# EFFECTS OF CREATIVE DANCE AND BODY PERCUSSION FOR OLDER ADULTS AT RISK FOR DEMENTIA - A MIXED-METHOD EXPERIMENTAL DESIGN

by

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**Dedication**

To my grandparents：

Hao Junying 郝俊英, Yang Haigang 杨海刚, Fu Fengying 傅凤英, and Wu Haiquan 吴海泉

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**Abstract**

Mild cognitive impairment (MCI) is considered the transitional stage from healthy aging to Alzheimer's disease or related dementia (ADRD), and people with MCI are at high risk for ADRD. Interventions for people with MCI to prevent and delay the onset of ADRD are significant in public health. This mixed-methods study evaluated and compared the impact of Creative Dance (improvisational approach) and Body Percussion (choreographic approach) on the cognition and well-being of older adults with MCI. **Methods:** 20 participants with MCI were randomized into either the Creative Dance (CD) or Body Percussion (BP) group. Each group had two one-hour interventions per week for 10 weeks. Quantitative assessments on attention, memory, and creativity were done before and after the interventions in both groups. Participants completed the Positive Well-being survey before and after the 1st, 5th, 10th, 15th, and 20th classes. Qualitative methods, including focus group interviews, survey answers, and observations, were used to explore the potential mechanisms of specific dance approaches. **Results:** The CD group showed a significant improvement in creativity ($p = .05$), with greater gains compared to the BP group ($p < .05$). Both groups experienced a significant increase in short-term positive well-being after the 1-hour class ($p < .001$); however, only the BP group demonstrated significant long-term improvement over ten weeks ($p < .05$). Even though quantitative data did not show a statistically significant difference, mixed data showed the BP group presented a positive indication of improving attention/reaction time, visual-spatial short-term memory, physical benefits, and self-efficacy than the CD group. The CD group showed a positive indication of promoting social interaction and personal expression compared to the BP group. Qualitative results showed that self-efficacy, emotional engagement, expression, and

social interactions contribute to Positive Well-being. Semi-structured improvisation in the CD group is the potential key factor to promote creativity. Remembering and repeating the movements with timing in the BP group are the potential key factors for improving attention, reaction time, and memory. A study diagram presents the mechanisms of how and why the intervention caused the primary outcomes.

## Positionality

Eight years ago, I came to the US from China as a dance and Chinese culture instructor. At the same time, my grandma on my dad's side started to forget things, became confused, and had an unstable temper -- she was diagnosed with Alzheimer's disease. As her primary caregiver, my grandpa physically, mentally, and socially suffered significantly from her cognitive deterioration. I started to be interested in searching for Alzheimer's disease information, and the results devastated me – it has no cure. Though some medicines may control some symptoms, my grandma refused to take any pills for many years, and I couldn't help with anything. Then, five years ago, I started this Ph.D. program to pursue my academic dream. I have not been able to go back to China to visit my family and my grandparents for four years because of COVID-related restrictions. When I saw my grandma again in the summer of 2023, she could not remember me at all. What was even more heartbreaking was that she yelled at me and kicked me out of the house.

In the past half year, while I was writing my dissertation, my grandma on my mom's side appeared to have many signs of cognitive decline: forgetfulness, slow reactions, and agitation. I have always wanted to do something for my grandparents, even though they live on the other end of the earth. In addition, some of my family members started to become afraid of getting dementia in the future because of the family history and to seek methods of dementia prevention. My family experiences inspired me to pursue a dissertation topic about dementia prevention through the lens of dance.

I have been a dance instructor for over 15 years. At least half of my students in community settings are adults and older adults. The experience of teaching dance to the aging population

has made me pay more attention to healthy aging-related topics. I am trained as a teacher in the areas of traditional Chinese dance, modern dance, jazz dance, and Mettler-based creative dance. I am a certified Chinese dance teacher from the Chinese Dancers Association and a senior yoga instructor at the International Association of Yoga. Though I had some dance therapy training classes, I am not a registered dance therapist. This study is not dance therapy research. My dissertation research is in a community setting instead of a clinical setting. I hope to explore ways that dance can be used as a form of dementia prevention in the community setting and how trained dance instructors can engage productively in this area despite not having clinical training.

In addition, I also started practicing Tai Chi in graduate school and have taught and researched Tai Chi in several programs. I participated in a research team as a Tai Chi instructor and a research assistant during my Ph.D. study, conducting three healthy aging research projects with Dr. Zhao Chen, who is the associate dean for research and a distinguished professor in the College of Public Health at the University of Arizona. Two of them are Tai Chi intervention studies for older adults using mixed methods. I decided to minor in Public Health in the second year of my PhD journey. Having quantitative training in public health and qualitative training in arts research allowed me to develop a deeper understanding of science and humanity. These experiences inspired me to develop the current dance intervention study using mixed methods in an intervention study. During my training and practice, I realized how powerful dance and movements could be as a potential tool to help with dementia issues, especially when I conducted my practicum with Dancesequences. This non-profit organization offers dance resources to marginalized populations, including older adults. I observed and taught dance classes in senior living communities and care homes with Dancesequences. From these

experiences, I further understand dance combines the benefits of artistic and physical activity, positively affecting physical, mental, and social well-being.

My grandma, my dance training, my advisors who focus on arts and healthy aging, all the exciting classes I have taken in this program, and the research projects I participated in pulled me to the current research topic. I hope to contribute a little to my grandparents and more "grandparents" in the world who live with dementia or are at risk for it. I am pursuing a Ph.D. degree to bring my training to the service of this issue that has affected my family and is affecting broader society. My training, combining dance and public health, positions me to make a valuable impact on Alzheimer's disease or related dementia prevention.

