EVALUATING THE IMPACT OF VIDEO BASED INSTRUCTION AND IMMEDIATE VISUAL FEEDBACK ON THE PERFORMANCE OF THREE GROSS MOTOR SKILLS FOR PARTICIPANTS WITH DOWN SYNDROME

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ABSTRACT

EVALUATING THE IMPACT OF VIDEO BASED INSTRUCTION AND IMMEDIATE VISUAL FEEDBACK ON THE VISUAL PERFORMANCE OF THREE GROSS MOTOR SKILLS FOR PARTICIPANTS WITH DOWN SYNDROME

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The purpose of this study was to evaluate the impact of video based instruction combined with immediate visual feedback on the performance of three different gross motor skills for children with Down Syndrome (DS). The participants in this study are two children with DS. They were selected for this study based upon these qualifying factors: enrolled in a moderate/severe special day class, enrolled in a title one school, have Down syndrome and displayed deficits in gross motor abilities based upon the administration of the Total Gross Motor Development-3 (TGMD-3) assessment. The research design is a multiple baseline design where three areas of concern are evaluated. These areas included skipping, overhand throw and underhand roll. The results of the study showed that in order for video modeling to be effective, multiple opportunities to view the video needed to present to participants. Video based modeling was combined with immediate visual feedback. The participants made minimal progress in the areas of overhand throw and underhand roll but the participants did not improve in the area of skipping. The participants' motor patterns and performance of skipping were identical to

another indicating a correlation to DS. This research shows that video based instruction is often more effective when paired with other evidence based practices.

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INTRODUCTION

Locomotor and non-locomotor skills are important aspects of motor development and motor learning and provide opportunities for future development (Newell, 2020; Seefedlt, 1980; Sport New Zealand, 2012; Thelen, 1980). Motor development and motor learning are important aspects of physical education and can help develop specific motor skills, such as gross motor and manipulative skills (Sheikh et al., 2011). Individuals with Down syndrome (DS) display deficits in motor development in a variety of areas such as lower levels of strength inhibiting movement skills, decreased mobility and decrease in balance, along with many others (Cannella-Malone et al., 2013; Carmeli et al., 2002). These deficits in motor development amongst individuals with DS are imperative to the physical development of participants with DS and their ability to navigate and participate in physical education (Newell, 2020; Seefedlt, 1980; Sport New Zealand, 2012). An important concept that can help aid in the improvement of motor development skills, is video modeling.

Down Syndrome

The Center for Disease Control (CDC, 2021) has stated that individuals born with DS occurs when an individual has an extra chromosome. When this happens, it changes how that person develops mentally and physically. A few physical features are a shorter neck, poor muscle tone, loose joints and these individuals tend to be shorter, along with many other features (CDC, 2021). Researchers have reported that participants with DS have reduced levels of physical activity when compared to their typically developing peers (Diaz, 2020; Shields & Blee, 2012). This lack of physical activity may be due to barriers experienced by participants with DS which include low muscle strength, parental concerns about safety, physical and behavioral skills and accessibility (Diaz, 2020; Shields & Blee, 2012). Individuals with DS face physical differences from birth that impact their willingness, or ability, to partake in physical education activities.

Gross Motor Skills for Children with Down Syndrome

Gross motor skills are an important component of physical development and physical activity (Burns et al., 2022; Leroy, 1951). Participants participate in physical activity at greater rates when these motor skills are developed (Burns et al., 2022; Leroy, 1951). As well as gross motor skills, manipulative skills are an important component of physical development and when developed allow participants to partake in physical activities (Burns et al., 2022). Malak (2015) stated that children with DS have delays in standing, walking and motor development due to smaller cerebrums, brain maturation disorders which correlate with motor functions and balance. Both standing and walking are motor task skills that are needed to perform more advanced, or concentrated, gross motor skills (Malak, 2015).

