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Melaina Valdez

Cal Poly Humboldt, valdezmelaina@gmail.com

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The Impact of a Teacher-Developed Physical Fitness Program on the Self-Perception and Basketball Skills of Two High School Students

Melaina A. Valdez, David Adams PhD, Chris Hopper, PhD, Rock Braithwaite, PhD



Abstract

This study had two purposes. The first purpose was to determine the impact of a teacher-developed physical fitness program on the performance of specific participant goals for the game of basketball. The second purpose was to determine the impact of this same program on the overall perception of the participants amongst their peers when participating in the game of basketball. The participants in this study included two high school males. Participant 1 had diagnosis of attention deficit hyperactivity disorder (ADHD) and was provided services through a 504 plan. Participant 2 was a typically developing student. Both participants had previous experience playing the game of basketball. This study occurred over a 5-week period with a pre and post assessments occurring in the 1st and 5th week. Additionally, participants completed a survey prior to the study taking place and on the last day. A qualitative analysis as well as descriptive statistics were used to analyze the data from the survey and demonstrate a change in behavior. The results of this study indicated that both participants improved in the basketball skill areas of standing vertical jump, standing long jump, 15m shuttle run, and squat jump repetitions. Participant 1 demonstrated a greater improvement in the areas of the 15m shuttle run, jump squat repetitions, and showed increases in self-perception related to their participation in fitness program and the game of basketball. Future researchers should expand on the number of participants and length of the intervention to determine the impact of a teacher developed fitness program for the game of basketball and self-perception of students with and without disabilities.

Introduction

Physical education and high school sports aim to motivate students to reach their highest levels of academic and sport performance (SHAPE America, 2021). Physical activity has been reported to positively impact self-efficacy, self-esteem, self-confidence, and self-concept in adolescence (McIntyre et al., 2015; Stein et al., 2007). Various forms of physical activity, including anaerobic, aerobic, and muscular strength exercise can positively influence self-perception and motivation; thus increasing engagement levels in physical activity for adolescence students (Daley, 2002; McIntyre et al., 2015). ADHD is a neurodevelopmental disorder that manifests itself in symptoms, such as inattention (Daley, 2002; McIntyre et al., 2015), ADHD is a neurodevelopmental disorder that manifests itself in symptoms, such as inattention to 18 years with boys being diagnosed three time more often than girls (Suarez-Manzano et al., 2018). Children with ADHD often reach adolescence suffering from poor self-concept, self-esteem, and self-confidence (Litner, 2003; Welsch et al., 2021). Self-Determination Theory (SDT) emphasizes support of the basic psychological needs of autonomy, competence, and relatedness to enhance intrinsic motivation and healthy development (Ryan & Deci, 2020). Researchers have suggested exercise or successful fitness programs have positive benefits on participants' psychological health including self-esteem and self-concept (Lubans et al., 2010; McIntyre et al., 2015).

Individuals with ADHD and Physical Activity

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder that may result in deficits in cognition and behavior (Litner, 2003; Suarez-Manzano et al., 2018; Welsch et al., 2021). Due to difficulties staying on task or inattentive behaviors, children with ADHD have additionally performed at lower levels academically when compared to their typically developing peers (DuPaul & Langberg, 2015). Physical activity has shown to have benefits on cognition and behavior of youth and adolescence with ADHD (Suarez-Manzano et al., 2018; Welsch et al., 2021). Additionally, individuals who participate in extra-curricular activities and exercise programs often display self-perceptions and sports competence (Daley, 2002).

Self-perception

Ryan and Deci (2020) stated that autonomy aids in improvements of intrinsic motivation and self-perception. For students with ADHD these opportunities for autonomy can directly benefit this population as the child is directly involved in decision making processes (Litner, 2003). Understanding and improving self-perception has been increasingly valued across educational, clinical, and health-related communities and programs (Ferreira & Fox, 2008). Perception of physical competence is an important predictor of participation, effort, and long-term interest in sport (Daley, 2002; Stein et al., 2007). Anaerobic, aerobic, and muscular strength engagement in adolescence can positively influence their self-perception and motivation in physical activity (Daley, 2002; McIntyre et al., 2015). Therefore, students in the high school setting may benefit from participation in physical activity outside of the educational setting (McIntyre et al., 2015).

