UNIVERSITY OF CALIFORNIA,
IRVINE

A Functional Cross-Training Approach to Enhance Strength, Cardiovascular Function, and Movement Execution of Contemporary Floorwork in Collegiate Dancers

THESIS

submitted in partial satisfaction of the requirements
for the degree of

MASTER OF ARTS

in Dance

by

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2023

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ACKNOWLEDGEMENTS

First and foremost, I would like to express my deepest gratitude to Dr. Kelli Sharp, my thesis chair, for her unwavering support, patience, and encouragement throughout this project. Her guidance and persistence have been instrumental in making this thesis research possible, and I am forever inspired by her remarkable leadership, enthusiasm, and honesty.

I am also grateful to my thesis committee, Dr. Lisa Naugle and Charlotte Griffin, for their valuable insights and suggestions that have contributed significantly to the advancement of this research.

Many thanks to the dance faculty and students at the Claire Trevor School of the Arts. Additionally, I extend my thanks to the global community of researchers, publishing professionals, and instructors in exercise science, sports medicine, and dance science, whose contributions have served as the foundational pillars of this work.

I would like to acknowledge Tariq for his consistent guidance and patience in aiding me during the writing process.

Thank you to the research study participants; this would not have been possible without your enthusiasm and willingness to participate and be on this journey with me.

My deepest appreciation goes out to my friends, colleagues, teachers, and clients, who have supported me throughout this entire process. Garrett O'Toole, Coco Croft, Jeevika Bhat, Joey Navarrete-Medina, Angela Rosenkrans, Shauna Merideth, and Kristen Daley, in particular, have provided invaluable encouragement, grounding, and inspiration, and I am grateful for their stimulating conversations and unwavering support.

Finally, I owe a debt of gratitude to my family, whose unconditional love, care, and inspiration have made my pursuit of graduate studies in dance possible. Without their support, I would not have been able to make it through this time, and I am forever thankful for the opportunity to pursue my academic goals.

ABSTRACT OF THE THESIS

A Functional Cross-Training Approach to Enhance Strength, Cardiovascular Function, and Movement Execution of Contemporary Floorwork in Collegiate Dancers

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Master of Arts in Dance

University of California, Irvine, 2023

Associate Professor Kelli Sharp, Chair

The incorporation of appropriate cross-training methods is essential for the overall fitness, injury prevention, and peak performance readiness of dancers. However, such methods are not frequently taught or integrated into dancers' training. This study aimed to enhance UCI dance majors' strength, cardiovascular function, and improve their execution of contemporary floorwork movements, and provide a launchpad for better understanding the importance of supplementary weight training and aerobic capacity by employing functional cross-training techniques. The primary purpose of this experiment was to evaluate the effects of supplementary weight and cardiovascular training on strength, speed, balance, power, and cardiovascular recovery time in pre-professional dancers. This study provided an opportunity for dancers to gain insights into the field of exercise science and training for 8-weeks, including personalized programming tailored towards the development of their dancing and targeted at their current weaknesses. The 8-week study was divided into two 4-week blocks, each consisting of three one-hour training sessions per week. Each 4-week block had specific goals and followed consistent movement patterns. Pre-, mid-, and post-study tests were used to evaluate aerobic fitness, trunk stability, upper- and lower-body strength, balance, and advanced floorwork movements. The outcome measures aimed to assess the participant's overall strength, speed, balance, endurance, and recovery capabilities. The data revealed that both supplementary weight training and aerobic training can improve the strength, endurance, and movement quality of contemporary floorwork techniques. This pilot study provided the groundwork for integrating functional cross-training into dancers' regular training regimes. It will serve as a catalyst for further research to improve the overall health and well-being of dancers. Future studies are

recommended to expand the sample size and implement more stringent controls in order to make more definitive conclusions, using the framework of this study as a guide.

INTRODUCTION

Dancers frequently face a notable discrepancy in their training when it comes to effectively addressing the domains of strength and cardiovascular endurance. While their artistic training emphasizes technique, flexibility, creativity? and artistic expression, these programs may not adequately prioritize building muscular strength and cardiovascular fitness. As a result, dancers may benefit from supplementary training that specifically targets these areas, enabling them to meet the physical demands of their performances while reducing the risk of injury and preventing boredom or a plateau of progress. By incorporating exercises and routines that focus on muscular development and cardiorespiratory conditioning, dancers can enhance their overall physical abilities and ensure a well-rounded approach to their training regimen.

This study was conducted by the principal investigator, who possesses a decade of extensive experience in training individuals within the health and fitness industry and holds qualifying certificates that endorse expertise in promoting health and wellness. Furthermore, as an interdisciplinary educator, the principal investigator has dedicated their efforts to dance training throughout their collegiate journey. To ensure the effectiveness and safety of this study, advisor Dr. Kelli Sharp holds relevant degrees and certifications in this field and provided valuable mentorship throughout the research process. Dr. Sharp's guidance and expertise were instrumental in guaranteeing the successful execution of this study. It is essential to emphasize that the execution of this study should only be undertaken by qualified researchers specializing in the field of fitness and exercise.

This research study is comprised of two main elements: 1) an evidence-based investigation into the impacts of a functional cross-training approach encompassing supplementary weight training and cardiovascular endurance training on pre-professional dancers, and 2) a creative body of work that synthesized the findings acquired from this study. This study examined the impact of an 8-week functional cross-training experiment on the development of seven UCI dance majors, focusing on their advancement in contemporary floorwork—a dance style that utilizes extreme physicality and acrobatic movements. The study gathered and evaluated data from five outcome measures to assess the effects. Subsequently, the findings of this experiment were translated into an artistic performance that showcased the participants' progress. By leveraging existing scholarship in the field, this study sought to equip

dancers and dance educators with a comprehensive, holistic approach to cross-training that fosters a sustainable practice and furnishes them with the expertise needed to achieve artistic goals and performance-ready outcomes.

This 8-week study was conducted in two 4-week blocks, with three one-hour training sessions per week. Pre-, mid-, and post-study tests were employed to assess various aspects of the outcome measures, such as aerobic fitness, trunk stability, upper- and lower-body strength, and advanced floorwork movements. The data showed that this program led to improvements in strength, endurance, and movement quality of contemporary floorwork. However, participants also reported notable improvements in their technique in other dance genres, such as ballet. These findings were reflected in the participants' ability to execute demanding floorwork and partnering movements for an extended duration of time, showcasing improved stamina, technical proficiency, and enriched artistry.

This study contributes to the field of dance science by addressing a prevalent training gap in the collegiate dance community (Angioi et al., 2009). It acknowledges the discrepancy between the artistic focus of dance training, which emphasizes technique, creativity, and expression, and the limited attention given to building muscular strength and cardiovascular endurance. This type of holistic training encompasses a comprehensive approach to the development of dancers. Rather than focusing solely on isolated aspects of dance, this training paradigm took into consideration multiple dimensions of dancers' abilities and well-being and recognized the interconnectedness of different physical and artistic aspects of dance. Compared to other cross-training methods, the unique aspect of this approach lies in its comprehensive focus on all elements relevant to dancers' performance, including general fitness and movements specific to their skills. By adopting this methodology, dancers can improve their overall well-being and strength while also achieving specific goals related to floorwork movements. This training methodology also equips dancers with the necessary tools to independently navigate through workouts without the presence of an athletic trainer. The findings of this study advocate for a paradigm shift in dance pedagogy, encouraging educators and curriculum designers to prioritize the holistic development of dancers by integrating cross-training principles into their instructional frameworks. Building upon these insights, the study's findings also suggest implications for future research endeavors, emphasizing the importance of expanding sample sizes and increasing the duration of the training period.

CHAPTER ONE

THE APPLICABILITY OF CROSS-TRAINING IN DANCE

For elite athletes, sport-specific training has historically led to the greatest improvements in technique and skills (Godfrey, 1998). However, cross-training has also been widely adopted by athletes for centuries to improve physical fitness and optimize peak performance (Godfrey, 1998). Indeed, cross-training has been proven to be an effective way to intensify training while reducing the risk of injury (Koutedakis et al., 2004 & Rafferty, 2010). It is also often used to rehabilitate and maintain fitness during the off-season or recover from an injury (Faulkner, 2020). This body of work will examine the impact of an 8-week cross-training intervention program in the weekly training regimen of pre-professional dancers. By drawing on existing scholarship, this study also aims to identify gaps or shortcomings in a current university dance curriculum.

Definition of Cross-Training

Although there are variations in how scholars across disciplines define cross-training, they generally share the common belief that it involves integrating a diverse range of exercises into a single program to enhance overall fitness, lower the risk of injuries, and prevent monotony and exhaustion (Baz-Valle et al., 2019; Feito, et al., 2018; Tanaka, 1994; Shea, 1991; Godfrey, 1998; Godfrey & Whyte, 2006). Baz-Valle (2019) defines cross-training as the process of training for one or more athletic endeavors by engaging in exercises that simulate the specific movements and physical demands of that endeavor while also engaging in complementary exercises that improve overall fitness. Feito (2018) referres to cross-training as a method of training that involves incorporating multiple modes of exercise into a single program to prevent boredom and burnout. Tanka and Shea (1994 & 1991) describe cross-training as a training approach that incorporates a variety of different activities to improve overall fitness and performance, reduce injury risk, and provide a varied and exciting exercise experience. Godfrey (2010) describes cross-training as a type of exercise program that involves engaging in various activities that challenge different muscle groups and systems in the body. Godfrey and Whyte (2006) define cross-training as an approach to physical fitness that involves engaging in various aerobic and resistance exercises to improve cardiovascular health. And dance scholars Pepito and Liu (2022) refer to cross-training as any form of fitness that differs from sport-specific training. In this study, cross-training is

defined as a regimen that combines diverse strength and cardiovascular exercises into one program to improve overall fitness, mitigate injury risks, and prevent boredom and fatigue.

In the world of sports, cross-training has been defined as either “dissimilar mode,” which refers to training that is an alternative to sport-specific, or “similar mode,” which refers to sport-specific training (Godfrey, 1998). The Specificity Principle states that training should closely mimic the demands of the sport in terms of energy systems and muscle groups used, as well as the force, speed, range, frequency, and duration of movement (O’shea, 1990). However, sport-specific training alone may not lead to peak performance (Major, 1996). Most Olympic athletes typically train using exercises that do not directly resemble the specific skills required for their sport (Major, 1996). Instead, cross-training should involve a range of training modalities that address multiple physiological variables (O’shea,1990). Cross-training involves “crossing over” multiple disciplines and should address all aspects of fitness, including endurance, strength, power, agility, speed, and fine motor skills (Liu et al., 2022). It is essentially a way to introduce variability into training. Variability is crucial as it helps to prevent plateaus, reduce injury risk, and promote overall fitness gains (Fisher et al., 2018).

Dance as an Artistic Sport

Dancing is a combination of athletic fitness and artistic expression. While it is not typically considered a sport in sports literature, dancers have similar physical demands as athletes in other sports, such as strength, endurance, metabolic efficiency, speed, coordination, balance, and mental preparedness. Just as with different sports, each genre of dance requires unique training methods tailored to meet its specific demands and requirements. (Faulkner, 2020). For instance, dance performance, in contrast to dance technique classes, places significant physical demands on dancers and requires a unique combination of physical fitness, physiological conditioning, and technical expertise to execute choreography effectively (Rafferty, 2010). Although dance requires extreme physicality and rigorous athleticism, there is often a focus on tradition and form, which places more emphasis on appearance than on the anatomy and muscular requirements necessary for optimal performance. In contrast, sport training programs are scientifically designed to achieve specific performance outcomes, utilizing the energy systems specific to the sport and resulting in overall physical preparedness (Faulkner, 2020).

Technique Classes vs. Cross-Training

Dance requires high-intensity and intermittent efforts that engage both the aerobic and anaerobic energy systems. Studies have found that the heart rate and maximal oxygen uptake are significantly higher during performances compared to classes or rehearsals, raising concerns about the effectiveness of technique classes in preparing dancers for performances (Cohen, 1984). Although technique classes prioritize coordination and exercises that improve muscular endurance and flexibility (though this may vary depending on the teacher), the standard duration and intensity of such classes may not be sufficient to fully address all the conditioning requirements (Erkert, 2003). Ekert believes the purpose of a technique class is to establish pathways that promote effective movement, and it is not feasible to address all aspects of physical fitness. The availability of space, the number of students, and time constraints for teaching and correcting movements can affect the pace of a technique class. As a result, it is recommended to supplement daily technique classes with additional strength and conditioning work in order to attain efficient and optimal development of dance skills and endurance (Rafferty, 2010).

Sport-Specific vs. Functional Training Approaches

When examining whether a functional cross-training approach can improve pre-professional dancers' strength, balance, and cardiovascular function, it is crucial to understand the various methods used in sports training and dance, including ‘sports-specific’ and ‘general’ or ‘functional’ training.

The meaning of “specificity of exercise components” varies widely in different research studies. Many studies use the term “sports-specific” to refer to exercises that develop general physical abilities, such as balance, core stability, or power (Mugele et al., 2018). In this study, the term ‘sport-specific’ training refers to exercises or movements that imitate the actions performed in dance technique classes or choreography. This can be seen in cross-training techniques such as yoga and Pilates (Kloubec, 2016 & Zaferiroudi, 2021).

Functional cross-training is a training method that combines exercises and movements from different disciplines and training styles to improve overall functional fitness and sports performance. It integrates a range of physical activities, including strength training, cardiovascular exercises, mobility drills, and sport-specific movements, into a unified training program. The "functional" aspect of this approach pertains to exercises and movements that imitate or enhance actions that the athlete is trying to

improve. Its objective is to bolster overall physical abilities and performance by simultaneously targeting multiple muscle groups and specific movement patterns (Mugele et al., 2018).

For a long time, a formal dance class has been considered the foundation of dance training, as it offers instruction in the technical, physical, and aesthetic aspects of dance (Wyon, 2002). Despite the importance of dance technique classes, research suggests that simply performing dance may not provide sufficient stimuli for achieving significant fitness improvements or help to reach an optimal level of physical preparedness for performance. In fact, studies have shown that professional dancers may have similar fitness levels to sedentary individuals of similar age (Koutedakis et al., 2004). This raises the question: Which type of training is more effective for both athletes and dancers - specific, functional, or a combination of the two?

Like dancers, gymnasts are recognized as artistic athletes who aim to perform movements with a combination of strength, power, and grace. Considering the training of a professional gymnast, coach and author James Major writes, “Consistent, special strength training is necessary for maximum performance in gymnastics,” and gymnastics training alone is insufficient to build or maintain the necessary level of strength for advanced gymnastics skills (1996). Strongly supporting in-season training for enhanced athletic performance, Major contends that solely adhering to the principle of specificity, which emphasizes training that closely resembles the sport, neglects functional training essential for building the strength and power required to execute advanced technical maneuvers at a high level (1996). Major asks questions like, “If the most specific training for a swimmer is swimming, why has it been clearly demonstrated, over many years, by many coaches and athletes, that swimmers get better faster if they also lift weights?” And “If the most specific form of training for a gymnast is gymnastics, why has experience shown the value of dedicated strength and conditioning exercises?” (Major, 1996). It appears that the idea of sport-specific training being the most effective method for improving performance may not always align with what has been found to be effective in practice. There may be contradictions or discrepancies between this concept of specificity and what has been demonstrated to produce the best results. For this reason, it is vital to consider the various cross-training methods used in dance currently and determine which form of training is most effective in producing peak performance while enhancing injury prevention strategies.

The Importance of Cross-Training for Contemporary Floorwork

Dance includes many styles that have their own specific techniques and varying training regimens. Some genres, such as ballet, tap, and jazz, are predominantly upright and vertical, while others, such as breakdancing and some forms of modern and contemporary dance, involve exploration of the horizontal plane and the use of the floor. This research will focus on (but is not limited to) cross-training methods specifically for contemporary floorwork.

Contemporary Floorwork Defined

Contemporary floorwork is a technique or movement quality within contemporary dance that involves intricate and fluid movements performed on the floor. Scholars define it as a practice in which the entire body is used to create complex movement patterns that often incorporate rolling, sliding, crawling, and partnering work. It is characterized by an emphasis on gravity, fluidity, and the connection between breath and movement (Rustad, 2019). Contemporary floorwork is often used as a tool for choreographic exploration and expression, and it can be incorporated into various styles of contemporary dance as well as other dance forms. While there are no specific definitions for “floorwork dance,” the term floorwork generally refers to a technique or movement quality that can be integrated into various dance and movement practices (Damasco, 2020).

For the purposes of this study, the lead researcher personally defines contemporary floorwork as: A merge of acquired techniques that utilize breath work, core engagement, gravity and momentum, sufficient upper body strength, and explosive actions derived from the pelvis. This style uses efficient movements that enable dancers to yield to the floor using their own body weight while simultaneously using their strength to push the floor away in opposition. It requires dancers to maneuver their bodies with a combination of weaving/threading, creasing/folding, and expanding/collapsing to construct patterns on the floor. Contemporary floorwork incorporates a considerable amount of inversion work where weight is poured into the hands and upper body musculature with various manipulations of the lower body. Contemporary floorwork employs various levels of acrobatics and propelling spirals derived from teachings of flying low technique and soft acrobatics. The primary emphasis of flying low is to explore the body's relationship with the floor, momentum, and energy usage in an efficient manner. The technique aims to cultivate qualities such as speed, agility, fluidity, and grounding. Soft acrobatics is a dance

technique that merges acrobatic elements with the fluid and expressive style of contemporary dance. It entails integrating acrobatic movements and skills into the choreography while emphasizing the importance of graceful, flowing, and controlled execution (Zambrano, n.d.). The term "soft" in soft acrobatics signifies the focus on maintaining elegance and smoothness throughout acrobatic maneuvers (Yudilevitch, n.d.).

Cross-Training for Contemporary Floorwork

Over the years, dance of all genres has seen an increase in athleticism, and as the physical demands of the sport continue to grow, it becomes essential to adopt cross-training into dancers' weekly routines and into dance education (Liu et al., 2022). In some forms of modern and contemporary dance, choreography has begun incorporating movements encompassing acrobatic skills and tricks. Many of these moves are “gymnastics based” and, therefore, require a great deal of muscular strength and power to execute (Liu et al., 2022). Contemporary and floorwork choreography especially challenges dancers to move in new ways that require greater physical ability and endurance. In the professional dance world, it is becoming more important for dancers to be physically fit enough to meet these demands (Rafferty, 2010). This study employs functional approaches to weight training and endurance training in order to meet the demands of contemporary floorwork.

Summary

This chapter presents the rationale and framework for cross-training in athletes and highlights the need for its adoption in the realm of dance as an artistic sport. Cross-training has been proven to be an effective way to improve physical fitness and peak performance for athletes. Viewing dance through the lens of sports science, applying the training techniques used by athletes, and utilizing the medical research that has been done in this area can significantly enhance the fitness training of dancers (Koutedakis et al., 1999). The following chapter discusses the design methods of a functional cross-training approach for pre-professional dancers.

CHAPTER TWO

CONSIDERATIONS FOR DESIGNING A FUNCTIONAL CROSS-TRAINING PROGRAM

To determine the fitness levels of dancers, it is essential to consider fundamental aspects such as aerobic and anaerobic capacity, muscular strength and power, and mobility. When designing this cross-training program, the research team considered the specific dance moves that would be performed and the target outcome measures. The overall program took into consideration which muscle groups needed to be targeted, how to engage them, and specific joints and the ranges they move through. Particular lifts and exercises performed by the participants replicated the speed or stability seen in the contemporary floorwork outcome measures and had similar kinematic patterns and structures (Bompa, 1999).

Specific Programming Methodology

This cross-training programming aimed to create a comprehensive training plan that targeted various aspects of fitness, such as strength, endurance, flexibility, and skill development, while incorporating movement-specific patterns to address specific outcome measures. The programming methodology was based, in part, on scientific evidence in the leading fitness and sports industries but also on the lead researcher's experience in the field. The programming was developed with consideration to key fitness concepts, including cardiovascular endurance or respiratory fitness, aerobic fitness for moderate and sustaining activity, anaerobic fitness for intense and short bursts, power for explosive and fast movements, strength or the capability to generate force, flexibility for joint mobility and range of motion, and neuromuscular coordination for balance, skill, and coordination (Rafferty, 2010). A well-rounded training regimen for dancers should equally emphasize all these main components (Koutedakis et al., 1999). However, a common mistake made by dancers is to prioritize flexibility at the expense of strength and conditioning, leading to weakened and unstable joints (Rafferty, 2010).

When it comes to the allocation of training time in these areas, it is crucial to factor in the amount of time required to see progress and achieve desired results (Rafferty 2010). It is recommended to have a periodized training plan for dancers that considers the combined workload from all their training activities, including class, rehearsal, performance, and supplementary training. Periodized training refers to a structured approach to training that involves breaking down an entire training program into smaller, progressive cycles or periods, which are designed to target specific fitness goals (Bompa, 1999). These

cycles typically vary in intensity, volume, and exercise selection over time to prevent plateaus and optimize performance gains (Bompa, 1999). The cycles can be designed to focus on different aspects of fitness, such as strength, power, endurance, or skill development, depending on the athlete's goals and the demands of their sport or activity (Bompa, 1999). Periodized training is commonly used in sports performance training and can be adapted for various fitness levels and training backgrounds (Bompa,1999). To prevent a decrease in performance due to a lack of consistent training, Clarkson and Skrinar suggest a workout frequency of once or twice a week for maintenance and three or more times a week for improvement (Clarkson & Skrinar, 1988). During this 8-week intervention study, participants had three weekly training sessions with the lead researcher.

To avoid plateaus and allow the body to adapt to training continuously, it is important to increase the intensity and volume of the workouts regularly. This aligns with the principle of progressive overload, which suggests that the body needs to be subjected to progressively increasing demands to generate an appropriate stimulus for improvement (Clarkson & Skrinar 1988). Progressive overload refers to the gradual increase in the amount of stress placed on the body during exercise over time. It is an essential principle of exercise training, which states that in order to continue making improvements in physical fitness, the body must be subjected to increasingly higher levels of stress or demand (Kraemer et al., 2002). This can be achieved through a variety of methods, such as increasing the weight, increasing the number of repetitions performed, increasing the duration or intensity of exercise, or decreasing the amount of rest between sets or exercises (Kraemer et al., 2002). By challenging the body with progressively higher levels of stress, the muscles, bones, and cardiovascular system are forced to adapt and become stronger, more resilient, and more efficient (Kraemer et al., 2002). This runs counter to the practice in many technique classes of maintaining a constant level of intensity and duration day after day (Rafferty, 2010). To achieve progressive overload in this research study, small movement variations, weight increases, repetition increases, varying movement tempo speeds, and decreases in rest periods were introduced into the program.

Consideration for a Cross-Training Program

This intervention study applied the principles of a periodized training plan: a systematic approach to organizing training over a period of time, usually several months to a year, to optimize performance

and prevent injury (Kraemer et al., 2002). This type of training plan involves breaking down the overall training program into specific phases or periods, each with its own goals and objectives. These phases are typically designed to build on each other, with each phase focusing on developing specific aspects of fitness, such as strength, endurance, power, or speed, while allowing for recovery and adaptation. A periodized training plan typically includes a combination of different training methods, including resistance training, cardiovascular training, and sport-specific drills or exercises.

This experiment also utilized the framework presented by Wyon for training sessions, which emphasizes the importance of prioritizing aerobic conditioning to combat fatigue-related injuries and incorporate strength, endurance, and power training (2005). Wyon's training sessions follow a general circuit format, with an intensity level of 60-85% of the individual's maximal oxygen uptake and 70-90% of their maximal heart rate, lasting 20-40 minutes. For V02max development, Wyon also suggests interval training with a 1:1 work-to-rest ratio, with optimal work intervals lasting 3-6 minutes at near maximal effort or 90-95% V02max and 90-95% heart rate max (Wyon, 2005).

The following is a list of considerations this study followed for designing a cross-training program for dance education provided by Pepito and Liu (Pepito et al., 2022):

1. The program should be designed to address dancers' specific needs based on their current strengths and the specific choreographic moves and skills required of them.
2. The movements in the workouts should reoccur regularly so dancers are able to benefit from progression.
3. Do not assume dancers are familiar with the equipment or know how to perform movements properly.
4. A balanced cross-training plan should encompass all fitness components and can be adjusted to target weak areas as needed.
5. Including cross-training in dance education can enhance students' learning and allow them to make the best possible progress.

It should also be noted that a critical component of the program was to incorporate modalities that are not typically found in traditional dance training environments, such as weight training.

Fundamental Components of Fitness

Aerobic and Endurance Training

According to the American College of Sports Medicine (ACSM), aerobic exercise refers to any rhythmic activity that engages large muscle groups and can be sustained over time (Patel et al., 2017). Examples of aerobic exercises include cycling, dancing, hiking, jogging, swimming, and walking. The ACSM defines aerobic capacity as the product of the ability of the cardiorespiratory system to supply oxygen and the ability of the skeletal muscles to use oxygen. This capacity is used to measure the effectiveness of aerobic exercises (Lippincott et al., 2009).

Dance is classified as an intermittent form of exercise that utilizes various metabolic pathways, including aerobic and anaerobic, as well as lactic or alactic systems (Rodrigues-Krause et al., 2015). The energy demands of dance can vary depending on the dance style and the movements' intensity (Rodrigues-Krause et al., 2015). Furthermore, research suggests that the cardiorespiratory demands of dance classes designed for technical skill development are lower than those required during actual dance performances. This indicates a difference between the physical fitness demands of dance training and those of dance performances (Rodrigues-Krause et al., 2015). Studies have shown that dance classes' cardiovascular and respiratory demands are notably lower than those of actual dance performances, particularly in ballet and modern (or contemporary) dance styles (Wyon & Redding, 2005). Given the lower cardiorespiratory demands of dance classes compared to dance performances, it is important for dancers to engage in supplementary fitness training to optimize their technical and artistic performance and reduce the risk of injury. Traditional forms of aerobic and strength training have been suggested to compensate for the lack of conditioning in technique classes (Rodrigues-Krause et al., 2015).

For the purposes of this study, participants engaged in a 20-minute long “Every Minute on The Minute (EMOM) style workout once a week to meet the requirements of aerobic activity and build their stamina (Silva-Grigoletto et al., 2020). This technique was used to maintain a consistent heart rate without ever reaching a state of maximal exertion and to simulate the demands of a longer performance piece in dance (Patel et al., 2017). Participants were instructed to find a pace that was manageable enough to maintain for the entire duration of the 20 minutes. During the initial four weeks of the experiment, the EMOM routine involved four distinct movements, with each movement allotted one minute. The objective was to perform each movement for 45 seconds and rest for 15 seconds, completing

a total of five rounds. In the second phase of the experiment, participants were instructed to aim for continuous movement throughout each minute, allowing for a brief transition time of 5-10 seconds.

Anaerobic and Speed Training

The American College of Sports Medicine (ACSM) has described anaerobic exercise as a form of high-intensity physical activity that is short in duration and relies on energy sources within the contracting muscles without requiring inhaled oxygen as an energy source (Lippincott et al., 2009). Anaerobic endurance refers to the ability to carry out multiple, brief bursts of high-intensity effort at the maximum possible level (Kuliś et al., 2020). Anaerobic exercises mainly involve fast twitch muscles and include activities such as sprinting, powerlifting, and high-intensity interval training (HIIT) (Patel et al., 2017).

As with aerobic exercise, dancers display lower anaerobic levels than other athletes. However, modern dancers tend to have higher anaerobic power outputs compared to ballet dancers. This may be because many modern dancers have a background in athletics. In contrast, classical dancers only show a moderate anaerobic training effect (Koutedakis et al., 2004). Dance class has also been classified as "high-intensity intermittent exercise" (Wyon et al., 2005). However, the type of energy system used during a class depends on several factors, such as the intensity and duration of the activity, as well as the rest period between activities (Wyon et al., 2005). For example, canter combinations offered in dance technique classes involve brief but intense bouts of physical activity that last between 10 to 40 seconds. These short activity periods are separated by longer rest periods that last between 2 to 5 minutes, meeting the requirements for anaerobic exercise (Wyon et al., 2005).

The participants of this study engaged in sprint intervals once a week to activate their fast-twitch muscles and to utilize their maximal oxygen uptake. These intervals were structured to include sufficient rest periods, allowing the participants to recover and perform each interval at 90% or above of their working capacity (Wyon et al., 2005). Participants were instructed to exert maximum effort during the short working periods and try to maintain or improve their pace in subsequent rounds. The movements were chosen to be low-risk but high-reward, ensuring that participants could work at their limits with minimal risk of injury. The high-intensity sprint intervals progressed each week from a 1:1 work-to-rest ratio to a 3:1 work-to-rest ratio, reducing the recovery time and increasing the intensity. This progression

was designed to replicate the demands of high-intensity dance pieces that require dancers to work intensely for short periods of time.

Strength and Power Training

Dancers' physical fitness and physiology are as crucial as their skill development due to the rigorous demands placed on them. Nevertheless, their bone and joint integrity, as well as muscular strength, appear to be negatively impacted by the exclusive focus on dance-only training (Koutedakis et al., 2005). However, research shows that adding strength training to dancers' routines can improve their dance performance and decrease the occurrence of dance-related injuries while still maintaining the essential artistic and aesthetic aspects of dance (Koutedakis et al., 2005).

For over 2,500 years, athletes have incorporated strength training into their preparations. The use of carved stones of various sizes by Greek athletes at the ancient stadium of Olympia, as confirmed by archaeological reports, exemplifies this. In general, strength is defined as the capacity of an athlete to use their muscles to resist external forces or overcome external resistances (Koutedakis et al., 2005).

The stimuli used in strength training for dancers should mimic the mechanics of the specific form of dance (Koutedakis et al., 2005). Overloading, which involves using a training load greater than what the dancer is used to, is a crucial principle in strength training (Bompa, 1999). This principle can be applied to both novice dancers and untrained individuals. At first, it is suggested to engage in multilateral strength training to strengthen and develop all muscle groups for future heavy loads and targeted training. This approach ensures that all muscle groups are trained evenly and prepares the body for more specific, intense training in the future (Rafferty, 2010). Examples of multilateral or multi-joint exercises include squats, deadlifts, lunges, pull-ups, push-ups, and rows. These exercises are often considered to be more functional than isolation exercises, as they mimic the movements used in everyday activities and sports (Reuter 2000).

To increase strength, it is recommended to have three evenly spaced resistance training sessions. However, to maintain the strength gained, one session per week is sufficient (Koutedakis et al., 1999). It has been suggested that an optimal strength training program should involve exercises that simulate the specific plane, direction, and angle in which the skill is performed. By doing so, peripheral

adaptations occur in the muscle fibers that are used in dance, which is advantageous (Koutedakis et al., 2005 & Wyon, 2005).

Throughout the 8-week intervention, participants engaged in a strength element in every session, which took place three times a week. Specifically, on Tuesdays, the focus was on lower body strength exercises, which included squat variations, lunge variations, deadlift variations, and more. On Thursdays, participants engaged in at least two upper body strength exercises, such as overhead pressing variations, rowing variations, weighted push-ups, weighted overhead sit-ups, and more. On Fridays, the focus was on full-body strength exercises, which included burpee deadlifts, devil's press, dumbbell snatches, and dumbbell cleans, as well as fine motor and joint accessory movements like weighted shoulder windmills, plank variations, waiter's carries, banded bird dogs, seated vertical box jumps, banded lat pull-downs, and more. Each exercise was carefully selected to promote overall health and fitness while also targeting specific muscle groups needed for dance-specific movement patterns (Rafferty, 2010 & Koutedakis et al., 2005).

Summary

This research study highlights the importance of considering various aspects of fitness when designing cross-training programs for dancers. Research suggests that a cross-training program should carefully consider the specific dance moves performed and the target outcome measures to inform the design of the program and ensure that it effectively targets the necessary muscle groups and joints. A program design should effectively incorporate key fitness elements, such as aerobic endurance, anaerobic conditioning, and strength training. Furthermore, applying the principles of a periodized training plan, which involves breaking down the overall training program into specific phases, can help mitigate the risk of fatigue-related injuries. With a comprehensive approach to fitness training, a cross-training program should target various aspects of fitness and be developed with careful consideration of the latest research in the fields of sports medicine and exercise science

CHAPTER THREE

BENEFITS OF FUNCTIONAL CROSS-TRAINING FOR A SUCCESSFUL DANCE PRACTICE

Cross-training provides dancers with several advantages, including increased muscular strength, increased endurance, improved flexibility, joint stability, refined motor skills, and body awareness for specific choreography (Rajic et al., 2020). Cross-training can also help address muscular imbalances, especially for dancers who compensate for natural misalignments like scoliosis, anterior or posterior pelvic tilts, and tibial torsion (Pepito & Liu., 2022). Incorporating cross-training workouts along with dance-specific training can result in stronger muscle activation and prevent the body from overcompensating for misalignments or imbalances, thus helping prevent future injury (Quin et al., 2015).

The primary aims of this chapter are to discuss 1) the relevance of cross-training in dance for injury prevention, 2) the prevention of boredom and plateauing progress, and 3) achieving optimal performance results. The aforementioned research led to the development of a cross-training paradigm fundamentally rooted in these evidence-based concepts.

Injury Prevention

The most common injuries in competitive sports are strains to the ligaments and muscles in the lower extremities, whether or not they involve contact with another player (Henke et al., 2014). In dance, it has been reported that a significant proportion of dancers, ranging from 60% to 90%, experience musculoskeletal injuries, with the majority of these injuries affecting their lower extremities and back (Schoene, 2007 & Hincapié, 2008). Most musculoskeletal injuries experienced by dancers are related to soft tissues, such as sprains, strains, and tendinopathies. However, some literature has also focused on stress fractures as another type of injury that may occur (Hincapié, 2008).

These findings have proven to be true in studies focusing on physically demanding dance forms such as ballet and modern dance. In classical ballet companies, the yearly rate of injuries can range from 67% to 95%, and most dance injuries (60% to 76%) are caused by overuse (Nilsson, Leanderson, Wykman, et al., 2001). Looking at injury patterns from a comprehensive 5-year study conducted at the Alvin Ailey American Dance Theater, many injuries experienced by dancers were microtraumatic or overuse injuries, which included minor sprains and strains, as well as more serious conditions such as metatarsal stress fractures and osteochondritis dissecans of the ankle. Over a five-year period, the

incidences of overuse injuries in the first and second dance companies ranged from 10% to 74% of all injuries (Brooner et al., 2003).

During the 5-year study conducted at Alvin Ailey American Dance Theater, the patterns of injury by body region among dancers were comparable to those reported in ballet companies. Foot and ankle injuries were the most common type of lower extremity injuries, which constituted the majority of injuries, while lower back and pelvic injuries were the second most frequent type of injury. These findings were similar to the rates reported in other ballet companies (Bronner et al., 2003 & Garrick et al., 1993). This study also found that the younger dancers in the 2nd Company had the highest rate of injury and experienced the most injuries per dancer. These results could indicate that young dancers may benefit from a program that helps them adapt to the new physical demands of professional dance (Bronner et al., 2003).

Given the physically demanding nature of contemporary floorwork, reminiscent of breakdancing and some modern dance, it is vital to consider the potential for acute or chronic musculoskeletal injuries, not only in the lower body but also in the upper body. Notably, research consistently demonstrates that modern dance places greater emphasis on upper-body movements and imposes higher overall demands on the upper body compared to other dance genres (Sides et al., 2009). A study focused on breakdancers revealed varying occurrence rates of musculoskeletal injuries, with the majority of injuries concentrated in the upper limbs and torso (Cho et al., 2009). Furthermore, findings from an upper-body endurance pilot study involving college-level modern dancers indicate a high susceptibility to upper-body injuries among female dancers at the university level (Ambegaonkar et al., 2012). Considering these factors, it becomes crucial to implement strategies that prioritize the prevention of both upper and lower body injuries in contemporary floorwork practices.

Given the physically demanding choreography and high rate of career-ending injuries in today's professional dance industry, it is imperative that improved training methods are established (Bronner et al., 2003).