Video-Based Instruction

Effective instruction requires teachers to use a variety of instructional practices, techniques, and procedures to present information to participants in specific ways to ensure learning occurs (Park et al., 2018). Video based instruction has been identified as a strong practice for improving skills for participants with disabilities, specifically gross motor skills (Adams et al., 2021, Bittner et al., 2016). Video modeling is one technique that uses observational learning to provide both visual demonstration and feedback, thus allowing the participants to see how a skill is performed and replicate that performance (Lee & Gao, 2020). When working with participants video modeling has been used to help with skill acquisition (Park et al., 2018). Researchers have reported that video modeling can be used with participants that have a wide range of abilities and in several different education contexts (Park et al., 2018; Yanardag et al., 2012). Park et al. (2018) demonstrated video modeling to be an effective instructional practice when working with participants with disabilities as the process provides a visual guided approach to learning skill development. Lee and Gao (2020) supported these results and further reported physical education being an ideal context to use video modeling as learning occurs within the psychomotor domain.

Video Modeling in Physical Education

Video modeling can be used to help teach participants how to acquire skills in physical education. There have been various studies demonstrating the effectiveness of video modeling across settings (Obrusnikova & Rattigan, 2016), such as aquatic skills (Yanardag, 2014) and gymnastics movements (Bouazizi et al., 2014). In a majority of the articles, researchers found that participants had an increase in performance relating to the desired skill the student was being taught (Bouazizi et al., 2014; Lee & Gao, 2020). Therefore, the purpose of this study was to evaluate the impact of video based instruction combined with immediate visual feedback on the performance of three different gross motor skills for children with DS. The researchers hypothesize that the combination of both video modeling and immediate impact will have a functional relationship to the improved performance of the participants.

METHOD

Participants

The participants in this study included two participants (N = 2) with Down syndrome. Both participants had a range of abilities and both displayed challenges with locomotor and manipulative skills. The areas of struggle for both participants included, skipping, throwing overhand and rolling a ball underhand as reported by their homeroom teacher through direct observation. Participants were chosen for this study based on the following similarities: (a) both participants were part of a moderate/severe special education day class at a Title I elementary school, (b) both participants scored 25 and 26 on their raw scores for locomotor and nonlocomotor skills on the TGMD-3. For locomotor skills, participants scored an 11 and 10 in locomotor skills. In nonlocomotor skills, participants both scored 15 raw scores. Based upon their raw scores their age equivalency based upon the TGMD-3 assessment is correlated to less than 3 years however their chronological age during assessment was 8 years and 10 months. Based upon scaled scores which were 1 for locomotor and 1 for ball skills, for both participants, they were classified as impaired/delayed under the category of descriptive term. Participants qualified for this study based on their total gross motor development score using the Test of Gross Motor Development 3 (TGMD-3; Ulrich, 2019).

Participant 1 in this study was an 8 year old male with DS. This student had been attending the school for 4 years. Prior to the study, visual cues, teacher modeling and repeated directions were provided for this participant when participating in physical education activities. As well as implementing prior interventions, this student participated in most physical education activities. This student did not qualify for adapted physical education services but displayed struggles with certain areas of gross motor skill development and functioning.

Participant 2 in this study was an 8 year old female with DS. This student had been attending the school for 4 years. Prior to the study, the main researcher provided the student with teacher modeling, visual cues and repeated directions were provided for this participant when engaging in physical education activities. Prior to this study, participant 2 did not always participate in physical education activities and needed positive reinforcement with the options of choice of which physical education activities were taught. This allowed participant 2 to engage in the physical education activities. This participant did receive adapted physical education services and displayed struggles with gross motor skills and functioning.

Procedure

Participants were selected for this study by attending a title one elementary school, enrolled within a moderate and severe special education classroom and exhibited difficulties with gross motor skills. The test that was administered in this research to gain the formal assessment results, was the Total Gross Motor Development 3. Only a portion of the test was used in this study, the section on throwing overhand, underhand roll and skipping. Participants' families were asked to give formal consent to participate in the study from the main researcher. Consent was given via telephone call and when verbal consent was given the researcher sent home paperwork to families documenting the experiment. The paperwork forms providing consent for the research discussed, what information was collected, how it was collected and the purpose of the collection.