Self-Determination Theory

SDT has been used by researchers to increase physical activity and promote healthy lifestyles (Edmunds et al., 2008; Fortier et al., 2012; Gillison et al., 2006; Silva et al., 2010; Teixeira et al., 2012). SDT has supported weight management (Silva et al., 2010) while also demonstrating positive results on exercise behaviors and quality of life (Gillison et al., 2006), physical activity promotion (Fortier et al., 2012), as well as motivational factors (Ryan & Deci, 2020; Teixeira et al., 2012). When motivation is internalized, researchers have reported individuals to be more autonomous or self-determined to engage in a related behavior (Edmunds et al., 2008; Fortier et al., 2012; Gillison et al., 2006; Silva et al., 2010; Teixeira et al., 2012). Deci and Ryan (2020) in their description of SDT indicate that factors of self-perception (e.g. confidence, self-esteem, and mental health) are deeply affected by school's support of basic psychological needs (e.g. autonomy, relatedness, competence). Further, McIntyre (2015) reported exercise programs focused on enjoyment, personal goals and achievements produced greater improvements in self-perception than those focused on extrinsic factor. Furthermore, researchers believe that improvements in self-perception of adolescence can be enhanced through successful fitness programs (Daley, 2002; Lubans et al., 2010; McIntyre et al., 2015) related fitness skills in high school athletes are to be achieved, a quality and feasible physical fitness program will most likely promote these changes.

Requirements for Performance

Successful basketball players will need to be able to perform a variety of movements (e.g., jumping, agility) throughout a game and researchers have reported these skills can be improved over time (Asadi, 2013; Klinzing, 1991). Muscular power is when an individual uses maximum strength levels in short spurts of time. To improve maximum strength performance in jumping and agility skills basketball programs should include exercises that include repeated muscular power and explosive strength (e.g. weightlifting; Asadi, 2013; Klinzing, 1991; Otto et al., 2012) and plyometric movements.

Purpose Statement/Hypothesis

This study has two purposes: (a) to determine the effect of a teacher-developed physical fitness program on the performance of specific participant goals for the game of basketball and (b) to determine the impact of this same program on the overall perception of the participants amongst their peers when participating in the game of basketball. The researchers believe that the physical fitness program will have a positive impact on the students' performance of the specific basketball skills. Additionally, the researchers believe the teacher-developed physical fitness program will have a positive impact on the participant's perception of themselves when participating in the game of basketball.

Methods

Participants

The participants in this study were two males between 16 and 17 years of age. Both participants attended the same high school in Northern California and were enrolled in a high school fitness and conditioning physical education course. Participant 1 for this study had a previous diagnosis of ADHD and received accommodations which included: (a) access to exercise breaks, (b) access to a core support course, (c) use of quiet study area for assignment and tests, (d) preferential seating near a positive peer, (e) assistance with organizational skills, and (f) access to notes for tests. Participant 1 reported having difficulty focusing for longer periods of time. Participant 1 had previously participated in 5 years of organized basketball at both the middle school and high school grade levels. Participant 2 is a typically developing peer who has participated in 10 years of organized basketball at the elementary, middle school, and high school grade levels. It should be noted that both participants played together during their 8-grade year, as well as the freshman and junior varsity basketball teams at their high school.

Instruments and Setting

This study included multiple measurement instruments. Additionally, each participant completed a self-perception survey developed by the research team. This study took place within multiple settings which included the school gym and the school weight room. Both settings provided the opportunity for the participants to test and train with limited interruptions and was within their natural environment.

Vertical Jump. The Vertec vertical jump tester was set up in the gymnasium and set at a height that where the top of the measuring instrument was double their standing reach height.

Standing Long Jump. A measuring tape was placed on an open and long concrete sidewalk on the campus measuring at 180 inches (15 feet). Masking tape was used to tape down the start of the measuring tape, where the top of the masking tape is perpendicular to the zero on the measuring tape. When participants landed, they could use their hands on the ground to stop their momentum but needed to have their feet remain where they landed.