Injury Prevention Programs (IPP):

Studies have shown that insufficient physical fitness in many dancers leads to a high incidence of injury and performance issues (Faulkner. 2021). It is important to note that physical activity, such as

dance, inherently carries a risk of musculoskeletal injury that increases with the difficulty of the activity and the amount of time spent participating. To ensure dancers are able to meet the demands of choreography while preventing injury, it is crucial for leaders of dance companies, dance educators, choreographers, and medical professionals to consider implementing specialized conditioning and strength training programs. To significantly enhance the health, athleticism, and artistry of dancers, further research is necessary to evaluate the effectiveness of choreography-specific training programs and explore the application of scientific principles in this context (Faulkner, 2021).

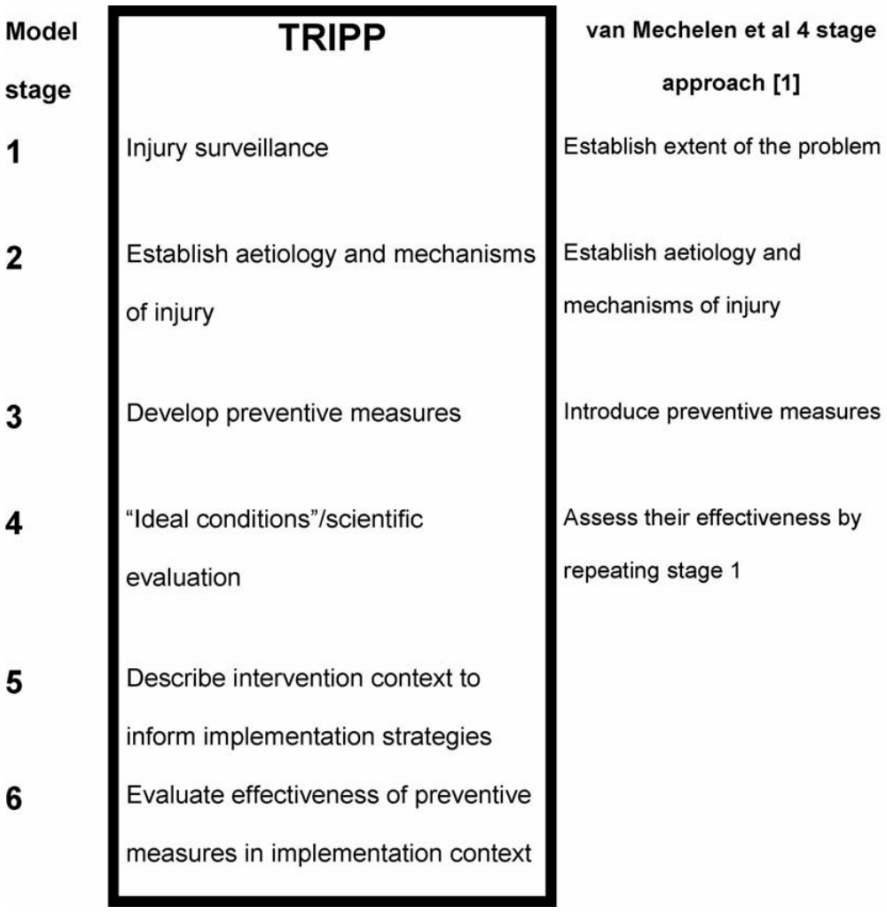


Figure. 1: This figure is an illustration of the Translating Research into Injury Prevention Practice (TRIPP) Model. © 2006 Elsevier.

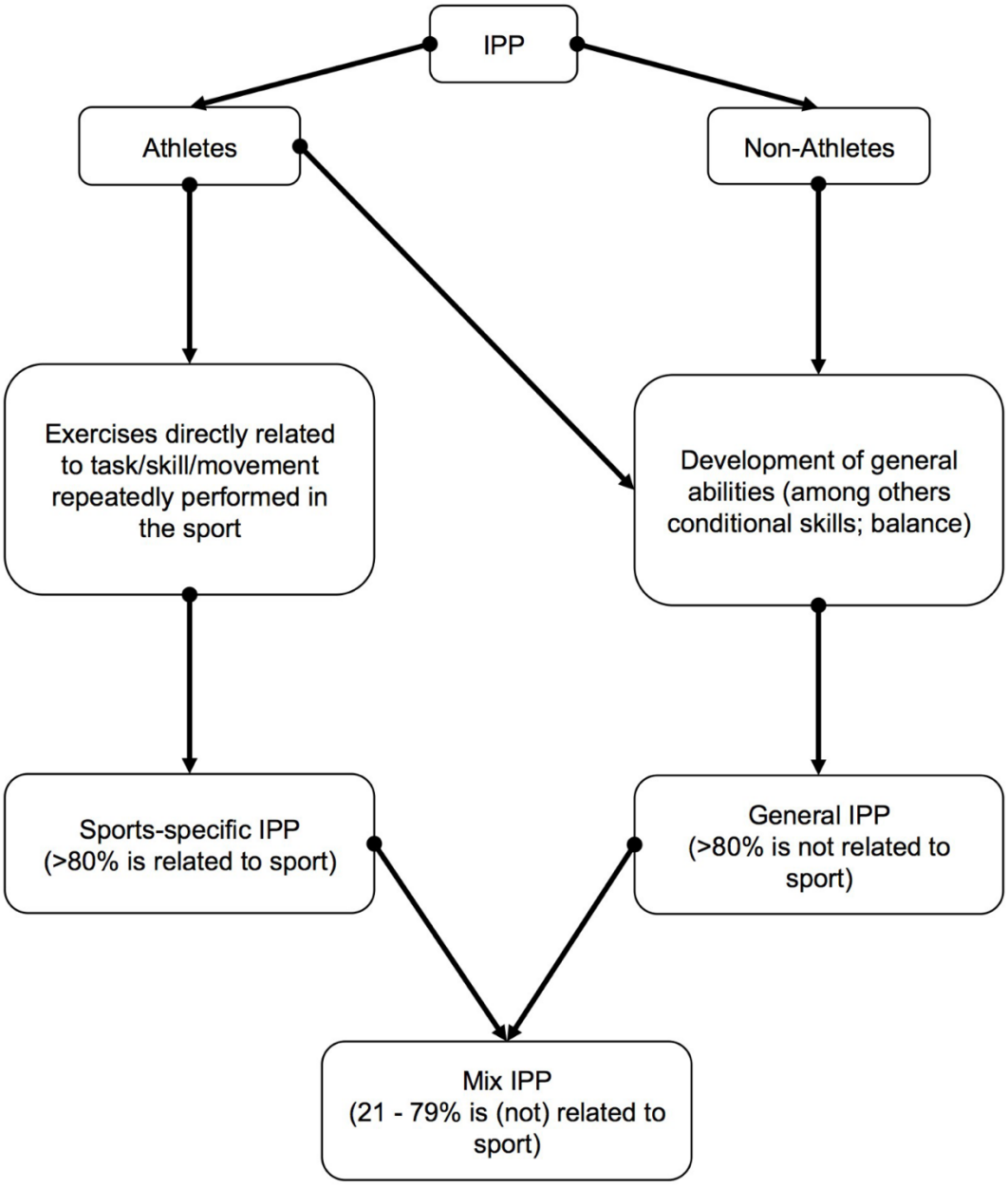


Figure 2: This figure depicts a comprehensive overview of an IPP model that incorporates both sport-specific training and general training. © 2018 Mugele et al.

According to the Translating Research into Injury Prevention Practice (TRIPP) model, sports organizations are unlikely to adopt new protocols unless they are accepted by coaches and athletes. Merely demonstrating the effectiveness of a program is often insufficient to increase compliance with it (Mugele et al., 2018). The TRIPP model (as seen in Figure 1) is a framework developed to guide the

implementation of injury prevention strategies in sports organizations. It emphasizes the importance of integrating research findings into practice and highlights the need for collaboration among researchers, practitioners, and policymakers to prevent and manage sports injuries effectively (see Figure 2). The TRIPP model also emphasizes the role of contextual factors, such as the attitudes and beliefs of coaches and athletes, in the adoption and success of injury prevention programs (Finch, 2006).

The TRIPP model can be a valuable framework to follow when developing an injury prevention program for dancers that incorporates functional cross-training. By applying the TRIPP model, the program can be tailored to the specific needs and preferences of the dancers and their instructors, ensuring that the program is both effective and well-received. Additionally, the model highlights the importance of considering contextual factors, such as the attitudes and beliefs of the dancers and coaches in the adoption and success of the injury prevention program. By taking a transdisciplinary approach and collaborating across different fields and perspectives, the program can be designed to address the unique challenges of dance training and promote injury-free performance (Finch, 2006). Overall, the TRIPP model provides a comprehensive framework to guide the development and implementation of injury prevention programs in sports organizations, including dance, to ensure that the program is evidence-based, practical, and successful.

This 8-week intervention study of functional cross-training for dancers, using supplemental weight training and cardiovascular training, followed the TRIPP model for sports injury prevention. This study utilized evidence-based approaches to injury prevention and considered contextual factors such as the attitudes and beliefs of dancers and dance educators. The goal of applying the TRIPP model was to produce a practical example of how to implement injury prevention programs in dance education and professional dance programs.

Plateau of Progress

Lorenz and Morrison's (2013) article, "Current Concepts in Periodization of Strength and Conditioning for the Sports Physical Therapist," provides insight into the phenomenon of plateauing in fitness progress and its implications for athletes. Plateauing occurs when an athlete's fitness progress stagnates despite continued effort and training, which can result from a variety of factors, including the body's adaptation to the same training stimulus and inadequate recovery time. Compared to other

athletes, dancers typically have lower levels of aerobic capacity and strength. This may be due to their daily dance training, which often prioritizes technical development over increasing the volume and intensity of their workouts, leading to fitness plateaus (Rodrigues-Krause et al., 2015).

To avoid plateauing, the authors recommend a periodized training approach that varies the volume, intensity, and type of training systematically. This approach ensures continued progress and prevents overuse injuries by allowing athletes to train at a high level while also providing sufficient recovery time (Lorenz et al., 2013).

This research study implemented concepts of periodization training by dividing the program into distinct phases or periods, each with specific goals and training activities, and varying the training stimulus over time rather than repeating the same training activities indefinitely.

Peak Performance Readiness

Peak performance readiness in dance refers to the physical, mental, and emotional state of a dancer that optimizes their ability to perform at their best (Koutedakis et al., 2004). Achieving peak performance readiness involves a variety of factors, including proper nutrition, hydration, fitness, sleep, and recovery, as well as effective warm-up and cool-down routines (Edmonds et al., 2018). Cross-training is an essential component of achieving peak performance readiness in dance. While technical training is critical for developing the specific skills required for dance, cross-training provides a broader foundation of fitness that supports the demands of dance performance (Rodrigues-Krause et al., 2015). Because dance classes are primarily designed to develop technical skills, they do not require as much cardiorespiratory endurance as dance performances do. This indicates that there is a discrepancy between the physical demands of dance training and those of actual dance performances (Rodrigues-Krause et al., 2015).

In order to attain an optimal physical state for performance, this study employed a multimodal training approach that incorporated weight training and cardiorespiratory training, which differed from the dancers' typical dance training routine. The training program was designed to replicate the physical demands of a show week and prepare the dancers for the unique challenges they would face during performances.

Summary

Cross-training is essential for athletes and dancers alike as it allows them to 1) minimize the risk of injury, which is critical for maintaining a consistent performance schedule in dance, 2) reduce boredom and increase adherence to training programs and 3) develop the necessary strength, power, and endurance to perform at their best. The following chapter will discuss the array of cross-training methods currently used in dance education and professional dance. It will also uncover the common misconceptions and stereotypes surrounding weight training in dance.

CHAPTER FOUR

CROSS-TRAINING METHODS IN DANCE

There are many forms of cross-training integrated into the practice of a professional or pre-professional dancer; among the most popular are Pilates, Yoga, and Gyrotonics. In order to determine which approach is most suitable for a contemporary floorwork dancer, we must examine what is being done currently. For the purposes of this research, this thesis will primarily examine Pilates, weightlifting, and conditioning.

Genre-Specific Methods

Genre-specific cross-training in dance refers to targeted approaches to cross-training that address the specific demands of different types of dance styles (Faulkner 2021). Since each genre of dance requires different energy systems, cross-training methods may vary accordingly. However, there are some commonalities among the various styles.

Pilates

Joseph Pilates created a workout system that combined elements of gymnastics, martial arts, yoga, and dance with philosophical concepts, which focuses on proper breathing, body alignment, and stability in the pelvis, using the abs, lower back, and glutes as a “power center” (Latey, 2001). In 1926, he opened the first Pilates studio in the United States, which quickly grew popular within the dance community. Many dance legends of that period visited the studio, further enhancing the quick spread of Pilates practice in dance. Pilates' six principles include Breath, Concentration, Centering, Control, Precision, and Flow, and his work concentrates on four primary deep core muscles (Pilatesfoundation.com & Ahearn, 2011). Pilates offers both mat classes and studio apparatus classes with an array of resistance mechanisms to provide feedback and allow for varying degrees of challenge in specific movements (Pilatesfoundation.com & Ahearn, 2011).

Pilates can be considered a genre-specific method of cross-training for ballet because it focuses on developing core strength, flexibility, balance, and control, which are all essential components of dance technique (Ahearn, 2006). Ballet dancers require a lot of strength and flexibility in their legs, feet, and core. Pilates exercises that can be genre-specific for ballet include leg circles, footwork on the Pilates reformer, and the roll-up exercise to improve spinal mobility (Yuspeh., 2021).

In a systematic review of Pilates for dancers, authors Bergeron and Greenwood analyzed nine peer-reviewed studies that investigated the effects of Pilates on various aspects of dance performance, including balance, flexibility, core stability, and injury prevention. They concluded that Pilates is a valuable supplemental training method for dancers of different genres. It can help improve their physical fitness, enhance their technique, and reduce their risk of injury. However, they also noted that further research is needed to better understand the optimal dosage and specific benefits of Pilates for different dance styles and populations. Existing research suggests that Pilates may help improve dynamic alignment in ballet students but not their vertical jump. (Bernardo & Nagle, 2006).

In an article about the Pilates method for Ballet, Elizabeth Ahearn explains how Pilates exercises can be easily incorporated into ballet technique classes. It discusses the potential physical benefits of Pilates, how Pilates can support the movement goals of a ballet class, and the technical and anatomical understanding that can be gained by both the instructor and students through the use of Pilates (Ahearn, 2011). Based on an informal investigation, it was discovered that the majority of university dance programs incorporate Pilates classes into their curriculum.

Pilates may offer particular advantages to dancers in terms of enhancing their overall health and performance. However, it may not encompass all the essential elements of physical fitness that are crucial for achieving professional success in demanding dance performances (Holland, 2017). The available evidence is restricted, and further investigation is necessary. When designing cross-training programs, trainers, clinicians, and educators should take into account the unique requirements and objectives of dancers, and Pilates should be combined with other types of physical activity to address the complete range of physical demands of dance (Ahearn et al., 2018).

Although this experiment did not include Pilates movements, it applied some principles of Pilates, such as breath, concentration, centering, and control. Using breath to coordinate movement and stabilize the core can help concentrate on proper technique and engage the center of the body while performing weight training movements (Kloubec, 2010).

Yoga

Yoga is a practice that originated from ancient Indian philosophy, which focuses on the connection between the mind and body (Nagendra, 2008). It is often recognized as both a therapeutic

practice and a system of exercises for promoting health and fitness. While yoga naturally benefits physical and mental well-being, its aims extend beyond these aspects. Yoga aims to achieve harmony between oneself and the universe, utilizing physical movements, breathing exercises, and meditation or relaxation techniques to align personal geometry with the cosmic realm, ultimately reaching a heightened state of perception and harmony. (Basavaraddi, 2015). For dancers seeking to enhance their physical fitness and aesthetic skills, yoga offers a range of benefits. First and foremost, yoga can help increase flexibility, balance, and core strength, all of which are crucial elements in dance genres like ballet, jazz, and contemporary (Zafeiroudi, 2021). Practicing yoga can also help dancers develop better body awareness and alignment, which can lead to a reduction in the risk of injury. Additionally, mindfulness and breathwork practices in yoga can help dancers improve their concentration, reduce stress and anxiety, and develop a greater sense of mental clarity and calm (Zafeiroudi, 2021). Overall, yoga can be an excellent way for dancers to enhance their flexibility, prevent injury, and cultivate a greater sense of wellness.

Yoga movements and breathing techniques have become increasingly popular in dance technique classes. Incorporating yoga postures into dance warm-ups can help prepare the body for the physical demands of dance, while incorporating them into cool-downs can aid in reducing muscle soreness and promoting relaxation after a performance or rehearsal (Caldwell et al., 2013). Such poses include downward-facing dog, plank, chaturanga, cobra or upward-facing dog, standing forward bend, tree pose, pigeon pose, and seated forward fold (Zafeiroudi, 2021).

The practice of yoga includes various asanas (postures) and practices that contribute to upper body strengthening. Certain yoga asanas such as Chaturanga Dandasana (Four-Limbed Staff Pose), Adho Mukha Svanasana (Downward-Facing Dog), and Plank Pose are particularly effective in engaging and building strength in the upper body muscles, including the arms, shoulders, and core (Cowen et al., 2005). Yoga supports contemporary floorwork by providing a foundation of strength, flexibility, and body awareness (Zafeiroudi, 2021). The core strength developed through yoga helps in executing movements on the floor with control and stability (Sorosky et al., 2008). Yoga's emphasis on fluidity, smooth transitions, and weight shifting has influenced contemporary floorwork techniques, allowing for seamless movements and creative exploration on the floor. The focus on body awareness and connection to the

breath has also influenced contemporary floorwork practitioners, as they incorporate these principles to enhance their movement quality and expressiveness (Zafeiroudi, 2021).

However, dancers who have hypermobility but lack strength may face increased injury risk when performing yoga postures that require an extreme joint range of motion. These postures can destabilize weak or unstable joints further, which is especially concerning for the lower back and knees (Cramer et al., 2018). While Yoga can provide some benefits for dancers in terms of improving their health and wellness, it may not address all of the necessary components of physical fitness required for professional success in rigorous dance performances (Zafeiroudi, 2021).

This experiment applied principles from yoga, such as mindfulness, to weight training by incorporating breathing techniques and intentional focus on each movement. This involved paying attention to the physical sensations of the muscles being engaged and the breath as it synchronizes with each movement. By staying present in the moment and avoiding distractions, participants were able to develop a deeper mind-body connection, which can enhance the effectiveness and safety of weight training.

Weight Training

Weight training is a form of strength training that involves using weights or resistance to work against the force of gravity. This type of training is designed to improve muscular strength and endurance by gradually increasing the amount of weight or resistance used during exercises. Weight training can be performed using a variety of equipment, such as free weights (e.g., dumbbells and barbells), weight machines, resistance bands, or even bodyweight exercises like push-ups and squats (Kraemer et al., 2002). The exercises typically target specific muscle groups or movements, such as the chest, back, legs, or arms, and are performed in sets and repetitions with rest intervals in between (Wolfe et al., 2004). Weight training can benefit a wide range of people, including athletes, fitness enthusiasts, and individuals looking to improve their overall health and wellness. It can help build and maintain muscle mass, improve bone density, enhance metabolic function, and even boost cognitive function (Penedo et al., 2005).

Weight training can benefit dancers across different genres, including ballet, contemporary, jazz, hip-hop, floorwork, and more. The specific muscles targeted in weight training can vary depending on the type of dance and the individual dancer's needs. However, generally, weight training can help improve

overall muscular strength, endurance, and power, which are important components of dance performance (Koutedakis et al., 2005). Additionally, weight training can help reduce the risk of injury and enhance recovery from dance-related stress and strain (Koutedakis et al., 2004).

Additionally, weight training has been shown to have a positive effect on bone mineral density (BMD), which is an important factor in maintaining bone health and reducing the risk of osteoporosis and bone fractures (Brown, 2017). Because dancers typically have a lean physique due to their emphasis on aesthetics and performance, they are at greater risk for low bone mass and osteoporosis (Brown, 2017). Weight training can help offset this risk by increasing bone density and reducing the risk of fractures. Specific weight training exercises can be tailored to target the areas of the body that are most stressed during dance, such as the feet, ankles, and legs (Koutedakis et al., 1999).

Stereotypes of Weight Training

In a blog post provided by a popular online dance platform, Dance Plug states the top six cross-training methods for injury prevention, rated from bottom to top, as Yoga, Cycling, Swimming, Gyrotonics Method, Pilates, and walking (Whitaker. 2018). This reference highlights the limited recognition of weight training as a cross-training option in the dance community due to the common stereotype that it leads to muscle bulk and inflexibility. (Wyon, 2019).

It has been suggested that dancers often prioritize the expressive aspects of their bodies over their physical fitness (Angioi, 2009). As a result, they may not see physical fitness as an important goal in and of itself but rather as a secondary benefit of improving their dance skills (Angioi 2009). Additionally, there is a common misconception among some dancers that engaging in strength and conditioning training will negatively impact their aesthetic appearance by making them too bulky and muscular (Brown et al., 2007). However, research has shown that participation in such training can improve strength without negatively affecting dance aesthetics and can even increase bone health and prevent osteoporosis (Rafferty, 2010 & Brown et al., 2007). A study observing the effects of supplemental weight training on ballet dancers revealed that there was no noticeable increase in the size of their limbs following the intervention. The study concluded that implementing a supplementary weight training regimen for ballet dancers can enhance their functional leg strength, endurance, and anaerobic power without impeding their artistic and physical performance demands in ballet (Stalder et al., 1990). Despite

these findings, incorporating strength and conditioning training into dance practice and performance is still a relatively new concept in the collegiate dance community (Pepito et al., 2022 & Wyon, 2005).

Summary

Pilates, Yoga, and weightlifting can be useful for a dancer's cross-training, but it depends on the dancer's specific goals and needs. Pilates and Yoga are forms of low-impact exercises that focus on strengthening the core muscles, improving flexibility, and increasing muscle control and coordination. They can be especially beneficial for dancers who want to improve their posture, balance, and control and for those who want to prevent injuries by creating better body awareness. Weightlifting, on the other hand, involves lifting weights in order to build muscle strength and power. It can be helpful for dancers who want to increase their overall strength and those who wish to improve their endurance and stamina. Weightlifting can also help dancers improve their explosive movements, such as jumps, lifts, and dynamic floorwork moves. Overall, it is essential to consider all aspects of fitness when looking at a cross-training program for dancers.

CHAPTER FIVE

RESEARCH STUDY METHODS AND DESIGN

Study Overview

The study paradigm involved the implementation of a functional cross-training approach over an 8-week period, utilizing a combination of existing scientific knowledge from scholarly literature and the lead researchers' professional expertise to enhance strength, balance, and cardiovascular function in undergraduate dance majors at UCI.

Study Aims

The experiment consisted of seven undergraduate dance majors from UCI who participated in an 8-week-long research study that implemented a functional cross-training approach designed to enhance strength, balance, and cardiovascular function. The learning aims of the study included using present scientific information from scholarly literature and identifying the gaps in dancers' current training methods to build a program that would help participants improve the study's outcome measures.

Research Study Timeline

This research study included obtaining expedited IRB approval, determining measurable outcomes to track pre-study, mid-study, and post-study, creating two four-week blocks of programming tailored to improve outcome measures, running three 1-hour training sessions per week with participants, and conducting data analysis as seen in Figure 3.

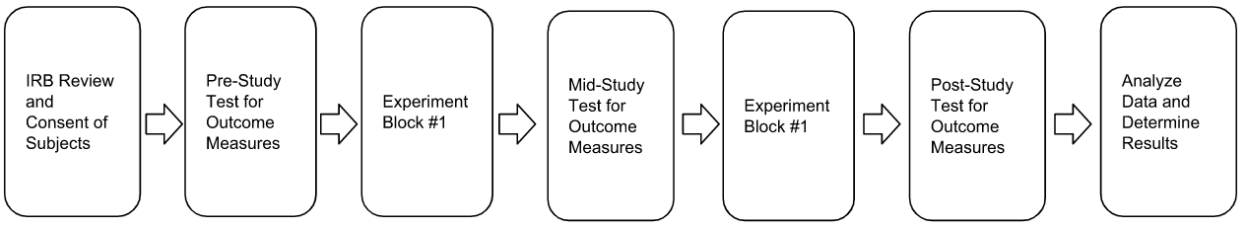


Figure 3: This figure is a portrayal of the research study timeline.

To evaluate the feasibility of the experiment, the research study was conducted with dance majors at the University of California, Irvine. IRB Approval for this research study was granted by the Institutional Review Board of the University of California, Irvine (IRB) and went through the expedited review process. All necessary documents, including the recruitment fliers, were created and stored for

future review if needed (see Appendix A). The participants were recruited in the following manner: 1) recruitment fliers were posted around the dance studios at the Claire Trevor School of the Arts, 2) emails were sent with the research study information to dance majors, and the research study information and flyers were posted on the Instagram account of the UCI Dance Community Student Advising Committee. If dance students demonstrated interest in the study either by word of mouth or by filling out a study interest sheet online via a QR code on the flier (see Appendix J), emails were sent to them with the study information sheet (see Appendix C). In the research study information sheet, inclusion criteria were defined as 1) each participant being at least eighteen years of age, 2) must be an English speaker, 3) currently enrolled as a Dance Major at the University of California, Irvine, 4) having no injuries that prevented from them participating in daily dance courses and 5) not currently participating in other forms of cross-training (not including Yoga or Pilates). Each participant filled out a digital pre-study interest form confirming that they met the study inclusion criteria and signed the audio and video release form on the research study consent form (see Appendix D) for the use of audio and video recording and had availability in their schedule to participate.

Outcome Measures

The programming for each 4-week block was designed to address specific, measurable outcomes and followed consistent patterns throughout. The study included five tests in order to measure the dancers' overall strength, speed, balance, endurance, and recovery capabilities. Outcomes evaluated included aerobic fitness and heart rate recovery through the 3-minute accelerated step test, trunk stability and lower-extremity mechanics and alignment through the airplane test, upper body strength with the 1-minute push-up test, leg strength and balance with the 1-minute single leg squat test, and advanced floorwork movements such as the kip up, inversions on the right and left, and tripod cartwheels on the right and left, to assess the participant's ability to move smoothly in and out of the floor and use the appropriate muscle groups. Each participant was given information sheets containing standards that defined each outcome measure (see Appendix J).

3-Minute Accelerated Step Test

The maximum amount of oxygen a person can use during physical activity (known as VO2 max) is directly linked to their ability to perform at high levels of intensity and is widely recognized as the

primary measure of both cardiovascular fitness and aerobic endurance, (Lippincott et al., 2009). Heart rate recovery is another measure of cardiovascular fitness, which assesses how quickly the heart rate returns to resting levels after either maximal or submaximal exercise. Studies have shown that heart rate recovery is closely linked with VO2max, and athletes with higher VO2max tend to exhibit a faster heart rate recovery (Hagberg., et al., 1980). For the purposes of this study, participants used the 3-minute accelerated step test as a measure of heart rate recovery. The participants stepped up onto a 12-inch riser with one foot and then the other and stepped down at a cadence of 96 beats per minute. The order of steps per beat was as follows: Right foot up, left foot up, right foot down, left foot down, and repeat for 3 minutes.

The participants then sat on a chair/stool and measured their heart rates for 30 sec and multiplied by 2 immediately following the three minutes. After one minute of rest, participants repeated measuring their heart rate for 30 seconds and multiplied by 2. Participants then subtracted the first number of beats per minute from the second number in order to find out how much they were able to recover in one minute. Each participant used the exact same 12-inch riser to maintain consistency throughout the study.

Airplane Test

As more research is conducted, it is becoming more apparent that pelvic and trunk stability play a vital role in the correct kinetics and kinematics of the lower extremities. Activating the core muscles to stabilize the pelvis and trunk has been identified as a requirement for the appropriate initiation of lower extremity movement (Hodges et al., 1997). In order to assess the neuromuscular control of the lower extremities and abdominals, the Airplane test was used, a common test used to evaluate point readiness (Richardson et al., 2010). During this test, the participant leans forward with their trunk and extends their non-support leg backward while keeping the pelvis parallel to the ground (Please see Figure 4) (Richardson et al., 2010). They then perform five controlled pliés while horizontally moving their arms towards each other in order to touch their fingertips to the ground (Richardson et al., 2010). Participants were tested with a points system. Any deviation from proper form and balance, such as breaking body alignment from head to toe, wobbling or hopping, or lifting the arch of the foot or toes during repetitions, resulted in points being added. The lower their score, the better they performed on the test.

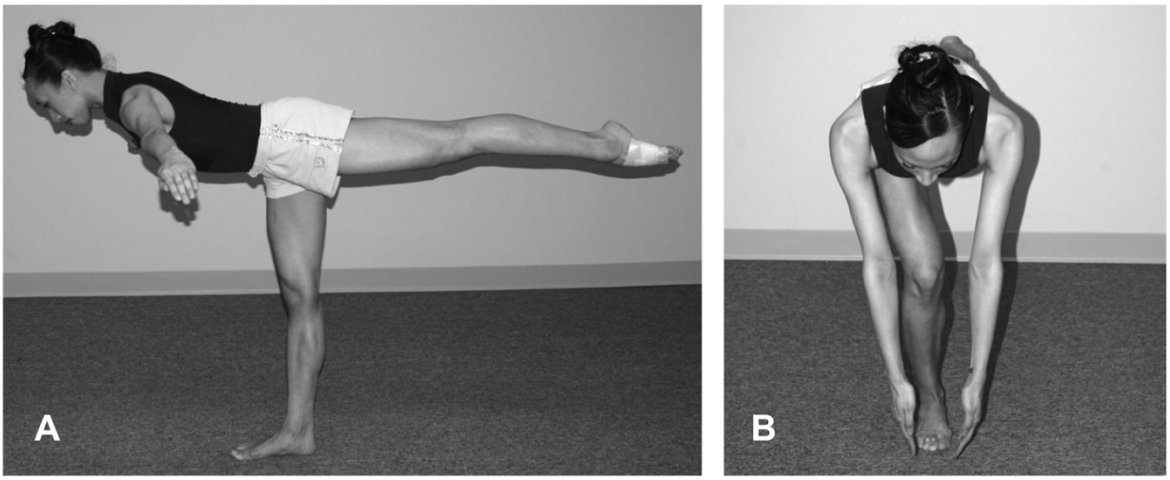


Figure 4: This figure illustrates A) the airplane test in the starting position from a side view and B) the finishing position from a front view. © 2010 J. Michael Ryan Publishing, Inc.

1-Minute Push-Up Test

Research has indicated that various fitness parameters, such as muscular endurance, strength, and power, can impact injury risk, and low muscular endurance is linked to a higher risk of injury (Baumgartner et al., 2004). To assess upper-body endurance in women, the American College of Sports Medicine recommends using the modified push-up test, which has been deemed a comprehensive field-based measure of upper-body fitness (Baumgartner et al., 2004 & Wood et al., 2004). Standards for the push-up test in university-age females have been established, further supporting its use (Fawcett et al., 2014). Recent investigations of physical fitness parameters and aesthetic components in contemporary dance have also identified the push-up test as the best indicator of a dancer's aesthetic competence (Angioi et al., 2009). In this study, the participant's ability to perform push-ups was evaluated by testing how many they could do in one minute. Standards were defined by four main factors for each rep to count: 1) Spine alignment must stay intact through the duration of the movement (no arched back, or tall hips, no sunk-in scapula's), 2) The elbows should stay tight to the body without winging, 3) Your chest

should make contact with the ground at the bottom of each rep, and 4) Your elbows must extend fully at the top of each rep. See Figures 5.1 and 5.2 from Strong Made Simple for reference (Tabor, 2023).

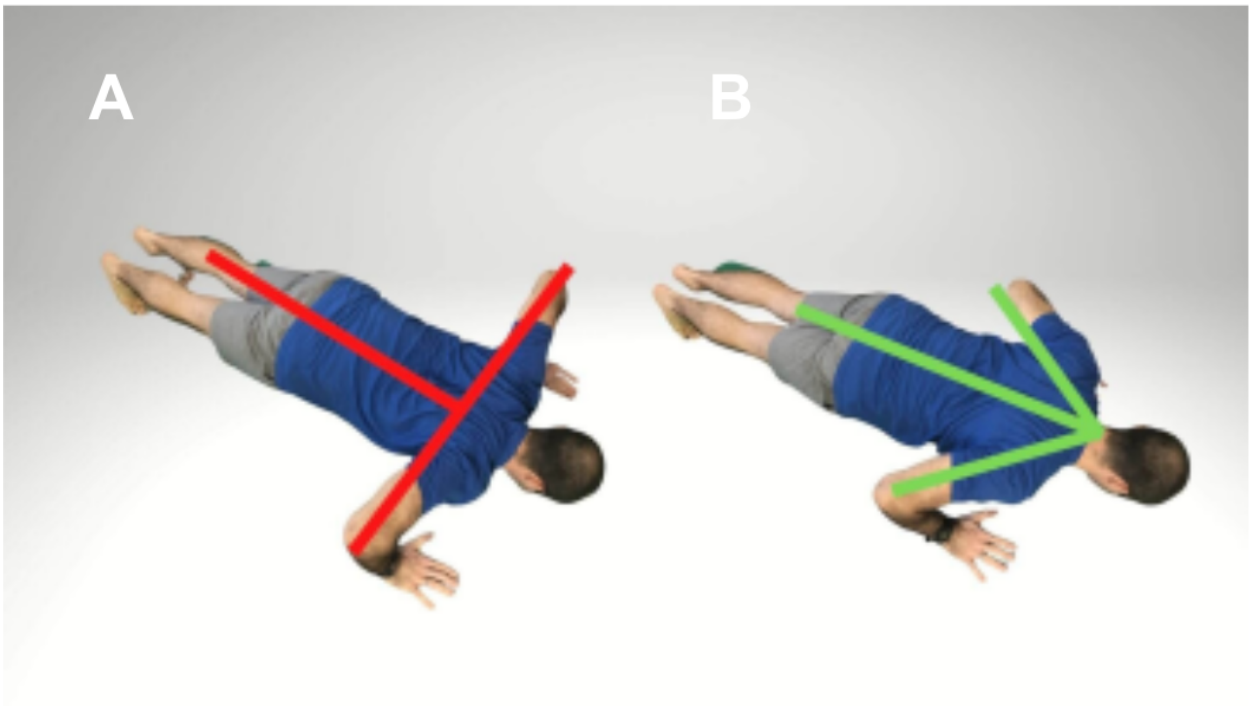


Figure 5.1: This figure depicts A) the improper form of elbows and scapula's during a push-up and B) the proper form of elbows and scapula's during a push-up. © 2023 Strong Made Simple®.

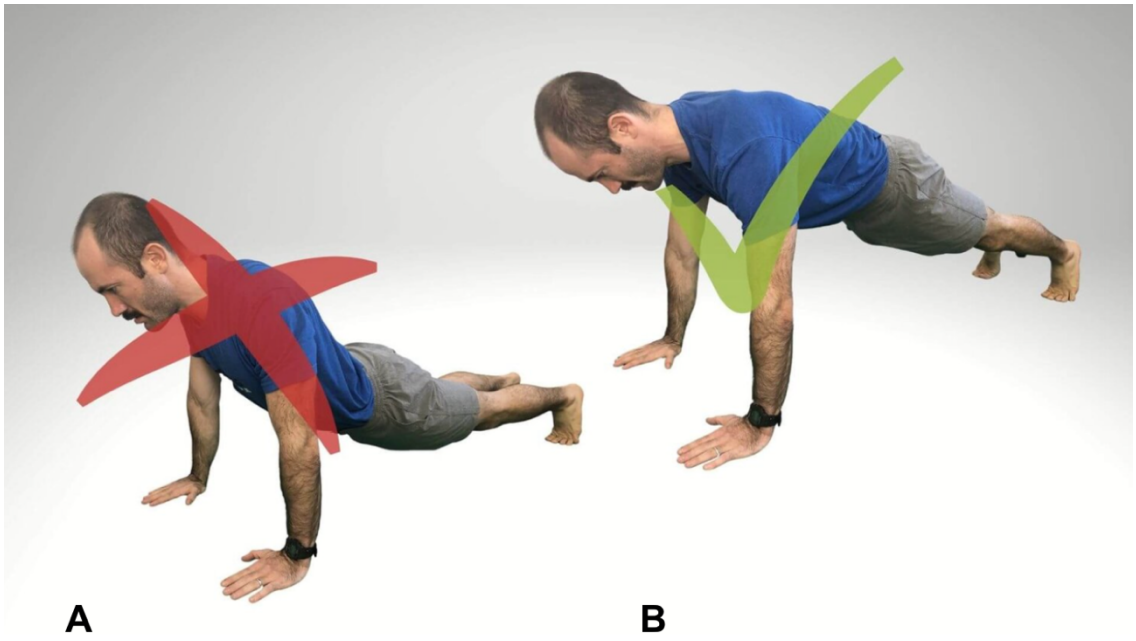


Figure 5.2: This figure depicts A) the improper form of the spine during a push-up and B) the proper form of the spine during a push-up. © 2023 Strong Made Simple®.