Participants participated in this study on a school campus where participants were enrolled in class. Participants were given a total of 10 opportunities over the course of a week to complete the task per trial. Participants engaged in this study every day at 1:00pm every afternoon over the course of 2 months. Baseline data was collected about each participant and their abilities in throwing a ball overhand, underhand roll and skipping. Data was video recorded and data was collected by the main researcher.

Participants performed the task and the main researcher determined if they met the above criteria. Following data collection, the main researcher implemented the intervention being studied. Over the course of 10 opportunities, participants were shown a video of a typically developed peer performing a physical education task, throwing a ball overhand, skipping and underhand roll. Following the viewing of the video, each student was asked to perform the same task their typically developed peer has performed. Data was collected through video recordings taken through Dartfish video collection and teacher collected rubric data. Data that was collected through Dartfish was recorded and viewed following the trials (Dartfish, 2004). The videos were viewed at a later date by the main researcher. Teacher collected data, will include collection through observation and documentation of the performed tasks.

Setting

This study takes place in the participant's homeroom classroom. The participants performed these activities inside the classroom in a designated area, in order to ensure optimal learning opportunities away from distractions. Participants were given a total of 10 opportunities over the course of a week to complete the task per trial. Participants engaged in this study every day at 1:00pm every afternoon over the course of 2 months, in order to complete the study.

Test/Instruments

There are two tests used in this study. One of the tests used for this research was the Total Gross Motor Development 3 (TGMD-3). The TGMD-3 is a motor development assessment that is rated and individually administered through a likert scale rubric per each category on the assessment, as well as each component within a category. This assessment looked at various gross motor skills and identified the areas of weakness for each student based upon their performance of each individual task. Each skill was rated either a 1 or a 0. A score of a 1 meant the individual exhibited that component while a 0 meant the student did not exhibit this action of the task.

The TGMD-3 is a formal assessment used across the United States to determine eligibility for adapted physical education services. The use of this assessment across states and districts ensures it is a valid assessment that can help educators determine the need and determine eligibility for participants with disabilities to receive special education services. The TGMD-3 is valid due to the scaled scores, percentile ranks and specific criteria a student must meet, or not meet, in order to qualify for adapted physical education services. In this study a portion of the TGMD-3 was used to determine ability levels pertaining to the task being studied.

The TGMD-3 is a reliable assessment because it uses data information from typically performing peers as a basis of comparison for individuals being given the TGMD-3 to determine eligibility of services. Educators across the country are able to use this form of formal assessment to determine a student's areas of struggle.

A second instrument used within this study was an application called, Dartfish (Dartfish, 2004). Dartfish is a video analysis application used on an iPad or iPhone and is used to record physical education activities. This video analysis application was selected for usage based on its consistent demonstration, consistent feedback and differentiated instruction to the participants. This video analysis application recorded the participants' tasks and were saved within the application for future review, scoring and analysis on the participants' performance regarding the performance of the desired task. Participants watched a desired task on the iPad in the Dartfish application. Following their viewing, participants were asked to perform the same task that they had watched on the electronic device. The main researcher recorded the participants performing the same task and analyzed the video and scored their performances later. Data was collected by the main researcher through a data collection chart following the recordings and was also reviewed by a teacher's assistant in an effort to compare tasks and performance of the participants.

Research Design

A multiple baseline design is a staggered research experiment, or design. It allows the researcher to predict and verify performance and the effectiveness of the intervention. The three behaviors being observed will be based upon TGMD-3 scores. The benefits of this research design is the researcher can document baseline, analyze data, analyze progress or lack or progress, data is visible through graphs, as well as the researcher can determine if an intervention is appropriate across all behaviors.

The research design of this study is a multiple baseline design across behaviors. To record the pre baseline data, the TGMD-3 was used. This was used to assess and establish the participants current gross motor performance level. The selection of the skills evaluated in this study were selected based on the three lowest scores.

For the baseline phase, the researcher instructed participants to perform each of the skills for a total of 10 attempts, or opportunities. Following a direct instruction, the researcher instructed the participant to perform the skill and provide a visual demonstration for the participant prior to each attempt.