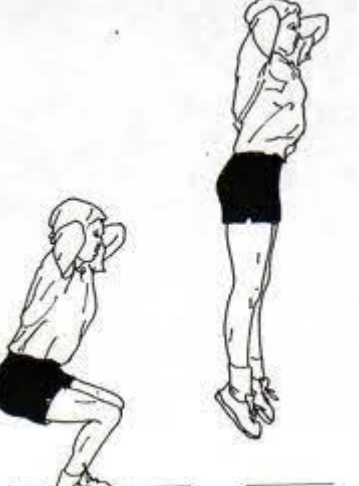
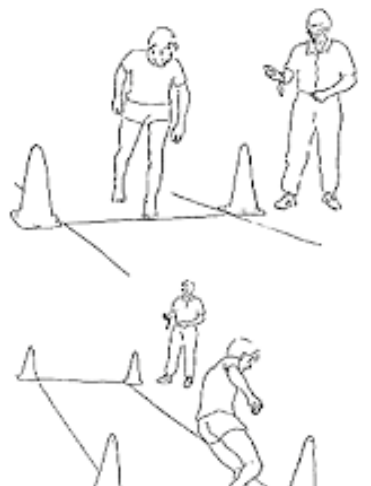
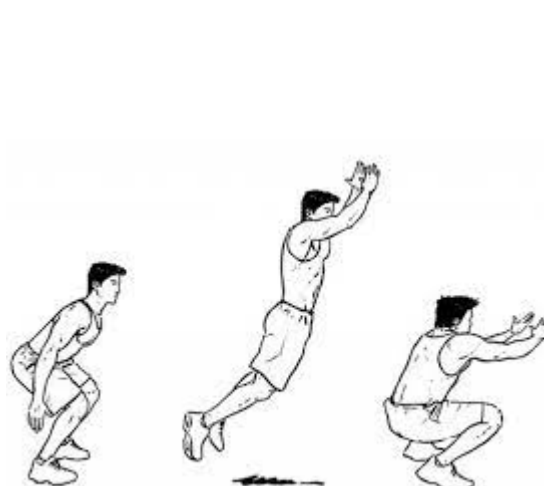
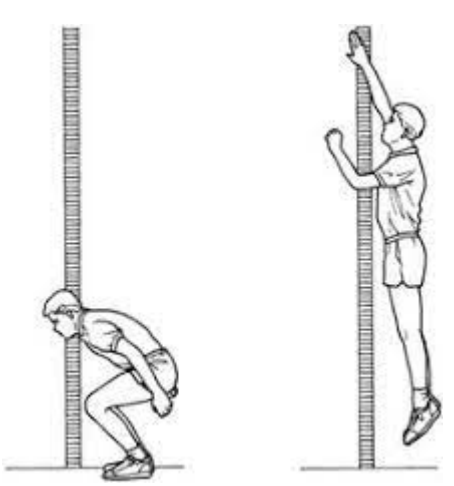
15 Meter Shuttle Run. A measuring tape was used to measure 5 meters on the hardwood inside the gymnasium. Cones were used to signify the start and end of the 5 meters, and 5 meters of masking tape was used perpendicular to the starting cone and ending cone.

Squat Jump Repetitions. A timer in a clock application on a smartphone device was set to one minute. Participants chose the location in the gymnasium to perform the squat jump test. When the participant showed initial movement into their first squat jump, the timer started.

1RM. Standard weightlifting equipment including a squat rack, barbells, weight bench and incline weight bench with safety rack, dumbbells, leg extension machine, and seated leg curl machine were used by participants in reaching their 1 repetition maximum (1RM) in back squat, incline bench press, knee extension, knee curl, forward arm raise, and lateral arm raise.

Baseline

Within the baseline phase, each participant was tested on their standing vertical jump, standing long jump, 15 m shuttle run, and number of jump squats over the course of 1-minute. Additionally, participants completed a self-perception survey that focused on how they perceived their abilities to participate in the open gym basketball time at their school. Researchers collected participants' 1RM for back squat, incline bench press, knee extension, knee curl, forward arm raise, and lateral arm raise used to calculate percentages of weight used during the intervention. All baseline testing took place during the participants normally scheduled physical education class within the first week of this study.