1-Minute Single-Leg Squat Test

Chris Benn, the first person to publish work on the single-leg squat, determined that utilizing single-leg squats as a means of strengthening the knee can lead to an improvement in muscular performance and increase the potential for dynamic stabilization of the knee (Bailey et al., 2011). And in 2002, Liebenson, a chiropractor in Los Angeles, California, transformed the single-leg squat exercise into a functional clinical test. This was done to aid practitioners in assessing the function of the lower extremity kinetic chain (Bailey et al., 2011). According to Liebenson, when the single-leg squat is used as a test, it can reveal various movement dysfunctions within the kinetic chain. These dysfunctions may include pelvic unleveling, valgus overstrain at the knee, and subtalar hyper pronation (Bailey et al., 2011). For the purposes of this study, participants were tested on how many adequate single-leg squats they could do in 1-minute, alternating legs each repetition. The three main factors considered for each rep to count were: 1. The hips breaking parallel, 2. The non-weight-bearing leg cannot touch the ground during the duration

of the entire movement, and 3. The hips must reach full extension to finish each rep again. Please see Figure 6 for an illustration of the single-leg squat (Venuto, 2022) (Hurst, 2023).

Figure 6: A) This figure illustrates the single-leg squat, showing A) the primary working muscle group and B) the full range of motion at the bottom of the squat with proper form and alignment. A) © 2022 Burn The Fat Inner Circle. B) © 2023 GMB Fitness®.

Movement Analysis

In order to evaluate the success of a functional cross-training program specifically for contemporary floorwork, participants were tested on three floorwork moves: the kip-up, an inversion on both the right and left sides, and a tripod cartwheel on both the right and left sides. Each of these movements was selected with particular muscle groups and strengths in mind. The kip-up was chosen to assess participants' dynamic lower body hip power and core engagement, while the inversion was used to evaluate their shoulder and core strength during a static hold. Lastly, the most challenging floorwork movement, the tripod cartwheel, was chosen to evaluate participants' overall upper body strength and control. Participants were evaluated in three categories specific to executing these moves: 1) clarity of moving in and out of the floor, 2) utilization of accurate muscle groups, and 3) overall movement proficiency. Each category was scored between 0-3.

Research Study Design Overview

The training program adhered to a well-structured and carefully balanced approach. Each training session began with a movement-specific warm-up for the primary working muscles and an activity to elevate the heart rate and generate heat in the body. On Tuesdays, participants engaged in two main lower body lifts and a longer 20-minute aerobic exercise, utilizing an "Every Minute on The Minute" (Silva-Grigoletto et al., 2020) method to maintain a steady heart rate and replicate a longer stage piece. On Thursdays, participants performed 2-3 main upper body lifts and concluded with sprint intervals to gradually increase their anaerobic capacity. Each interval was programmed to give the participant enough rest for them to recover to about 90% of their cardiorespiratory function. The rest period during sprint intervals gradually decreased as the program progressed. On Fridays, participants participated in a 9-15-minute workout designed to challenge and exhaust the entire body, pushing their limits close to failure. This approach provided an opportunity for the participants to identify their true limits. The remainder of the training day was dedicated to performing accessory movements to enhance stability, expand the range of motion, and refine fine motor skills.

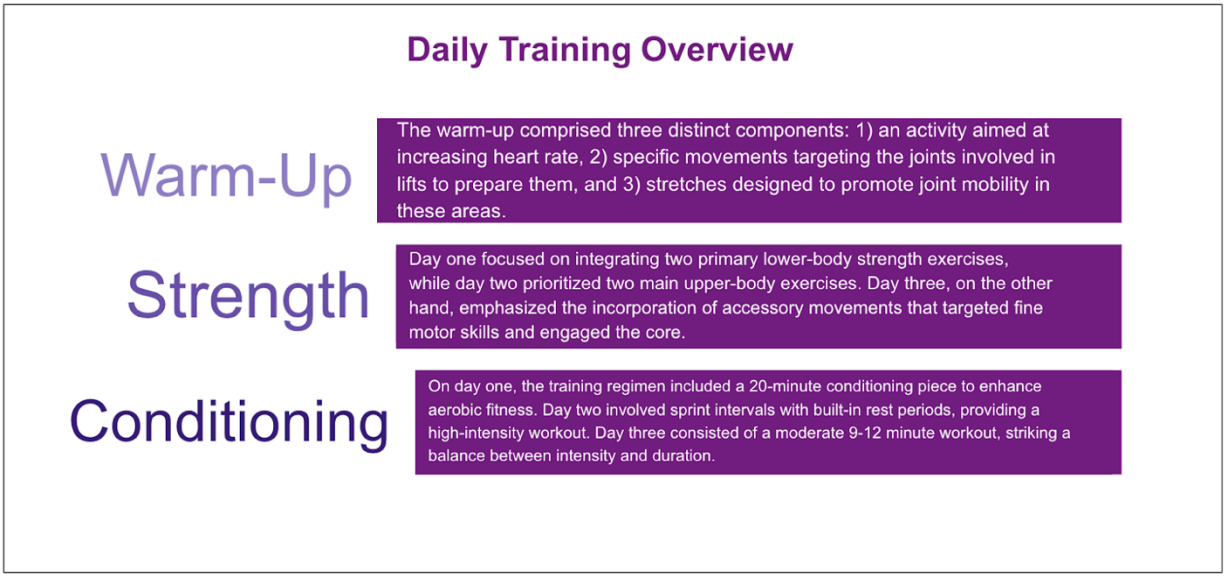


Figure 7: This figure is an overview of the daily training structure.

Required Program Equipment

The equipment used for this experiment included 1) (Alllvocles) resistant bands of up to eight different resistances, 2) 5 speed ropes (Gsssport), 3) benches, and 4) dumbbells (Rogue) in weights that ranged from 5lbs to 35lbs. All training was conducted in a dance studio on campus. Music was played from a Spotify playlist on a computer (Macbook Pro), and a stopwatch feature of a watch (apple watch) was used to time exercises and workouts.

Data Collection Overview

The experiment aimed to assess the effectiveness of implementing functional cross-training on five primary outcome measures: 1) 1-minute push-up test, 2) 1-minute single-leg squat test, 3) 3-minute accelerated step test, 4) airplane test, and 5) movement analysis of three contemporary floorwork movements. Pre-, mid-, and post-study tests were conducted to analyze and compare results. In addition, pre- and post-study questionnaires were administered to collect qualitative data. The collected data was analyzed to evaluate the impact of the 8-week experiment on achieving the research study's learning objectives.

Statistical Methods

The statistical methods used in this study involved organizing the data for each outcome measure into separate Excel sheets, categorizing the data by pre-, mid-, and post-testing for each participant and generating graphs to visualize any changes over the 8-week period. The data was analyzed by determining the means, SD, and determination of common themes in the qualitative data. Paired t-tests were calculated for all the means of each outcome measure at each time point with statistical software (GraphPad, Inc).

Summary

The experimental design was grounded in extensive background research on the proven benefits of cross-training techniques, fundamentals of exercise science, and research across multiple disciplines on functional training for maximized performance. The 8-week training phase was structured to achieve specific learning objectives and improve the outcome measures evaluated during testing. The subsequent

chapter delves into the compelling study findings, discusses its limitations, and highlights the promising potential for incorporating this dynamic cross-training program into dance curricula to enhance overall performance.

CHAPTER SIX

RESEARCH STUDY RESULTS

Seven dance majors at the University of California, Irvine, were screened and consented to participate in this study. Among the participants, six were female, and one was male, with a median age of 26 years (SD = 3). Four of the participants were undergraduate students, with one being in their first year and three in their third year. The remaining three participants were graduate students, all in their first year of study.

Intervention Attendance

The intervention was held over an eight-week span in the academic winter quarter of 2023. Pre-study testing took place throughout week one. The first four-week block of training sessions was held in weeks 2-5, with mid-study testing at the end of week five. The second four-week block of training was conducted in weeks 6-9 and concluded with post-study testing at the beginning of week 10. Participants' attendance was affected by their class schedules and rehearsal commitments, but overall attendance was not significantly impacted. Participant One missed two sessions, Participant Two did not miss any sessions, Participant Three missed four sessions, and Participants Four, Five, Six, and Seven only missed one session each. The daily programming for each session was provided to participants who missed, and participants one, three, and five all went to the on-campus gym and made up their training.

Pre- Mid- and Post-Study Testing Results

The pre-study tests were conducted to establish a baseline measurement of strength, endurance, movement proficiency, and recovery time. These measurements were used to evaluate any changes that occurred after the first four weeks of training. At the midpoint of the training program, another round of testing was conducted to assess the effectiveness of implementing consistent functional cross-training. Finally, post-study testing was performed to evaluate any changes that occurred after the full 8-week period.

3-Minute Accelerated Step Test Analysis and Results

Throughout this experiment, participants' cardiovascular fitness was tested using the 3-minute step test. This test was designed to assess an individual's aerobic capacity and endurance by measuring their heart rate recovery after stepping up and down a 12-inch step for three minutes at a consistent pace. The test was used to evaluate the fitness level of seven pre-professional dancers and determine the effectiveness of this cross-training program. Figure 8.1 shows the results of the participant's heart rate immediately following the step-test, and Figure 8.2 shows the results of the participant's heart rate after one minute recovery period. Each figure shows results from pre-, mid-, and post-study testing.

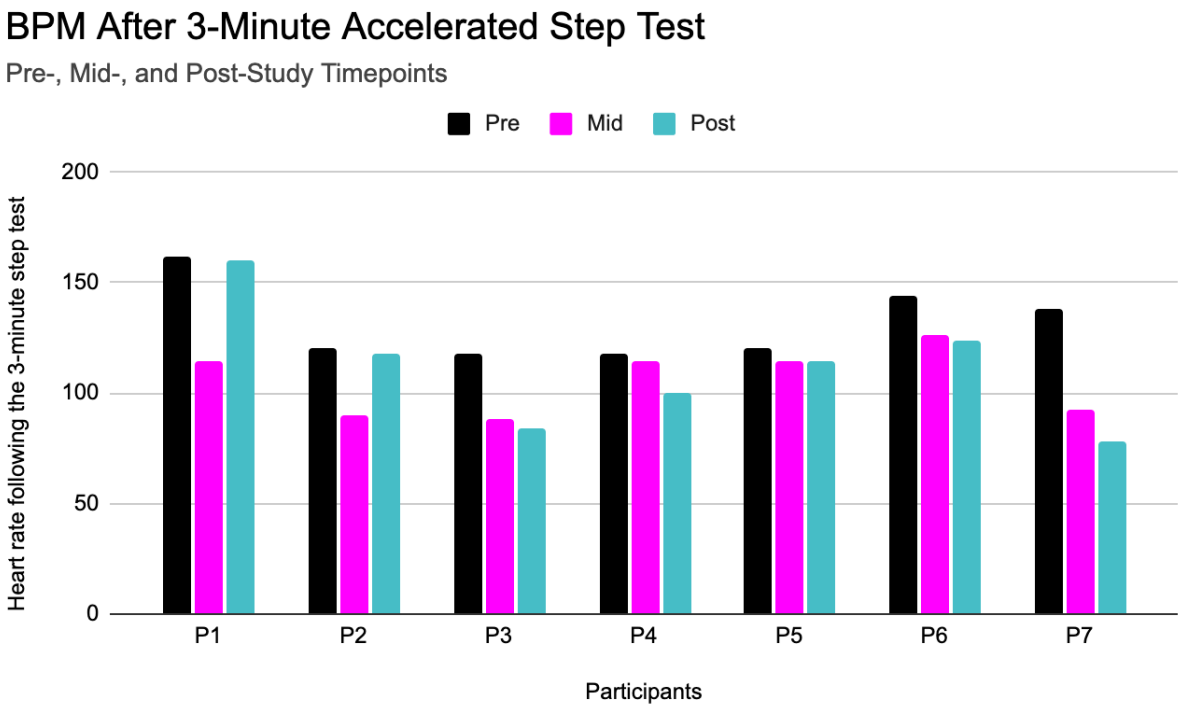


Figure 8.1: This graph depicts the heart rate immediately following the 3-Minute Step Test.

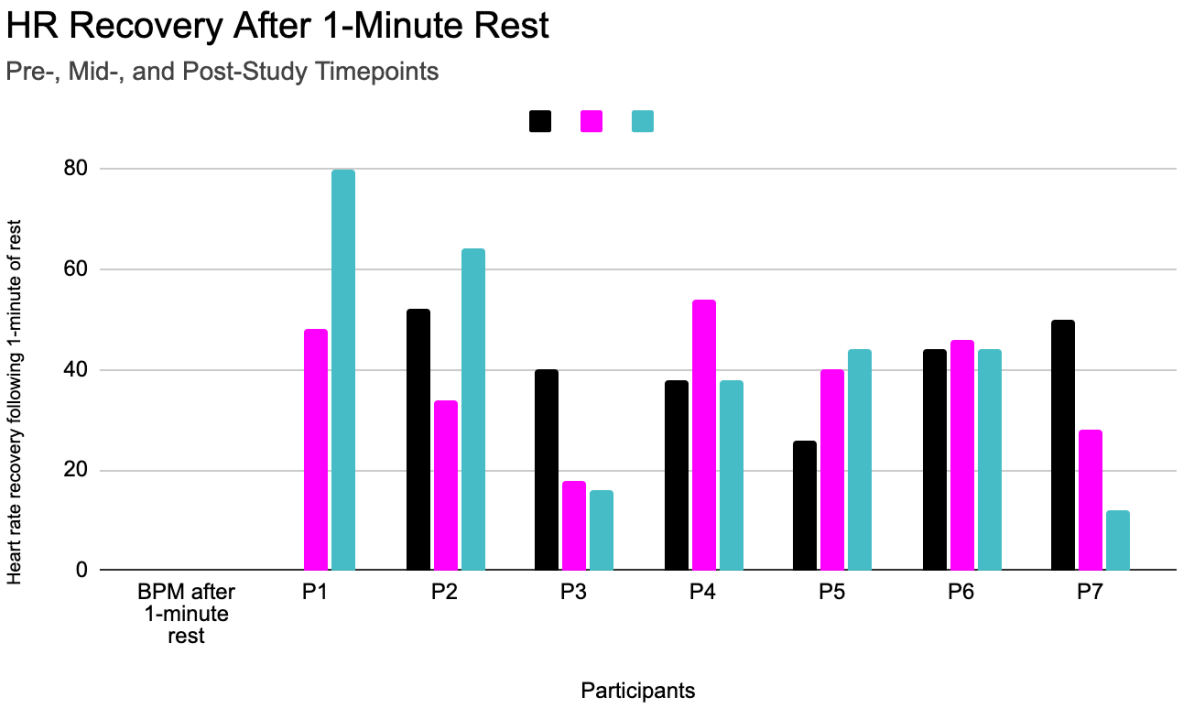


Figure 8.2: This graph depicts the heart rate following one minute of rest after the 3-minute accelerated step test.

The pre-study testing revealed an average beats per minute of 131 bpm (SD = 17), which decreased to 105 bpm (SD = 15) in mid-study testing and increased slightly to 111 bpm (SD = 27) in post-study testing. (Please see Figure 7.1). The average recovery heart rate of the participants improved from 45bpm (SD = 12) in pre-study testing to 38bpm (SD = 12) in mid-study testing but slightly worsened to 42bmp (SD = 24) in post-study testing. (Please see Figure 7.2). Although the overall change in recovery heart rate was not significant, the immediate heart rate following the step test significantly improved, indicating an improvement in the participants' cardiovascular endurance. The slight decline in post-study testing may have been influenced by external factors beyond the study's control, such as stress and lack of sleep during finals week. Overall, the results suggest that the participants demonstrated improvement in both their immediate heart rate following the step test and their ability to recover in a short resting period.

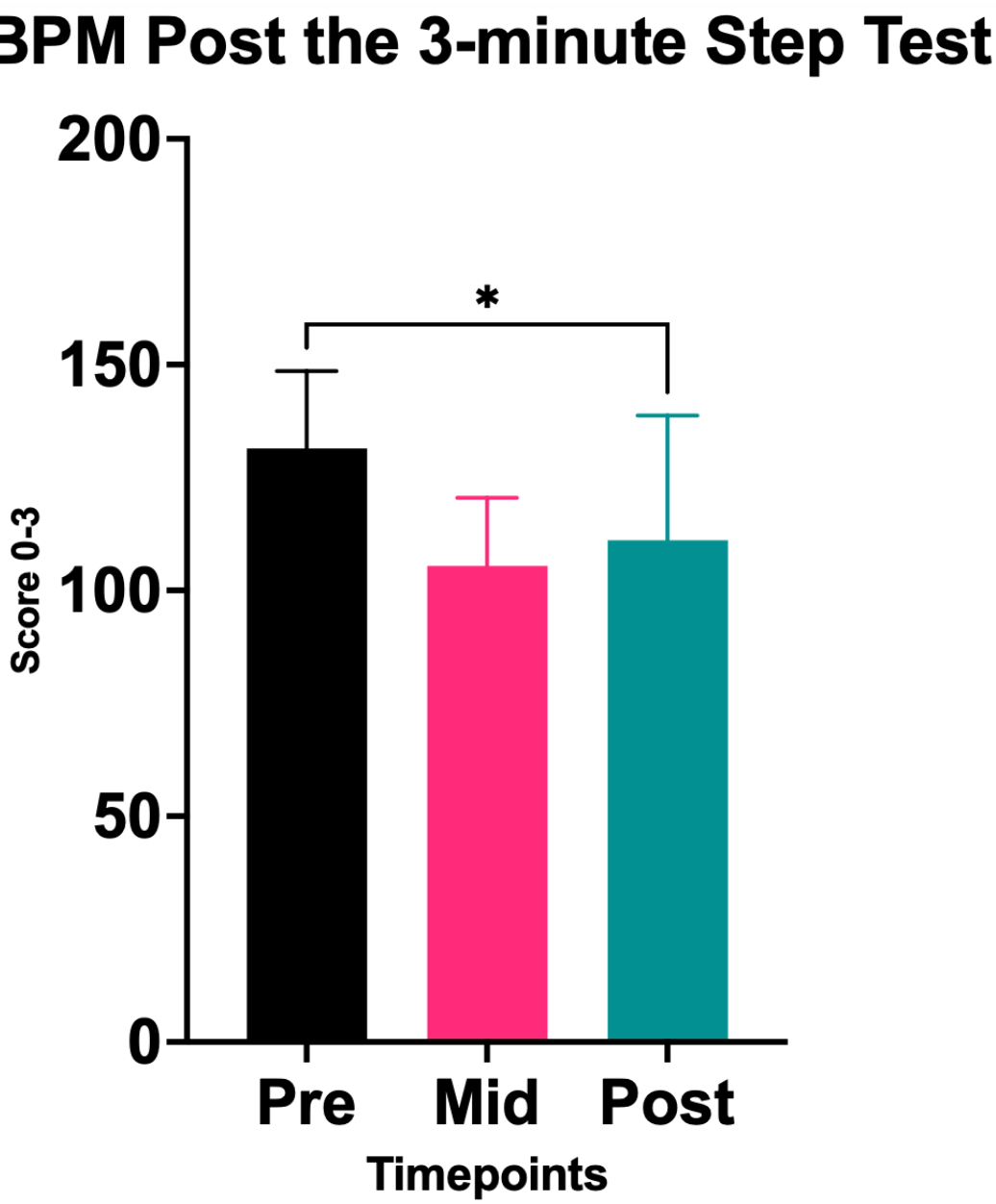


Figure 8.3: This graph presents comprehensive statistical data of the participant's heart rates following the 3-minute accelerated step test, encompassing all three testing periods.

A paired-sample t-test was conducted to compare the means of the Pre and Post timepoints, as seen in Figure 8.3. The t-statistic was 2.6, with df=6 (p =0.04). The results of this study indicate that there is a statistically significant difference between the mean test scores of the pre-testing and the post-testing. These findings suggest that the new study strategy effectively improved test performance on the BPM immediately following the 3-minute accelerated step test.

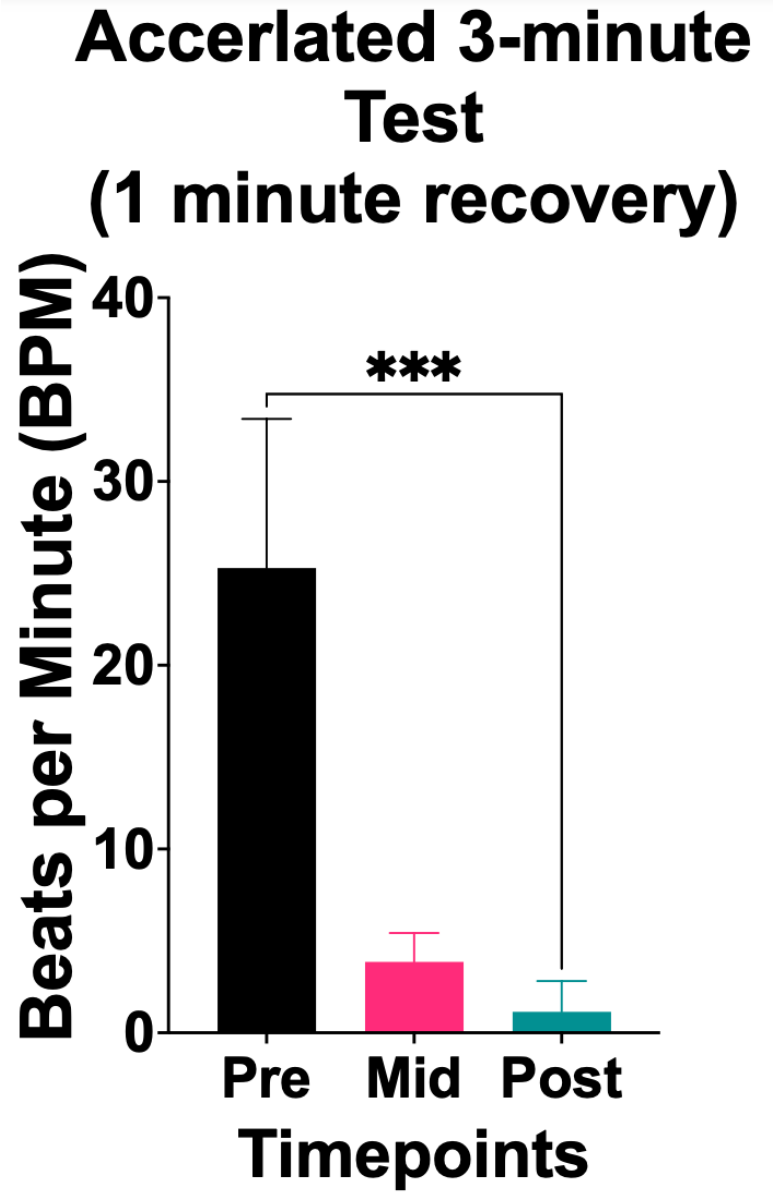


Figure 8.4: This graph presents comprehensive statistical data of the participant's heart rates following a 1-minute recovery from the accelerated step test, encompassing all three testing periods.

A paired-sample t-test was conducted to compare the means of the Pre and Post timepoints, as seen in Figure 8.4. The t-statistic was 4.8, with df=6 ($p = 0.003$). The results of this study indicate that there is a statistically significant difference between the mean test scores of the pre-testing and the post-testing. These findings suggest that the new study strategy effectively improved test performance on the BPM after 1 minute.

Instructor's Findings

This study included a weekly 20-minute endurance workout and weekly sprint intervals to enhance the participants' 3-minute step test results. The sprint intervals were deliberately designed to replicate 3 minutes of work followed by 1 minute of rest. The 20-minute workouts aimed to teach the participants how to conserve energy and maintain prolonged periods of movement.

Airplane Test Analysis and Results

The airplane test is a standard test used to assess point readiness. A points system was used to evaluate the participants, where any deviation from proper form and balance, such as breaking body alignment from head to toe, wobbling or hopping, or lifting the arch of the foot or toes during repetitions resulted in points being added. A lower score indicates better performance on the test. Figure 9 below

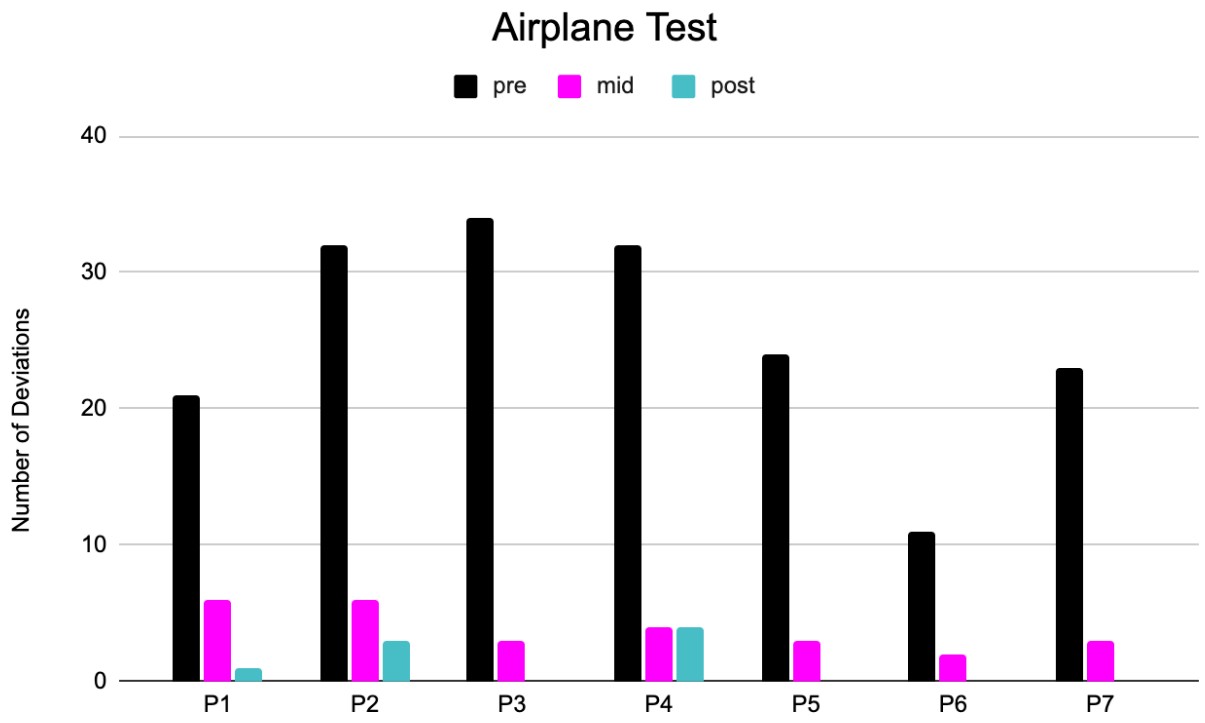


Figure 9: This graph shows the total number of deviations on both the right and left sides during the airplane test.

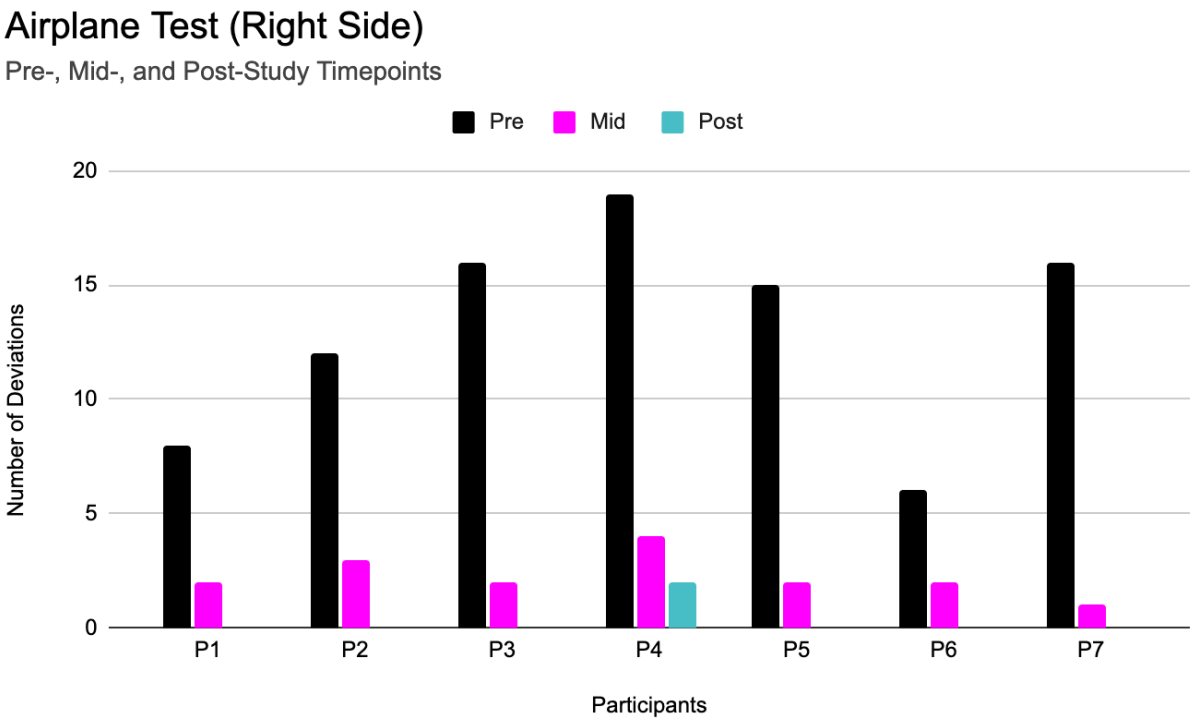


Figure 9.1: This graph represents the airplane test results on the right side.

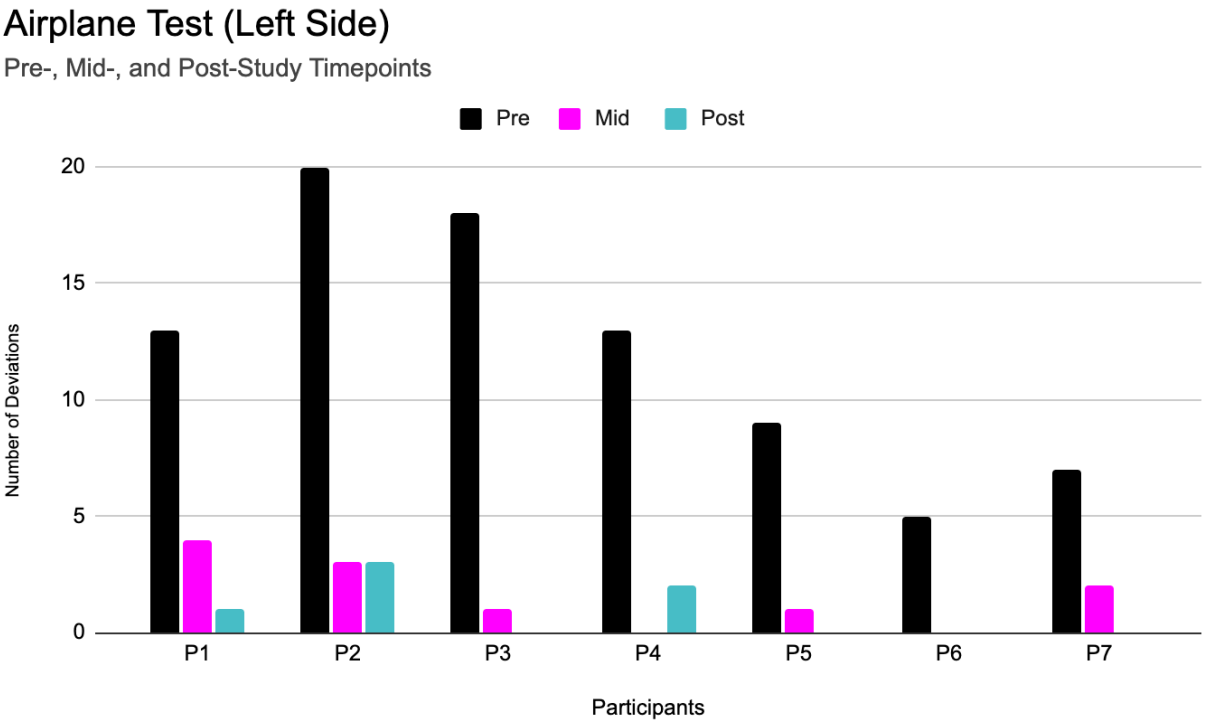


Figure 9.2: This graph represents the airplane test results on the left side.

The average amount of points earned during the airplane test on the right side went from 13 (SD = 4) pre-study to 0.2 (SD = 0.7) post-study, as seen in Figure 9.1, and the average score on the left side went from 12 (SD = 5) pre-study to 0.8 (SD = 1.2) post-study, as seen in Figure 9.2. All but one participant was able to score a perfect score of 0 on the right side during post-study testing, and 4 participants were able to get a perfect score of 0 on the left. This shows that the right side seemed to be the more dominant side for the overall group. Figure 9 shows the total number of deviations on both the right and left sides during all three testing periods of the airplane test.

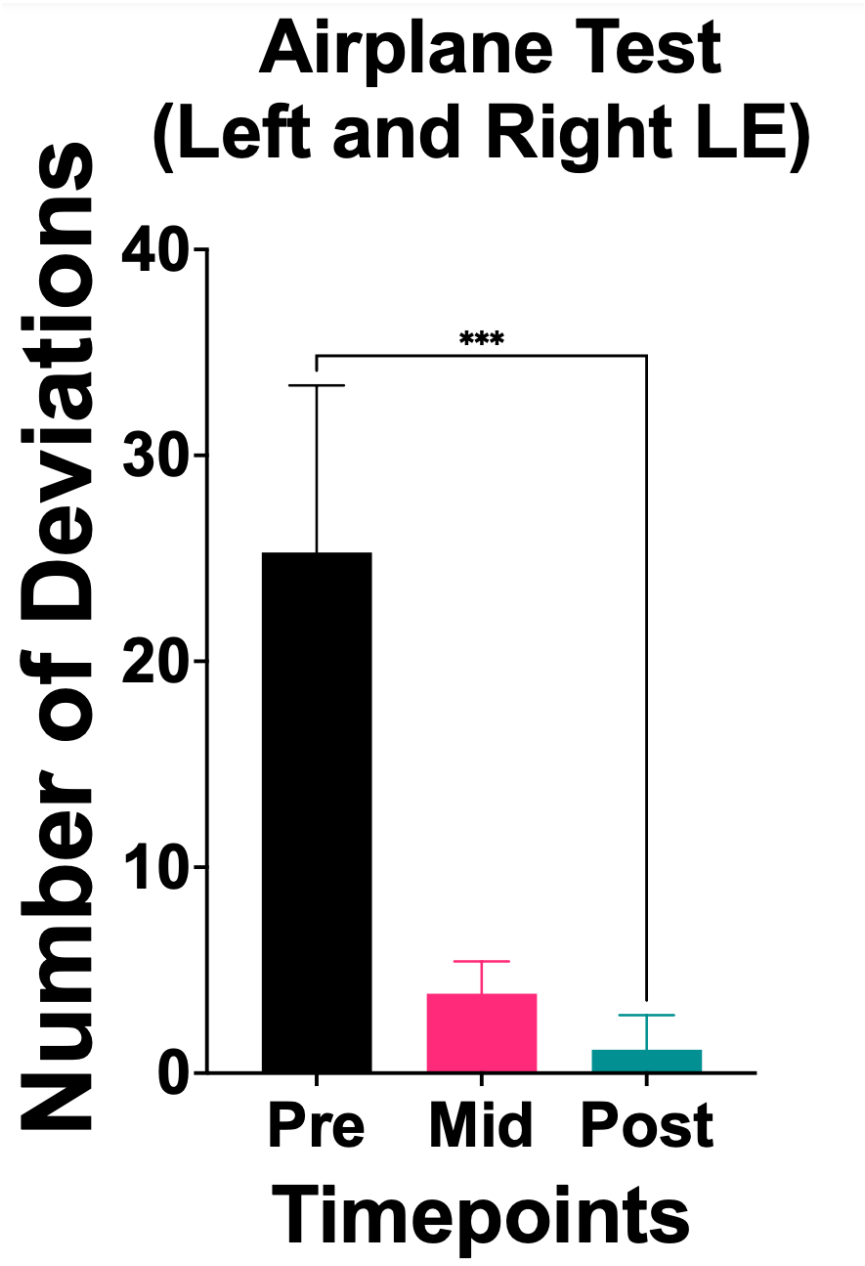


Figure 9.3: This graph presents comprehensive statistical data of the participant's deviations during the airplane test during all three testing periods.