Within the intervention phase, each participant watched a video of a peer model performing the desired skill. After watching the video, each participant was asked to perform the skill watched in the video. The video was shown prior to the participant being asked to perform the skill on 30% of the total attempts (i.e., 1st, 4th, 7th). If the participant demonstrated no change in the behavior within a session the primary researcher increased the number of video demonstrations by 10% within the next session (e.g: 30% to 40%). If the participant demonstrated an improvement in the behavior in a session, the primary research reduced the total number of video demonstrations by 10% within the next session (i.e., 30% to 20%). The importance of the intervention was the immediate visual feedback provided to participants through the Dartfish video analysis application. Participants were able to immediately view their performance with the desired task.

Following a multiple baseline design each participant received the intervention once a behavior was determined stable (i.e., 4-6 consistent data points). After the participant demonstrated an improvement in their performance from baseline to the intervention phase, the primary researcher introduced the intervention within the second desired skill. The process continued until the performance of behaviors showed stable data.

Following 1-week of no intervention by the primary researcher each participant was asked to perform the desired skills assessed within the study. During this phase, the researcher followed the same instruction protocol from the baseline. Each participant was given a total of 10 opportunities to complete the skill.

Social Validity

Social validity is used with research design to ensure that procedures are appropriate for participants within the context of the study (Fawcett, 1991). It is practiced within research to determine goals that are appropriate for the focus of the study (Fawcett, 1991). Two instructional assistants participated in observing this study and were given a survey at the conclusion of this study to determine their thoughts on the effectiveness of the intervention and possibility of future use for this population and at this school. These two assistants are permanent classroom assistants and assist the main researcher in educating and facilitating classroom instruction and procedures.

Data Analysis

Descriptive statistics is the data that was collected based upon the intervention implemented across behaviors for each participant. Descriptive statistics (e.g., mean, medium, mode) was collected with pre-baseline, baseline, intervention and follow-up phases. The horizontal line (x-axis) represents the number of sessions while the vertical line (y-axis) represents the percentage of success across each behavior. Participants scores will be determined based on the average of 10 opportunities given and a score will be determined out of 4 points. 25 points means participants scored 1 point, 50 points means participants scored 2 points, 75 points means they scored 3 points and 100 means they scored 4 points.

RESULTS

Researchers have reported that participants with Down Syndrome (DS) have reduced levels of physical activity when compared to their typically developing peers (Shields & Blee, 2012). This lack of physical activity may be due to barriers experienced by participants with DS which include low muscle strength, parental concerns about safety, physical and behavioral skills and accessibility (Shields & Blee, 2012).

Participant One

Participant one in this study is an 8 year old male who had a diagnosis of intellectual disability, specifically diagnosed with DS. This student does not qualify for adapted physical education services but displays struggles with certain areas of gross motor skill development and functioning. Overall, this student displayed improvements in all areas except for skipping.

Baseline

During the baseline phase in skipping, overhand throw and underhand roll, participant one scored 0% accuracy in all areas. Participant one did not respond to initial requests to perform the task after the model, so the main researcher modeled a second time. During this phase no interventions were used aside from a teacher model prior to asking the participant if they wanted a turn.

Intervention

During the intervention phase, participant one was shown the video model of a peer one time before the opportunities. When participant one made minimal progress, even with the interventions implemented, the main researcher showed the participant the peer model video a total of 4 times at opportunities 4 and 7. Participant one continued to make minimal progress after opportunities 4 and 7. After this the main researcher increased the opportunities, on opportunity 10, to view the peer model of the behaviors. Participant continued to show minimal improvement in performance in skipping. Participants ones motor pattern and skipping pattern was similar to participant two's performance. Participant one made few improvements in the area of underhand roll and overhand throw.