## Chapter 1 Introduction

Alzheimer's disease or related dementia (ADRD) affects around 55 million individuals worldwide, and the population is predicted to rise to 139 million in 2050 as the population of older people grows in almost every country (WHO, 2022). The effects of dementia (physical, psychological, social, and economic impacts) are felt not only by individuals living with cognitive impairment but also by families and caregivers (Alzheimer's Association, 2020). The lack of a cure for ADRD emphasizes the importance of early detection and intervention. Age is the most significant risk factor for dementia. Mild cognitive impairment (MCI) is an interstage between healthy aging and dementia (DeCarli, 2003). People with MCI are at high risk of getting ADRD – 50% of people with MCI will develop dementia in 5 years (Gauthier et al., 2006). Therefore, interventions for individuals with MCI aiming to prevent or delay ADRD onset may significantly reduce ADRD's incidence, prevalence, and economic cost.

Although there is no cure for neurodegenerative dementias like Alzheimer's, there are FDA-approved monoclonal antibody treatments (Alzheimer's Association, n.d.) that may help curb the deterioration in individuals with early-stage Alzheimer's. Other medications may control symptoms like anxiety or behavioral problems. Although many new treatments are being tested at various phases of clinical trials, current medications for ADRD have limited efficacy, have been associated with potential harms or side effects (Watt et al., 2019), and are primarily designated for Alzheimer's disease (CDC, 2019).

Non-pharmacological strategies have been shown to play a crucial role in alleviating some symptoms and maintaining or improving cognitive function, overall quality of life, and the ability

to perform activities of daily living for people living with dementia(Abraha et al., 2017; Horr & Pillai, 2015; H. Li et al., 2011; Lissek & Suchan, 2021), (details in Chapter 2 session 2.2. Pharmacological & Non-Pharmacological Treatments). Studies have shown dance, a non-pharmacological strategy, to have a positive impact on motor abilities (gait or balance); cognitive outcomes (memory, attention, reaction time, and orientation); and psychological and behavioral outcomes (mood, agitation, self-esteem, quality of life, social interactions), (Bennett et al., 2021; Guzmán-García et al., 2013; Wu et al., 2021). Details of this information are in session 2.5. Dance in MCI and ADRD.

Most current dance intervention studies related to ADRD focus on the effects of certain types of dances; the comparative study of different types of dances is rare. The effects of dance intervention are influenced by the dance types and the class design. We need to pay closer attention to the actual dance practices, not just the fact that they are dance. Therefore, different dance types and class designs may show different effects in different stages of dementia progress. Distinct dance formats matter. For example, ballroom dance may do a better job at social connection, Zumba may be good at lower body strength and balance, and body percussion (BP) pays more attention to beat and reaction time. The dance class design also matters. For example, individual, partner, or group creative dance may produce different results. In addition, most studies do not describe how dance interventions were designed and implemented. Therefore, it is difficult for teaching artists, caregivers, or therapists to recreate programs in the way the studies were originally intended.

While there are endless dance cultures and styles worldwide, categorization may offer a useful pathway toward understanding the strengths and limitations of different types of dances

and informing future intervention designs to support certain populations. For this study, I categorize existing dance interventions into two main approaches: improvisation and choreography. These two approaches to dance require the dancer to use their brain differently. Improvisational dance uses the creative, free, and expressive processes of the artistic creation of participants. In contrast, choreographic dance requires the participants to learn and remember a specific sequence of movement and dance repetitively.

Only a few studies have looked at the comparative effects of these different dance modalities on cognitive health. Kimura and Hozumi (2012) investigated the reaction time of two styles of aerobic dance exercises on executive cognitive function: freestyle and combination style - a choreographic repetitive routine among older adults. The study found that the combination style group's switch cost (the difference in reaction time between switch and repeat conditions) became significantly smaller compared to the freestyle group between pre- and post-exercise, despite participants in both programs performing the same dance elements at the same exercise intensity. Another study comparing choreography and creative dance in 6-7-year-old children showed that the choreography-dance group improved working memory capacity more than the creative dance group (Rudd et al., 2021).

My overarching goals of this study are to understand (1) What are the advantages and limitations of different kinds of dance for promoting cognitive and psychological health for individuals living with MCI? (2) How might this knowledge help to inform the design of dance interventions intended to support people living with MCI and explore how specific dance approaches may be used to lower the risk of dementia?

This study specifically aims to evaluate and compare the effects of Creative Dance (improvisational approach) and Body Percussion (choreographic approach) on older adults with MCI in quantitative and standardized assessments of attention, long-term and short-term memory, creativity, and positive well-being. The present study also explores how and why specific dance approaches may address targeted outcomes with qualitative methods.

Drawing on the Arts And Culture In The Public Health Framework(Golden et al., 2024) and my experience with a pilot project, I developed the research questions and designed the qualitative data collection strategies. The framework hypothesizes a link between art activities, mechanisms, and health outcomes. The mechanisms include self-efficacy, emotional engagement, and expression.

Based on the previous literature, three hypotheses were formulated for this study:

(H1): CD leads to more improvements than BP in terms of creativity, emotional engagement, expression, and triggering long-term memory. CD may work better on psychological health than cognitive health for people living with MCI.

(H2): BP leads to more improvements in attention, reaction time, alertness, self-efficacy, and triggering short-term memory. BP may work better on cognitive health than psychological health for people living with MCI.

(H3): Both CD and BP promote overall well-being.

Utilizing the goals and hypotheses, my study explored the following research questions:

(RQ1): What are the different effects of CD and BP on attention, short-term and long-term memory, creativity, and positive well-being for older adults living with MCI?

(RQ2): What are the potential mechanisms of each dance intervention's results, and how and why do the interventions lead to the results?

Understanding the differences in how CD and BP impact cognitive and psychological well-being in older adults living with MCI can be used to inform the strengths and limitations of each dance approach and help the dance instructors use dance materials according to the participants' needs and situations in their intervention. It can also serve to develop dance programs for special needs and offer evidence to design dance interventions at different stages of MCI and ADRD.