A paired-sample t-test was conducted to compare the means of the Pre and Post timepoints, as seen in Figure 9.3. The t-statistic was 8.65, with df=6 ($p = 0.0001$). The results of this study indicate that there is a statistically significant difference between the mean test scores of the pre-testing and the post-testing. These findings suggest that the new study strategy effectively improved test performance on the airplane test.

Instructor's Findings

To improve performance on the airplane test, the instructor integrated exercises such as weighted single-leg deadlifts and front-foot elevated split squats. The single-leg deadlift was utilized to enhance hamstring strength, core stability, and ankle stability for balance, while the split squats were utilized to develop participants' quad strength for the plié portion of the movement. Both exercises were performed unilaterally to simulate the airplane test.

1-Minute Max Push-Up Test Analysis and Results

Throughout this study, participants were assessed on their ability to perform proper form push-ups with a full range of motion within a one-minute timeframe. The purpose of this test was to evaluate the upper body strength of the collegiate-level dancers who participated in this study.

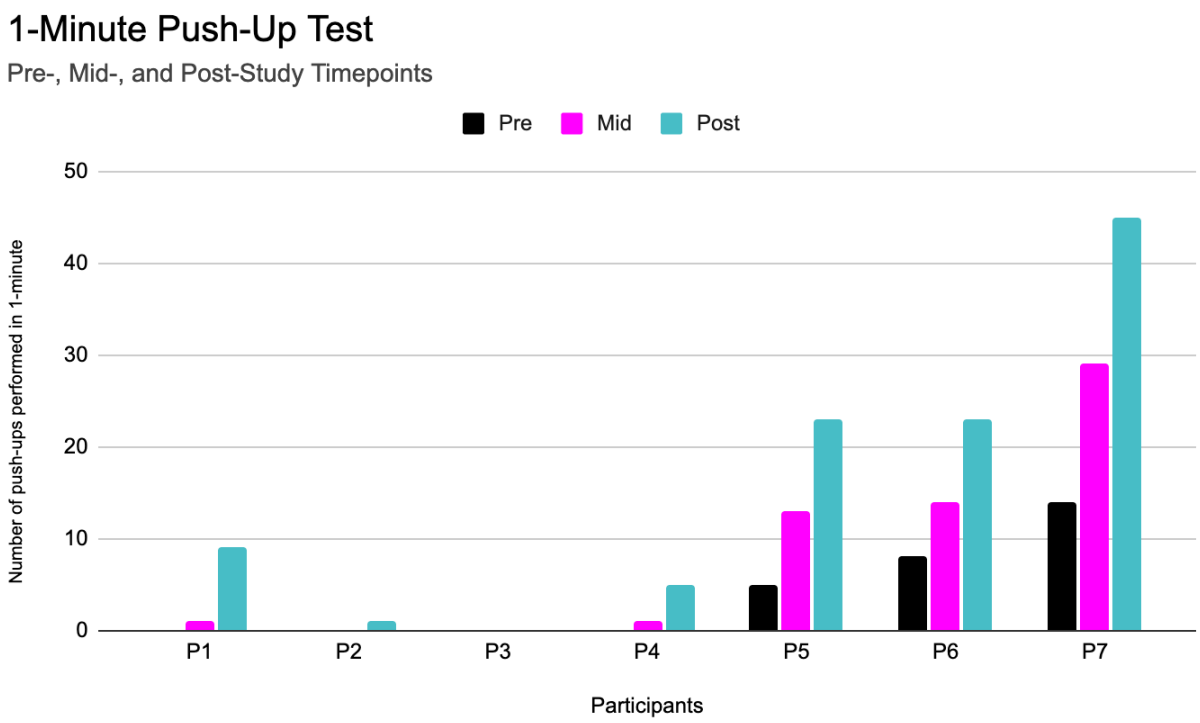


Figure 10: This graph depicts the number of push-ups participants were able to achieve throughout each testing period.

The average number of push-ups performed within a one-minute timeframe increased significantly from 3.8 (SD = 5.4) during pre-study testing to 15 (SD = 16.2) in the post-study testing, as seen in Figure 10. Although, there was a notable increase in the standard deviation, which rose from 5.4 to 16.2. It is possible that this increase was due to the fact that many participants entered the study, unable to perform even a single push-up. By the end of the study, every participant, with the exception of one, had achieved at least one push-up. Individuals who started with some baseline upper body strength and were able to perform a few push-ups within the minute saw greater improvements. It was concluded that having a baseline level of upper body strength is essential for achieving significant growth in a short period of time. Even a modest level of strength and muscle awareness can lead to improvements. However, those participants who were able to accomplish their first push-up during the study achieved a major milestone.

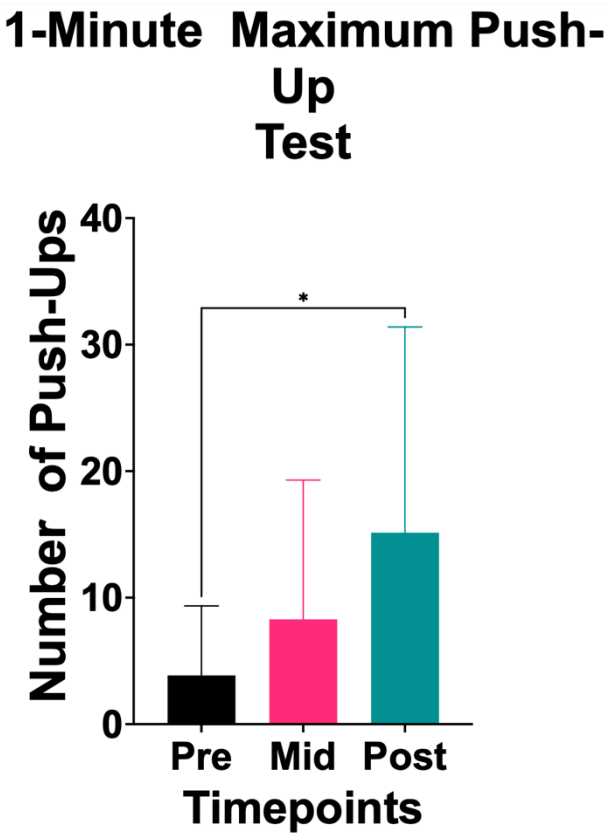


Figure 10.1: This graph illustrates the comprehensive statistical data depicting the participant's progress in increasing their push-up repetitions within a 1-minute timeframe throughout the study.

A paired-sample t-test was conducted to compare the means of the Pre and Post timepoints, as seen in Figure 10.1. The t-statistic was 2.72, with df=6 ($p = 0.0348$). The results of this study indicate that there is a statistically significant difference between the mean test scores of the pre-testing and the post-testing. These findings suggest that the new study strategy effectively improved test performance on the Push Up Test.

Instructor's Findings

A significant aspect of this study was focused on enhancing the upper body strength of the participants, which was achieved through various exercises aimed at improving push-ups. For those who were unable to perform push-ups, movements such as push-up negatives, elevated push-ups on a bench, and bench or floor presses with dumbbells were incorporated. Participants who already had some proficiency in push-ups were given weighted negative push-ups, band-resisted push-ups, and bench or floor presses with dumbbells to further enhance their strength.

1-Minute Max Single-Leg Squat Test Analysis and Results

In this study, the lower body strength, stability, and mobility of collegiate-level dancers were evaluated through the assessment of their ability to perform alternating, full-range-of-motion single-leg squats.

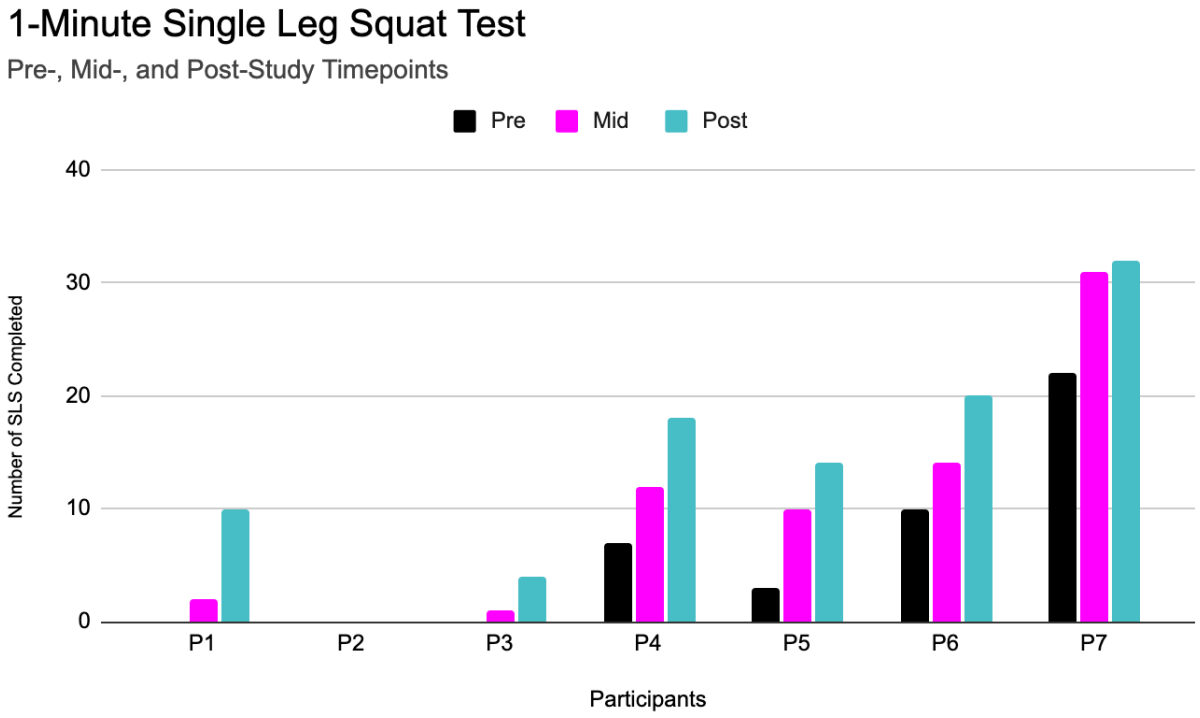


Figure 11: This graph presents the number of single-leg squats participants were able to achieve following each testing period.

The average number of alternating single-leg squats performed within a one-minute timeframe increased from 6 (SD = 8) during pre-study testing to 14 (SD = 10.7) during post-study testing, as seen in Figure 11. However, similar to the push-up test, the standard deviation increased from 8 to 10.7. This indicates that having a baseline level of lower body strength is necessary for achieving significant improvements within a short period of time. Despite initially achieving the required range of motion for performing the squat, none of the participants were able to stand back up from the bottom position. It could be hypothesized that the participants' inability to stand up from the bottom position was due to

insufficient quadriceps strength. Nonetheless, like the push-up test, all but one participant was able to achieve their first couple of single-leg squats.

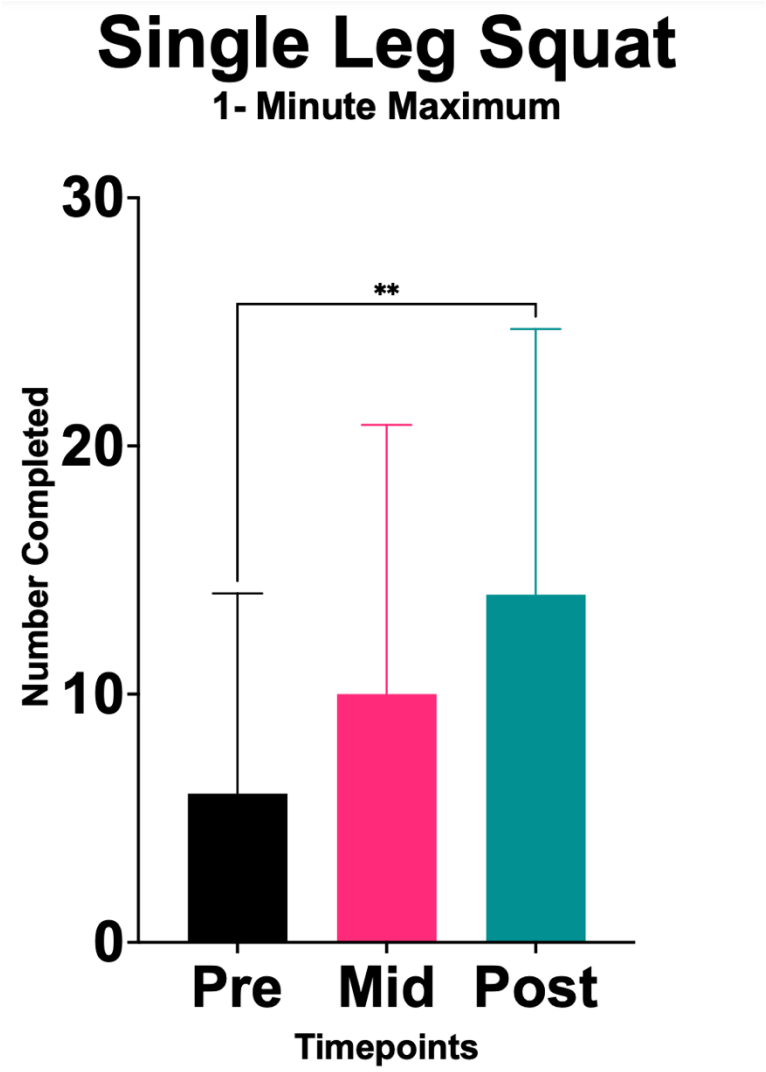


Figure 11.1: This graph illustrates the comprehensive statistical data depicting the participant's progress in increasing their single-leg squat repetitions within a 1-minute timeframe throughout the study.

A paired-sample t-test was conducted to compare the means of the Pre and Post timepoints, as seen in Figure 11.1. The t-statistic was 4.93, with df=6 ($p = 0.0026$). The results of this study indicate that there is a statistically significant difference between the mean test scores of the pre-testing and the post-testing. These findings suggest that the new study strategy effectively improved test performance on the Single Leg Squat.

Instructors Findings

To enhance single-leg strength and mobility in a single-leg squat, the instructor utilized various exercises, including air squats, weighted squats, lunges, and step-ups. In addition, specific exercises were given to improve the balance and coordination required for performing single-leg squats, such as single-leg squat negatives on a bench (or on a mat for added difficulty), single-leg candlestick roll-ups, single-leg squats to a bench, and leg lifts performed in the bottom of a squat.

Movement Analysis

Participants underwent testing on three different contemporary floorwork movements: the kip up, an inversion to the right and left, and a tripod cartwheel to the right and left. Each movement was assessed and scored on three categories: 1) clarity when moving in and out of the floor, 2) utilization of accurate muscle groups, and 3) overall movement proficiency (see Appendix J). Scores ranged from 0-3, with 0 indicating that the participant was unable to attempt the movement, 1 indicating that the participant displayed little clarity when moving in or out of the floor, displayed little engagement and awareness of proper muscle use, or little to no proficiency within the movement; 2 indicating that the participant displayed some clarity when moving in or out of the floor, displayed some engagement and awareness of proper muscle groups, or displayed some proficient movement similar to what was demonstrated; and 3 indicating that the participant displayed exemplary clarity when moving in or out of the floor, accurate engagement and awareness of proper muscle groups, and precise and proficient movement that was accurate to what was demonstrated. While this testing method is subjective to the lead researcher's discretion of the movements performed, each participant was assessed by the lead researcher to maintain consistency across all tests.

Kip-Up Analysis and Changes

The kip-up is a common movement used in various types of floorwork styles as well as soft acrobatics and some forms of martial arts. The kip-up was selected for this study because it demands a significant amount of explosive power from the hips and core to perform. Please see Appendix E for the movement demonstration link.

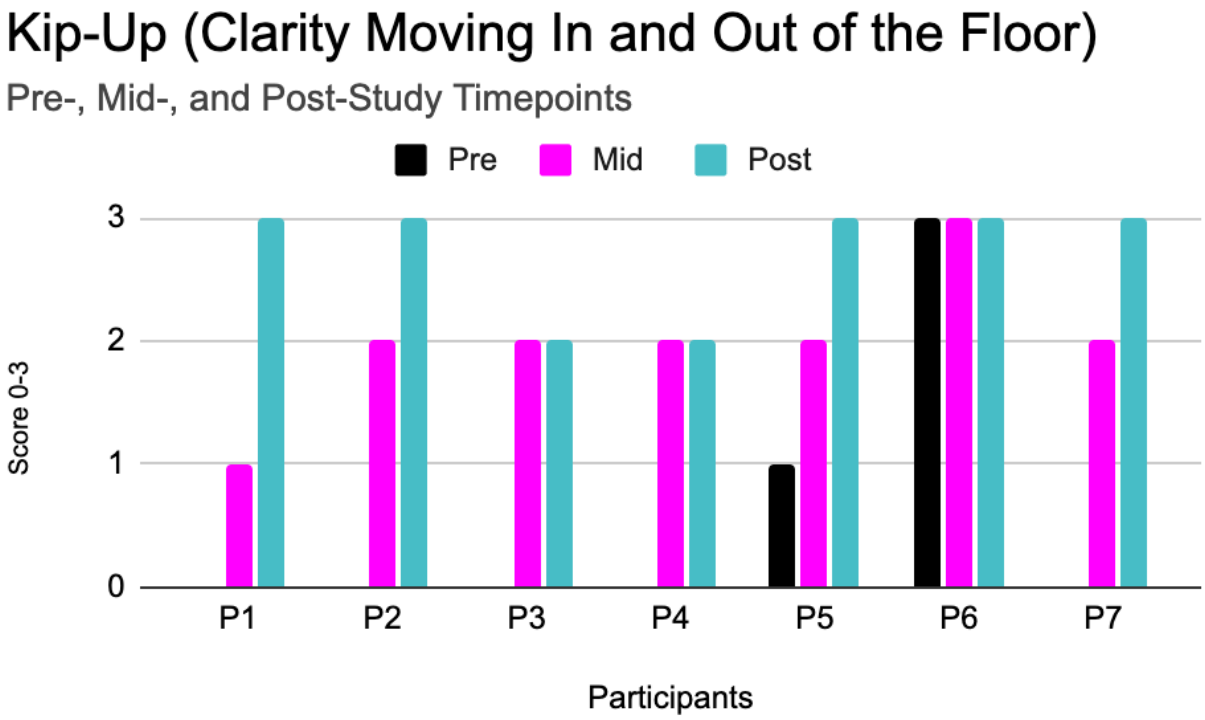


Figure 12.1: This graph shows the kip-up test results for clarity moving in and out of the floor for all three testing periods.

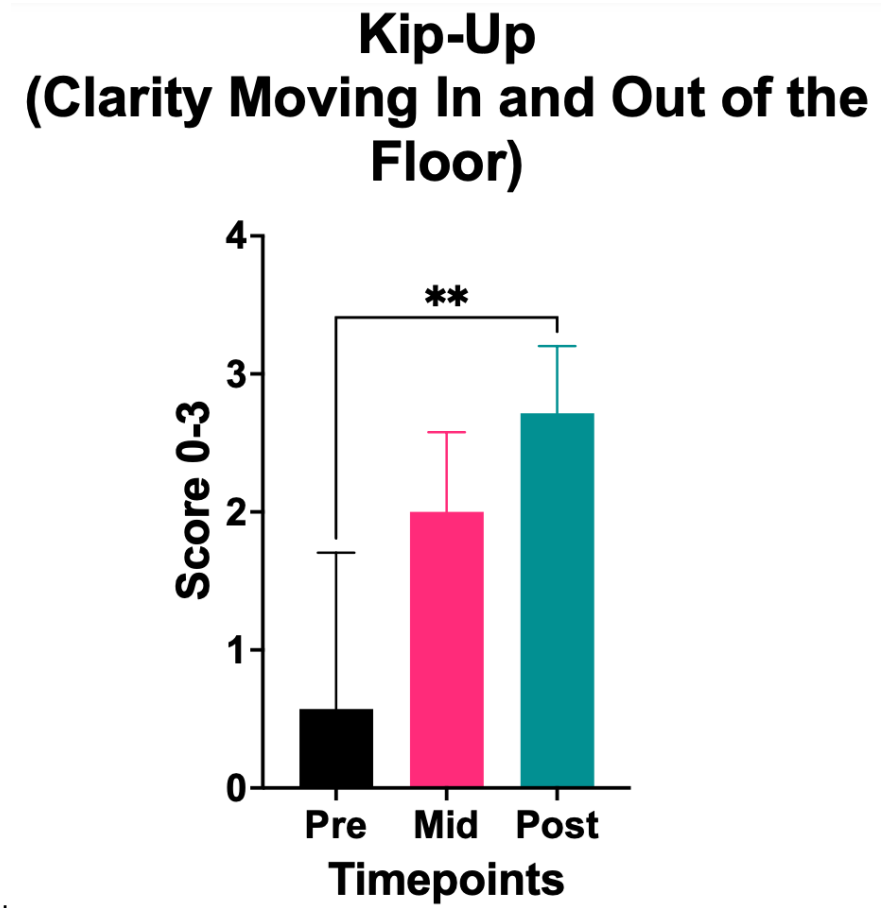


Figure 12.2: This graph displays the comprehensive statistical data depicting the participant's progress of moving in and out of the floor during the kip-up throughout

A paired-sample t-test was conducted to compare the means of the Pre and Post timepoints, as seen in Figure 12.2. The t-statistic was 5.303, with df=6 ($p = 0.002$). This study's results indicate a statistically significant difference between the mean test scores of the pre-testing and the post-testing. These findings suggest that the new study strategy effectively improved test performance on the Kip-Up (Clarity Moving in and Out of the Floor).

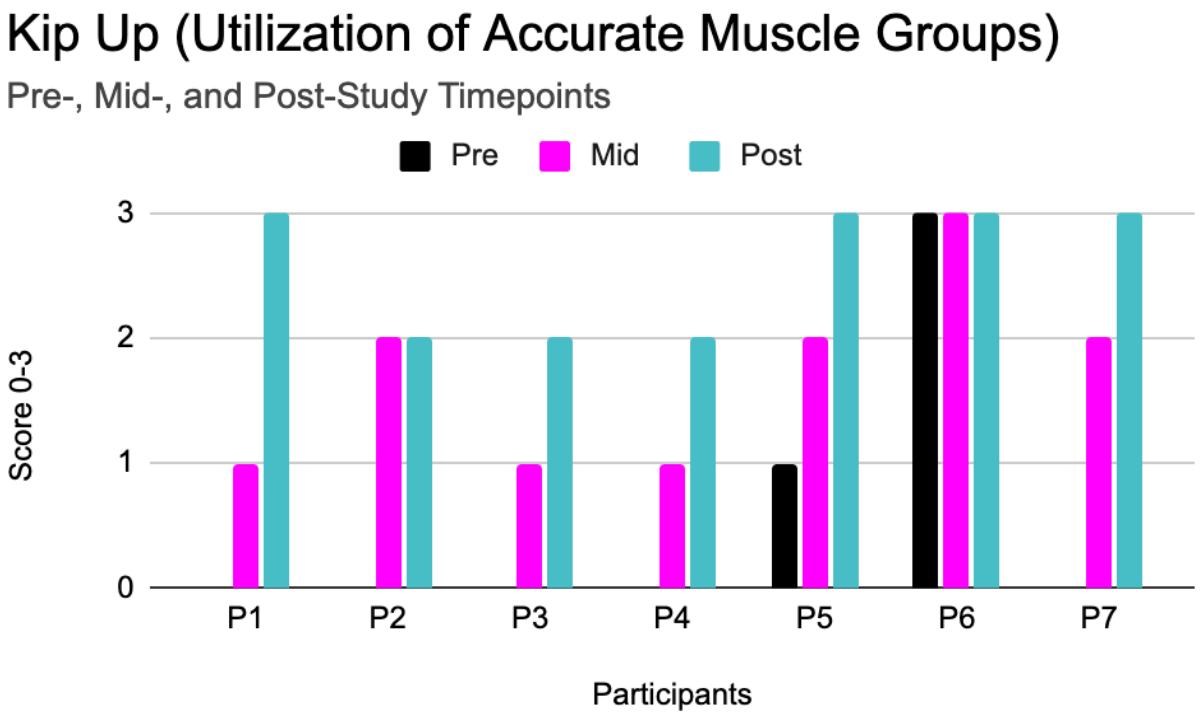


Figure 12.3: This graph shows the kip-up test results for utilization of the accurate muscle groups for all three testing periods.

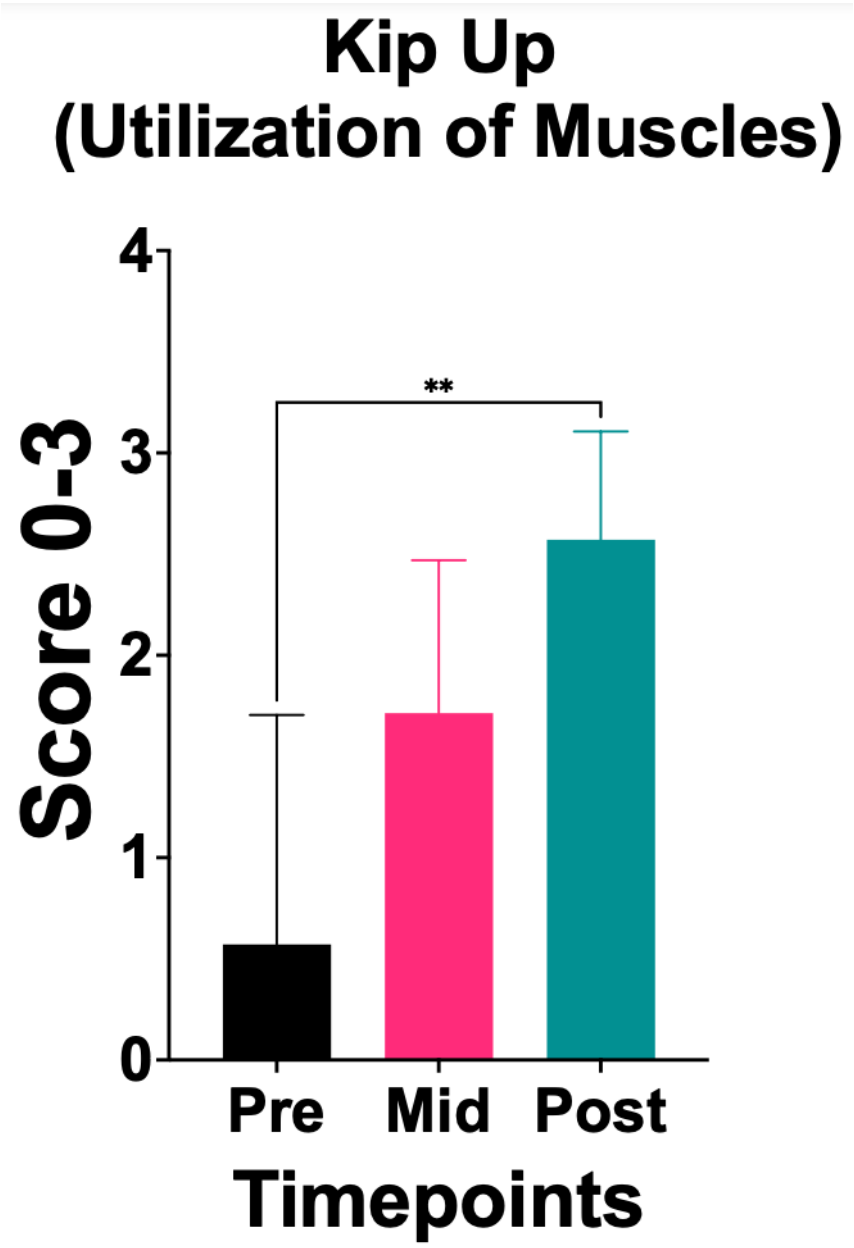


Figure 12.4: This graph displays the comprehensive statistical data depicting the participant's progress in utilizing the accurate muscle groups during the kip-up throughout all three.

A paired-sample t-test was conducted to compare the means of the Pre and Post timepoints, as seen in Figure 12.4. The t-statistic was 5.292, with df=6 (p= 0.002). This study's results indicate a statistically significant difference between the mean test scores of the pre-testing and the post-testing. These findings suggest that the new study strategy effectively improved test performance on the Kip-Up (Utilization of Accurate Muscles).

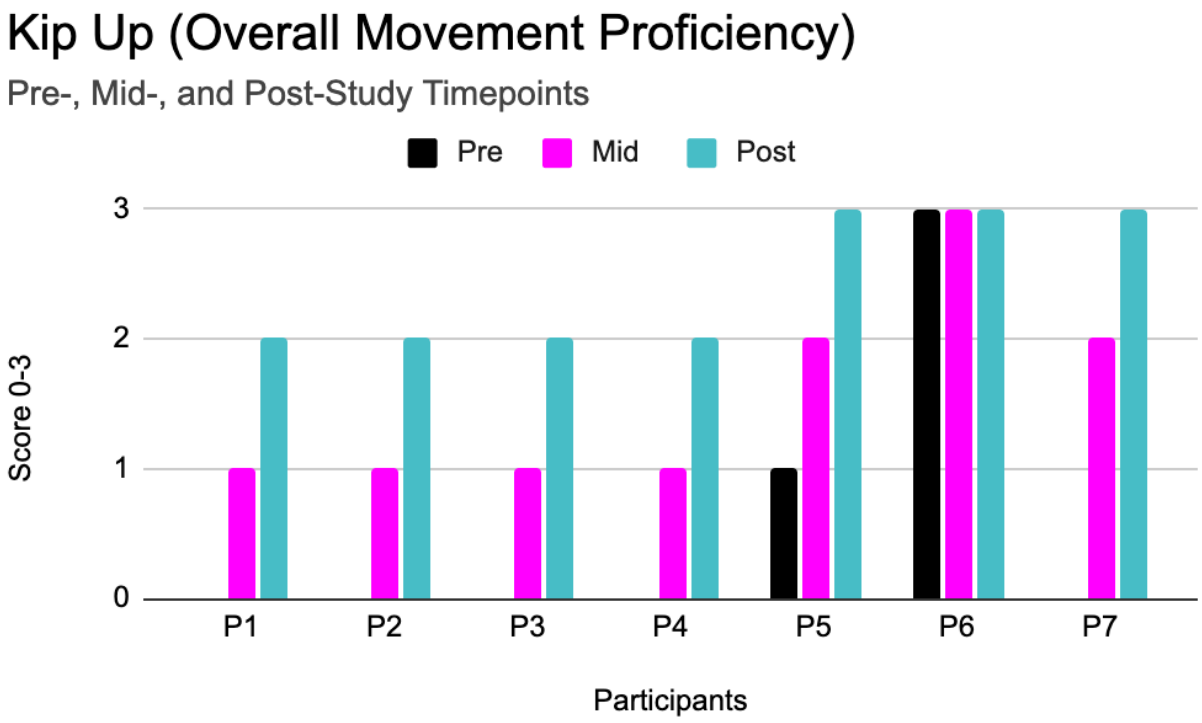


Figure 12.5: This graph shows the kip-up test results for overall movement proficiency for all three testing periods.

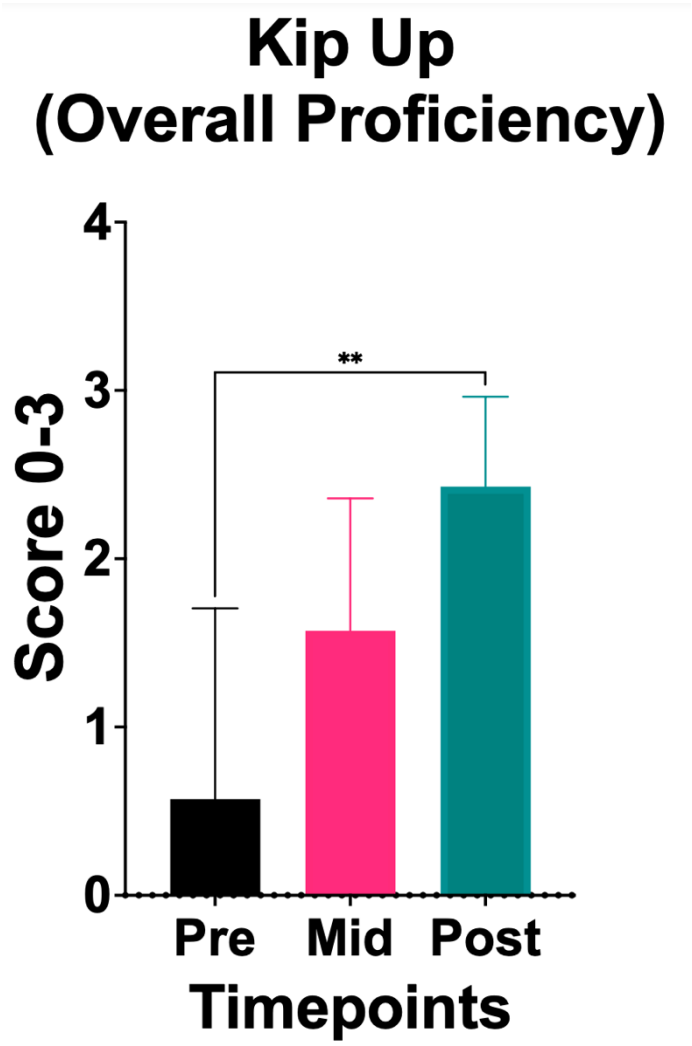


Figure 12.6: This graph displays the comprehensive statistical data depicting the participant's progress in overall movement proficiency during the kip-up throughout all three.

A paired-sample t-test was conducted to compare the means of the Pre and Post timepoints, as seen in Figure 12.6. The t-statistic was 5.46, with df=6 ($p = 0.002$). This study's results indicate a statistically significant difference between the mean test scores of the pre-testing and the post-testing. These findings suggest that the new study strategy effectively improved test performance on the Kip-Up (Overall Movement Proficiency).

Each category for scoring the kip-up had a maximum possible score of 3. During pre-study testing, the average score for clarity of moving in and out of the floor was 0.57 (SD =1.13), which improved to 2.7 (SD = 0.4) in post-study testing (please see Figure 12.1). Similarly, the average score for utilization of accurate muscle groups increased from 0.57 (SD = 1.13) to 2.57 (SD = 0.5) (see Figure

12.3), and the average score for overall proficiency rose from 0.57 (SD = 1.13) to 2.4 (SD = 0.5) (see Figure 12.5).

Instructors Findings

To enhance the explosive hip power required for performing a kip-up, the instructor included exercises such as candlestick roll-ups, dumbbell thrusters, and dumbbell cleans. To improve the deep core strength needed for performing a kip-up, the participants were given exercises such as hollow body rocks, dumbbell Russian twists, and overhead dumbbell sit-ups.

Inversion Analysis and Changes

An inversion is a widely used floorwork movement in various dance styles, such as modern, contemporary, and breakdancing. The inversion was chosen for this study because it requires a significant of strength and control in the shoulder girdle. Please see Appendix E for the movement demonstration link.