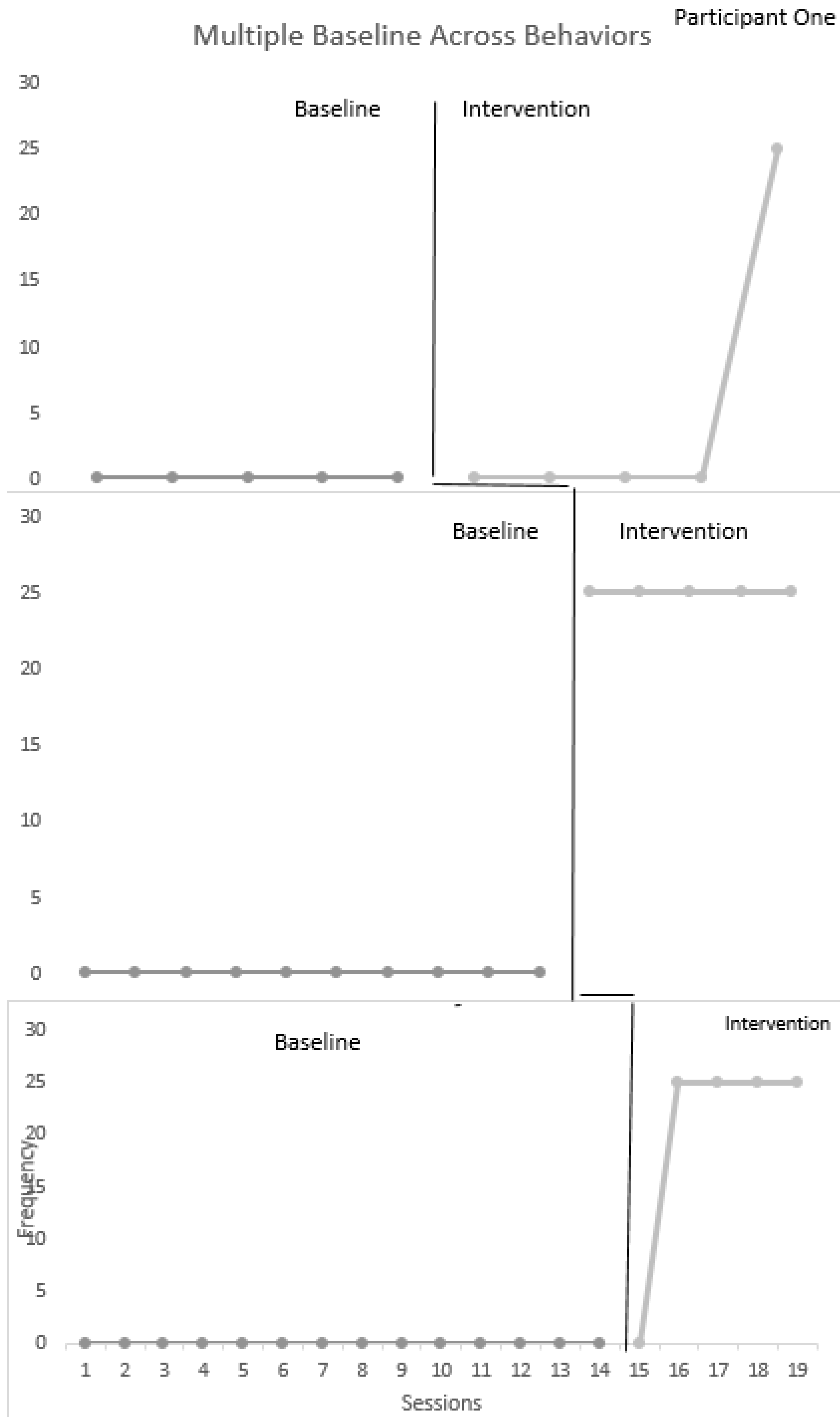

Figure 1 Multiple Baseline Across Behaviors

Participant Two

Participant two in this study is an 8 year old female who has a diagnosis of intellectual disability, specifically diagnosed with DS. This student receives adapted physical education services and displays struggles with gross motor skills and functioning. Overall, this student displayed improvements in all areas except for skipping.

Baseline

During the baseline phase, participant two scored 0% accuracy in skipping, overhand throw and underhand roll. During this phase no interventions were used aside from a teacher model prior to asking the participant if they wanted a turn. Participant two needed encouragement to perform the task confidently.