# Chapter 2 Literature Review

## 2.1. ADRD & MCI Prevalence and Symptoms

Alzheimer's disease and related dementia (ADRD) affect around 55 million individuals worldwide (CDC, 2019). This population is predicted to rise to 78 million in 2030 and 139 million in 2050 as the population of older people grows in almost every country (Alzheimer's Association, 2020). 44% of adults in the U.S. have a family member or friend with Alzheimer's disease (MetLife Foundation, 2011). ADRD are the seventh-largest cause of death globally and one of the top causes of disability and dependency among the elderly (World Health Organization, 2021). Common symptoms of ADRD include memory loss, falling, unsteady walking, jumbled speech disorientation, personality changes, and depression (Alzheimer's Association, 2020).

Alzheimer's disease is the most prevalent category of dementia that affects memory, thinking, and behavior (CDC, 2019). The most common early symptom of Alzheimer's is difficulty remembering newly learned information (CDC, 2019). As Alzheimer's symptoms become more severe, there are more severe memory loss and behavioral changes; confusion about events,

time, and place; unfounded suspicions about family, friends, and professional caregivers; and difficulties speaking, swallowing, and walking (Alzheimer Association, 2022). Symptoms of Alzheimer's disease eventually grow severe enough to interfere with daily tasks. Not only people living with dementia (PLWD) suffer from physical, psychological, social, and economic impacts, but also their caregivers, families, and society overall (Alzheimer Association, 2022).

Mild Cognitive Impairment (MCI) is viewed as a risk state for ADRD, which is known as a transitional phase between normal aging and ADRD (Petersen et al., 2014). The intervention of ADRD is generally most effective when initiated in the early stages of the condition (Morovic et al., 2019). In the past two decades, many studies targeting the MCI population aim to lower the risk, delay the onset, and reduce the potential cost of ADRD. The most common symptoms of MCI are memory impairment, depression, irritability, apathy, anxiety, agitation, and sleep problems (RC et al., 1999). Individuals with MCI may be aware that their memory or other mental abilities have declined, and close relatives and friends could also notice changes. However, these changes aren't severe enough to interfere with daily life or affect routine tasks (DeCarli, 2003). One subtype of MCI, the amnestic subtype, has a high likelihood of progressing to Alzheimer's disease, and the yearly incidence of the progression of amnestic MCI to ADRD is 10–15% (Gauthier et al., 2006). More than half of people with MCIs will develop ADRD within five years (Gauthier et al., 2006). Approximately 12% to 18% of people aged 60 or older are living with MCI (DeCarli, 2003). Studies are underway to investigate further classifications and subtypes of MCI as possible precursors of Alzheimer's disease and other types of ADRD (Gauthier et al., 2006). In addition, possible biomarkers and other assessments may aid in identifying MCI for early

intervention to lower the risk, delay the onset, and reduce the potential cost of ADRD (DeCarli, 2003; Martin & Velayudhan, 2020).

According to Brookmeyer et al.'s (1998) study about the public health impact of delaying Alzheimer's disease onset, if an intervention could delay the onset 1 year, the number of people with Alzheimer's disease would be nearly 210,000 and 770,000 lower than expected 10 and 50 years respectively. A 5-year delay in the disease onset would reduce the prevalent cases by 50%, by dropping 4.04 million after 50 years. The total public health costs associated with an Alzheimer's disease patient is approximately $47,000 per year. An average one-year delay in disease onset would result in an annual saving of nearly $10 billion 10 years after initiation of the intervention (Brookmeyer et al., 1998). Therefore, preventing or delaying ADRD onset greatly impacts public health.

**2.2. Pharmacological & Non-Pharmacological Treatments**

Both pharmacological and non-pharmacological treatments are available to treat persons with MCI and ADRD. Concerning pharmacological treatment, no medication can cure ADRD so far (WHO, 2022). The FDA has approved medications in two main categories for ADRD: those that modify disease progression in individuals with early-stage Alzheimer's and those that may temporarily alleviate some symptoms of Alzheimer's dementia(Alzheimer's Association, n.d.). The disease-modifying drugs are designed for individuals with early-stage Alzheimer's, including those with mild cognitive impairment (MCI) or mild dementia, who have confirmed elevated beta-amyloid in the brain. They are called monoclonal antibody treatments or anti-amyloid treatments. Medicare now covers FDA-approved monoclonal antibody treatments. These include aducanumab (Aduhelm®), donanemab (Kisunla™), and lecanemab (Leqembi®), though their

safety and effectiveness remain highly debated (Lythgoe et al., 2022). Aducanumab will be discontinued on Nov. 1, 2024 (Alzheimer's Association, 2024). However, these drugs have been reported to have side effects, such as serious allergic reactions, amyloid-related imaging abnormalities (ARIA), infusion-related reactions, headaches, and falls (Alzheimer's Association, n.d.).

Other medications, such as Aricept®, Exelon®, Razadyne®, and Namenda® may temporarily relieve symptoms like memory, thinking, depression, and agitation and may slow the progression of symptoms (Dhillon, 2021). The side effects of these drugs include nausea, vomiting, loss of appetite, increased frequency of bowel movements, headache, constipation, confusion, and dizziness (Alzheimer's Association, n.d.). For pharmacological prevention, several ADRD vaccines are undergoing various phases of clinical trials to examine their effectiveness and safety, as reported by Medical News Today, and it may take years before any impactful vaccines are available to the public (Pelc, 2022). Although many new treatments are being tested at various phases of clinical trials, current medications for ADRD have limited efficacy, have been associated with potential harms or side effects (Watt et al., 2019), and are primarily designated for Alzheimer's type of dementia (CDC, 2019).