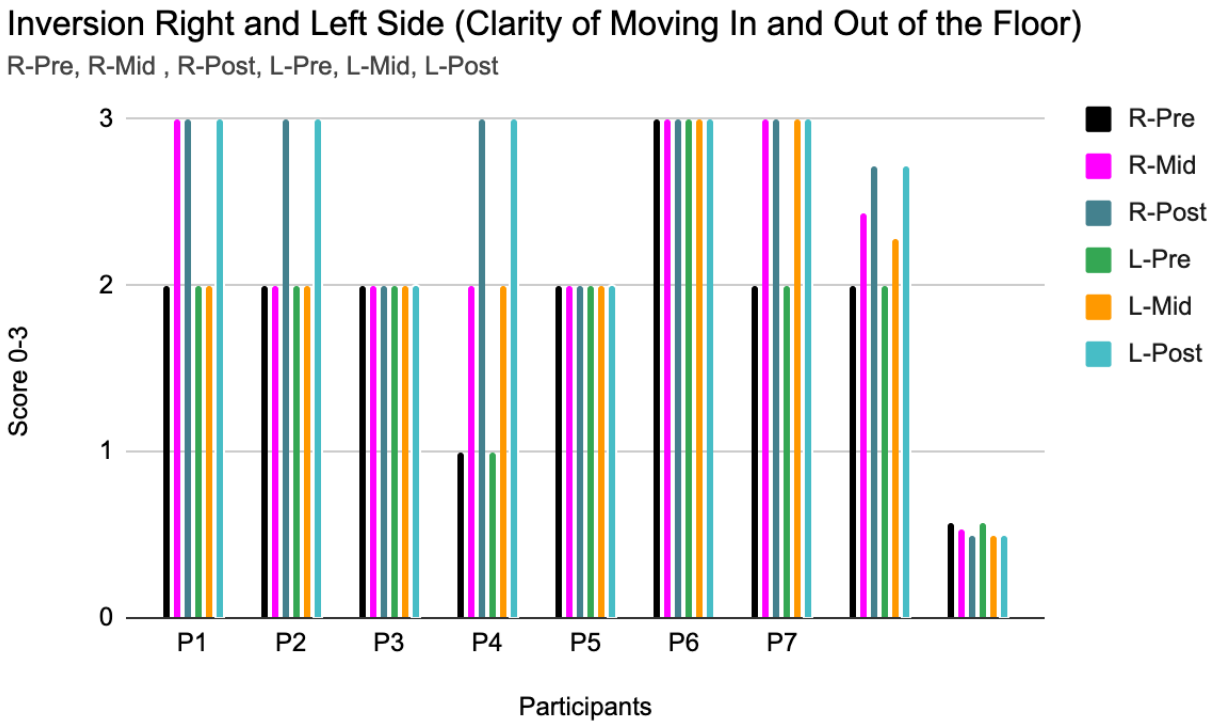


Figure 13.1: This graph illustrates the inversion test results (right and left side) for clarity of moving In and out of the floor during all three testing periods.

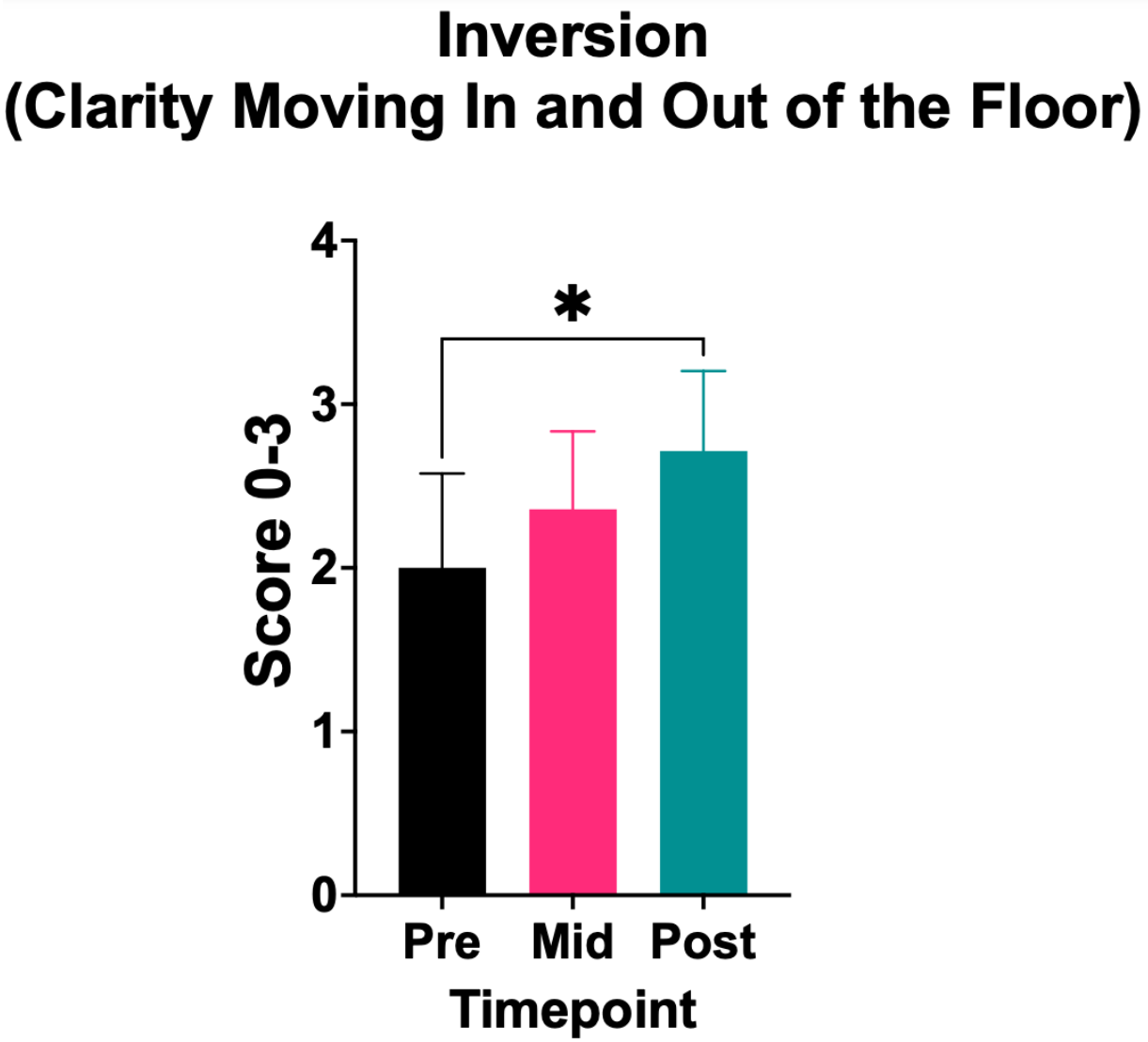


Figure 13.2: This graph displays the comprehensive statistical data depicting the participant's progress of moving in and out of the floor during the inversion throughout all three.

A paired-sample t-test was conducted to compare the means of the Pre and Post timepoints, as seen in Figure 13.2. The t-statistic was 2.5, with df=6 ($p = 0.05$). This study's results indicate a statistically significant difference between the mean test scores of the pre-testing and the post-testing. These findings suggest that the new study strategy effectively improved test performance on the Inversion (Clarity of Moving in and Out of the Floor).

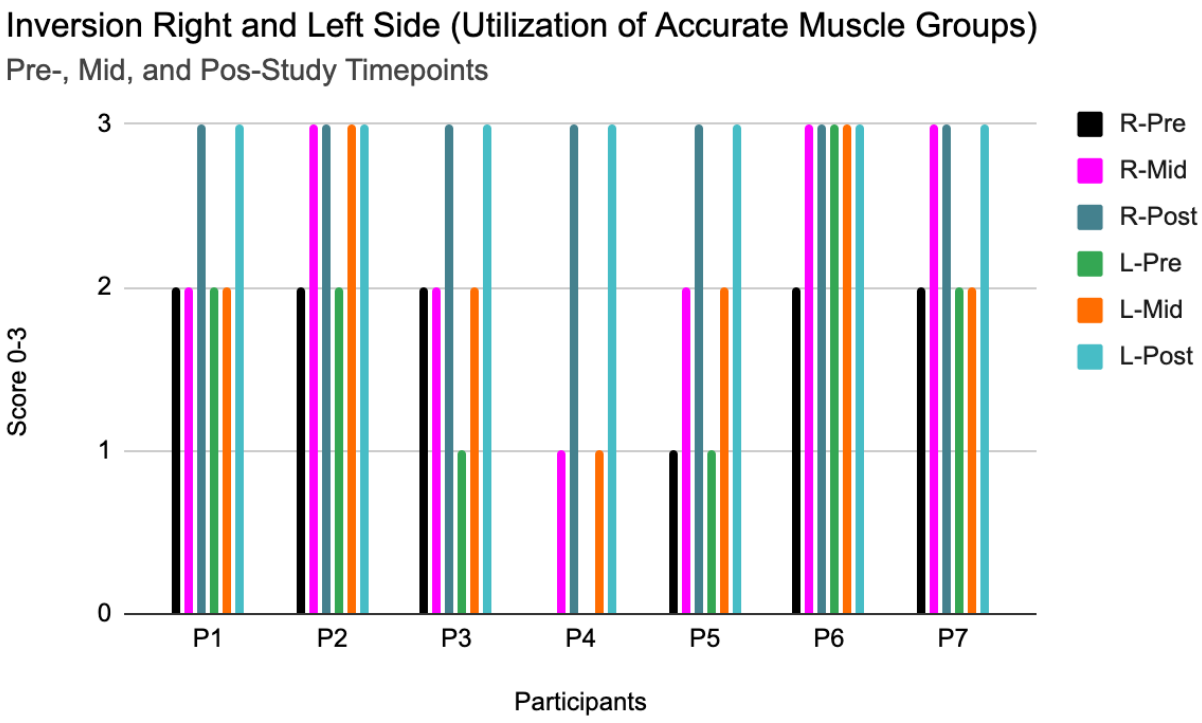


Figure 13.3: This graph illustrates the inversion test results (right and left side) utilization of accurate muscle groups during all three testing periods.

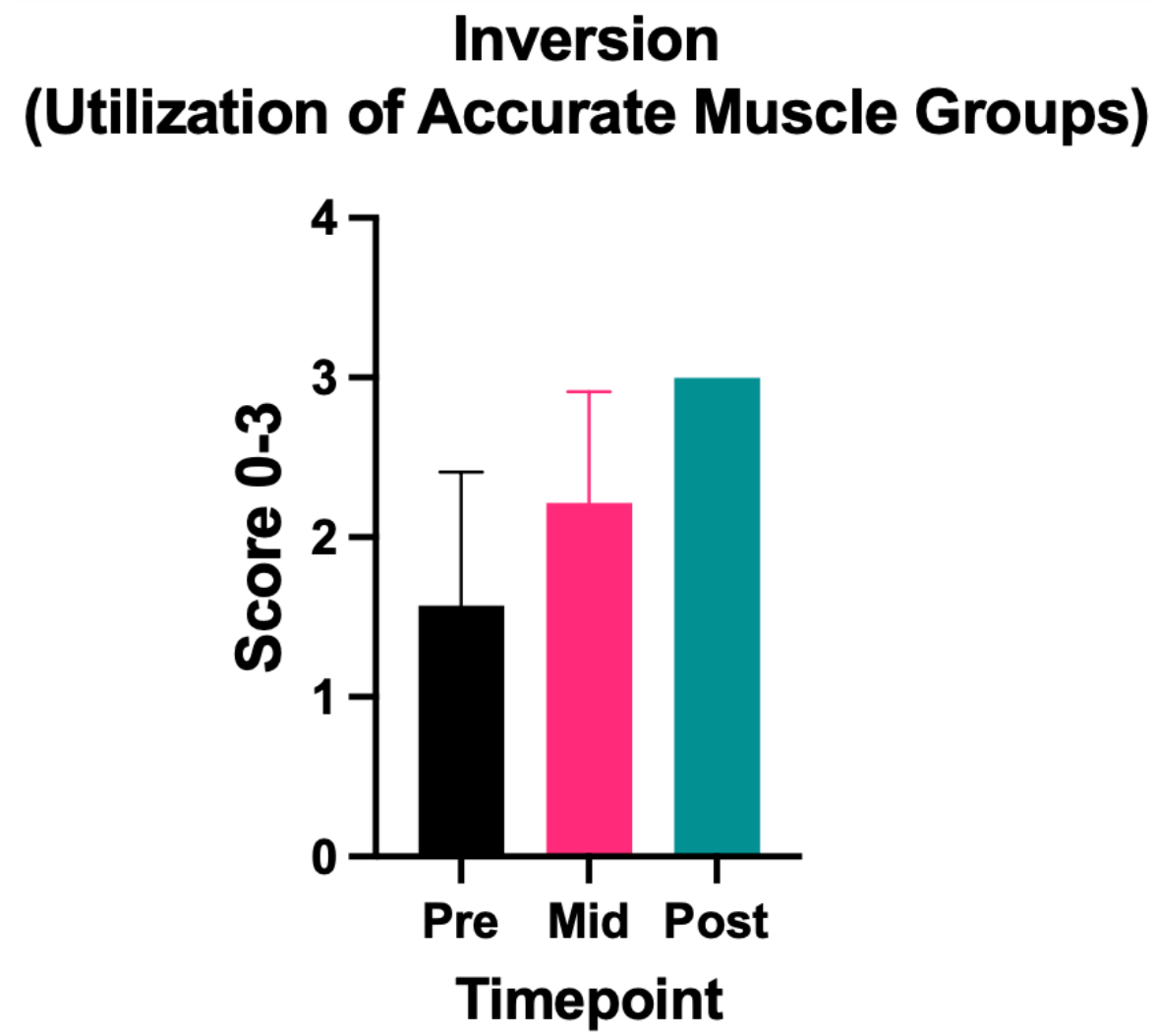


Figure 13.4: This graph displays the comprehensive statistical data depicting the participant's progress in utilizing the accurate muscle groups while performing an inversion throughout all three testing periods

A paired-sample t-test was conducted to compare the means of the Pre and Post timepoints, as seen in Figure 13.4. The t-statistic was 4.51, with df=6 (p =0.004). This study's results indicate a statistically significant difference between the mean test scores of the pre-testing and the post-testing. These findings suggest that the new study strategy effectively improved test performance on the Inversion (Utilization of Accurate Muscle Groups).

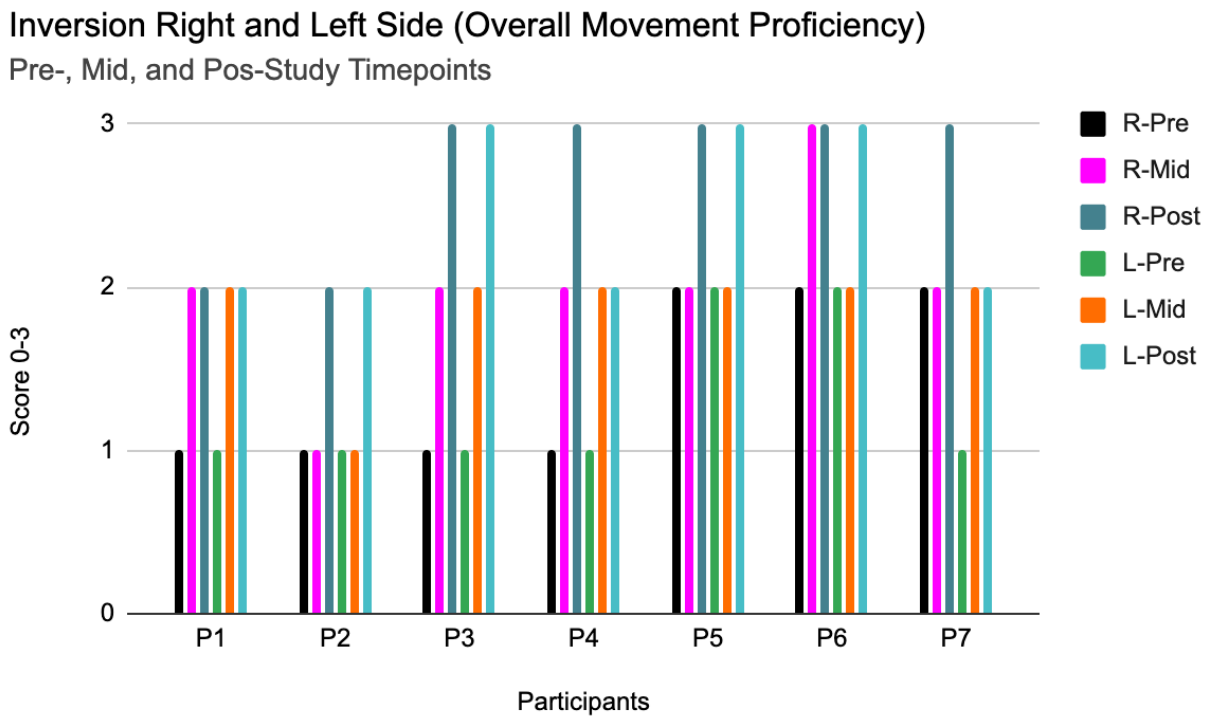


Figure 13.5: This graph illustrates the inversion test results (right and left side) for overall movement proficiency during all three testing periods.

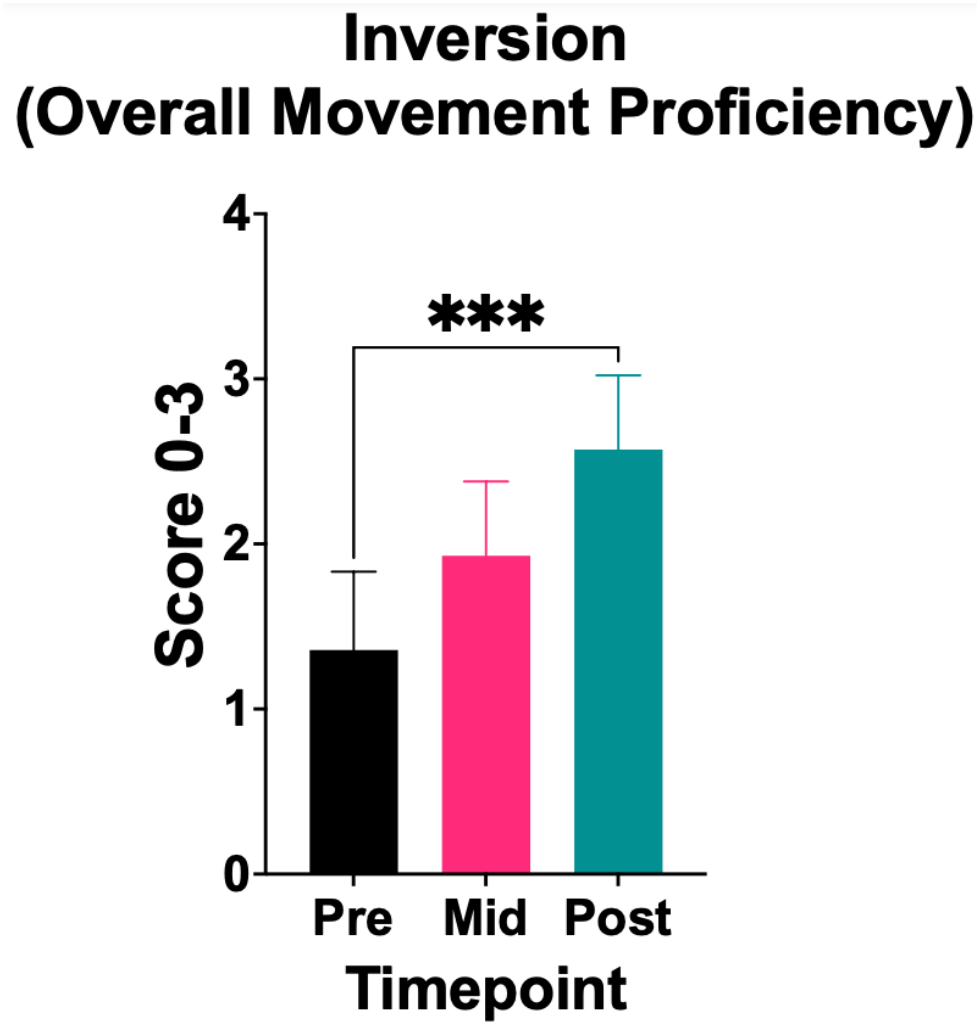


Figure 13.6: This graph displays the comprehensive statistical data depicting the participant's progress in overall movement proficiency while performing an inversion throughout all three testing periods.

A paired-sample t-test was conducted to compare the means of the Pre and Post timepoints, as seen in Figure 13.6. The t-statistic was 8.17, with df=6 ($p = 0.0002$). This study's results indicate a statistically significant difference between the mean test scores of the pre-testing and the post-testing. These findings suggest that the new study strategy effectively improved test performance on the Inversion (Overall Movement Proficiency).

For each category of inversion scoring, the maximum possible score on both the right and left sides was 3. During pre-study testing on both sides, the average score for clarity of moving in and out of the floor was 2 (SD = 0.5), which improved to 2.7 (SD = 0.4) in post-study testing (refer to Figure 13.1).

Additionally, the average score for utilizing accurate muscle groups on the right and left sides increased from 1.57 (SD = 0.7) to 3 (SD = 0) (refer to Figure 13.3). The average score for overall proficiency also increased from 1.42 (SD = 0.5) to 2.42 (SD = 0.5) on the right side and 1.28 (SD = 0.4) to 2.42 (SD = 0.5) on the left side (refer to Figure 13.5).

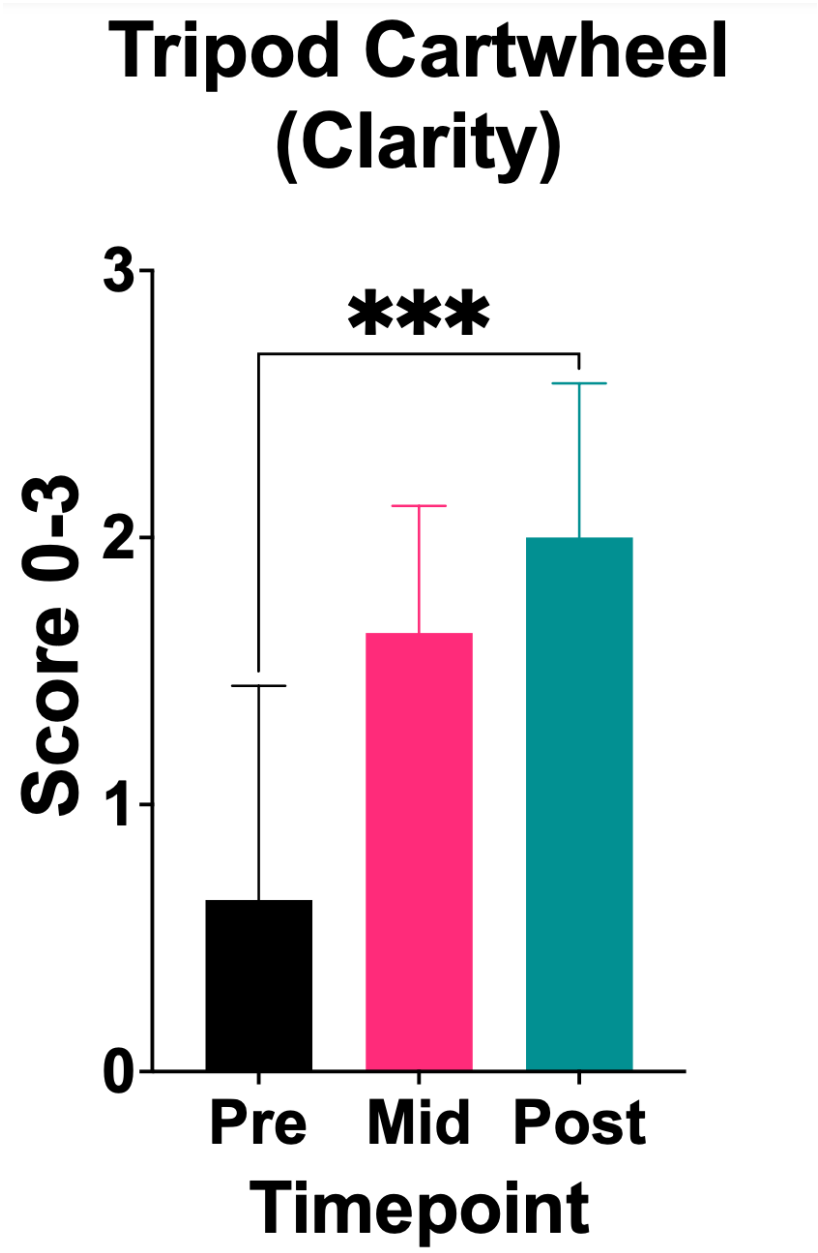
Instructors Findings

To enhance the shoulder strength needed to perform an inversion, the instructor incorporated various versions of overhead pressing or holds, such as seated overhead press, single-arm overhead press, and dumbbell overhead carries. To improve the shoulder and core stability required to sustain the balance of an inversion, the instructor included exercises like dumbbell windmills, dumbbell plank slide-throughs, and wall walks (bench walks were used as a modification).

Tripod Cartwheel Analysis and Changes

The most challenging floorwork movement in this study was the tripod cartwheel, which involves a combination of a tripod planche and a cartwheel, placing significant weight on the shoulders, triceps, and core muscles of the participants.

Figure 14.1: This graph exhibits the tripod cartwheel test results (right and left side) for clarity of moving



In and out of the floor during all three testing periods.

Figure 14.2: This graph displays the comprehensive statistical data depicting the participant's progress of moving in and out of the floor during the tripod cartwheel throughout all three testing periods

A paired-sample t-test was conducted to compare the means of the Pre and Post timepoints, as seen in Figure 14.2. The t-statistic was 6.45, with df=6 ($p = 0.0007$). This study's results indicate a statistically significant difference between the mean test scores of the pre-testing and the post-testing.

These findings suggest that the new study strategy effectively improved test performance on the tripod cartwheel (Clarity of Moving in and Out of the Floor).

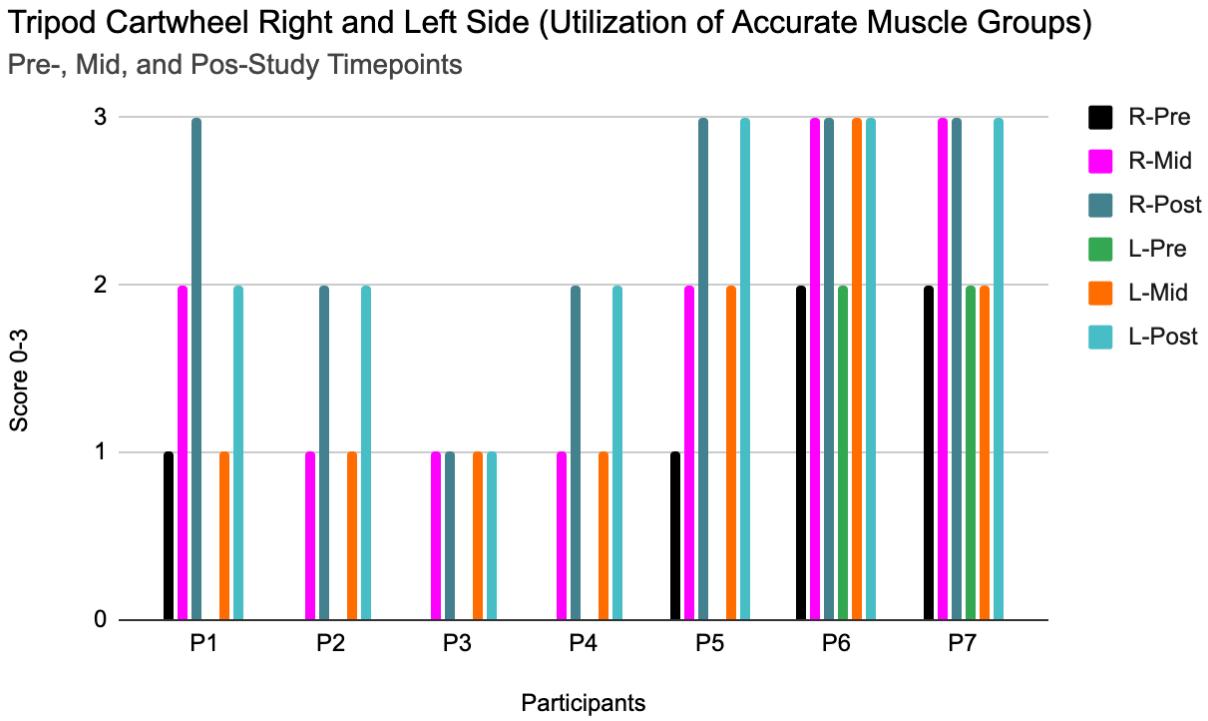


Figure 14.3: This graph exhibits the tripod cartwheel test results (right and left side) for utilization of accurate muscle groups during all three testing periods.

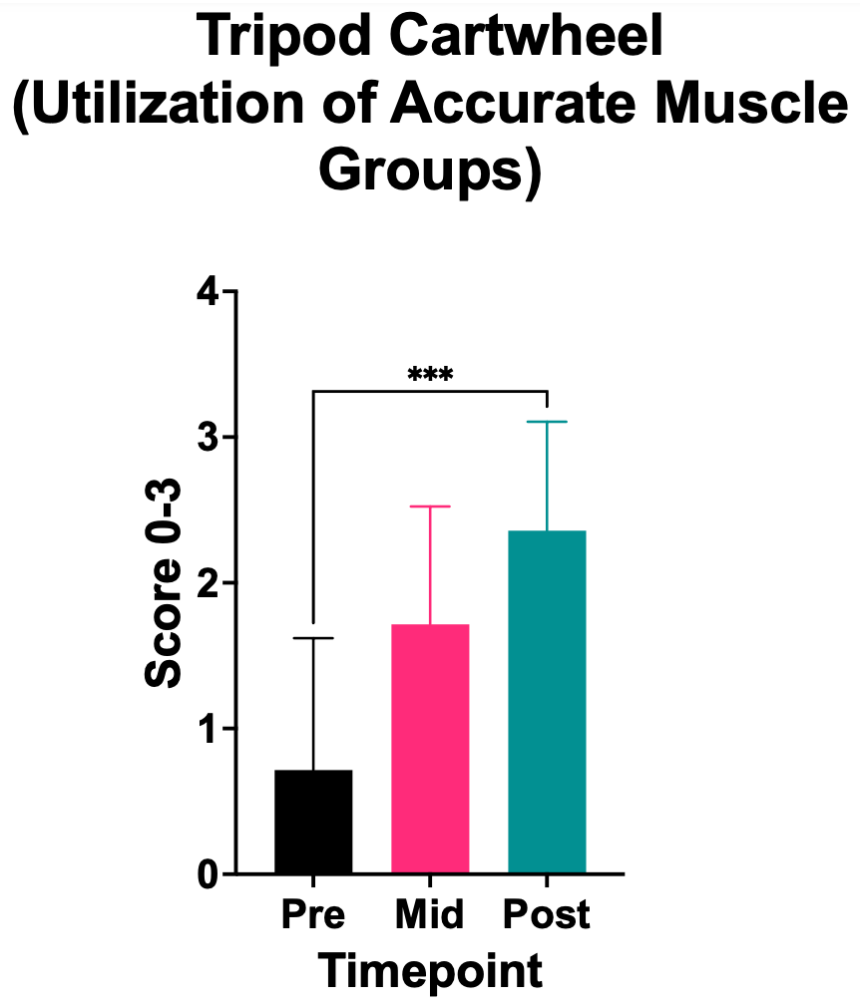


Figure 14.4: This graph displays the comprehensive statistical data depicting the participant's progress utilizing the accurate muscle groups during the tripod cartwheel throughout all three testing periods.

A paired-sample t-test was conducted to compare the means of the Pre and Post timepoints, as seen in Figure 14.4. The t-statistic was 6.91, with df=6 ($p = 0.0004$). This study's results indicate a statistically significant difference between the mean test scores of the pre-testing and the post-testing. These findings suggest that the new study strategy effectively improved test performance on the tripod cartwheel (Utilization of the Accurate Muscle Groups).

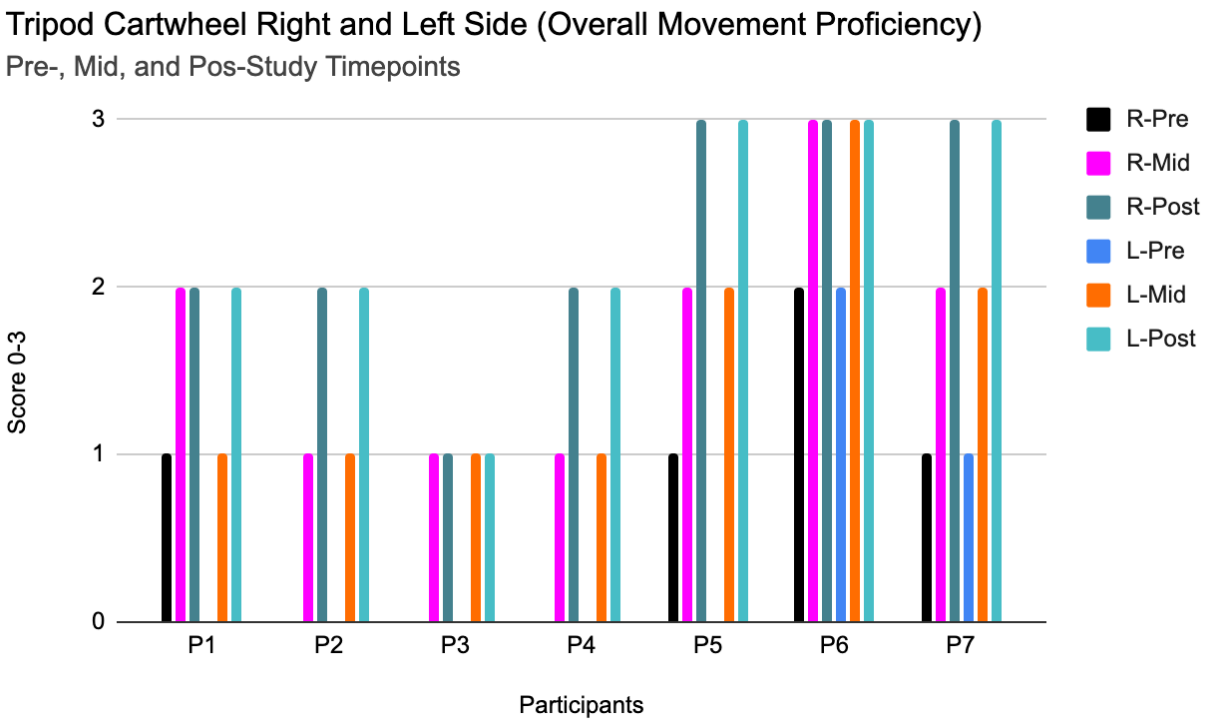


Figure 14.5: This graph exhibits the tripod cartwheel test results (right and left side) for overall movement proficiency during all three testing periods.