Intervention Phase

The intervention phase of this study replicated two previous studies (Asadi, 2013; Klinzing, 1991) where participants completed specific movements to improve functional power, ground force power, and repetition endurance. The exercises performed for weight training was be based on similar studies (Klinzing, 1991) and exercises, intensity and volume of plyometric training was based on recommendations of (Asadi, 2013). Exercises worked to develop the primary muscle groups used in jumping: glutes, quadriceps, hamstrings, gastrocnemius, soleus, trapezius, deltoids, and back extensors (Klinzing, 1991). Refer to Table 1 for weightlifting schedule and exercises and Table 2 for plyometric training schedule and exercises.

Table 2. Plyometric Training Schedule for Participants During 5-Week Intervention		
	Monday	Wednesday
Sets/Reps	3 x 15	3 x 15
Exercises	Depth box jump Double leg bounding Forward vertical jump Side vertical jump Backward vertical jump	Depth box jump Double leg bounding Forward vertical jump Side vertical jump Backward vertical jump
Note. Participants will be performing each exercise listed for 15 repetitions and a total of 3 sets.		

Table 1.					
5-Week Weightlifting Training Schedule for Participants					
	Week 1	Week 2	Week 3	Week 4	Week 5
Tuesday	2 x 8-10 65% 1RM	2 x 6-8 85% 1RM	2 x 8-10 75% 1RM	2x8-10 65% 1RM	2 x 6-8 85% 1RM
Exercises	Incline bench press, forward arm raise, back extension, knee extension, core				
Thursday	2 x 8-10 65% 1RM	2 x 6-8 85% 1RM	2 x 8-10 75% 1RM	2x8-10 65% 1RM	2 x 6-8 85% 1RM
Exercises	Back squat, knee curl, lateral arm raise, toe raises, core				
Note. 1RM = one repetition maximum.					

Self-perception survey. After the intervention, participants took a 16-question survey based on self-perception after the intervention was complete. Questions focused on how the participants' perceived themselves when participating in basketball and fitness after the implementation of the intervention.

Basketball skills. Within the Post-intervention phase, each participant was tested on their standing vertical jump (Vertec), standing long jump, 15 m shuttle run, and number of jump squats over the course of 1-minute. Additionally, qualitative data was collected via a 3-question survey completed by the primary physical education teacher at the end of the study.

Research Design

The relationships between fitness programs and self-esteem are well established (Lubans et al., 2010; McIntyre et al., 2015). Similarly, effective fitness program that include weightlifting and plyometric training components have been shown to increase jump ability in basketball athletes (Adams et al., 1992; Arabatzis et al., 2010; Klinzing, 1991). However, less is known about the effects of a teacher-developed physical fitness program on jump ability and self-perception of high school students. To investigate this, researchers conducted an experimental research study to determine the effects of a teacher-developed physical fitness program on basketball skills and self-perception of two high school athletes.

Social Validity

Social validity refers to independent variables (IVs) functional relevance to socially important outcomes and is enhanced by dependent variables with high social importance, IVs applied with fidelity by typical intervention agents (e.g. teachers, parents) in typical contexts across meaningful periods of time, and typical intervention agents report the procedures to be acceptable, feasible within available resources, effective, and choose to continue the use of the intervention procedures after formal support is removed (Horner et al., 2005). The participants' primary physical education teacher completed a 3-question survey based on the quality and validity of the intervention via a link to the Qualtrics survey through their teacher email. Questions focused on the appropriateness of the intervention, possible changes to the fitness program or intervention, and possible use or the same or similar program for future students with and without disabilities.

Results

Basketball skill focus areas of standing vertical jump, standing long jump, 15m shuttle run, and squat jump repetitions were compared between baseline scores and post-intervention scores. Participant self-perception was reported qualitatively.