With limited pharmacological treatment options for MCI and ADRD, non-pharmacological strategies play a crucial role in alleviating some symptoms and maintaining or improving cognitive function, overall quality of life, and the ability to perform activities of daily living (Alzheimer's Association, 2022; Lissek & Suchan, 2021). Non-pharmacological interventions (NPIs) mean action mechanisms do not involve medications, instead calling on other biological, behavioral, or

psychosocial processes (Ninot, 2021, p.27). The "Plateforme CEPS," founded in 2011 at the University of Montpellier, France, studies methods to assess the benefits and risks of non-pharmacological interventions (NPIs) on health, autonomy, longevity, and quality of life. The Plateforme CEPS distinguishes NPIs into five categories— psychological, physical, nutritional, digital, and elemental health interventions—and twenty subcategories (Ninot, 2021, p.31). The current NPIs addressing MCI and ADRD mainly use the first two categories: psychological health intervention and physical health intervention.

According to Ninot (2021), psychological health interventions include five subcategories: arts interventions, health education programs, psychotherapies, mind-body programs, and animal-assisted therapies. The first subcategory, “arts interventions,” refers to arts therapy, art-based health methods, and art-related health programs. As part of the non-pharmacological interventions, creative arts such as music, visual arts, dance, theater, and museum activities have also been introduced to people with MCI or ADRD to improve their mood and quality of life, promote social interaction, relieve symptoms, and optimize cognitive functions (Takehiko Doi et al., 2017; Sorrell, 2018; Yoon Irons et al., 2020). Arts intervention applies to individuals and caregivers within all stages of MCI and ADRD. The second subcategory, “health education programs,” refers to proximal terms such as educational programs, health education methods, psychoeducation programs, and community-based programs. Health education programs help with MCI and ADRD early detection, and caregivers and family support. The third subcategory is “psychotherapies,” with proximal related terms such as psychological therapies and cognitive and behavioral therapies. Examples that address MCI and ADRD include cognitive stimulation and behavioral interventions. Cognitive stimulation involves a vast array of activities that seek to

enhance thinking and memory in general; activities may include discussion of past and current events and interests, word games, puzzles, and learning new languages or skills (Dementia UK, 2021). Behavioral interventions are centered on controlling disabilities and problem behaviors through principles of learning (Kasl-Godley & Gatz, 2000). The fourth subcategory is "mind-body programs," for example, yoga, Tai chi, and Qigong. The fifth subcategory is "animal-assisted therapies," with proximal terms such as zoo therapies and traditional healing with animals (Ninot, 2021, p. 32-33).

Physical health intervention is "an individual or group, non-invasive, manualized, supervised, and comprehensive program using passive or active mobilization of the body improving significantly health markers with an impact on health optimization, prevention or care. (Ninot, 2021, p. 34)" Physical health intervention includes five subcategories: exercise programs, horticultural therapies, physiotherapies, manual therapies, and balneological programs. All of the above physical health interventions are introduced to the care of MCI and ADRD.

The first subcategory of physical health intervention is "exercise programs," (Ninot, 2021, p.34) is more relevant to the current study. Examples addressing MCI and ADRD include walking, swimming, aerobic exercise, and cycling. Scholars categorize dance, yoga, and Tai Chi as exercise programs, but they sometimes categorize them into psychological health interventions as well (Nuzum et al., 2020).

Numerous studies have highlighted the benefits and effectiveness of non-pharmacological interventions on people with MCI and ADRD (Abraha et al., 2017; Horr & Pillai, 2015; Lissek & Suchan, 2021). According to a review and analysis of nonpharmacologic

interventions for agitation and aggression in ADRD patients, nonpharmacologic interventions appear to be more efficient than pharmacologic treatments and involve little risk or harmful effects (Watt et al., 2019). Depression is one of the common symptoms of MCI and ADRD. Depression management may consist of both nonpharmacologic and medications (Hogan et al., 2008). The fifth Canadian consensus conference on the diagnosis and treatment of ADRD (Hogan et al., 2008) suggests that physicians consider referring patients and caregivers to community-based programs for the management of behavioral disturbances and individual or group physical exercise.

Dance is one of the creative arts that combines the benefits of psychosocial and physical interventions. Dance has been found to have a potentially positive impact on decreasing the risk of ADRD in longitudinal research (Sanders & Verghese, 2007) and physical and mental health benefits for people with MCI and ADRD (Takehiko Doi et al., 2017; Guzmán-García et al., 2013; Ho et al., 2020; Wu et al., 2021). A more detailed literature on dance interventions for older adults with MCI and ADRD will be in session 2.5. Dance in MCI and ADRD.

**2.3. Dementia Non-Modifiable and Modifiable Risk Factors**

A risk factor is anything that increases a person's risk of developing a condition (Van Der Flier & Scheltens, 2005). Age is the major non-modifiable risk factor for ADRD: dementia risk increases to roughly one-third after the age of 85 (Alzheimer Association, 2022). Besides age, family history, genetics, and head injury are other non-modifiable risk factors (Alzheimer Association, 2022).

Modifiable risk factors are lifestyle and behaviors that can reduce or increase a person's chances of developing a disease(Baumgart et al., 2015). According to the 2024 report of the Lancet Standing Commission(Livingston et al., 2024), fourteen modifiable risk factors might prevent or delay nearly half of dementia cases: physical inactivity, depression, low social contact, hypertension, obesity, high cholesterol, diabetes, less education, hearing impairment, smoking, excessive alcohol consumption, traumatic brain injury (TBI), air pollution, and vision loss (Livingston et al., 2024). However, not all physical activities can reduce the risk of dementia. Aerobic exercise produces more significant benefits than other types of physical activities (Livingston et al., 2020). The word "aerobic" literally means "with oxygen," which suggests that the amount of oxygen that may reach the muscles during exercise to help them burn fuel is regulated by breathing. Dance as an aerobic activity is one of the beneficial exercises that may potentially reduce the ADRD risk, while resistance exercises such as weightlifting showed no effects (Livingston et al., 2020, p. 422). Research indicates that dance increases physical activity (Fong Yan et al., 2018; Schroeder et al., 2017), reduces depression (Adam et al., 2016; Vankova et al., 2014; Yao et al., 2021), promotes social contact (Atkins et al., 2019; Keyani et al., 2005; Thumuluri et al., 2022), and reduces hypertension (Conceição et al., 2016; Mario, 2018), obesity (Johar et al., 2017; Moreira-Reis et al., 2022; Murrock & Gary, 2008), diabetes (Borges et al., 2019), and cholesterol(Choe, 1988; Fitrianingsih, 2019). Thus, dance as an intervention can potentially address seven out of fourteen modifiable risk factors for dementia (Livingston et al., 2024).