Intervention

During the intervention phase, participant two was shown the video model of a peer one time before the opportunities. When participant two made minimal progress, even with the interventions implemented, the main researcher showed the participant the peer model video a total of 4 times at opportunities 4 and 7. Participant two continued to make minimal progress after opportunities 4 and 7. After this the main researcher increased the opportunities, on opportunity 10, to view the peer model of the behaviors. Participant two continued to show minimal improvement in performance in skipping.

Participants' two motor patterns and skipping pattern was similar to participant one's performance. Participant two made few improvements in the area of underhand roll and overhand throw.

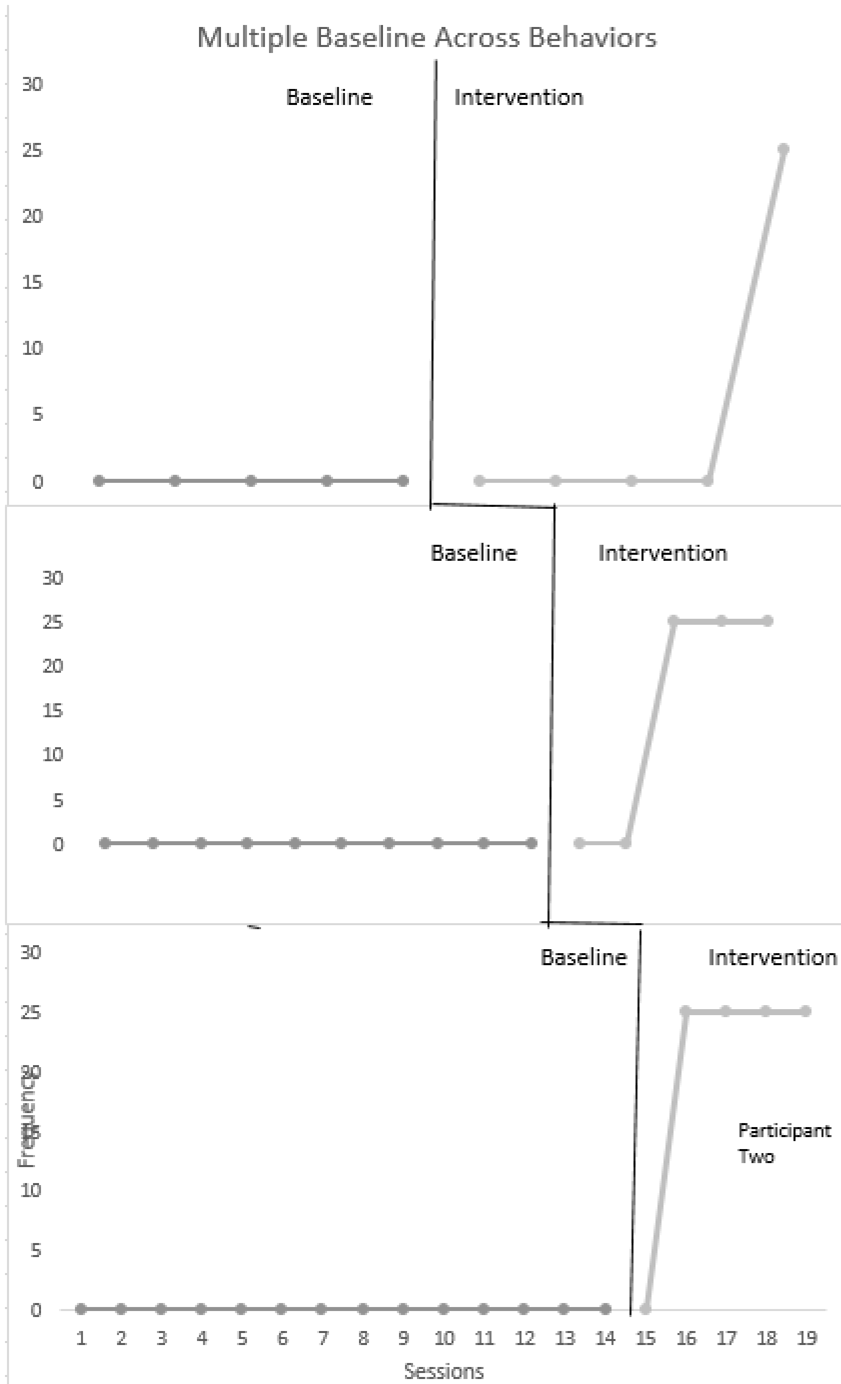

Figure 2 Multiple Baseline Across Behaviors

Social Validity Findings

Assistant one stated that the intervention was effective because when participants watch a video they are able to master the movement after watching the video of someone else during the movement. Assistant one stated that this intervention supports participants with Down syndrome in improving gross motor skills because they are able to view someone else perform the movement first. For question 3, assistant one stated that video modeling can be used in the future to support participants with DS in improving other gross motor skills because they are able to watch someone else perform the task. For question 4, assistant one stated that this intervention, video modeling, is cost effective, it is helpful for participants and has a good outcome in turn proving that schools could purchase this intervention as an effective tool for future use.

Assistant two stated that the intervention was effective because it helped the participants develop skills that they may not realize they can accomplish. This intervention could be used to support future participants develop gross motor skills and would be a good tool to have access to. This intervention could be used to support future participants with Down syndrome and help the participants' further gain, or develop, skills. The final answer states that this intervention is cost effective and the school would be willing to purchase this intervention because it could help further a child's development.

DISCUSSION

Video modeling was used to teach participants various skills related to physical education. It can also be used to teach participants with disabilities. Video modeling has been linked to an increase in skill performance, or skill acquisition (Obrusnikova & Rattigan, 2016). In those articles, video modeling was used to teach a certain skill to participants with disabilities and used to analyze the effectiveness of the video modeling. The use of video modeling can be used to teach different skills such as social skills, cooking skills, as well as physical education activities. As well as being used in various ways, there are steps that need to be implemented in order for video modeling to be effective. These steps include using learning cues, using video equipment, using a video model, creating a video, determining where the activity will take place, monitoring the performance and finally reducing the cues, also known as fading (Obrusnikova & Rattigan, 2016).