Participants

Basketball skills Participant 1 showed increases in standing vertical jump, standing long jump, 15m shuttle run, and squat jump repetitions over 1-minute. The standing vertical jump score increased by 1.5 inches from 35 inches (baseline) to 36.5 inches (post-intervention). The standing long jump distance increased by 3 inches from 98 inches (baseline) to 101 inches (post-intervention). The 15m shuttle run decreased in time by 0.39 seconds from 4.13 seconds (baseline) to 3.74 seconds (post-intervention), and squat jump repetitions over 1-minute increased by 12 from 44 (baseline) to 56 (post-intervention). Participant 2 showed increases in standing vertical jump, standing long jump, 15m shuttle run, and squat jump repetitions over 1-minute. The standing vertical jump score increased by 4 inches from 29 inches (baseline) to 33 inches (post-intervention). The standing long jump distance increased by 11 inches from 91 inches (baseline) to 102 inches (post-intervention). The 15m shuttle run decreased in time by 0.06 seconds from 4.05 seconds (baseline) to 3.99 seconds (post-intervention), and squat jump repetitions over 1-minute increased by 8 from 40 (baseline) to 48 (post-intervention).

Table 4. Descriptive statistics of change in behavior across major focus areas

	Vertical Jump		Long Jump		15m Shuttle run		Squat Jump	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
P1	35in	36.5in	98in	101in	4.13sec	3.74sec	44	56
P2	29in	33in	91in	102in	4.05sec	3.99sec	40	48

Note. P1= Participant 1, P2= Participant 2, in= inches, sec= seconds

Self-perception

When asked what each participant enjoyed most about playing basketball Participant 1 prior to the intervention reported that he enjoyed the aspect of "teamwork" as opposed to Participant 2 who reported "playing with the team." After the intervention Participant 1 reported "playing with the team" as opposed to Participant 2 who reported being successful in individual skills within the game. When asked how many days per week participants played basketball with a friend Participant 1 prior to the intervention reported playing 1-2 days as opposed to Participant 2 who reported playing 3-4 days. After the intervention Participant 1 reported 4-5 days per week as opposed to Participant 2 who reported playing with a friend every day. When asked how many days per week participants played basketball on their own Participant 1 prior to the intervention reported playing 1-2 days as opposed to Participant 2 who reported 3-4 days. After the intervention Participant 1 reported 1-2 days while Participant 2 reported 4-5 days. When asked how many days per week each participant lifted weights Participant 1 prior to the intervention reported 1-2 days as opposed to Participant 2 who reported 3-4 days. After the intervention Participant 1 reported 3-4 days as opposed to Participant 2 who reported 4-5 days. When asked what each participants lifts focused on both participants prior to the intervention reported lifts being a combination of upper body, lower body, and core. After the intervention Participant 1 reported lifts being lower body as opposed to Participant 2 who reported a combination of upper body, lower body, and core.

When asked what each participants best skills were in the game of basketball Participant 1 prior to the intervention reported his best skills being defending and teamwork as opposed to Participant 2 who reported shooting, dribbling, passing, and teamwork. After the intervention Participant 1 reported shooting, defending, and teamwork while Participant 2 reported shooting, dribbling, and passing. When asked what skills each participant wanted to improve Participant 1 prior to the intervention reported shooting, dribbling, and passing as opposed to Participant 2 who reported defending. After the intervention Participant 1 reported shooting while Participant 2 reported defending. When asked what level of success each participant had when playing basketball with peers Participant 1 prior to the intervention reported being pretty good as opposed to Participant 2 who reported being very successful. After the intervention both participants' answers remained the same. When asked what level of fitness each participant had compared to their peers while playing the game of basketball Participant 1 prior to the intervention reported being as good as other as opposed to Participant 2 who reported being in their best shape. After the intervention both participants reported being in their best shape. When asked to rate how confident participants were in building an exercise plan appropriate for the areas they want to improve in, Participant 1 prior to the intervention reported "average" as opposed to Participant 2 who reported "not confident at all". After the intervention Participant 1 reported "confident" while Participant 2 reported "average." When asked to how confident participants were in their ability to perform the same movements as their peers, Participant 1 prior to the intervention reported "confident" as opposed to Participant 2 who reported "average". After the intervention both participants' answers remained the same. When asked how each participant viewed working out with weight in the gym to obtain their goals for basketball both participants prior to the intervention reported it being moderately important. After the intervention Participant 1 reported it being extremely important while Participant 2 reported it being very important. When asked how each participant viewed working out through playing basketball on their own to achieve their goals, Participant 1 prior to the intervention reported it being very important as opposed to Participant 2 who reported it being extremely important. After the intervention both participants' answers remained the same. When asked how each participant viewed working out through playing basketball with their peers to achieve their goals, Participant 1 prior to the intervention reported it being moderately important as opposed to Participant 2 who reported it being extremely important. After the intervention Participant 1 reported it being extremely important while Participant 2 reported it being moderately important.