**2.4. Arts in Public Health, MCI and ADRD**

The arts are defined as any medium of creative expression, including singing, dancing, painting, drama, writing, storytelling, gardening, cooking, pottery making, or needlework (Basting, 2006, p.16). Even though applying arts and cultural activities to prevent illness and promote recovery from disease has existed in many cultures throughout the world for thousands of years, the potential of the arts in healthcare interventions has only received serious consideration at the beginning of the 20th century, especially in the area of psychology (Clift & Camic, 2015, p.3). This practice and its evaluation processes have evolved, and so has the role of the arts in the greater picture of community well-being and health promotion in the last 30 years (Clift & Camic, 2015, p.3). Arts and health were rarely mentioned in the same scenario in public several decades ago, but they are inexorably intertwined today, especially in English-speaking countries. Academic journals and professional organizations in arts and health emerged about 20 years ago (Clift & Camic, 2015, p. 22). The increasing number of publications, international conferences, and professional organizations, such as the National Organization for Arts in Health (NOAH), also demonstrate the fast growth in this field. The growing interest in arts in public health is moving forward in both clinical and community settings.

Arts and health research and practice involve “practice-related research (Candy, 2006)” and “evidence-based practice (Clift, 2012).” The current study is practice-related research applying knowledge from an evidence-based framework and evaluating the effects of two types of dances for older adults living with MCI. Clift also claims that the challenge in the field of public health is now to extend these arts practice-based research efforts into progressive research programs that provide a robust body of knowledge for evidence-based practice (Clift, 2012).

Therefore, the long-term goal of the current, practice-based study is to develop an evidence-based dance intervention in a community setting for older adults at risk for ADRD.

Arts in older adult health and ADRD care is a fast-growing field in public health that can approached in three ways.

First, arts have been found to play an increasingly important role in health care, including health promotion and disease prevention. The arts are used in medical and social programs for people with ADRD. Certified therapists facilitate arts programs that are reimbursable as medical treatments. On the other hand, social arts programs can be implemented by anyone with a passion for creative expression and experience working with people with ADRD. According to Young et al. (2015), arts activities and interventions are more influential and widely applied in the community than in clinical settings in the ADRD care area. The creative arts may contribute to healing and making the whole through profound reunion with spirit (Baliszewski, 2008). Key findings of systematic reviews(Lam et al., 2020; Moreno-Morales et al., 2020) of music intervention impact on ADRD suggest that music-based interventions for individuals with ADRD can improve retention of verbal fluency, minimize symptoms such as agitation and aggression, reduce anxiety and depression, and enhance the quality of life. Therefore, music is employed as a health promotion approach for each stage of ADRD alongside pharmacological treatments (Soufineyestani et al., 2021). Dance interventions have shown the effects of slowing down the cognitive deterioration of older adults with mild cognitive impairment (MCI) according to a systematic review and meta-analysis, which included eight randomized controlled trial studies that evaluate dance interventions (Wu et al., 2021). For a ADRD population, dance can be done

with a therapeutic or leisure intention as a holistic intervention (Mabire et al., 2019), and it is especially effective in pre-clinical and MCI stages.

Second, arts can play a role in emotional support for older adults living with ADRD and their caregivers. The families and caregivers of individuals with ADRD often experience being forgotten; the sentiments of loss, regret, guilt, desperation, sorrow, and anger don't have any dedicated area to be heard and acknowledged. The creative arts can provide a means of expressing, releasing, and coming to terms with such difficult feelings. Carly Marchant, a registered movement psychotherapist, uses music and movement to rebuild broken bridges between people with ADRD and their families and friends (Hayes, 2011). In her program, “arts offer expressive ways to share empathy, emotions, and letting go” (Hayes, 2011, p.101). By letting go of a creative process, they let lyrics, melody, and movements take over the sadness and fully enjoy the artistic moment, sensing the present. In addition, two integrative reviews suggest that music and dance have the potential to impact the anxiety and agitation symptoms of persons living with ADRD (Bennett et al., 2021; Coxey et al., 2021).

Third, arts play a role in social support for the elderly living with ADRD and their caregivers. Increasing evidence has shown that the arts play a vital role for individuals living with ADRD and their care partners throughout the progression in terms of health care, emotional support, and social support. The creative arts provide a valuable vehicle for individuals isolated by the forgotten world to contact life. The creative arts form a relational bridge between people with ADRD, those who care for them, and the larger population. Allison et al., (2024) highlighted the importance of music engagement as part of everyday life in dementia caregiving relationships at home. Karin Diamond, from the UK, her Re-Live story work has developed a collaborative theater

performing and storytelling approach, encouraging people to reflect on their experiences and tell their own stories. According to the website of Re-Live's Life Story, "theatre and storytelling can provide a vehicle for people to take ownership of their experiences differently, edit them, fictionalize them, find catharsis or closure through the ritual, structure, and camaraderie of a theatre performance" (Re-live, n.d.). Re-Live's Life Story works (Re-live, n.d.) with families affected by ADRD to produce a series of dementia-related theater performances. The project offers an insight into the world of individuals living with ADRD and the impact on families; addresses the needs of individuals living with ADRD; demonstrates best practices in communicating with a person living with ADRD; shares insight about behavior that can be seen as challenging; and connects the elderly living with ADRD and their caregivers with the public.