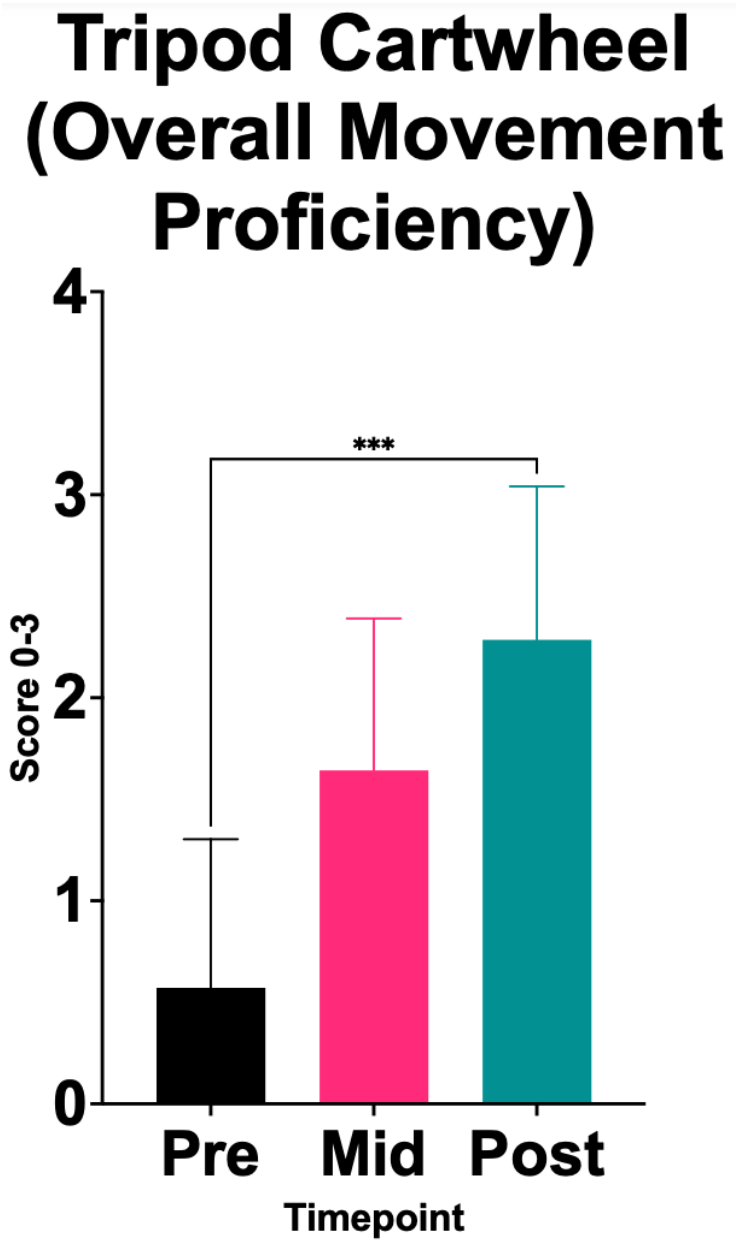


Figure 14.6: This graph displays the comprehensive statistical data depicting the participant's progress in overall movement proficiency during the tripod cartwheel throughout all three testing periods.

A paired-sample t-test was conducted to compare the means of the Pre and Post timepoints, as seen in Figure 14.6. The t-statistic was 8.0, with df=6 ($p = 0.0002$). This study's results indicate a statistically significant difference between the mean test scores of the pre-testing and the post-testing. These findings suggest that the new study strategy effectively improved test performance on the tripod cartwheel (Overall Movement Proficiency).

The maximum possible score for each category of tripod cartwheel scoring on both the right and left sides was 3. During pre-study testing, the average score for clarity of moving in and out of the floor was 0.71 (SD = 0.7) on the right side and 0.57 (SD = 0.9) on the left side. However, in post-study testing, the average score improved significantly, reaching 2 (SD = 0.5) on both the right and left sides (refer to Figure 14.1). Additionally, the average score for utilizing accurate muscle groups on the right increased from 0.85 (SD = 0.8) to 2.42 (SD = 0.7), and on the left increased from 0.57 (SD = 0.9) to 2.28 (SD = 0.7) (refer to Figure 14.3). The average score for overall proficiency also increased from 0.71 (SD = 0.7) to 2.28 (SD = 0.7) on both the right and left sides (refer to Figure 14.5).

Instructors Findings

To enhance the upper body and core strength needed to perform a tripod cartwheel, the instructor incorporated exercises such as bicep curls, tricep extensions, banded lat pull-downs, and renegade rows. Additionally, push-up negatives and extended plank holds were utilized to improve positional strength.

Qualitative Data

Qualitative data was collected from the participants by distributing anonymous pre- and post-study questionnaires through Google Forms (see Appendix F & G). The pre-study questionnaire aimed to gather information about the participants' fitness and cross-training background, preferred style of dancing, and goals for participating in the study. On the other hand, the post-study questionnaire was designed to obtain an overall understanding of the participants' feelings toward the study and their perceived improvements.

Pre-Study Questionnaire Results

The pre-study questionnaire asked the participants six questions: 1) What is their primary dance style? 2) What is their preferred dance style? 3) What are they looking to improve in their dance training by participating in this study? 4) What components in other cross-training modalities have they found helpful to their dance practice? and 5) Anything else they would like to share with the research team that felt important to note. Upon reviewing the Google form, it was found that only two participants had prior weight training knowledge, while others mainly had practiced Yoga and Pilates, and one participant had a prior gymnastics background. Only one participant had prior training in floorwork, while all the others had

primarily ballet training or modern training. The average responses to what they hoped to improve in their dancing were narrowed down to four categories: 1) improvement in upper body strength and inversions, 2) better stamina and endurance, 3) better explosive power, and 4) overall strength gains. The average responses to what they have found helpful for their dancing from other cross-training modalities fell into three categories: 1) core exercises for stability, 2) upper body exercises for partnering, and 3) endurance training. Only one participant had additional information to share, expressing a previous knee injury from three years ago and a desire to strengthen the muscles surrounding the knee joint for better movement quality and pain management. These responses provided valuable insight into the participants' fitness backgrounds and goals for improving their dancing, thereby informing the study's learning objectives.

Post-Study Questionnaire Results

The post-study questionnaire asked the participants six questions: 1) In what ways, if any, did this study help improve their dancing? 2) Would they continue with this type of cross-training or recommend it to other dancers, and why? 3) Which areas of their overall health and fitness have they seen the most improvement? 4) Have they noticed any areas of improvement beyond fitness? 5) What aspects of the study felt the most limiting or challenging? And 6) Any further thoughts that felt important to share with the research team. Participants reported that the study primarily helped improve their upper body strength in movements such as inversions or those that required yielding to get in and out of the floor. Some also noted improvements in back stability by engaging their core, as well as increased stamina for performing longer combinations. All participants expressed a longing to continue this type of training to support their dance practice and recommended it for dancers of any genre. One participant even expressed a desire for this type of training to be integrated into their regular dance curriculum. The participants reported experiencing the most significant improvements in their fitness and health in the following areas: 1) upper body and shoulder strength, 2) cardiovascular endurance and stamina, and 3) mental health. Several unexpected improvements were reported by the participants, including enjoying the discipline of waking up early, appreciating the structure of the study that helped them start their day off right, feeling more committed to other areas of their lives, feeling proud of themselves for overcoming a difficult challenge, forming strong bonds with other participants and looking forward to training with them, found this study improved their ballet technique and not just their floorwork, and gaining more self-confidence. When

asked about the areas that felt the most challenging or limiting, participants reported that the push-ups were the most difficult due to their lack of upper body strength coming into the study. Sprint intervals challenged their willingness to push through fatigue, and some felt limited by the lack of equipment. However, one participant noted that although all the exercises were challenging, none felt impossible, and they appreciated that modifications were offered for every exercise at every level. Lastly, only one participant wanted the research team to know that, overall, this study helped them develop greater self-confidence in their own strengths and abilities.

Summary

For both the quantitative and qualitative outcome measures, the 8-week intervention overall proved to be an effective method of enhancing UCI dance major's strength, cardiovascular function, and execution of contemporary floorwork movements. Additionally, the intervention had unexpected positive effects on their dance technique in other genres, instilled discipline and structure into their daily routine, and boosted their confidence in their abilities.

CHAPTER SEVEN

ARTISTIC INTEGRATION AND PERFORMANCE

As part of Aim 2, a creative installation performance was developed, featuring a multimodal presentation that incorporated video projection, live demonstrations, a feedback session, and dance. The performance was designed to reflect the learning objectives of the research study. Through video documentation and the dancers' permission, the creative body of work showcased the progress made in the outcome measures of this study and contemporary floorwork dancing. The performance was held in the Experimental Media and Performance Lab (XMPL), an adaptable black box theater, at the University of California, Irvine, following the 8-week intervention. The use of the XMPL aided in the interdisciplinary nature of the performance and aided in audience participation due to the arrangement of the space. It was crucial to integrate the training into the dancers' performance practice to fully understand the study's impact on their ability to perform vigorous work for extended periods. The goal for this creative performance was to incorporate elements of the experiment into the choreography, highlighting the dancers' increased strength, speed, and energy. This chapter describes the following components included in the thesis installation: 1) the use of projection and demonstration for presenting the research, 2) research elements incorporated into the performance portion, and 3) audience engagement and feedback session.

Video Projection and Outcome Measure Demonstrations

Before the show, the audience was presented with a visually engaging video that showcased the pre-, mid-, and post-study testing, giving them an insight into the participants' accomplishments during the 8-week research study. Additionally, the dancers were stationed at various locations to guide the audience in participating in the same outcome measures that were used in the study. It was essential to provide the audience with a broader understanding of the study before the artistic creation came to life through dance. Merely watching the performance alone would not have fully showcased the effort and dedication of the participants. By offering more context, the audience could better appreciate the hard work that went into this experiment and the significance of the artistic creation that resulted from it.

Video Projection

As audience members entered the space, they were greeted by a seven-minute video playing on a loop projected on both the back wall and floor. The video featured clips from pre-, mid-, and post-testing were arranged in Hollywood squares format, allowing viewers to see the progress of the participants over the course of the eight-week program (see Appendix N). Although the clips were not shown in a linear fashion, the video was designed to stimulate the audience and provide an overall sense of the work accomplished by the participants before viewing their dance. Despite the non-linear format, the video effectively showcased the progress and success of the participants.

Outcome Measure Demonstrations

Upon arrival, the audience was greeted and invited onto the stage, where participants were stationed at two locations showcasing the outcome measures through both video and live action. The participants encouraged audience participation in performing the outcome measures using the same prompts from the initial research study. The selected outcome measures for these demonstrations and live engagement were the 1-minute push-up test and the airplane test. Out of the five outcome measures, these two were chosen due to 1) audience safety and 2) audience familiarity. This approach successfully integrated the research into the artistic work while allowing for greater audience understanding through participation. Overall, this proved to be an effective method for combining research and art.

Research Elements Incorporated into the Dance

The intended purpose of this dance piece was to demonstrate the success of an 8-week intervention study on functional cross-training for peak performance readiness in pre-professional dancers performing in contemporary floorwork. The dance portion of this artistic installation was about 25 minutes long. It incorporated several elements of the 8-week research study, including all five outcome measures and the fundamental fitness components of aerobic capacity and strength training.

Aerobic Capacity

The duration of the dance performance was determined based on the 20-minute aerobic training sessions that were conducted throughout the study. The participants engaged in these workouts once a week to enhance their aerobic capacity and enable them to perform longer and more challenging dance pieces that are not typically covered in technique classes. This piece of training was designed with the intention of replicating the length of professional dance pieces. To showcase the participants'

cardiovascular function, the piece utilized a movement vocabulary that included a five-minute-long jumping jack series, a section in the middle where the dancers stepped to the same metronome beat from the 3-minute accelerated step test, and a longer group phrase that tested the limits of full-body movement and endurance.

Strength

For this artistic process, dancers performed contemporary floorwork, which is characterized by a dance style that combines an array of techniques that utilize strength and efficiency to spiral into the floor, create patterns on the floor, and explode up and out of the floor while incorporating elements of acrobatics and inversions. Throughout the experiment, dancers performed upper, lower, and full-body strength movements aimed at enhancing their ability to execute challenging contemporary floorwork and partnering movements. The 25-minute performance incorporated partner lifts, holds, supports, carries, and tosses, which demanded significant strength in the shoulders, biceps, quads, core, and lower back muscles. Many of these partnering sequences and floorwork movements were entirely new to the participants, and the strength and weight training proved to be invaluable in the artistic integration of these elements.

To showcase the impressive strength gained by the dancers during the study, they were instructed to fall into a plank position facing the audience and hold the position until they could no longer sustain the a proper plank. They were given options to holding the position: they could perform the plank on their forearms, hands, or even on one hand. A stopwatch counting up to 10 minutes was projected on the back screen during the maximum plank hold, indicating to the audience and the dancers how long they had been holding it. The music faded out around 15 seconds in, allowing the audience to hear the dancers breathing and working hard to sustain the position. This prompted the audience to start cheering for the dancers and supporting them to stay in the plank position for longer. During rehearsals, the dancers had never held the planks for longer than two minutes. In the performance, the first dancer to release from their plank came down at six minutes, while the last two remaining held on for the entire 10 minutes, with the entire crowd counting down from 10. Although this was not pre-planned, it proved to be a successful way to demonstrate the dancers' true potential to the audience, the lead researcher, and the participants.

Outcome Measures

All five outcome measures, including the 1) accelerated step test for heart rate recovery, 2) the airplane test for trunk and lower extremity stability, 3) the 1-minute maximum push-up test for upper body endurance, 4) the 1-minute maximum single-leg squat test for lower body strength and range of motion, and 5) three physically demanding floorwork movements assessing movement quality, were incorporated into the performance, with varying levels of prominence. The kip-up, inversions, and tripod cartwheel floorwork movements were easily and visibly integrated into the dance. However, the push-ups, single-leg squats, and 1-minute step test was incorporated in a less overt manner. The push-ups were utilized to facilitate dancers in softening into the floor after partnering moves or low-flying rolls. The single-leg squats were demonstrated during specific movements that required the dancers to lower on one leg while spinning or jump out of the floor by pushing off one leg. The step test was the most subtly incorporated outcome measure. The dancers marched together in a group to the same beat of a 96 beats per minute metronome, elevating their heart rate before moving into the next section.

Audience Engagement and Feedback Session

Following the dance performance, the lead researcher and faculty representative held a feedback session, inviting the audience to ask questions or share their experiences. During the feedback session, the audience showed particular interest in the participants' personal experiences throughout the study. They asked questions related to the participant's progress, personal achievements, and challenges encountered during the study. The audience encouraged the participants to elaborate on their growth and to share anything they had learned from the cross-training program. The audience's active participation created an engaged atmosphere, providing the participants with a platform to speak candidly about their study experience. Overall, the audience's engagement with the research was evident, and the participants felt heard and supported.

Summary

The creative element of this research study effectively showcased the growth of the participants throughout the program and their newfound ability to perform a lengthy piece that demanded significant strength and endurance. The use of video projections provided the audience with insight into the progress

and success of the participants, while the outcome measure demonstrations allowed for audience participation and engagement. The dance portion of the installation effectively incorporated the elements of the 8-week research study, including all five outcome measures. The use of aerobic capacity training and strength movements enabled the dancers to execute challenging contemporary floorwork and partnering movements. Overall, this performance demonstrated the efficacy of this cross-training program in enhancing contemporary floorwork and promoting functional improvements. The following chapter will discuss the study findings, study limitations, and the potential for incorporating functional cross-training into dance curriculum.

CHAPTER EIGHT

DISCUSSION

The purpose of this chapter is to examine the findings of an 8-week study aimed at enhancing UCI dance majors' strength, cardiovascular function, and execution of contemporary floorwork movements. Additionally, this chapter reviews the limitations of the study and discusses the implications of using functional cross-training techniques to improve pre-professional dancers' physical abilities. The study evaluated the effects of supplementary weight and cardiovascular training on several key parameters, including strength, speed, balance, power, and recovery. Overall, this study provides valuable insights into the benefits of cross-training for pre-professional dancers, highlighting the potential of a functional cross-training program for dance curriculum.

Overview of Research Study Findings

The study's comprehensive analysis of all five outcome measures revealed significant improvements across the board for every participant, thereby affirming the feasibility and efficacy of the intervention. These findings demonstrate the effectiveness of the intervention in enhancing dancers' performance across a range of measures, indicating the potential for functional cross-training programs to improve dancers' technical proficiency, physical stamina, and artistic expression. These results have significant implications for the design of dance training programs, offering a promising avenue for elevating dancers' overall performance.

The 3-Minute Step Test

Weekly anaerobic and aerobic workouts were conducted with a specific focus on improving participants' heart rate during the 3-minute step test and enhancing their ability to recover their heart rate within a minute. The mid-study testing showed significant improvement, with participants reducing their heart rate by an average of 26 bpm immediately after the test and recovering by an average of 3 bpm within one minute. However, post-study testing showed a slight decrease in improvement, most likely due to lack of sleep and high stress. In a 1991 study published in the Journal of Sports Science and Medicine, it was found that sleep deprivation significantly impaired the ability of athletes to perform high-intensity exercise, such as the 3-minute step test, by reducing their endurance and increasing their heart rate (Mougin et al., 1991).

The literature affirms that the enhancement observed between the pre-study and mid-study period was attributable to the adoption of high-intensity interval (HIIT) exercises, or anaerobic exercises, which involved sprint intervals that incorporated rest periods. Additionally, aerobic training was utilized by implementing 20-minute circuits that kept participants moving at a moderate and steady pace with minimal rest between exercises. Rodrigues-Krause et al. (2015) found that both high-intensity interval training (HIIT) exercises and aerobic circuit training were effective in improving cardiovascular function and endurance in dancers, which is likely the reason for the observed improvements in the 3-minute step test.

The Airplane Test

The exercises prescribed for the participants were carefully selected to meet the specific requirements of the Airplane test, which demands extending one leg backward while keeping the pelvis level with the ground and flexing the torso forward (Richardson et al., 2010). The results showed that the participants were able to significantly improve their test scores, reducing the number of mistakes made by an average of 12.9 points on the right side and 11.2 points on the left side. The literature supports that these improvements can be attributed to the incorporation of unilateral resistance exercises that enhance core stability and lower body strength, such as the weighted single-leg deadlift and front-foot elevated split squats (Munn et al., 2004). These exercises target critical muscle groups, including the core, knee, and ankle muscles (Hodges et al., 1997), ultimately improving balance and stability. By strengthening these areas, the participants were better equipped to maintain the necessary postures and movements required for the Airplane test, resulting in significantly improved performance.

The 1-Minute Maximum Push-Up Test

Based on the results, participants were able to increase their one-minute push-up count by an average of 12 reps. Participants trained to improve their push-up count by performing exercises such as bench press, shoulder press, tricep extensions, plank variations, and back rows, Additionally, participants performed push-up variations, such as elevated push-ups, push-up negatives, and banded push-ups. This approach was informed by studies that have shown that these exercises can enhance push-up performance and gradually increase strength and endurance in the push-up movement (Fisher et al., 2017).

The 1-Minute Maximum Sigle-Leg Squat Test

The outcomes of the study revealed that the mean quantity of single-leg squats performed in one minute by the participants had a noteworthy increase of 8 repetitions. The literature indicates that the single-leg squat movement is a multifaceted functional exercise that necessitates coordination, balance, and force from various muscle groups, including the quadriceps, gluteus medius, hip adductors, hip abductors, and ankle dorsiflexors (Bailey et al., 2011). To develop strength and enhance the target muscles, exercises like air squats, weighted squats, lunges, and step-ups were implemented (Bailey et al., 2011). Additionally, banded glute bridges and banded clam shells were used to strengthen the hip abductors and adductors (Bailey et al., 2011). These specific exercises played a key role in amplifying the subjects' capacity to perform a greater number of single-leg squats within the given one minute.

Movement Analysis

Kip-Up

The kip-up assessment revealed significant improvement in all three evaluation criteria: 1) clarity of entry and exit from the floor, 2) utilization of correct muscle groups, and 3) overall movement proficiency. Explosive hip extension, knee flexion, and trunk rotation are the fundamental biomechanical components of a kip-up, which primarily rely on the hip and leg muscles (Chayun et al., 2020). Moreover, timing and coordination among different body segments are crucial for executing this move successfully (Chayun et al., 2020To address these requirements, the study introduced specific exercises, such as dumbbell thrusters and dumbbell cleans, to strengthen the legs and enhance hip explosiveness, along with the candlestick roll-up to improve body segment coordination. These targeted exercises are believed to be the key reason why participants demonstrated enhanced kip-up performance.

Inversion

The results of the inversion assessment demonstrated significant improvements in all three evaluation criteria for both the left and right sides. According to a study conducted by Liemohn and Baumgartner (2019), which aimed to identify the specific muscles activated during a handstand, several upper body and core muscles were found to be significantly activated, including deltoid, pectoralis major, serratus anterior, latissimus dorsi, rectus abdominis, external oblique, erector spinae, and gluteus maximus. This research suggests that performing a handstand requires not only significant upper body

strength but also core strength, coordination, and balance (Okubo, 2015). Therefore, the exercises incorporated in this study, such as dumbbell windmills, dumbbell plank slide-throughs, dumbbell shoulder presses, and wall walks, were likely the reason for participants' improvements in the inversion assessment.

Tripod Cartwheel

Participants demonstrated significant improvements in all three assessment criteria for both the left and right sides in the tripod cartwheel evaluation. In Chou's (2008) biomechanical analysis of the push-up, they found that the trapezius and serratus anterior muscles in the shoulder girdle play a crucial role in stabilizing the scapula and shoulder joints during the end range of the movement, similarly to position you are during the tripod cartwheel. Additionally, the latissimus dorsi and rhomboids in the upper back are responsible for maintaining spinal extension, while the rectus abdominis and obliques in the abdominal muscles are essential for stabilizing the trunk and pelvis. Consequently, the study employed exercises like dumbbell shrugs, banded lat pulldowns, and renegade rows to target the shoulder and upper back muscles. Push-up negatives and extended plank holds were utilized to improve positional strength, which contributed to the observed improvements in the tripod cartwheel evaluation.

Key Components to Consider

If this study were to be replicated in the future, it is important to consider the unexpected key components that emerged. These components offer valuable insights for the development of a framework for incorporating a cross-training program. The research team identified the following components. 1) this style of cross-training can be utilized for genres of dance beyond contemporary floorwork, 2) a group setting for training is crucial for instilling a sense of camaraderie and pushing participants to reach their fullest potential, 3) morning training sessions proved successful in instilling discipline and setting the tone for the rest of the participants' day, and 4) the trainer must have sufficient knowledge to provide modifications for each exercise and progressively increase the difficulty level of the movements.

Successful Improvements Beyond Fitness

Based on the participants' self-reflection, it was discovered that this style of cross-training has provided them with additional benefits beyond physical fitness. The following is a list of self-reported successes throughout the study: 1) improvement in participants' mental health and self-confidence. 2)

enhancements in participants' mental fortitude in daily life aspects during challenging and stressful times, such as the ability to manage their schedule and stay consistent in showing up to their responsibilities, and 3) participants were able to find a greater sense of self-accomplishment, which made them realize they are capable of achieving difficult things.

Overview of Study Limitations

Research Study Design Limitations

One of the most significant limitations of this study was the constraints of time. The necessary process of IRB approval delayed the study by a month from its intended start date, resulting in difficulties in coordinating testing periods and delaying the start of rehearsals for the creative portion. Additionally, participants' availability was a major limiting factor in scheduling training sessions, as dance majors typically have demanding schedules. The only available time for all participants to meet was at 7 am before classes. It was challenging for many as they often had rehearsals until late at night, resulting in some participants being slightly sleep-deprived during morning training sessions. This limitation may have also contributed to the missed sessions by some participants.

Space and Equipment Limitations

This study was solely funded by the lead researcher, and due to budget constraints, the research team had to rely on the resources available on campus. Given the lack of funding and liability, this study was limited to training in a studio space that did not have specialized equipment. Although the team was able to afford some equipment, it was restricted to what could fit in the closet of the dance studio. As a result, the study was limited to lighter-weight dumbbells and resistance bands. Cardiovascular endurance exercises were also limited to movements such as jumping rope, shuttle runs, and burpees instead of cardio machines found in gym facilities.

Creative Limitations

Due to the delayed start of the experiment, the rehearsal schedule was also delayed, resulting in less time to create choreography and teach advanced movements and partnering. The participants' schedules were already demanding, making rehearsal availability scarce. Additionally, participants were concurrently involved in 2-3 other shows, one of which had tech and dress rehearsals the same weekend as the study's performance. As a result, the participants were under a lot of mental and physical stress,

resulting in missed sleep and inadequate body maintenance. Lastly, the limited budget constrained the research team's production resources and ability to hire a production team.

Considerations for the Future

If the opportunity arises to repeat this research study, the following considerations would be taken into account: 1) extending the duration of the experiment to twelve weeks instead of eight, which would provide participants with more time to enhance movement progressions and achieve greater improvements, and 2) introducing additional floorwork skills and partner work earlier in the study to increase participants' familiarity with movement vocabulary prior to the performance.

Potential for Implementation of Function Cross-Training in Dance Curriculum

Based on the framework and results of this research study, dance education can integrate functional cross-training into interdisciplinary dance classes as well as separate training programs. This approach can help dancers develop physical abilities beyond the traditional demands of dance, improve overall fitness, prevent injury, and enhance performance. The incorporation of functional cross-training can also provide additional benefits such as mental and emotional wellness, time management skills, and increased confidence. By implementing functional cross-training into dance curriculum, dance educators can better prepare their students for the demands of the profession and promote lifelong health and wellness practices.

Interdisciplinary Class or Separate Training Sessions

Incorporating functional cross-training into dance technique classes can provide a time-efficient way for dancers to improve their physical abilities. By combining strength training with dance techniques, dancers can save time and see improvements in both areas simultaneously. Incorporating this training into dance technique classes would also benefit educational institutions by saving money on separate fitness facilities, classes, and instructors. However, there are also some potential disadvantages to consider. Introducing new movements and techniques into a dance technique class can disrupt the flow and consistency of the class and may require additional time and attention to master. Additionally, it is important to ensure that the cross-training exercises are appropriate and safe for dancers at all levels. Some movements may be too advanced or potentially harmful if not performed correctly. It is also important to strike a balance between the focus on the dance technique and the incorporation of cross-

training to avoid diluting the core curriculum of the class. Lastly, this would require the teacher of the class to be trained in multiple disciplines and have experience in this type of cross-training.

One benefit of having cross-training separate from dance classes is the potential for more specialized and targeted training. Separate cross-training classes can be designed with specific goals in mind, such as improving cardiovascular endurance or building strength in certain muscle groups. Additionally, separate classes may provide a change of pace for dancers, helping to prevent burnout from the repetition of dance technique classes. On the other hand, separating cross-training from dance classes can create scheduling conflicts for dancers who already have demanding schedules and can also lead to additional costs for both the students and the education system. Additionally, cross-training that is separate from dance classes may not always be tailored to the specific needs of dancers, and it may not be as well-integrated into the overall dance curriculum. Many universities currently list “cardio conditioning” classes in their course catalog. However, after running an informal investigation, these classes are actually offering teachings of Pilates and Yoga principles.

It may be beneficial for cross-training to take place outside of the regular dance class schedule. By offering separate cross-training sessions, dancers can have the opportunity to focus solely on fitness without sacrificing valuable technique class time. This approach can also allow for more targeted and varied training to be offered, potentially leading to more significant improvements in strength, endurance, and overall fitness. However, integrating cross-training into dance technique classes could act as a catalyst in motivating dancers and instructors to adopt this approach to training.

Summary

In summary, this study has expanded upon an existing framework for integrating exercise science principles into a functional cross-training program for collegiate dancers. By including weight training and cardiovascular exercises in their week, participants were able to improve their physical abilities and mental resilience. This study underscores the significance of group fitness, progressive movements, and modifications, as well as the advantages of training first thing in the morning. It emphasizes the value of cross-training programs for dancers and supports inclusion in pre-professional dance education.

CHAPTER NINE

CONCLUSION

This two-part thesis was comprised of 1) a scholarly literature review that aided in the development of a working hypothesis to design an 8-week experimental intervention study. and 2) implementing a functional cross-training program for seven UCI dance majors with the objective of enhancing their overall performance in a contemporary floorwork piece. The review of literature covered a broad range of disciplines, including dance, sports, injury prevention, and exercise science. This extensive exploration aided in refining the scope of the present study, directing attention toward a gap in dance training that supports the execution of the selected outcome measures and contemporary floorwork. The intervention procedures involved familiarizing participants with five outcome measures, employing functional cross-training methods in accordance with the literature, conducting pre-, mid-, and post-study tests on the participants regarding the outcome measures, and analyzing the data to evaluate the participants' progress. The test results showed an overall increase in participants' strength and endurance. Personal reflections of the participants were gathered through pre- and post-study questionnaires in order to analyze and present qualitative data. The qualitative data indicated that participants reported significant gains in strength and expressed a strong recommendation for this style of cross-training to be implemented for dancers of all genres. In addition to implementing an intervention study, this thesis presented a reflective, creative body of work that incorporated elements of the research study content. What distinguishes this approach from other cross-training modalities is its holistic consideration of all aspects pertinent to dancers' performance, encompassing skill-specific movements. This methodology aims to enhance dancers' overall health and strength while also targeting specific outcomes associated with floorwork movements. To further substantiate the findings of this study, it is recommended to conduct future research with a larger sample size and a longer duration of at least 12 weeks. This will facilitate a more comprehensive data analysis, enhance participants' fitness development, and contribute to validating the findings of the outcome measures.

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APPENDIX A

IRB Documents

PROTOCOLS

#2143 - Functional Cross Training Methods For Collegiate Dancers

Protocol Information

Review Type	Status	Approval Date	Continuing Review Date
Expedited	**Approved**	**Nov 29, 2022**	**--**

Expiration Date	Initial Approval Date	Initial Review Type
Nov 28, 2025	**Nov 29, 2022**	**Expedited**

Feedback

Approval Comment

The IRB Approval Letter and any approved documentation (e.g. stamped consent forms) can be downloaded in the Attachments section of the protocol.

Project Details

Project Title (100 words max):

Functional Cross Training Methods For Collegiate Dancers

Lead Researcher/Investigator:

Frances Henderson

Lead Unit (i.e., Department, Organized Lead Unit, Center or Institute):

IR-8041 - THE ARTS-DANCE (Lead Unit)

Kuali Research (KR) follows the KFS Organizational Unit Hierarchy.

ATTENTION! For new submissions, Department Chair (DC) or Organized Lead Unit Director (OLUD) sign-off in KRP is required before final committee approval will be granted. For more information, visit the listserv.

Submission Screener

Submission Type:

IMPORTANT! Be sure to select the correct 'Submission Type'. When 'Submission Type' is changed, the contents of the form will be cleared and replaced with a set of new questions specific to the submission type.

Institutional Review Board (IRB) Review

Lead Researcher's primary school/department/program is:
Social/Behavioral/Educational (Non-Health Sciences)

Select the level of review for this protocol:
Minimal Risk (Expedited)

Specify who initiated/authored the project:
Investigator

Is the project limited to review of records (e.g., medical, educational, prison, etc.) and/or biospecimens (e.g., discarded tissues) without subject contact?
No

Project Funding

Select the funding source(s) (check all that apply):
Student project that will incur no costs

Clinical Trials

Clinicaltrials.gov

Registration on ClinicalTrials.gov may be required if one (or more) of the following is true:

- Study is NIH funded and meets the NIH definition of a clinical trial
- Study is DoD funded and registration is required by your specific program
- Study meets the International Committee of Medical Journal Editors (ICMJE) definition of a clinical trial

Does this research meet the definition of a clinical trial that requires adherence to Clinicaltrials.gov (CT.gov)?

No

Scientific/Scholarly Review

The proposed research qualifies as minimal risk research.

The Department Chair, Division Chief, or Institute Director provides assurance that the research uses procedures consistent with sound research design, the study design can be reasonably expected to answer the proposed question, and the importance of the knowledge expected to result from the research is known.

Other UCI Committee Reviews

Research involving human subjects sometimes requires the approval or authorization of Other Reviews Required by UCI.

For a list of all ancillary committees, their requirements and how they relate to the IRB review process, refer to the Other UCI Required Reviews Chart.

Is the research cancer-related?

No

Potentially Hazardous Materials

Does the research involve human/primate blood, tissue, fluids or primary cells?

No

Study Team

- **Lead Researcher (LR): The LR must meet LR Eligibility requirements or have a Faculty Sponsor (FS) listed who is eligible.**
- **Co-Researcher (CR): CRs are key personnel for conducting the research study. These individuals work closely with the LR to design, conduct, and/or report on the research.**
- **Research Personnel (RP): Review the RP Heat Map to determine whether they should be listed below.**
- **Administrative Contact (AC): Add ACs in the Permissions tab. Do NOT list below.**
- **Non-UCI researchers: Address non-UCI researchers in the Single IRB Reliance (sIRB) section. Do NOT list below.**

All study team members must complete the following Collaborative Institutional Training Initiative (CITI) trainings:

- **Human Subjects Research Protections and**
- **Good Clinical Practice, as applicable**

Incomplete or expired CITI training will delay IRB approval. For more information, visit HRP Training and Education.

Researcher:

Frances Henderson

Email:

fhender1@uci.edu

To promote the objectivity of the research, all researchers are required to disclose their related disclosable financial interests, per the IRB COI Policy. If you have any questions about the COI process in general, contact the COI team.

Each member of the study team for this protocol must be asked the following question to comply:

"Do you, your spouse/registered domestic partner, and dependent children have any disclosable financial interests* (i) that would reasonably appear to be affected by this research study; or (ii) in entities whose financial interests would reasonably appear to be affected by this research study?"

No

Training

Social/Behavioral Investigators - Basic Course	11/30/21 - 11/29/26

Degree:

Other

Degree Other:

MFA

Position/Title:

Dance

IR-8041 - THE ARTS-DANCE (Lead Unit)

Affiliation:
UCI Grad Student

Researcher Role:
Lead Researcher

Permissions:
Full Access

Duties:
Oversight of Research
Screen/Recruit Subjects
Finalize Informed Consent
Translate Consent
Access/Analyze Identifiable Information
Research Procedures (specify below)

Specify which research procedures:
To conduct an 11 week research study that will apply a functional cross training method for UCI dance majors.

Specify relevant training and experience for the referenced duties/responsibilities:
CrossFit Level 1 Certification. 7+ years of experience in the fitness industry and personal training.

Researcher:

Kelli G Sharp

Email:

ksharp@uci.edu

To promote the objectivity of the research, all researchers are required to disclose their related disclosable financial interests, per the IRB COI Policy. If you have any questions about the COI process in general, contact the COI team.

Each member of the study team for this protocol must be asked the following question to comply:

"Do you, your spouse/registered domestic partner, and dependent children have any disclosable financial interests* (i) that would reasonably appear to be affected by this research study; or (ii) in entities whose financial interests would reasonably appear to be affected by this research study?"

No

Training

GCP for Clinical Trials with Investigational Drugs and Medical Devices (U.S. FDA focus) - Refresher Course 08/28/20 - 08/28/23	Biomedical Investigators - Basic Course 08/21/17 - 08/20/22 Expired	IRB Members - Biomedical - Refresher Course 08/21/17 - 08/20/22 Expired	IRB Members - Biomedical - Basic Course 08/29/22 - (no expiration)

Biomedical Investigators - Refresher Course	08/29/22 - (no expiration)

Degree:
PhD

Position/Title:
Principal Investigator

IR-8041 - THE ARTS-DANCE (Lead Unit)

Affiliation:
UCI Faculty

Researcher Role:
Faculty Sponsor

Permissions:
Full Access

Duties:
Oversight of Research

Specify relevant training and experience for the referenced duties/responsibilities:
I

Are RP tracked outside the approved protocol, in accordance with the RP Heat Map?
Not applicable, there are no RP

sIRB Screener

Is a non-UCI investigator and/or their site engaged in human subjects research activities (e.g., interact with subjects; have access to identifiable information)?
No

Non-Technical Summary

Provide a non-technical summary of the project that can be understood by non-scientists (250 words max):

This study will investigate a functional cross-training method for collegiate dancers at UCI who train in contemporary floor work. This cross-training method will focus on strength training and aerobic capacity measured through five outcomes. 1) three specific floor work dance moves, 2) the 1-minute test, 3) the airplane test, 4) the 1-minute single leg squat test, and 5) the 3-minute accelerated step test. The participants will be put through a series of strength training-related exercises and various circuits to emphasize speed, power, and recovery. I hypothesize that participants in this study will enhance their strength, balance, and cardiovascular function.

Background & Purpose of Research

Describe the purpose, specific aims or objectives and specify the hypotheses or research questions to be studied:

The purpose of this study is to implement a functional cross training approach to supplement collegiate dancers training. The primary specific aim of this study is to identify the feasibility of the cross-training program. Second specific aim is to identify any effects on dancers' physical strength for performing contemporary floor work. The third and final specific aim is to investigate its effects on balance, strength, and cardiorespiratory function.