Research has found that in order video modeling to be successful several critical elements need to be included (Obrusnikova & Rattigan, 2016). Additional studies have found that video modeling in isolation is less effective than when combined with other evidence based practices throughout a physical education lesson (Obrusnikova & Rattigan, 2016). Evidence based practices that have combined with video modeling producing positive results include educator feedback and video prompting (Lee & Gao, 2020; Park et al., 2018). To date there the overall effectiveness of video modeling in physical education context is understudied and needs attention. Research suggests that video modeling should be used with other evidence based practice to be impactful (Lee & Gao, 2020; Park et al., 2018). However, the overall influence of video modeling on participants learning in physical education is unknown, therefore, the purpose of the current investigation is to determine the effect of video modeling on student learning and skill acquisition.

A few limitations of this study include the number of participants which included two individuals. A second limitation of this study is the duration of the study was two months long and participants were observed completing the task. A third limitation of this study is participants were given 4 opportunities to participate in the study but both participants refused to participate due to being in a combined classroom. The study was then paused for two weeks due to staffing issues on campus related to the COVID-19 crisis, resulting in combined classes.

CONCLUSIONS, SUMMARY OR RECOMMENDATIONS

In a majority of the articles, researchers found that participants had an increase in performance relating to the desired skill the student was being taught. The increase in performance was related to the task being taught through video modeling. More research needs to be done with the implementation of video modeling being the sole evidence based practice in order to evaluate the effectiveness of video modeling with an educational setting.

More research is needed related to the effectiveness of solely implementing video modeling with the intention to teach new skills pertaining to physical education. More research needs to be done related to the effectiveness of video modeling on participants with DS across subject areas as there is currently little research. Current findings reveal that video modeling has been paired with other instructional strategies and its effectiveness in educating participants with disabilities is inconclusive. Although these research articles found that video modeling and prompting helped a participants performance and their skill acquisition, it was often paired with another evidence based practice which limits the true effectiveness of a sole intervention, video modeling.

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