Besides the arts' roles in health care, emotional support, and social support for people living with dementia (PLWD) and their caregivers, arts can also be a part of ADRD health education for the public (Burns et al., 2018; Gubner et al., 2020). Such education can increase public health awareness, build compassion around ADRD, and promote inclusive/ equal/accessible social environments to work against ageism and stigma of ADRD through arts education and arts activities.

Anne Basting is an influential figure in the field of arts in ADRD. She developed an innovative program, "TimeSlips," to connect people living with ADRD. She proposed accepting and valuing who the person is now, using improvisational arts, rather than focusing on who the person was in the past, which can lead to shame and embarrassment. TimeSlips is shifting from memory expectation to imagination freedom. TimeSlips facilitators reach people whose thoughts may have been lost to us by asking open-ended questions ("What should we call her?" "Where

should we say this is?") and accepting all responses: movements, sounds, words, and any medium used for creative expression. Facilitators echo the responses back to the participant to confirm and then weave the responses into the fabric of the story as they retell it. They rediscover joy by connecting through creativity in any place and circumstance. The researchers discovered that involvement in TimeSlips benefits residents, staff, and nursing home communities. People with ADRD increased creativity and communication skills, improved quality of life, positively altered behavior, and engaged in meaningful activity. Staff members increased job satisfaction, learned new practices, developed a deeper understanding of residents, and thought creatively about challenges. Care homes that received TimeSlips training had significantly more interactions between staff and residents (George & Houser, 2014). TimeSlips is sparking a creative care revolution to transform how we think about late life and how we interact with elders from a place of isolation and loss through arts (Basting, 2006).

People living with ADRD benefitted greatly from TimeSlips by focusing on the present and engaging in more improvisational arts, which inspired my research questions. We know that the main goal for arts in ADRD care is to focus on quality of life, and improvisational arts are helpful for that. So, how might improvisational arts benefit people with MCI and those at risk for ADRD? In addition to considering the benefits of improvisation, some dance and music programs created interventions such as cognitive training that asks the participant to learn and repeat certain pieces, which shows positive effects on cognitive function and mental state to prevent ADRD (Parial et al., 2021; Sawami et al., 2019). Anne Basting's work (Basting, 2006) inspired my research questions. Therefore, I am trying to understand if improvisational and choreographic/learning approaches benefit differently among different stages of ADRD, and the advantages and

limitations of each approach for promoting the health of individuals living with MCI through the current study.

## 2.5. Dance in MCI and ADRD

Evidence suggests psychosocial interventions will effectively support individuals living with ADRD. Group interventions that provide social contact, peer support, information, pleasurable activities, and mental stimulation have been shown to have benefits (Field et al., 2021). In recent decades, behavioral and artistic interventions have emerged to improve the quality of life for people living with ADRD and their care partners, and they have the potential to help decrease the risk of ADRD or slow its deterioration.

Previous works of literature addressed the effects of dance intervention on people with MCI/ADRD, including all types of dances, which have shown benefits on mental health (details in session 2.5.1. Mental Health), physical health (details in session 2.5.2. Physical Health), behavior (details in session 2.5.3. Behavioral Health), social health (details in session 2.5.4. Social Health), quality of life (details in session 2.5.5. Quality of Life), and even language function (details in session 2.5.6. Language Function).

### *2.5.1. Mental Health*

Dance interventions have shown benefits for mental health, including slowing cognitive deterioration, increasing hippocampal volume, improving memory, promoting attention, reducing depression & anxiety, and promoting self-esteem. Furthermore, research has shown that moderate-intensity exercise is associated with a decreased risk of MCI, especially aerobic exercise (Zhu et al., 2018). Unexpectedly, one study found that dance offers more advantages

than general physical activities (e.g., running, walking) in daily functioning and diurnal cortisol slope (an indicator for stress response and immune regulation), as well as significant reductions in depression, loneliness, and negative mood (Ho et al., 2020). Dance has the potential to increase cognitive and psychological health.

#### 2.5.1.1. Cognition

There is evidence that dance may slow down the cognitive deterioration of older adults with MCI, according to a systematic review and meta-analysis (Wu et al., 2021). After reviewing fourteen related quantitative studies, meta-analysis and systematic review results showed dance intervention significantly improved global cognition (Liu et al., 2021). In a cross-sectional study, the elderly participants identified themselves with and without dance experiences. People with dance experience performed better in cognitive tasks involving learning and memory. The finding suggests that dance may improve cognitive reserve in older age, preventing or postponing the onset of MCI (Porat et al., 2016). After reviewing 64 related papers, Whitty et al. (2016) found that aerobic exercise twice a week over four months had slight to moderate effects on memory or global cognition in people with MCI (Whitty et al., 2020). The choreographic intervention yielded more significant cognitive gains than physical therapy, particularly in those cognitive functions more closely associated with the risk of developing ADRD (Bisbe et al., 2020). According to the evidence from a systematic review (Teixeira-Machado et al., 2019), dance practice integrates brain areas to improve neuroplasticity.

##### *2.5.1.1.1. Memory*

A systematic review and meta-analysis reported dance intervention significantly improved memory, immediate recall, and delayed recall (Liu et al., 2021). Studies showed

evidence that three to four months of dance intervention could increase the right and total hippocampal volume and improve episodic memory and processing speed in elderly people with MCI (J. Li & Zhu, 2018; Qi et al., 2018; Whitty et al., 2020). According to Alves et al. (2013), the dance group improved in reasoning and working memory measures. Other randomized clinical trial studies also support similar results in memory improvement through dance interventions (Anderson-Hanley et al., 2018; Takehiko Doi et al., 2017).