When asked what each participants' level of optimism was about starting an individualized exercise program based on their identified goals, Participant 1 prior to the intervention reported feeling excited as opposed to Participant 2 who reported feeling average. After the intervention, when asked how confident each participant was in their ability to build a program for themselves for the game of basketball having experienced an individualized exercise program, Participant 1 reported being very confident while Participant 2 reported being confident. When asked to rate each participants' ability to complete some workouts without an instructor present Participant 1 prior to the intervention reported "high" as opposed to Participant 2 who reported "very high." After the intervention Participant 1 reported "very high" while Participant 2 reported "high".

Discussion

There were two purposes within this study: (a) to determine the effect of a teacher-developed physical fitness program on the performance of specific participant goals for the game of basketball, and (b) to determine the impact of this same program on the overall perception of the participants amongst their peers when participating in the game of basketball. The researcher hypothesized that improvements to basketball related fitness skills and self-perception of high school athletes can be achieved through a quality and feasible physical fitness program. The results of this study indicated that both participants improved in the basketball skill areas of standing vertical jump, standing long jump, 15m shuttle run, and squat jump repetitions. Participant 1 had a larger improvement in the areas of the 15m shuttle run and jump squat repetition while Participant 2 showed larger improvements in the standing vertical jump and standing long jump. Further, both participants demonstrated increases in self-perception related to their participation in fitness and the game of basketball, where Participant 1 reported a greater overall increase in self-perception when compared to Participant 2. Study results align with previous studies (Adams et al., 1992; Arabatzis et al., 2010; Asadi, 2013; de Villarreal et al., 2009; Klinzing, 1991; Otto et al., 2012; Sáez de Villarreal et al., 2021), showing that weightlifting and plyometric fitness programs can significantly increase vertical jump ability. The intervention in this study replicated and combined two previous studies that independently focused on weightlifting (Klinzing, 1991) and plyometrics (Asadi, 2013) to improve power and agility performance in young male basketball players. In a study designed to examine the effect of a six-week squat, plyometric, and squat-plyometric training on power production, researchers found that the combined squat-plyometric training increased power production, as measured by the vertical jump, significantly more than the separate squat or plyometrics training programs (Adams et al., 1992). These results align with the results of the current study as participants increased their vertical jump height after combined weightlifting-plyometric training. In one study aimed to determine whether change in physical activity levels impacts adolescents' self-perceptions, researchers found that increase in physical activity was positively associated with changes in social and athletic self-perceptions (Stein et al., 2007). In this study, researchers found that the fitness program aimed to help participants achieve their goal of increasing their vertical jump and basketball skills also had a positive impact on participants' self-perception when playing the game of basketball.

Future Research

Limitations in the study include a portion of the intervention where participants were expected to complete fitness program on their own without the oversight of the primary researcher. Additionally, Participant 1 missed a total of 4 sessions within the intervention phase. Moreover, participation in open gym basketball practices, could have interfered with the results of this study due to the nature of the experimental design. Finally, results of this study should be looked at with caution as a limited sample of two students (one typical developing, one with ADHD) as well as a shortened duration of the study due to school holidays and ending of semester. For these reasons future researchers looking to expand on this study by increasing the number of participants, length of duration of the study, and the control of participants behaviors outside the study.

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