- We hypothesize that implementing a functional cross training method that uses both strength and aerobic capacity exercises into UCI dance majors weekly training will enhance their strength, balance, and cardiovascular function.
- In addition, we hypothesize that the dancers' will report subjective changes in their abilities to do the contemporary floor work.

Provide the scientific or scholarly rationale for the research and describe the relevant background information and the specific gaps in current knowledge that this study intends to address:

This study intends to address the gaps in collegiate dancers current cross-training methods. Many scholars acknowledge the necessity of cross-training for dancers, but little of them mention weightlifting and cardiovascular training as possible solutions to injury prevention and progression in choreographic movements. Liu et al., writes, "Cross-training refers to any forms of exercise that are different from sport-specific training. It is essentially the 'crossing over' of disciplines or sports. Cross-training addresses all fitness aspects, including strength, power, endurance, balance, speed and agility, as well as refinement of motor skills and movements." However, the exercises Liu et al. offers as possible cross-training modalities reflect that of Yoga or Pilates, such as hip circles on a Pilates reformer machine. The literature on Pilates and Yoga as methods of cross-training for dancers is extensive, and the two forms parallel dance quite well. Many dance schools also offer Pilates and Yoga classes for credit to the dancers, such as UCI. However, not much literature exists on weightlifting or high interval training for dancers. The study aims to implement a method that "crosses over" disciplines, rather than parallel them. The research team will be offering the UCI dance majors a form of training UCI does not already offer in hopes they will enhance their strength, balance, and cardiovascular function.

List up to ten relevant references/articles to support the rationale for the research:

Asman, C. R. (2018). *Dance Specific Integrative Methods to Incorporate Supplemental Training Into a Technique Class* (Order No. 10825925). Available from Dissertations & Theses @ University of California; ProQuest Dissertations & Theses A&I; ProQuest Dissertations & Theses Global. (2097116771).

Brown, Andrea. 2007. "Effects of Plyometric Training Versus Traditional Weight Training on Strength, Power, and Aesthetic Jumping Ability in Female Collegiate Dancers." *Journal of Dance Medicine and Science. Vol. 11 Issue 2, p38-44. 7p.*

Megan Richardson, M.S., A.T.C.; Marijeanne Liederbach, Ph.D., P.T.; Emily Sandow, P.T., D.P.T. 2015. "Functional Criteria For Assessing Pointe Readiness." *International Association for Dance Medicine & Science*

Milina, D. 2012. "Filling in the Gaps." *Dancing Times. Vol. 102 Issue 1221, p33-35. 3p.*

Murphy, J. 2014. "Modern Dancer Cross-trains to Another Tune". *Wall Street Journal: Tuesday, January 21. Health and Wellness section D4.*

Mya Pepito & Jiling Liu (2022) Integrating Cross-Training in Dance Education, Strategies, 35:3, 42-45

Pistilli, Emidio E.1; Mitchell, Mikaela1; Florence, Lindsey2. "Incorporating Unilateral Variations of Weightlifting and Powerlifting Movements Into the Training Program of College-Level Dancers to Improve Stability." *Strength and Conditioning Journal: June 2021 - Volume 43 - Issue 3 - p 1-8*

Redding, Emma. 2009. "The Development of a High Intensity Dance Performance Fitness Test." *Journal of Dance Medicine and Science. Vol. 13 Issue 1, p3-9. 7p.*

Sides, S. N., Ambegaonkar, J. P., & Caswell, S. V. (2009). "High Incidence of Shoulder Injuries in Collegiate Modern Dance Students." *Athletic Therapy Today, 14(4), 43–46.*

Stracciolini, Andrea. 2016. "Resistance Training For Pediatric Female Dancers." *Journal of Dance Medicine and Science. Vol 20.* Pg. 64-71

Subject Population(s)

Targeted subject populations/data sources (check that apply):
Adults Competent to Provide Informed Consent
UCI Students/Staff/Faculty

Sample Size

Specify the maximum and expected numbers of individual-level information and/or biospecimens to be accessed/analyzed within each category/group.

Category/Group
Adults

18 and over

Maximum Number of Subjects, Subjects to be Consented or Reviewed/Collected
12

Number Expected to Complete the Study or Needed to Address the Research Question
9

Explain how the overall target sample size was determined:
The population size was selected due to a minimum requirement for a target sample size for data analysis.

Eligibility Criteria

IMPORTANT! If utilizing UCI Health Enterprise Data & Analytics services, include specific timeframes for each eligibility factor, as applicable.

Example:

1. **Birth sex: female**
2. **Age: >= 18 years old as of 2020-01-01**
3. **The result of the most recent SARS-CoV-2 test (of any type), performed between 2020-01-01 and 2020-12-31, was positive**
4. **With any sub-classification of type 2 diabetes (E11*) diagnosed at any date prior to 2020-01-01**
5. **Did NOT have an ED visit between 2020-01-01 and 2020-12-31**

Inclusion/Exclusion Criteria: Identify the factors for limited eligibility and provide a scientific rationale.

Category/Group Eligibility

Adults. 18 and over

Inclusion Criteria

Participant must be able to commit to three days a week, one hour sessions each week. All Participants must be UCI dance majors or have an equivalent of 5 plus years of dance training in any style.

Exclusion Criteria

Participant does not already do cross training outside of dance class aside from yoga and pilates. Participant must not have any current injuries that prevent participating in daily dance classes.

Is eligibility based on age, gender, pregnancy/childbearing potential, social/ethnic group, or language spoken (e.g., English Speakers only)?

Yes

Identify the special population that is excluded from the study and provide the rationale for excluding the specific population. (e.g., Eligibility Group: Age 70+, Rationale: Disease that affects the elderly).

Limited Eligibility Factors:

Eligibility Limited to the Following Factors

Language Spoken (e.g., English speakers only)

Specify the rationale for this group:

English speakers only

Pre-Screening for Recruitment

Will identifiable information be accessed/obtained for the purpose of screening, recruiting, or determining eligibility of prospective subjects?

Yes

Pre-Screening Activities (check all that apply):

Study team will obtain information through oral or written communication with the prospective subject or LAR (i.e. self-report of medical information; medical records will not be screened)

Oral/Written Communication

REQUIRED! Submit the pre-screening script in the Attachments section.

UCI IRB requires the pre-screening script meets the Recruitment Requirements.

Data Points

Provide a complete list of ALL data points, variables, and/or information that will be collected/recorded (i.e. data abstraction form) for pre-screening/recruitment purposes:

The following information will be collected: Name, age, list of previous injuries, dance experience, and cross training experience.

If the list of variables will be attached as a separate document [i.e. case report form (CRF; eCRF)], enter "See Attached" above and check the confirmation box below.

Recruitment Methods

IMPORTANT! Recruitment materials must adhere to UCI Recruitment Guidelines. Various templates are available here: IRB Forms → Recruitment Templates.

Indicate all methods that will be used to recruit subjects for this study:

Recruitment Methods:
Online/Social Media

Specify Where Posted:
Instagram

Type of Space:
Public (i.e., site/media that allows open access to content)

Recruitment Methods:
Flyers/Brochures

Specify Where Posted:
UCI newsletter. Instagram

Type of Space:
Public (i.e., site/media that allows open access to content)

HIPAA Authorization

Does this study involve the creation, use, or disclosure of Protected Health Information (PHI) (i.e. access to medical records)?

List of 18 PHI Identifiers from medical records/clinical encounters:

1. **Names**
2. **Social Security Numbers**
3. **Dates (including birth date, admission date, discharge**
4. **date, date of death and exact age if over 89)**
5. **Medical record numbers**
6. **Address**
7. **Health plan numbers**
8. **Phone numbers**
9. **Fax numbers**
10. **Email address**
11. **Account numbers**
12. **License/Certificate numbers**
13. **Vehicle ID numbers**
14. **Device identifiers/Serial numbers**
15. **Web URLs**
16. **IP address numbers**
17. **Biometric identifiers**
18. **Facial Photos/Images**

19. **Any other unique identifier**

No

Informed Consent Process

Identify the methods of Informed Consent or assent process as applicable for each participant population (check all that apply):

Paper-based signed informed consent/assent

Paper-based Signed Informed Consent

Indicate the paper-based signed informed consent/assent (check all that apply):

Signed Informed Consent

Is this consent method used for all subjects?

Yes

REQUIRED! Submit the Adult Consent Form, Child Assent Form and/or Parental Permission Form in the Attachments section.

Circumstances of Consent

Indicate the location where the consent process will take place (check all that apply):
Other

Specify 'Other' location:
In studio PTSU 1140

Specify how the research team will assure that subjects, their parents, or their legally authorized representative (LAR) have sufficient time to consider whether to participate in the research:
Subjects or their LAR will be allowed to take home the unsigned consent form for review prior to signing it

Project Locations

Check all sites where UCI investigator(s) will conduct research activities (e.g., recruitment, informed consent, and research procedures including accessing identifiable, private information about participants):
UCI Campus Facilities or Sites (e.g. school, lab, etc.)

Study Design & Statistics

Include an explanation of the study design (e.g., randomized placebo-controlled, cross-over, cross-sectional, longitudinal, etc.) and, if appropriate, describe stratification/ randomization/blinding scheme:

This is a pilot study to evaluate feasibility.

Is this a study for which a statistical analysis plan is appropriate (e.g. quantitative study design)?

No

Specify a non-statistical analysis plan for assessing study results:

This is pilot study, no statistical analysis will be preformed.
Secondary analysis, will be performed to compare the results of the primary outcome measures performed throughout the duration of the study.

Project Procedures

Research Procedures (check all that apply):

Audio, Video, Digital or Image Recording and/or Photography for Collection of Research Data
Behavioral Experiments (e.g., Cognition, Perception, Motivation, Communication, Social Behavior)
Non-invasive Physical Measurements (e.g., ECG, EEG, moderate exercise, muscular strength testing, body composition assessment)
Surveys/Questionnaires/Interviews/Focus Group

Provide a detailed chronological description of the procedures:

Participants will be tested on five outcomes. Once before the study, and then once every four weeks for a total of 11 weeks. These five outcomes include, three specific floor work dance moves, the airplane test , the 1 minute push-up test, the 1 minute single leg squat test, and the 3 minute accelerated step test. During the 11 week study, participants will be put through a series of functional fitness movements for strength training and aerobic capacity to test a method of cross training for dancers. Participants will meet for 3 sessions a week lasting for one hour.

Research Study Timeline:

Week 1:
- Initial primary outcome measures tested

Week 2-5:
- 3 one hour training sessions a week

Week 6:
- Second time primary outcome measures are tested

Week 7-10:
- 3 one hour training sessions a week

Week 11:
- Final time primary outcome measures are tested

Weekly training session break down:

Session 1:
- strength portion for lower body specific muscle isolation and lower body power
- strength portion for core muscles
- 15-20 minute circuit for aerobic capacity

Session 2:
- strength portion for the upper body push and pull muscles
- strength portion for the core muscles
- print intervals with rest built in for recovery working anaerobic states

Session 3:
- full body (upper/lower) superset or monster set
- 40 minute endurance piece that switches movements every minute on the minute.

Specify the total duration of a subject's participation in the study and clearly outline the duration of participation for each study visit and sub-study, as applicable:

Participants will meet for a total of 11 weeks. Each week they will meet for three training sessions a week for one hour. Except for testing weeks when participants will only meet for one day for two hours to be tested on the primary outcome measures.

List all data collection tools (e.g., measures, questionnaires, observational tool) below; include citations for standardized/validated measure(s):

Outcome Measures

- Movement Quality Assessment: A rubric was created to evaluate overall movement proficiency.
- The Airplane test- Single Limb Test
- 1 Minute Push-UP Test
- 1 Minute Single leg Squat Test
- The 3 min accelerated step test
- An anonymous questionnaire will be used to identify the participants' observations of their own body changes and overall opinions about the study in its correlation to their dance training. This will be given before and after the study.

Are all data collection tools standardized or validated?

No

REQUIRED! For data collection tools that are not standardized or not validated, submit a copy of the draft or final tool in the Attachments section.

The final version must be submitted for IRB approval via an amendment application prior to subject enrollment.

List all procedures involving the use and/or collection of photographs, or audio/video recording:
Video footage will be used in order to record the testing of primary outcome measures and documented in written form for research purposes. Each participant will be given an identifiable number in order for their results to stay anonymous. In the case that all participants give permission, some video footage may be used for artistic purposes.

UCI Health Clinical Services

Will this study require clinical items/ services from UC Irvine Health?
No

Return of Results

Will Individual results be shared with subjects?
No

Will overall study results will be shared with subjects?
Other

Specify how overall study results will be shared with subjects:
Overall study results will be shared through written documentation and through artistic creation, However, all results on the individual level will be kept anonymous.

Expedited Categories

Minimal Risk - No more than minimal risk to subjects

Select the applicable category(ies) (check all that apply):
4. Collection of data through noninvasive procedures (not involving general anesthesia or sedation) routinely employed in clinical practice, excluding procedures involving x-rays or microwaves
6. Collection of data from voice, video, digital, or image recordings made for research purposes
7. Research on individual or group characteristics or behavior (including,but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies

Risk Assessment

Risks and Discomforts

1. Describe and assess any reasonably foreseeable risks and discomforts associated with each procedure for each subject population — physical, psychological, social, legal or other.

2. If this study will involve the collection of identifiable private information, even temporarily, for which the disclosure of the data outside of the research could reasonably place the subjects at risk, include the risk of a potential breach of confidentiality.

A bullet point list is recommended.

- Potential breach of confidentiality.
- Potential discomfort regarding the subject material.
- Potential for physical injury, no more risk than a dance class.

EXPEDITED/FULL COMMITTEE ONLY: Include an assessment of their expected frequency (e.g., common – 65%, less common – 40%, unlikely – 5%, rare - <1%) and the seriousness (mild, moderate, severe).

Discuss what steps have been taken and/or will be taken to prevent and minimize any risks/potential discomforts to subjects:

- A breach of confidentiality will be minimized by proper data storage and a use of non-identifier code, and allowing access by only lead researcher and faculty sponsor. Permission for use of video footage for artistic purposes will be required.
- Potential discomfort due to the session material will be minimized by allowing participants to take a break, moving at their own pace, modifying movements, and/or cease participation in the study.
- Potential Injury to workshop participants will be minimized by allowing participants to participate at their own pace, take a break, or modify movement based on ability and pain levels.

Certificate of Confidentiality

Is the research partially or wholly funded by National Institutes of Health (NIH), including NIH Institutes and Centers?

No

Does the research involve a sensitive health-related topic that collects names or other identifiable, sensitive information pertaining to subjects?

No

Potential Benefits

Is there the prospect of a direct benefit anticipated for subjects?
Yes

Describe the potential benefits subjects may expect to receive from participation in this study:
Potential benefits include enhanced body awareness, amplified strength, and increased aerobic capacity for their dance training.

Specify the expected potential societal/scientific benefit(s) of this study:
Workshop participants may benefit from the opportunity to learn about ways to incorporate supplemental strength and endurance training into their daily lives.

Alternatives to Participation

Describe the alternatives to participation in the study available to prospective subjects (check all that apply):
No alternatives exist. The only alternative to study participation is not to participate in the study

Participant Compensation

Compensation is when participants are paid for their time & efforts in research.

- Compensation should be offered on a prorated basis when the research involves multiple sessions.
- For additional information about researcher's/department's responsibilities and current Accounting procedures, see **UCI Policy Sec. 701-03**.

For more information see: **Compensation Info**.

Are participants compensated?

No

Participant Costs

Will subjects or their insurers be charged for study procedures?

No

Reimbursement

Will subjects be reimbursed for out-of-pocket expenses?

No

Confidentiality of Research Data

Participant Identifiers

Will subject/patient identifiers be collected or retained?

Yes

Will any subject/patient identifiers be collected or retained for data analysis, recruitment, consenting and/or compensation (check all that apply)?

Email addresses
Full-face photographs and any comparable images
Names
Telephone numbers

Coding Identifiers

Will a code be used to link subject/patient identifiers with the information and/or biospecimens?

A code will be used. Subject/Patient identifiers will be kept separately from the information and/or biospecimens. The code key will be destroyed at the earliest opportunity, consistent with the conduct of this research

Photos/Audio/Video

Will any identifiable photos or audio/video recordings be collected or used (check all that apply)?

Photographs / Digital Images
Video Recordings

Photographs/Digital Images

Will the identifiable photographs/digital images be de-identified?

Yes

Specify timeframe for the photographs/digital images de-identification and how will the photographs/digital images be de-identified:

All photographs and video footage will be used only for the research team to look over for written translation of study results. Participants will be given identifying number for all written translation of the study and its results.

Video Recordings

How will the video recordings be transcribed?

Identifiable video recordings transcribed by the study team

Specify timeframe for the video transcription:
All videos will be transcribed by late April.

Will the identifiable video recordings be de-identified?
Yes

Specify timeframe for the video recordings de-identification and how will the recordings be de-identified:
All photographs and video footage will be used only for the research team to look over for written translation of study results. Participants will be given identifying number for all written translation of the study and its results.

Presentation/Publication

Specify whether subject/patient identifiers be disclosed in presentations and/or publications:
Subject/Patient identifiers will be disclosed. Text regarding the disclosure will be included in the consent document and specific permission to disclose will be discussed with subjects/patients

Identifier Retention

Specify how long all subject/patient identifiers will be retained. This includes identifiers stored in paper format, stored electronically as well as video recordings, audio recordings, photographs, etc.:
Destroyed after publication/presentation or end of protocol

Info/Biospecimen Storage

Indicate how information and/or biospecimens (including signed consent forms) will be stored (check all that apply):
Information will be maintained electronically. Information will be password protected and maintained in an encrypted format

Encrypted Format

Specify where the information will be maintained electronically:
All information will be stored on a password protected cloud service.

Info/Biospecimen Transport

Will research data/biospecimens be transported or maintained on portable devices (e.g., laptop, smartphone, external hard drive, etc.)?
Yes

Specify the device(s) or method(s) of transportation:
All information will be stored on a password protected cloud service.

Explain why transporting or maintaining subject/patient identifiable data/biospecimens on portable devices is necessary:
It is necessary to store the identifiable data on the password protected cloud service as it is easily accessible to the research team.

Info/Biospecimen Retention

Indicate how long research information/biospecimens will be retained:
Other

Specify time frame and provide the rationale for research information and/or biospecimens retention:
Research and information will be destroyed after study.

Info/Biospecimen Sharing

The research team, authorized UCI personnel, the study sponsor (as applicable) and regulatory entities such as the Office of Human Research Protections (OHRP), may have access to participants' study records to protect their safety and welfare.

Sharing Within Scope of Project

Will research materials (information/ biospecimens) be shared with collaborators (i.e., researchers not covered under the UCI project), for purposes within the scope of the current project?

No

Sharing Outside Scope of Project

Will information and/or biospecimens be shared, used again, or stored for undefined future research purposes beyond the scope of the current protocol?

No

Attachments

For UCI IRB templates, visit IRB Forms.

ATTENTION! If requisite documentation is not attached, the submission will be returned as incomplete.

Maximum file size is 30MB

2143 RECRUITMENT MATERIALS (FLYER).PNG

Attachment Type
Recruitment Material

File Comments

File Name

Status (HRP Use Only)
Approved - Editable Version

Agenda (HRP Use Only)

2022_(NEW)FUNCTIONAL CROSS TRAINING STUDY_ POST-QUESTIONNAIRE.PDF

Attachment Type
Data Collection Tool/Instrument

File Comments

File Name

Status (HRP Use Only)

Agenda (HRP Use Only)

2143 RECRUITMENT MATERIALS (SCRIPT).DOCX

Attachment Type
Recruitment Material

File Comments

File Name

Status (HRP Use Only)
Approved - Editable Version

Agenda (HRP Use Only)

2022_MOVEMENT RUBRICS.PDF

Attachment Type
Data Collection Tool/Instrument

File Comments

File Name

Status (HRP Use Only)

Agenda (HRP Use Only)

2022_(NEW)FUNCTIONAL CROSS TRAINING STUDY_ PRE-QUESTIONNAIRE.PDF

Attachment Type
Data Collection Tool/Instrument

File Comments

File Name

Status (HRP Use Only)

Agenda (HRP Use Only)

2143 INFORMED CONSENT 11-29-22.DOCX

Attachment Type
Consent Form

File Comments

File Name

Status (HRP Use Only)
Approved - Editable Version

Agenda (HRP Use Only)

2143 APPROVAL LETTER 11-29-22.PDF

Attachment Type
UCI IRB Approval Letter

File Comments

File Name

Status (HRP Use Only)
Approved

Agenda (HRP Use Only)

2143 INFORMED CONSENT 11-29-22.PDF

Attachment Type
Consent Form

File Comments

File Name

Status (HRP Use Only)
Approved - Stamped Version

Agenda (HRP Use Only)

2143 RECRUITMENT MATERIALS (SCRIPT).PDF

Attachment Type
Pre-Screening Script

File Comments

File Name

Status (HRP Use Only)
Approved - Stamped Version

Agenda (HRP Use Only)

2143 RECRUITMENT MATERIALS (FLYER).PDF

Attachment Type
Recruitment Material

File Comments

File Name

Status (HRP Use Only)
Approved - Stamped Version

Agenda (HRP Use Only)

Lead Researcher Certification

Investigator's Assurance

As Lead Researcher, I have ultimate responsibility for the performance of this study, the protection of the rights and welfare of the human subjects, and strict adherence by all co-investigators and research personnel to all Institutional Review Board (IRB) requirements, federal regulations, and state statutes for research involving human subjects.

I hereby assure the following:

1. The information provided in this application is accurate to the best of my knowledge.
2. The information provided in this application has been discussed and shared with my Department Chair. Any requests for changes based on this discussion are included in this application upon submission or will be initiated by the research team either during the IRB review process or via an amendment.
3. All named individuals on this project have read and understand the procedures outlined in the protocol and their role on the study.
4. All named individuals on this project have completed the required Educational research tutorials and have been made aware of the "Common Rule" (45 CFR Part 46), applicable Food and Drug Administration (FDA) regulations (21 CFR Parts 50, 56, 312 and 812), have read the Belmont Report, and UCI's Federalwide Assurance (FWA) that are available on the Human Research Protections Program (HRP) website.
5. All experiments and procedures involving human subjects will be performed under my supervision or that of another qualified professional listed on this protocol.
6. Any responses submitted on my behalf by named individuals on this project I have prospectively agreed to.
7. I understand that, if the study described in this IRB application is supported by a federal award or used as a basis for a proposal for funding, it is my responsibility to ensure that the description of human subjects activities in the proposal/award is identical in principle to that contained in this application. I will submit modifications and/or changes to the IRB as necessary to assure the proposal/award and application are identical in principle.

I and all co-investigators and research personnel agree to comply with all applicable requirements for the protection of human subjects in research including, but not limited to, the following:

1. Obtaining the legally effective informed consent of all human subjects or their legally authorized representatives (unless waived) and using only the currently approved, stamped consent form (if applicable).
2. Per federal regulations, once a human research study has received IRB approval, any subsequent changes to the study must be reviewed and approved by the IRB prior to implementation except when necessary to avoid an immediate, apparent hazard to a subject. See Reporting of Unanticipated Problems.
3. Reporting any unanticipated problems involving risk to subjects or others, including protocol violations per UCI IRB policy. In addition, HIPAA privacy violations must be PROMPTLY disclosed to the UCI Privacy Officer. There are time requirements for reporting these breaches

of confidentiality, which, if not met, may result in monetary damages to the researcher and the institution.

4. Responding appropriately to subjects' complaints or requests for information about the study; and reporting to the IRB any subject complaints that are not resolvable by the study team.
5. Promptly providing the IRB with any information requested relative to the project.
6. Assuring the appropriate administration and control of investigational test articles (i.e., investigational drugs, biologics or devices) by a qualified investigator or other appropriate individual or entity (e.g., UCI Health pharmacy), and assuring use and maintenance of an Investigational Drug/Biologic Accountability Log or Device Accountability Log.
7. Registering applicable clinical trials with clinicaltrials.gov. For more information about this topic, visit the ClinicalTrials.gov web page or the HRP webpage. The consequences of not meeting the registration and reporting requirements include monetary damages to the researcher and the institution.
8. Obtaining continuing review prior to study expiration (I understand if I fail to apply for continuing review, approval for the study will automatically expire, and all human research activities must cease until IRB approval is obtained).
9. Promptly and completely complying with an IRB decision to suspend or terminate its approval for some or all research activities.
10. Submitting to a routine review of human subject research records. The Compliance & Privacy Office at UCI Health performs ongoing routine reviews of open biomedical research protocols, in an effort to ensure in part that human subject research activities are conducted in accordance with regulations, laws and institutional policies regarding the protection of human subjects. In addition, the HRP unit of the Office of Research has developed the Education Quality and Improvement Program (EQUIP). Through EQUIP, HRP staff conduct periodic quality improvement monitoring and educational outreach.
11. For clinical trials initially approved by the IRB on or after January 21, 2019, posting one (1) IRB-approved clinical trial consent form at a publicly available federal website. The consent form must be posted after recruitment closes, and no later than 60 days after the last study visit. For additional guidance, refer to the OHRP FAQs on Informed Consent.
12. Filing a final report with UCI HRP at the conclusion of this project.

As the Lead Researcher, I assure all of the above

Investigators' Disclosure of Financial Interest

In order to inform research subjects of circumstances that may affect their decision to participate in this study, all researchers are required to disclose their financial interests with outside institutions.

The Lead Researcher of the protocol must ask the following question of all study team members:

"Do you, your spouse/registered domestic partner, and dependent children together have any disclosable financial interests (i) that would reasonably appear to be affected by the research; or (ii) in entities whose financial interests would reasonably appear to be affected by the research?"

A member of the study team who answers in the affirmative will be contacted by the Conflict of Interest Oversight Committee (COIOC) to obtain additional information regarding their specific financial interest(s).

IMPORTANT! If there has been a change in the financial disclosures of the LR or the study team, please also request a 'Change in Financial Interests'.

As Lead Researcher, I certify that the disclosures for all study team members are accurate

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Need Help?

09/27/2022 UPDATE: There is a slight time delay (30+ seconds) when "submitting" a transaction. Please do not refresh or close the page. The transaction will eventually go through.

Kuali is currently working to resolve the performance issues our customers are experiencing. Thank you for your patience and your partnership.

Contact the Office of Research

For KRP technical questions or issues:

- Visit the KRP User Guide
- Contact Electronic Research Administration (ERA)

For IRB questions and regulatory or institutional guidance:

- Visit Human Research Protections (HRP)
- Contact the HRP staff

Administrative Details Form

Project Status

Committee:
IRB C

Project Status:
Approved

Date of Action/Determination:
11-29-2022

Amendment Status:

Date of Amendment Action/Determination:

ERA Transcription Date:

Not applicable for new studies submitted after September 07, 2021

Pre-2018 Common Rule:

Not applicable for studies initially approved after January 21, 2019

Date of Transition:

Not applicable for studies initially approved after January 21, 2019

APPENDIX B

Research Study Recruitment Flyer

APPENDIX C

Study Information Sheet

UCI IRB USE ONLY:

University of California, Irvine
Study Information Sheet

Functional Cross Training For UCI Dance Majors

Lead Researcher
Frankie Henderson, Graduate Student
Dance Department
(619)971-1862
fhender1@uci.edu

Faculty Sponsor
Kelli Sharp, DPT Dance Science
Dance Department
ksharp@uci.edu

- We are asking you to take part in a research study being done by researchers at the University of California, Irvine.
- The purpose of this study is to implement a functional cross training approach to supplement collegiate dancers training. The goal of this study is to apply an approach of cross training that will enhance dancers' physical strength for contemporary floor work and investigate its effects on balance, strength, and cardiorespiratory function.
- The research study will run for 11 total week and will take place on UCI campus.
- Prior to the start of the research study you will be asked to sign a release form. This form will allow for the use of video recording during the study, as well as the use of information given in the study for research purposes including publication and presentation. You will have the option to opt-out of video recording if you wish. If you choose not to be recorded, you may still participate in the research study, but in order to opt out of the video recording you must sign the release form.
- You may experience potential discomfort regarding the subject material.
- Potential for physical injury, no more risk than a dance class.

- There is no direct benefit to participating in the study. Benefits to others or society may include adding to the existing body of knowledge on cross training for dancers as well as act as a guide for college level dancers to properly add cross training into their
- We will keep the data we collect confidential, and we will not share your personal information with anyone outside the research team. All data will be maintained until the completion of research by July of 2022.

- Participating in this study is optional. Please tell the researcher if you do not want to participate.
- You will not be compensated for your participation in this research study.
- Questions? If you have any comments, concerns, or questions regarding this study please contact the researchers listed at the top of this form.

- If you have questions or concerns about your rights as a research participant, you can contact the UCI Institutional Review Board by phone, (949) 824-6662, by e-mail at IRB@research.uci.edu or at 141 Innovation, Suite 250, Irvine, CA 92697.

What is an IRB? An Institutional Review Board (IRB) is a committee made up of scientists and non-scientists. The IRB's role is to protect the rights and welfare of human subjects involved in research. The IRB also assures that the research complies with applicable regulations, laws, and institutional policies.

- Participation in this study is voluntary. There is no cost to you for participating. You may choose to skip a question or a study procedure. You may refuse to participate or discontinue your involvement at any time without penalty. You are free to withdraw from this study at any time. **If you decide to withdraw from this study you should notify the research team immediately**.

APPENDIX D

Research Study Informed Consent Form

UNIVERSITY OF CALIFORNIA, IRVINE
CONSENT TO ACT AS A HUMAN RESEARCH SUBJECT

Examining a functional cross training method for contemporary floor work dance and athletic dance: Strength and aerobic capacity for dancers

Lead Researcher Chair
Frankie Henderson, MFA Dance Candidate
Claire Trevor School of the Arts Dance Department
(619)-971-1862, fhender1@uci.edu

Faculty Sponsor
Kelli Sharp, DPT Associate Professor
Claire Trevor School of the Arts Dance Department
(949) 824-5145, ksharp@uci.edu

STUDY LOCATION(S):

This study will solely take place on UCI campus.

SUMMARY OF KEY INFORMATION:

The information provided in this box includes a brief yet complete summary of key information about the research, presented first as required by the federal regulations. Some sections that require additional information may be repeated later in this document.

Participation is Voluntary
You are being asked to participate in a research study. Participation is completely voluntary. Please read the information below and ask questions about anything that you do not understand. A researcher listed above will be available to answer your questions.

Study Purpose
The purpose of this research study is to investigate a functional cross training method that incorporates strength training and endurance to supplement full time collegiate dancers and aid in their success with contemporary floor work and athletic dancing. The goal of this study is to apply an approach of cross training that will enhance dancers' physical strength and investigate its effects on balance, strength, and cardiorespiratory function.

Study Procedures

During the duration of this study you will be tested on four primary outcome measures a total of three times. You will also attend three 1 hour training sessions a week. You will also be asked to complete a pre and post questionnaire.

Expected Duration

The study will be 11 weeks in duration not including winter break. Each week you will train 3 days a

week for one 1 hour. You will be tested on the primary outcomes measures 3 total times throughout the study.

Risks of Participation

There are no known harms or discomforts associated with this study beyond those encountered in normal daily dance classes. Possible risks and/or discomforts may include slight fatigue and soreness of the body, as expected with performing exercises that promote stress on the body. Participants may endure physiological discomfort due to training with peers who may all be at different levels in their fitness.

Benefits to Participants

Subjects may gain a greater understanding of their muscular strength and endurance, which in return can be beneficial for injury prevention purposes.

Benefits to Others or Society

The benefit is from developing a greater understanding of the need to focus on the integration of a functional cross training technique for undergraduate collegiate dancers.

Alternative Procedures or Treatments

There are no alternative procedures available. The only alternative is not to participate.

HOW MANY PEOPLE WILL TAKE PART IN THIS STUDY?

The study will include 9-12 participants.

AM I ELIGIBLE TO PARTICIPATE IN THIS STUDY?
You must meet the following requirements to be in the study:

1) You are a student enrolled full-time as an undergraduate dance major in the Claire Trevor School of the Arts Dance Department.
2) You are 18 years old or older.
3) You must not have any current injuries that would inhibit you from taking part in regular dance classes.
4) You must not partake in any other forms of cross training currently, aside from yoga and pilates.

WHAT PROCEDURES ARE INVOLVED WITH THIS STUDY AND HOW LONG WILL THEY TAKE?

1. As a participant you will first be asked to read and sign the consent form. After completing this step,you will fill out the questionnaire form that should take less than 20 minutes to complete. The study will be 11 weeks in duration not including winter break. During the first week you will be tested on the primary outcomes measures: 1) the 1 minute single leg squat test, 2) the airplane test, 3) the 1 minute push up test, 4) the 3 minute accelerated step test, and 5) perform 3 distinct floor work movement sequences. Then weeks 2-5 you will participate in 3 one hour long training sessions a week, and then

week 6 you will be testing on the primary outcomes. Then week 7-11 you will participate in 3 one hour long training sessions per week, ending with primary outcome testing on the last day of week 11. Then you will receive a post study questionnaire form that should take less than 20 minutes to complete.

2. Participation in the study will include about 27 visits in total and take a total of about 27 hours over a period of 11 weeks.

WHAT ARE THE POSSIBLE DISCOMFORTS OR RISKS RELATED TO THE STUDY?

There are no known harms or discomforts associated with this study beyond those encountered in normal daily life. The possible risks and/or discomforts associated with the procedures described in this study include:

- There is a high likelihood of slight fatigue and soreness of the body, as expected with performing exercises that promote stress on the body and muscle growth.
- There is minimal potential for participants to endure an injury related to exercises being executed during this study. In this case, the participant has full autonomy over their decision to withdraw from this study.
- There is a small chance participants may endure physiological discomfort due to training with peers who may all be at different levels in their fitness.
- In addition, because identifiable information is collected about you, there is minimal potential for breach of confidentiality.

WILL I BE PAID FOR TAKING PART IN THIS STUDY?

Participants will not be paid for this study.

Compensation

You will not be compensated for your participation in this research study.

Reimbursement

You will not be reimbursed for any out of pocket expenses, such as parking or transportation fees.

Costs

There is no cost to you for participation in this study. However there may be out-of-pocket expenses such as parking and transportation fees.

WHAT HAPPENS IF I AM INJURED BECAUSE I TOOK PART IN THIS STUDY?

It is important that you promptly tell the researchers if you believe that you have been injured because of taking part in this study. You can tell the researcher in person or call him/her at the number listed at the top of this form.

If you are injured as a result of being in this study, UCI will provide necessary medical treatment. The costs of the treatment may be covered by the University of California, or billed to you or your insurer just

like other medical costs, depending on a number of factors. The University and the study sponsor do not normally provide any other form of compensation for injury. For more information about this, you may call the UCI Human Research Protections unit at (949) 824-6662 or by e-mail at IRB@research.uci.edu

WHAT HAPPENS IF I WANT TO STOP TAKING PART IN THIS STUDY?

You are free to withdraw from this study at any time. **If you decide to withdraw from this study you should notify the research team immediately**. The research team may also end your participation in this study if you do not follow instructions, miss scheduled visits, or if your safety and welfare are at risk.

If you withdraw or are removed from the study, the researcher may ask you to complete the post survey, and if they can use your data results for the study.

If you elect to withdraw or are withdrawn from this research study, the researchers will discuss with you what they intend to do with your study data. Researchers may choose to analyze the study data already collected or they may choose to exclude your data from the analysis of study data and destroy it, as per your request.

You are free to withdraw your consent to use your identifiable private information for future research at any time however there are some limitations. If you withdraw your consent, the researchers will not use your information in future research studies. However, any of your information already being used in a research study that began before your request to withdraw will continue to be used for that specific study. Also if information has already been provided to another researcher, institution, or company, it may not be possible to limit their continued and new uses.

HOW WILL MY PERSONAL INFORMATION BE KEPT?
Subject Identifiable Data

Identifiable information collected about you will be kept with the research data, but NOT included in the final thesis writing for public view. All identifiable information will only be accessible by authorized study team members. Each participant's name and personal information will be assigned a unique identifying code for data collection.

Data Storage

Research data will be stored electronically on a laptop computer in an encrypted file and password protected.The recordings will be retained with the other research data and destroyed after the research has been presented.