#### *2.5.1.1.2. Attention*

A systematic review and meta-analysis reported dance intervention significantly improved attention (Liu et al., 2021). In addition, dance, including Zumba and traditional Greek dance, is said to positively affect concentration and attention (Douka et al., 2019; Fong et al., 2020; Parial et al., 2021). Naranjo et al. (2023) and Lazarou et al. (2017) who used choreography as an intervention, also found statistically significant improvement in attention. Coubard et al. (2011) showed that a contemporary dance intervention with an improvisational approach improved switching attention, which used rule shift cards to test attention. Reaction time is one way to test attention. Kimura and Hozumi (2012) investigated the reaction time of two styles of aerobic dance exercises on executive cognitive function: freestyle and combination style in a choreographic repetitive routine among older adults. The freestyle in Kimura and Hozumi's study is an improvisational approach that is similar to creative dance in my study. The combination style is a choreographic approach similar to body percussion in my study, which engages in remembering and repeating movements. Kimura and Hozumi's study found that the combination style group's switch cost (the difference between the reaction time under the repeated

and switch conditions, which was used as an indicator of computational speed in the brain circuit) became significantly smaller compared to the freestyle group between pre- and post-exercise.

#### 2.5.1.2. Mood/ depression/ anxiety and self-esteem

Two systematic review and meta-analysis studies reported significant decreases in depression following dance-based interventions compared with controls (Y. Wang et al., 2022; Wu et al., 2021). In one example, a body percussion intervention shows biological evidence of lower stress and anxiety levels by reducing cortisol (Romero-Naranjo, 2014). Another study comparing the mean differences between baseline and 48-week assessments for dancers and controls revealed that the dance intervention group improved in depression(Dominguez et al., 2018). Studies also show that dance, including folk dance, body percussion, and creative dance, enhances self-esteem for people with MCI and ADRD(Guzmán-García et al., 2013; Koch et al., 2014).

### *2.5.2. Physical Health*

Wu et al. (2021) found that dance interventions produced a significantly moderate effect on physical function. The dance intervention results reflect improved physical fitness, including lower body strength and physical endurance (Sejnoha Minsterova et al., 2020). Other physical benefits of dance for MCI include improving balance or gait and visuospatial function (Noguera et al., 2020; H. Wang et al., 2024). Dance also benefits cardiovascular health (Fong Yan et al., 2018), reducing hypertension (Conceição et al., 2016; Mario, 2018; Peng et al., 2020), obesity (Johar et al., 2017; Moreira-Reis et al., 2022; Murrock & Gary, 2008), and diabetes (Borges et al., 2019).

#### 2.5.2.1. Balance or gait

Evidence shows that dance benefits balance and gait. For example, Greek traditional dance was proven to significantly improve balance (Douka et al., 2019). Hugenschmidt et al. (2016) and Thumuluri et al., (2022) showed that improvisational dance could improve balance for older adults with MCI or early-stage ADRD.

#### 2.5.2.2. Visuospatial function

From the result of an intervention study, the dance group improved visual processing after a 4-month ballroom dance intervention for MCI (Alves, 2013). Furthermore, a meta-analysis and systematic review also show that dance is good for visuospatial function (Meng et al., 2020).

#### 2.5.2.3. Cardiovascular health, hypertension, obesity, and diabetes

Nowadays, it is commonly acknowledged that regular aerobic exercise, like dancing, can help lower blood pressure and improve cardiovascular health (Mario, 2018). One study reviewed 28 studies that showed dance interventions significantly improved body composition, blood biomarkers, and musculoskeletal and cardiovascular function (Fong Yan et al., 2018). Another review study found dance significantly reduced blood pressure and increased exercise capacity (Conceição et al., 2016). It is also widely known that regular aerobic exercise is helpful to lose weight and reduce the risk of developing type 2 diabetes and metabolic syndrome (CDC, 2022). For example, a 12-week dance intervention for overweight, sedentary adults had significantly improved obesity diagnoses (Johar et al., 2017). Other intervention studies such as Moreira-Reis et al.(2022) and Murrock & Gary (2008) showed similar results wherein dance helped weight loss among an overweight elderly population. Patients with type 2 diabetes also saw improvements of mobility, gait and motor-cognitive function after a four-month moderate-intensity dance intervention (Borges et al., 2019), and similar results can be found in other dance intervention

studies for diabetes patients(Haryono et al., 2022; Murrock et al., 2009). These results support the notion that dance may be a helpful activity to address the modifiable risk factors to lower risk and delay the onset of ADRD.

### *2.5.3. Behavioral Health*

Dance/ movement interventions were also found to be effective in reducing agitation and aggressive behavior (Bennett et al., 2021; Guzmán-García et al., 2013; Ho et al., 2020). 75% of care-home staff agreed that there were improvements in residents' behavior after 12 weeks of Latin Ballroom dance intervention (Guzmán et al., 2017).

### *2.5.4. Social Health*

People with MCI or ADRD are easily isolated from the public and family due to memory issues. Group dance provides a leisurely environment for people to connect. Many studies have shown the social benefits of dance. For example, dance can develop relationships between caregivers and people with ADRD (Melhuish et al., 2017). Ballroom dance has been reported as a powerful social connection tool for MCI and people with ADRD (Alves, 2013; Blumen et al., 2020; Dominguez et al., 2017). Additionally, a body percussion intervention showed an improvement in social relations as a result of working as a group (demonstrated via increased levels of oxytocin), and improvements seen in self-esteem and a variety of personal aspects through the Aspects of Identity questionnaire (Romero-Naranjo, 2014).

### *2.5.5. Quality of Life*

Dance helps develop the quality of life for people with MCI or ADRD, their care staff, and family members (Melhuish et al., 2017; Tay et al., 2014). Studies have proved that creative or improvisational dance can improve the quality of life in people living with ADRD and their

caregivers (Choo et al., 2019; Genné & Anderson, 2011; Hameed et al., 2018; Thumuluri et al., 2022). In addition, some systematic reviews showed dance interventions had a moderate (but significant) effect on the quality of life of the MCI population and people with ADRD (Fong Yan et al., 2018; Meng et al., 2020; Wu et al., 2021).

