questions to ask the facility include: • Is the facility accessible for all persons with disabilities • Is there a rental fee • Is it available at the time requested	Pictures of an adapted aquatics class Sample proposal highlighting each of the areas Clips of students swimming in a pool Put questions on screen

	• Be sure to schedule a visit to see the facility and their locker rooms before using it to be sure it fits your students' needs Here are a few suggestions of facilities you may be able to use: • Hotel • Nursing home/assisted living • University • Another building in your district • YMCA	Screen with images of each facility with facility type written next to it
	Step 3 is to determine and find funding for your program. Consider how much funding your new adapted aquatics program will need and determine how much of your budget will go towards the program. Create a chart outlining what money will go toward transportation, equipment, and the rental fee. Have a way to cover the rest of the funding if your budget does not cover it all. Consider looking into community business and organizations for donations if you do not have enough funding. Administration will want to see an exact break down of funding in the proposal so be sure to have a chart depicting exactly that.	Picture of student with DS swimming. Sample chart pic Logos of organizations that might donate funds Picture of student with DS swimming
	The next step is to create a schedule. Once the program is approved collaborate with special educators, physical therapists, occupational therapists, classroom teachers and anyone else who may be effected by scheduling to create a schedule that accommodates to all students who will participating in aquatics.	Video clip of students with DS swimming
	Step 5 is risk management, be sure to complete the following before beginning your program • Field trip permission forms sent home to parents • Emergency release form and consent • Medical clearance • Liability form and consent • Medical information on all students • Sign facility liability forms if they have their own • Discuss parent goals, outcomes, and concerns	List steps and documents on screen

	• Discuss current swimming ability with parents of students you have never seen swim Step 6 is to plan the program. It is important to plan what teachers will assist and what their roles will be in the program. Who will work with the students during their time in the pool? It is also important to have assessment planned out as well as goals that are communicated to support teachers and those who are assisting in the pool. Another aspect of planning is how the students will be grouped; by age, swimming ability, classrooms, or gender are a few examples). Once everything else is planned create a step by step schedule for teachers and students including what time the bus will pick them, arrival time, changing time, pool time, after swimming changing time, bus departure time, and anything else you many need to add to your schedule. Next, determine what equipment and swimming supports your students need. Determine the equipment you will need to teach your lessons as well as individualized equipment based on individual needs. Some examples of supports include: flotation devices, gait belts, Dan mar neck floats, noodles, aqua joggers, life vests, and one on one assistance. After equipment is determined and purchased you need to determine transportation. Be sure to contact your school's bus company to schedule bussing and call each week to confirm. Be sure they are aware of your needs including size of the group, seat belt needs, and wheelchair accommodations. After transportation is solidified, be sure to double check that everything is correct then all you have to do is facilitate and run your program. Interview with Jana about benefits of adapted aquatics.	Video of me in a professional setting Images of different types of support devices and aquatics equipment Image of bus that meets disability needs Pictures of students with Down syndrome swimming
32:46-35:07		
35:07-36:05	**Assessment**	Title on screen

	The final portion of teaching your adapted aquatics program is assessment. You will need to assess students' skills and track their progress to prove that you have met your goals and outcomes for the program, as well as to set new goals and outcomes as they are met. One way is to do a pre and post assessment is to have either the students fill out a sheet such as this with basic skill on it with what they think they can do, or have the teachers or aides circle what the students can do. At the end of the semester or program have the student circle what they know they can do or have the teacher or aide circle what they can do at that point. Older elementary aged students can most likely accurately circle their skill level, however, preschool students may need assistance or to have a teacher fill it out. This sheet works well for students with Down syndrome because it is very visual oriented. Beyond this pre and post assessment you can create teacher made rubrics for each of the skills you teach and would like to assess. Remember each student's progress and assessment can be on different skills based on their needs and skill levels. I have attached a copy to all of my rubrics and assessment tools to the script document in the link under the video.	Video of me in a professional setting Image of pre and post document blank and filled out Jana Image of one or two rubrics
36:05-37:41	**Conclusion** The purpose of this video was to provide you with instructional strategies for teaching aquatics to preschool and elementary aged students with Down syndrome, as well as provide you with the instruction and tools you will need to start your own adapted aquatics program. Get students comfortable in the water first, then work on breath control, floating, swimming on their back, and flutter kicking on their front. Use a progression that is within the correct zone of proximal development for each student so they may continue to improve and find enjoyment in swimming and continue to swim as a form of independent physical activity that will lead them to a healthy lifestyle. When starting your own program remember to clearly state the purpose and need for your program in your proposal as well as give a detailed picture of where the	Video of me in a professional setting

	funding is going to come from and where funding will be spent. When you have a program all ready to go, doing a pre assessment on your students and deciding what to teach is important. Be sure to meet your students where they are at and provide them with many visual demonstrations and visual cues Also be sure to create assessments that will show your goals and outcome and each student's progress in aquatics.	
37:41-38:04	Thank you for watching my video and thank you to everyone that contributed to making this video possible.	"Thank you" on screen