The audio/video recordings that can identify you will also be stored in a secure location; then transcribed and erased as soon as possible.

Data Retention

In accordance with UC Office of the President policy, information will be retained for 10 years after the end of the calendar year in which the research is completed.**WHO WILL HAVE ACCESS TO MY**

STUDY DATA?
The research team, authorized UCI personnel, and regulatory entities such as the Office of Human Research Protections (OHRP), may have access to your study records to protect your safety and welfare.

While the research team will make every effort to keep your personal information confidential, it is

possible that an unauthorized person might see it. We cannot guarantee total privacy.

Future Research Use

Researchers will use your information to conduct this study. Once the study is done using your information, we may share them with other researchers so they can use them for other studies in the future. We will not share your name or any other private identifiable information that would let the researchers know who you are. We will not ask you for additional permission to share this de-identified information.

ARE THERE OTHER ISSUES TO CONSIDER IN DECIDING WHETHER TO PARTICIPATE IN THIS STUDY?

Investigator Financial Conflict of Interest

No one on the study team has a disclosable financial interest related to this research project.

WHO CAN ANSWER MY QUESTIONS ABOUT THE STUDY?

If you have any comments, concerns, or questions regarding the conduct of this research, please contact the research team listed at the top of this form.

Please contact UCI Institutional Review Board by phone, (949) 824-6662, by e-mail at IRB@research.uci.edu or at 160 Aldrich Hall, Irvine, CA 92697-7600, if you are unable to reach the researchers listed at the top of the form and have general questions; have concerns or complaints about the research; have questions about your rights as a research subject; or have general comments or suggestions.

What is an IRB? An Institutional Review Board (IRB) is a committee made up of scientists and non-scientists. The IRB's role is to protect the rights and welfare of human subjects involved in research. The IRB also assures that the research complies with applicable regulations, laws, and institutional policies.

HOW DO I AGREE TO PARTICIPATE IN THIS STUDY?

You should not sign this consent form until all of your questions about this study have been answered by a member of the research team listed at the top of this form. You will be given a copy of this signed and dated consent form to keep. **Participation in this study is voluntary.** You may refuse to answer any question or discontinue your involvement at any time without penalty or loss of benefits to which you might otherwise be entitled. Your decision will not affect your future relationship with UCI or your quality of care at the UCI Medical Center.

_____ Yes, I agree to allow the research team to video record the study procedures and primary outcome measures.

_____ No, I do not agree to allow the research team to video record the study procedures and primary outcome measures.

Your signature below indicates you have read the information in this consent form and have had a chance to ask any questions you have about this study.

I agree to participate in the study.

_____ _____
Subject Signature Date

_____
Printed Name of Subject

_____ _____
Signature of Person Obtaining Informed Consent Date
(For research that is greater than minimal risk, this individual must be listed on Page 1 of this consent)

_____
Printed Name of Person Obtaining Informed Consent

APPENDIX E

Research Study Movement Demonstration Links

The Kip-UP:

https://drive.google.com/file/d/1VZOcVbU_nYamcy-8-vqj3S8tRve4T7c9/view?usp=sharing

The Inversion:

https://drive.google.com/file/d/1WXE7PcfUWJ7TUg5x2D1ZmssuS_rfl_07/view?usp=sharing

The Tripod Cartwheel:

https://drive.google.com/file/d/1LxbVkkMfJ33HTH4OkDU6z8UGFheYL-XY/view?usp=sharing

APPENDIX F

Research Study Pre-Questionnaire

This questionnaire is a pre-assessment to better understand what everyone needs coming into this study. This functional cross-training method will address standard holes in dancers' training. However, I want to know how to best serve the group and the individual by understanding where everyone is at with their cross-training journey. Thus, we can later see where everyone has arrived after the study.

Name:

Email:

Do you have any previous cross-training experience? If so, please specify the method and briefly explain your experience.

What is your primary and or preferred dance style? **1) Please list your primary dance style.** **2) Please list your preferred dance style.**

What are you looking to improve upon in your dance training by participating in this study?

What components in previous cross-training modalities have you found beneficial for your dance practice?

Anything else you would like the research team to know?

APPENDIX G

Research Study Post-Questionnaire

This questionnaire serves as a post-assessment to gain a better understanding of what participants have gained from the study. The functional cross-training method was developed to address gaps in dancers' training, but we would like to receive specific feedback on what participants have gained from it, as well as any suggestions on what they would have preferred more or less of, and any other essential insights they would like to share.

In what specific ways, if any, did the functional cross-training method help improve your performance in dance classes or rehearsals? Please provide detailed examples, including what style of dance or particular moves it has helped.

Based on your experience with this functional cross-training method, would you consider using it again in the future to enhance your dance training? Would you recommend this form of training to other dancers? Please explain your reasoning, including any specific benefits you believe this method provides.

Since implementing the functional cross-training method, which areas of your overall fitness and health have significantly improved? Please provide specific examples and detail the specific benefits you have observed.

Have you noticed any improvements in areas beyond fitness and dance? For example, have you observed changes in your overall well-being or other aspects of your life? Please provide specific examples.

During your participation in this research study, what aspects of the study or the cross-training felt the most limiting or challenging for you? For instance, were there any specific exercises that you found particularly difficult or aspects of the study design that felt constraining? Please provide specific examples

Any further thoughts that feel important to share with your research team?

APPENDIX H

Block 1 Programming

BLOCK 1:
Week 1:

Tuesday 01/17/23
*Pistols progression and hip explosion focus:

Warm-up:
Tabata:
1):20 jumping jacks:10 rest
2):20 mountain climbers:10 rest

Then:
X2

- 5/5 lunge twists
- 10 hamstring flossers
- 10 alternating Cossack squats
- 10 dead bugs

Main lift #1:
-Front foot elevated dumbbell split squat

3 set/side x 8 reps
(Going up in weight if possible)

Main lift #2
-hip thrust with a mini band 3x20-25
(Going up in weight if possible)

EMOM 20:
Min 1) 12-15 narrow goblet squats (cyclist squats)
Min 2) :45 v-ups (sub tuck ups)
Min 3) :45 alternating jumping lunges
Min 4) :45 burpees (substitute up-downs)

Thursday 01/19/23
*Push-up progression and shoulder stability focused

Warm-up:

- 10 alternating scorpion twists
- 10 cat-cow stretches
- 10/10 shoulder circles forward and back on hands and knees

Then.
X2

- 3 inch worms
- 20 shoulder taps
- 7 scapular push-ups

Main movement #1:
Push-up Negatives
3-4 sets x 8-10 reps
(use an elevated surface or partner if needed)

Main movement #2:
Seated DB strict press
3-4 x 8-10 reps
(weight is by feel. Good quality reps only

Sprint intervals:
3:00x5

- 4 shuttle runs (scale back if needed)
- 12 lateral hops over dumbbells
- 12 alternating dumbbell snatches

*(rest in your remaining time of the 3:00, and start back at the top each 3:00.)
*(GOAL is to try and get all 3 movements done in about 1:30 or less and rest 1:30. However, I'm looking for consistency each round. So either stay in the same time domain when finishing or get a little faster each round. This is about trying to recover in a short window to about 90%.)

Fri 01/20/23
*Overall fitness: balance, coordination, range of motion, and fine motor skills

Warm-up:
(Across-the-floor warm-up)

- toe walks
- heel walks
- high knees
- butt kickers
- tall skips
- figure 4 stretch
- sampson stretch
- inch worms

Workout:
x5 rounds for time (9min time cap)

- 15 Dumbbell Russian swings
- 8 Dumbbell step-ups
- 15 DB Russian twists
- 30 single unders with jump rope

Accessories

15-20 min AMRAP style

- 5/5 Bulgarian split squat runners jump
- 10/10 banded bird dog
- 10/10 lat pulldowns

- 15-20 hollow-body rocks
- 10/10 banded clam shells
- 5/5 banded forearm plank twists

Week 2:

Tue 01/24/23
*Pistols progression and hip explosion focus:

Warm-up:
Tabata:
1):20 jumping jacks:10 rest
2):20 mountain climbers:10 rest

Then:
X2
- 5/5 lunge twists
- 10 hamstring flossers
- 10 alternating Cossack squats
- 10 dead bugs

Main lift #1:
Front foot elevated dumbbell split squat
3 set/side x 8 reps
(Going up in weight if possible)

Main lift #2
Hip thrust with a mini band
3x20-25
(Going up in weight if possible)

EMOM 20:
Min 1) 12-15 narrow goblet squats (cyclist squats)
Min 2) :45 Jump rope
Min 3) :45 Russian twists
Min 4) :45 up-down with dumbbell deadlift

Thursday 01/26/23
*Push-up progression and shoulder stability focused

Warm-up:
- 10 alternating scorpion twists
- 10 cat-cow stretches
- 10/10 shoulder circles forward and back on hands and knees

Then.
X2
- 3 inch worms
- 20 shoulder taps
- 7 scapular push-ups

Main movement #1:
Push-up Negatives
3-4 sets x 8-10 reps

(use an elevated surface or partner if needed)

Main movement #2:
Seated dumbbell strict press
3-4 x 8-10 reps
(weight is by feel. Good quality reps only)

Sprint intervals:
3:00x4
-4 shuttle runs (scale back if needed)
-16 lateral hops over dumbbells
-12 alternating dumbbell squat cleans
*(rest in your remaining time of the 3:00, start back at the top each 3:00.)
*(GOAL is to try and get all 3 movements done in about 1:30 or less and rest 1:30. However, I'm looking for consistency each round. So either stay in the same time domain when finishing or getting a little faster each round. This is about trying to recover in a short window to about 90%.)

Fri 01/27/23
*Overall fitness: balance, coordination, range of motion, and fine motor skills

Warm-up:
(Across-the-floor warm-up)
- toe walks
- heel walks
- high knees
- butt kickers
- tall skips
- figure 4 stretch
- sampson stretch
- inch worms

Workout:
x5 rounds for time (9min time cap)
- 10 dumbell thrusters
- 15 dumbbell Russian twists
- 8 dumbbell step-ups
- 30 single unders with jump rope

Accessories:
15-20 min AMRAP style
- 10/10 single leg dumbbell deadlift
- 10/10 banded bird dog
- 10/10 candle stick roll-ups (1 leg or 2)
- 15-20 hollow body rocks
- 7/7 dumbbell Turkish sit-ups
- 5/5 banded forearm plank twists

Week 3:

Tue 01/31/23
*Pistols progression and hip explosion focus:

Warm-up:

Tabata:
1):20 jumping jacks:10 rest
2):20 mountain climbers:10 rest

Then:
X2

- 5/5 lunge twists
- 10 hamstring flossers
- 10 alternating Cossack squats
- 10 dead bugs

Main lift #1:
Front foot elevated db split squat
3 set/side x 8 reps
(Going up in weight if possible)

Main lift #2
Hip thrust with a mini band
3x20-25
(Going up in weight if possible)

EMOM 20:
Min 1) 12-15 narrow goblet squats (cyclist squats)
Min 2) :45 plank marches
Min 3) :45 double jump squats
Min 4) :45 sumo stance dumbbell high pulls

Thursday 02/02/23
*Push-up progression and shoulder stability focused

Warm-up:

- 10 alternating scorpion twists
- 10 cat-cow stretches
- 10/10 shoulder circles forward and back on hands and knees

Then.
X2

- 3 inch worms
- 20 shoulder taps
- 7 scapular push-ups

Main movement #1:
Push-up Negatives (banded for those who don't have push-ups)
3-4 sets x 8-10 reps
(use an elevated surface or partner if needed)

Main movement #2:
Seated dumbbell strict press
3-4 x 8-10 reps
(weight is by feel. Good quality reps only)

Sprint intervals:
3:00x4

- 6 shuttle runs (scale back if needed)

- 16 high knees
- 6 lateral burpees over a dumbbell

*(rest in your remaining time of the 3:00, start back at the top each 3:00.)
*(GOAL is to try and get all 3 movements done in about 1:30 or less and rest 1:30. However, I'm looking for consistency each round. So either stay in the same time domain when finishing or getting a little faster each round. This is about trying to recover in a short window to about 90%.)

Fri 02/03/23
*Overall fitness: balance, coordination, range of motion, and fine motor skills

Warm-up:
(Across-the-floor warm-up)

- toe walks
- heel walks
- high knees
- butt kickers
- tall skips
- figure 4 stretch
- sampson stretch
- inch worms

Workout:
5 rounds for time (9min time cap)

- 10 dumbbell thrusters
- 8 dumbbell step-ups
- 15 dumbbell overhead sit-ups
- 10 burpees

Accessories:
15-20 min AMRAP style

- 5/5 Bulgarian split squat runners jump
- 10/10 banded good mornings
- 10/10 lat pulldowns
- 15-20 arch rocks
- 10/10 clam shells
- 10 jack knives

Week 4:

Tue 02/07/23
*Pistols progression and hip explosion focus:

Warm-up:
Tabata:
1):20 jumping jacks:10 rest
2):20 mountain climbers:10 rest

Then:
X2

- 5/5 lunge twists
- 10 hamstring flossers
- 10 alternating Cossack squats

- 10 dead bugs

Main lift #1:
Front foot elevated db split squat
3 set/side x 8 reps
(Going up in weight if possible)

Main lift #2
Hip thrust with a mini band 3x20-25 (single leg variation as a more advanced option)
(Going up in weight if possible)

EMOM 20:
Min 1) 12-15 narrow goblet squats (cyclist squats)
Min 2) :45 plank marches
Min 3) :45 double jump squat
Min 4) :45 sumo DB high pull

Thursday 02/09/23
*Push-up progression and shoulder stability focused

Warm-up:
- 10 alternating scorpion twists
- 10 cat-cow stretches
- 10/10 shoulder circles forward and back on hands and knees

Then.
X2
- 3 inch worms
- 20 shoulder taps
- 7 scapular push-ups

Main movement #1:
Push-up Negatives (banded for those who don't have push-ups)
3-4 sets x 8-10 reps
(use an elevated surface or partner if needed)

Main movement #2:
SUPERSET

- Seated dumbbell strict press

3-4 x 8-10 reps

(weight is by feel. Good quality reps only)

- Dumbbell bent over row

3-4 x 8-10 reps

(weight is by feel. Good quality reps only)

Sprint intervals:
AMRAP 3:00 rest 1:00

- 4 shuttle runs (scale back if needed)
- 10 Dumbbell thrusters
- 6 burpees over DB

*(rest in your remaining time of the 3:00, start back at the top each 3:00.)
*(GOAL is to try and get all 3 movements done in about 1:30 or less and rest 1:30. However, I'm looking for consistency each round. So either stay in the same time domain when finishing or getting a little faster each round. This is about trying to recover in a short window to about 90%.)

Friday 02/10/23
testing*

APPENDIX I

Block Two Programming

BLOCK 2:
Week 1:

Tue 02/14/23
*Pistols progression and hip explosion focus:

Warm-up:
Tabata
1):20 jumping jacks :10 rest
2):20 mountain climbers :10 rest

Then:
X2

- 10 squat twists
- 10/10 single-leg hamstring flossers
- 10 alternating curtsey lunges
- 10 heels lowering

Main lift #1:
Single-leg squat Progressions (This will look different for everyone)
4 x 5/side
Options include: 1) single-leg squat negatives standing on a bench or mat or floor, 2) single-leg squat to bench, or 3) assisted sig=ngle-leg squat

Main lift #2
Deadlifts
5x15
Tempo :05 down/:03 bottom hold/explode up/:01 top hold
(Choose weight)

EMOM 20:
Min 1) :50 dumbbell Lateral step-ups
Min 2) :50 lateral burpees over dumbbells
Min 3) :50 candles stick roll-ups
Min 4) :50 jack knives

Thursday 02/16/23
*Push-up progression and shoulder stability focused

Warm-up:

- 10 alternating twisted puppy stretch
- :30 elevated cow stretch
- 10/10 shoulder circles forward and back on hands and knees

Then..
X2

- 3 inch worms to up dog pose
- 20 toe taps from down dog pose
- 7 scapular push-ups

Main movement #1:
Resisted banded push-ups (or scale to dumbbell bench press)
3-4 sets x 8-10 reps

Main movement #2:
Seated dumbbell strict press
3-4 x 8-10 reps
(weight is by feel. Good quality reps only)

Sprint intervals:
3:00x4 1:00 rest between

- 6 shuttle runs (scale back if needed)
- 16 lateral hops over dumbbells
- 12 alternating hang dumbbell snatches

*(rest 1:00 between rounds / try and beat your score each round.)
*(GOAL is to try and get all 3 movements done in about 1:30 or less and rest 1:30. However I'm looking for consistency each round. So either stay in the same time domain when finishing or getting a little faster each round. This is about trying to recover in a short window to about 90%.)

Fri 02/17/23
*Overall fitness: balance, coordination, range of motion, and fine motor skills

Warm-up:
Across the floor warm up

- toe walks
- heel walks
- high knees
- butt kickers
- kareokes
- spiderman lunges
- quad stretch
- inch worms

Workout:
9 min AMRAP:

- 3 wall (bench) walks
- 15 v-ups
- 10 devils press

Accessories:
15-20 min AMRAP style

- 5 seated box jumps
- 50ft dumber waiter carry per side
- 10/10 B-stance dumbbell deadlifts
- Max hold forearm plank

Week 2:

Tue 02/21/23
*Pistols progression and hip explosion focus:

Warm-up:

Tabata
1):20 jumping jacks :10 rest
2):20 mountain climbers :10 rest

Then:
X2

- 10 squat twists
- 10/10 single-leg hamstring flossers
- 10 alternating curtsey lunges
- 10 heels lowering

Main lift #1:
Single-leg squat Progressions (This will look different for everyone)
4 x 5/side
Options include: 1) single-leg squat negatives standing on a bench or mat or floor, 2) single-leg squat to bench, or 3) assisted sig=ngle-leg squat

Main lift #2
Deadlifts
5x15
Tempo :05 down/:03 bottom hold/explode up/:01 top hold
(Choose weight)

EMOM 20:
Min 1) 12 alt front rack dumbbell lunges
Min 2) :50 jump rope
Min 3) :50 candles stick rolls ups
Min 4) :50 russian twists

Thursday 02/23/23
*Push-up progression and shoulder stability focused

Warm-up:

- 10 alternating twisted puppy stretch
- :30 elevated cow stretch
- 10/10 shoulder circles forward and back on hands and knees

Then..
X2

- 3 inch worms to up dog pose
- 20 toe taps from down dog pose
- 7 scapular push-ups

Main movement #1:
Resisted banded push-ups (or scale to dumbbell bench press)
3-4 sets x 8-10 reps

Main movement #2:
Seated dumbbell strict press
3-4 x 8-10 reps
(weight is by feel. Good quality reps only)

Sprint intervals:
3:00x3 1:00 rest between

- 15 v-up (substitute tuck-ups)
- 10 alternating hang dumbbell clean and press

*(rest 1:00 between rounds / try and beat your score each round.)
*(GOAL is to try and get all 3 movements done in about 1:30 or less and rest 1:30. However, I'm looking for consistency each round. So either stay in the same time domain when finishing or getting a little faster each round. This is about trying to recover in a short window to about 90%.)

Fri 02/24/23
*Overall fitness: balance, coordination, range of motion, and fine motor skills

Warm-up:
Across the floor warm up

- toe walks
- heel walks
- high knees
- butt kickers
- kareokes
- spiderman lunges
- quad stretch
- inch worms

Workout:
9 min AMRAP:

- 3 wall (bench) walks
- 12 dumbbell plank pass throughs
- 10 devils press

Accessories:
15-20 min AMRAP style

- 5 seated box jumps
- 7/7 dumbbell windmills
- 10/10 single-leg deadlifts
- Max hold for an extended plank

Week 3:

Tue 02/28/32
*Pistols progression and hip explosion focus:

Warm-up:
Tabata
1):20 jumping jacks :10 rest
2):20 mountain climbers :10 rest

Then:
X2

- 10 squat twists
- 10/10 single-leg hamstring flossers
- 10 alternating curtsey lunges

- 10 heels lowering

Main lift #1:
Single-leg squat Progressions (This will look different for everyone)
4 x 5/side
Options include: 1) single-leg squat negatives standing on a bench or mat or floor, 2) single-leg squat to bench, or 3) assisted sig=ngle-leg squat

Main lift #2
Deadlifts
5x15
Tempo :05 down/:03 bottom hold/explode up/:01 top hold
(Choose weight)

EMOM 20:
Min 1) 8/8 dumbbell Lateral step-ups
Min 2) :50 max renegade rows
Min 3) :50 max candles stick rolls ups
Min 4) :50 dumbbell thrusters

Thur: 03/02/23
*Push-up progression and shoulder stability focused

Warm-up:
- 10 alternating twisted puppy stretch
- :30 elevated cow stretch
- 10/10 shoulder circles forward and back on hands and knees

Then..
X2
- 3 inch worms to up dog pose
- 20 toe taps from down dog pose
- 7 scapular push-ups

Main movement #1:
Resisted banded push-ups (or scale to dumbbell bench press)
3-4 sets x 8-10 reps

Main movement #2:
Seated dumbbell strict press
3-4 x 8-10 reps
(weight is by feel. Good quality reps only

Sprint intervals:
3:00x3 1:00 rest between
- 30 Jump rope
- 15 jump squats
- 5 dumbbell man makers

*(rest 1:00 between rounds / try and beat your score each round.)
*(GOAL is to try and get all 3 movements done in about 1:30 or less and rest 1:30. However I'm looking for consistency each round. So either stay in the same time domain when finishing or getting a little faster each round. This is about trying to recover in a short window to about 90%.)

Fri 03/03/23

*Overall fitness: balance, coordination, range of motion, and fine motor skills

Warm-up:
Across the floor warm up

- toe walks
- heel walks
- high knees
- butt kickers
- kareokes
- spiderman lunges
- quad stretch
- inch worms

Workout:
9 min AMRAP:

- 3 wall (bench) walks
- 10 plank marches
- 10 dual dumbbell devils press

Accessories:
15-20 min AMRAP style

- 10 alternating ice skater jumps
- 3/3 Turkish get-ups
- 10/10 Single-leg deadlift with one foot on wall
- Max hold plank of choice

Week 4:

Tue 03/07/23
*Pistols progression and hip explosion focus:

Warm-up:
Tabata
1):20 jumping jacks :10 rest
2):20 mountain climbers :10 rest

Then:
X2

- 10 squat twists
- 10/10 single-leg hamstring flossers
- 10 alternating curtsey lunges
- 10 heels lowering

Main lift #1:
Single-leg squat Progressions (This will look different for everyone)
4 x 5/side
Options include: 1) single-leg squat negatives standing on a bench or mat or floor, 2) single-leg squat to bench, or 3) assisted sig=ngle-leg squat

Main lift #2
Deadlifts
5x15
Tempo :05 down/:03 bottom hold/explode up/:01 top hold

(Choose weight)

EMOM 20:
Min 1: max push-ups
Min 2: max pistols
Min 3: max dumbbell (on chest) sit-ups
Min 4: max jump rope

Thursday 03/09/23
*Push-up progression and shoulder stability focused

Warm-up:
- 10 alternating twisted puppy stretch
- :30 elevated cow stretch
- 10/10 shoulder circles forward and back on hands and knees

Then..
X2
- 3 inch worms to up dog pose
- 20 toe taps from down dog pose
- 7 scapular push-ups

Main movement #1:
Resisted banded push-ups (or scale to dumbbell bench press)
3-4 sets x 8-10 reps

Main movement #2:
Seated dumbbell strict press
3-4 x 8-10 reps
(weight is by feel. Good quality reps only

Sprint intervals:
3:00x3 1:00 rest between
- 30 Jump rope
- 15 air squats
- 5 burpees

*(rest 1:00 between rounds / try and beat your score each round)
*(GOAL is to try and get all 3 movements done in about 1:30 or less and rest 1:30. However I'm looking for consistency each round. So either stay in the same time domain when finishing or getting a little faster each round. This is about trying to recover in a short window to about 90%.)

Fri 03/10/23
*Overall fitness: balance, coordination, range of motion, and fine motor skills

Warm-up:
Across the floor warm up
- toe walks
- heel walks
- high knees
- butt kickers
- karaokes
- spiderman lunges
- quad stretch
- inch worms

Workout:
9 min AMRAP:

- 3 wall (bench) walks
- 12 DB OH SIT-ups
- 10 devils press

Accessories:
15-20 min AMRAP style

- 5-8 pike push-ups
- 15/15 single-leg glute bridge
- 3/3 Turkish get-ups
- :30/:30 side plank

APPENDIX J

Outcome Measure Study Information Sheets

The Three-Minute Accelerated Step Test

Instructions for Tasks:

1. **Name of the Task: Three-minute Accelerated Step test**
   Purpose of the task: An objective measure of assessing cardiovascular strength.
   Equipment needed: Stopwatch or clock with a second hand; a friend to help you free online version at www.MetronomeOnline.com

- The participant will step up onto the 12-inch riser with one foot and then the other and step down at a cadence of 96 beats per minute. The order of steps per beat will be as follows: Right foot up, left foot up, right foot down, left foot down, and repeat for 3 minutes.
- The participant will then sit on a chair/stool and measure:
  - Measure Maximum Heart Rate immediately at the end of the test (for 30 sec and Multiply by 2).
  - Measure Recovery Heart Rate one minute after the end of the test (for 30 sec and Multiply by 2).

Name:

Heart rate Immediately after step test:
Heart rate one minute after step test:

The Airplane Test Standards

Name of the Task: Airplane Test
Purpose of the task: To measure unilateral balance
Equipment needed: The research team will help you
Reference Video: https://www.youtube.com/watch?v=huzr00t9aAU

- The participant will stand in parallel and shift weight onto one leg
- The participant will perform a single-leg stand (arabesque) with the body and the other leg parallel to the ground. Move the other leg behind (like a tendu derrière) and then lift it off the floor as the participants' trunk shifts forward
- The arms are lifted beside the torso in the shape of a "T."
- Once the torso and leg are parallel with the floor, the participant will lower down into a plié – i.e. bend the hip and knee of the supporting leg and bring both arms down and touch the floor with fingertips with complete control and balance
- Then return to the top while maintaining control of the supporting leg, torso, and pelvis
- Repeat 5 times on each support leg.

For the purposes of this research study, you will be tested with a points system. Any deviation from proper form and balance, such as breaking body alignment from head to toe, wobbling or hopping, or lifting the arch of the foot or toes during repetitions, will result in one point being added. The lower your score, the better you perform on the test.

Name:
Tallied number of deviations in alignment and balance during total repetitions:
Right Side:
Left Side:

Total # of points:

Push-up Test Standards

To determine your capacity for maximum push-ups in one minute, it is essential to establish criteria for a valid repetition. For the purposes of this study, a proper push-up begins in a high plank position with a rigid midline and a neutral spine from head to toe. While maintaining this alignment, bend your elbows to lower your body until your chest touches the floor. To complete the rep, fully extend your elbows to return to the starting position.

For this research study, you will be tested on how many clean push-ups you can do in 1-minute. The four main factors to consider for each rep to count are: 1) Spine alignment must stay intact through the duration of the movement (no arched back, or tall hips, no sunk in scapulas), 2) The elbows should stay tight to the body without winging (please see the example below), 3) Your chest should make contact with the ground at the bottom of each rep, and 4) Your elbows must extend fully at the top of each rep.

The following page contains examples of how and how not to perform a push-up. Please see the YouTube video linked below for a full breakdown of the movement.

Please watch the video below for a full description of how to perform a proper push-up:

https://youtu.be/0pkjOk0EiAk

Name:
Tallied number of valid repetitions in 1-minute:

Single-Leg Squat (Pistols) Test Standards

To determine your capacity for single-leg squats in one minute, it is important to establish clear criteria for a clean repetition. For the purposes of the study, a proper single-leg squat involves a full range of motion squat on one leg, with the hips dropping below or breaking the line of the knees. The non-weight-bearing leg should remain extended and hovering above the ground the entire time, with an active and engaged quadriceps muscle. This exercise also requires a certain degree of flexibility in the posterior chain. To finish each rep, stand tall and fully extend at the hips. To maintain proper alignment, strive for a straight torso and keep your arms extended in front of you to support your posture.

For this research study, you will be tested on how many alternating single-leg squats (sometimes referred to as pistol squats), you can do in 1-minute. The three main factors to consider for each rep to count are: 1. The hips breaking parallel, 2. The non-weight-bearing leg can not touch the ground during the duration of the entire movement, and 3. The hips must reach full extension to finish each rep again.

Below are examples of clean repetitions that meet the criteria for a valid repetition. Please see the YouTube video linked below for a full breakdown of the movement.

Please watch the video below for a full description of the Single Leg Squat (Pistol Squat):

https://youtu.be/qDcniqddTeE

Name:
Tallied number of valid repetitions in 1-minute:

Qualitative Movement Rubric

The three movements participants will be tested on are the following:

1. Kip Up
2. An Inversion
3. Tripod Cartwheel

The participants' movement abilities will be rated 0-3 across 3 qualitative measurable outcomes.

1. Clarity Within Moving In and/or Out of the Floor
2. Engagement and Awareness of the Accurate Muscle Groups for Performing This Movement
3. Overall Movement Proficiency

Kip UP:

Clarity Moving IN/Out of Floor:	Participant displays exemplary clarity for moving in or out of the floor **Pts: 3**	Participant displays some clarity for moving in or out of the floor **Pts: 2**	Participant displays little clarity for moving in or out of the floor **Pts: 1**	Participant is unable to attempt the Kip up or failed during the attempt. **Pts: 0**	**Score:**
Utilization of Accurate Muscle Groups:	Participant displays accurate engagement and awareness of proper muscle groups within this movement **Pts: 3**	Participant displays some engagement and awareness of proper muscle groups within this movement **Pts: 2**	Participant displays little engagement and awareness of proper muscle groups within this movement **Pts: 1**	Participant is unable to attempt the Kip up or failed during the attempt. **Pts: 0**	**Score:**
Overall Movement Proficiency:	Participant displays precise and proficient movement that is accurate to what was demonstrated by the lead researcher **Pts: 3**	Participant displays some proficient movement that is similar to what was demonstrated by the lead researcher **Pts: 2**	Participant displays little to no proficiency within the movement and the movement does not match what was demonstrated by the lead researcher **Pts: 1**	Participant is unable to attempt the Kip up or failed during the attempt. **Pts: 0**	**Score:**

Inversion:

Clarity Moving IN/Out of Floor:	Participant displays exemplary clarity for moving in or out of the floor **Pts: 3**	Participant displays some clarity for moving in or out of the floor **Pts: 2**	Participant displays little clarity for moving in or out of the floor **Pts: 1**	Participant is unable to attempt the Inversion or could not stay in the inversion for at least :01 **Pts: 0**	**Score:**

Utilization of Accurate Muscle Groups:	Participant displays accurate engagement and awareness of proper muscle groups within this movement **Pts: 3**	Participant displays some engagement and awareness of proper muscle groups within this movement **Pts: 2**	Participant displays little engagement and awareness of proper muscle groups within this movement **Pts: 1**	Participant is unable to attempt the Inversion or could not stay in the inversion for at least :01 **Pts: 0**	**Score:**
Overall Movement Proficiency:	Participant displays precise and proficient movement that is accurate to what was demonstrated by the lead researcher and was able to stay in the inversion for :05 or more. **Pts: 3**	Participant displays some proficient movement that is similar to what was demonstrated by the lead researcher and was able to stay in the inversion for :03 or more. **Pts: 2**	Participant displays little to no proficiency within the movement and the movement does not match what was demonstrated by the lead researcher and was able to stay in the inversion for :01 or more **Pts: 1**	Participant is unable to attempt the Inversion or could not stay in the inversion for at least :01 **Pts: 0**	**Score:**

Tripod Cartwheel:

Clarity Moving IN/Out of Floor:	Participant displays exemplary clarity for moving in or out of the floor **Pts: 3**	Participant displays some clarity for moving in or out of the floor **Pts: 2**	Participant displays little clarity for moving in or out of the floor **Pts: 1**	Participant is unable to attempt the tripod cart wheel or failed during the attempt **Pts: 0**	**Score:**
Utilization of Accurate Muscle Groups:	Participant displays accurate engagement and awareness of proper muscle groups within this movement **Pts: 3**	Participant displays some engagement and awareness of proper muscle groups within this movement **Pts: 2**	Participant displays little engagement and awareness of proper muscle groups within this movement **Pts: 1**	Participant is unable to attempt the tripod cart wheel or failed during the attempt **Pts: 0**	**Score:**
Overall Movement Proficiency:	Participant displays precise and proficient movement that is accurate to what was demonstrated by the lead researcher **Pts: 3**	Participant displays some proficient movement that is similar to what was demonstrated by the lead researcher **Pts: 2**	Participant displays little to no proficiency within the movement and the movement does not match what was demonstrated by the lead researcher **Pts: 1**	Participant is unable to attempt the tripod cart wheel or failed during the attempt **Pts: 0**	**Score:**

APPENDIX K

Thesis Show Flyer

APPENDIX L

Thesis Show Program

Program Note

Welcome to STRONG, an artistic expression of an eight-week research study on functional cross-training for dancers. Through a series of rigorous workouts and training sessions, our dancers have developed not only their physical strength but also their mental fortitude and emotional resilience.

Inspired by the transformative power of cross-training, STRONG showcases the artistry and athleticism of our dancers as they explore the limits of their bodies and push beyond them. From explosive bursts of power to delicate moments of grace, this performance embodies the dedication, discipline, and drive it takes to become a truly STRONG dancer.

We invite you to join us on this journey of discovery and growth as we celebrate the beauty and power of the human body in motion.

I am incredibly grateful for the unwavering support and guidance provided by the Claire Trevor School of the Arts, Dance Department at UCI and for the countless opportunities, resources, and encouragement they have provided me with over the past two years.

Choreography By

Frankie Henderson in collaboration with cast

Cast

Ari Pulido
Barbara Dos Reis
Bella Lara
Maggie Liang
Mia Marino
Naomi Sagen
Yinqi Wang

Lighting Designer

Jacqueline Malenke

Original Music By

Daniel Manoiu

Production Team

Stage Manager: Frankie Henderson & Jeevika Bhat
Costumes: Cast
Video Editing: Lean Damasco
Light Board Operator: Jeevika Bhat
Sound Board Operator: Emily Chapman
Projectionist: Danniel Monroy
Stage Assembly: Kyle Martin, Joey Navarentee, & Frankie Henderson

Thesis Commitee

Thesis Chair: Dr. Kelli Sharp
Committee Member: Dr. Lisa Naugle
Committee Member: Charlotte Griffin

Acknowledgments:

Without the following individuals, grad school would not have been possible.

Darcy Fagerwold

Without you, my world has no dancing, no purpose, no home, and no family. Your love knows no bounds. Thank you for giving me a life worth living and showing me that dance can save the world, one child at a time.

Angie Rosenkrans & Shauna Meredith

Through your guidance and mentorship, you have shown me the value of hard work, discipline, and perseverance and that anything is possible with focus and dedication. Thank you for teaching me patience and the willingness to embrace failure in order to develop resilience, creativity, and the courage to take risks.

Kristen Daley

You have been a consistent guiding light in reminding me that true strength lies in our vulnerability to be our most authentic selves. Thank you for being a shining example of what it means to live with an open heart and for showing me that anything is possible when we lead with radical love.

Dr. Kelli Sharp

I want to express my sincere gratitude to my thesis chair for their unwavering support and guidance throughout this past year. Your patience, wisdom, and encouragement have been instrumental in helping me navigate the challenges and complexities of my research. Even when things got tough, you remained steadfast in your commitment to my success, and for that, I am truly grateful. I couldn't have done this without your expertise and guidance, and I am honored to have had you as my mentor and champion.

My Dearest Family

Thank you for your unwavering support and encouragement throughout my academic endeavors in dance. Not many are fortunate enough to say their family supports them in making a career out of dance. This has all been for you, Mom & Dad. I love you!

APPENDIX M

Thesis Concert Link

STRONG Concert Link:

https://youtu.be/PwcCAqRgeoo

APPENDIX N

Video Projection Links

Artistic Footage of Participants' Progress

https://youtu.be/hH8Qlo59vsM

10-Minute Stopwatch Counting up

https://youtu.be/DOtb3yHtApk