#### *2.5.6. Language Function*

Surprisingly, language function and verbal fluency also reported significant improvements following dance interventions besides the effects mentioned above (Douka et al., 2019; Meng et al., 2020; Wu et al., 2021)

Considering the natural decline of health indicators for people with MCI and ADRD, dance interventions turn out to perform well, maintaining and even improving overall health. Therefore, dance may be used as a preventive intervention for ADRD, and it is especially effective in the pre-clinical and MCI stages. For the ADRD population, dance can be done as a therapeutic intervention or a leisure activity as a holistic intervention (Mabire et al., 2019).

However, the majority of recent studies only show shorter-term results of three to four months of dance intervention, and some of them show positive health effects for one-year follow-up. Longer-term observational research and larger sample sizes are needed to show stronger external validity.

### 2.6. Improvisational and Choreographic Approaches to Dance

As seen above, previous literature supports the feasibility of my study that compares the impact of Improvisational and Choreographic approaches to dance on cognitive and psychological health measurements.

The most common benefits of improvisational dance interventions are clustered in mood, self-esteem, social support, and quality of life. Some dance interventions that used an improvisational approach found a statistically significant improvement in quality of life and well-being among people with MCI or ADRD (Choo et al., 2019; Hameed et al., 2018; Hugenschmidt et al., 2016; Koh et al., 2019; Thumuluri et al., 2022). Another dance movement therapy study with an improvisational approach showed significant decreases in depression, loneliness, and negative mood and improved daily functioning after a 12-week dance intervention for older adults with mild ADRD (Ho et al., 2020). A therapeutic creative dance study demonstrated reduced tension, depression, and confusion and increased in people with ADRD (de Andrés-Terán et al., 2019). Qualitative results through participant observation and informal interviews showed that creative dance provided and stimulated the following four primary outcomes: (1) Enjoyment, pleasure, and a sense of humor; (2) Social interaction, feelings of connection and belonging, and allowing autonomy and identity; (3) Creative expression, imagination, and intuition; (4) Less stressful relations between the people with ADRD and their caregivers (Choo et al., 2019; Smith et al., 2012).

Choreographic dance interventions seem to show more benefits in memory, reaction time, and attention in previous literature. In one study, a four-month ballroom dance intervention showed improved memory and reasoning in healthy older adults (Alves, 2013). A forty-week ballroom dance intervention for an MCI population resulted in improvements in memory recall tests and general cognitive function compared to controls (T. Doi et al., 2017). Attention and reaction time were significantly improved after a 24-week choreographed dance intervention for healthy older adults (Kattenstroth et al., 2013). Zumba and traditional Greek

dance (Choreographic approach) showed positive effects on concentration and attention (Douka et al., 2019; Fong et al., 2020). After reviewing 64 related papers, Whitty et al. found that aerobic exercise twice a week over four months had slight to moderate effects on memory or global cognition in people with MCI (Whitty et al., 2020). In another study, a choreographic intervention yielded more significant cognitive gains than physical therapy, particularly in those cognitive functions more closely associated with the risk of developing ADRD (Bisbe et al., 2020). In another, a specially designed aerobic dance routine for people to memorize the complex movements improved cognitive function, especially episodic memory and processing speed in people with MCI (Zhu et al., 2018b).

In conclusion, this literature review chapter explores the landscape of Alzheimer's Disease and Related Dementias (ADRD) and Mild Cognitive Impairment (MCI), focusing on their prevalence, symptoms, and various pharmacological and non-pharmacological treatment approaches. A comprehensive examination of risk factors highlights modifiable and non-modifiable aspects that influence the progression of these conditions. Additionally, the review emphasizes the significant role of the arts, particularly dance, in public health interventions to improve the lives of individuals with MCI and ADRD.

Dance is explored as a multifaceted intervention, benefiting mental, physical, behavioral, and social health and overall quality of life. It also positively impacts cognitive functions, such as language skills. Improvisational and choreographic approaches, including creative dance and body percussion, emerge as particularly beneficial. They offer a creative and embodied way to engage individuals with MCI and ADRD, fostering both physical and mental improvements.

This body of literature supports the potential of dance and related artistic interventions as meaningful tools for enhancing health outcomes and well-being in those affected by MCI and ADRD. It also offers the evidence to support the feasibility of this study.

## Chapter 3 Theoretical Framework and Study Conceptual Diagram

In this study, the "Arts and Culture in Public Health: An Evidence-Based Framework (ACPH framework)" (Golden et al., 2024) gave me a pathway for developing research questions, planning qualitative data collection strategies, and developing my study conceptual diagram. The ACPH framework drew on research and thoughts from leaders in the fields of public health, arts and culture, and community development. Although this framework does not focus specifically on dance, dance intervention is a form of arts and cultural activity and fits into ACPH. The framework guides the design and implementation of dance interventions, informs the importance of health and social services with dance activities, and strengthens the collaboration and coordination between the dance instructor, health service, and researcher.

The framework provides evidence-based links between arts involvement, six broad areas of individual and population levels of health outcome, and seven mechanisms that can mediate or moderate these outcomes(Golden et al., 2024). Among them, five outcomes from the ACPH framework are not directly relevant to my study. These are increasing health service equity and access, creating safe, inclusive, and engaging environments, supporting social, cultural, and policy change, enriching research methods and practices, and strengthening health communication. One outcome that my study addresses is that arts and cultural activities provide direct health benefits (Golden et al., 2024, p.7). This outcome informed the development of my first research question: What are the different effects of creative dance (CD) and body percussion (BP) on attention, memory, creativity, and positive well-being for older adults living with MCI? I propose that CD and BP affect cognitive and psychological health benefits differently. In addition, the dance interventions can lead to these benefits via seven potential mechanisms according to the

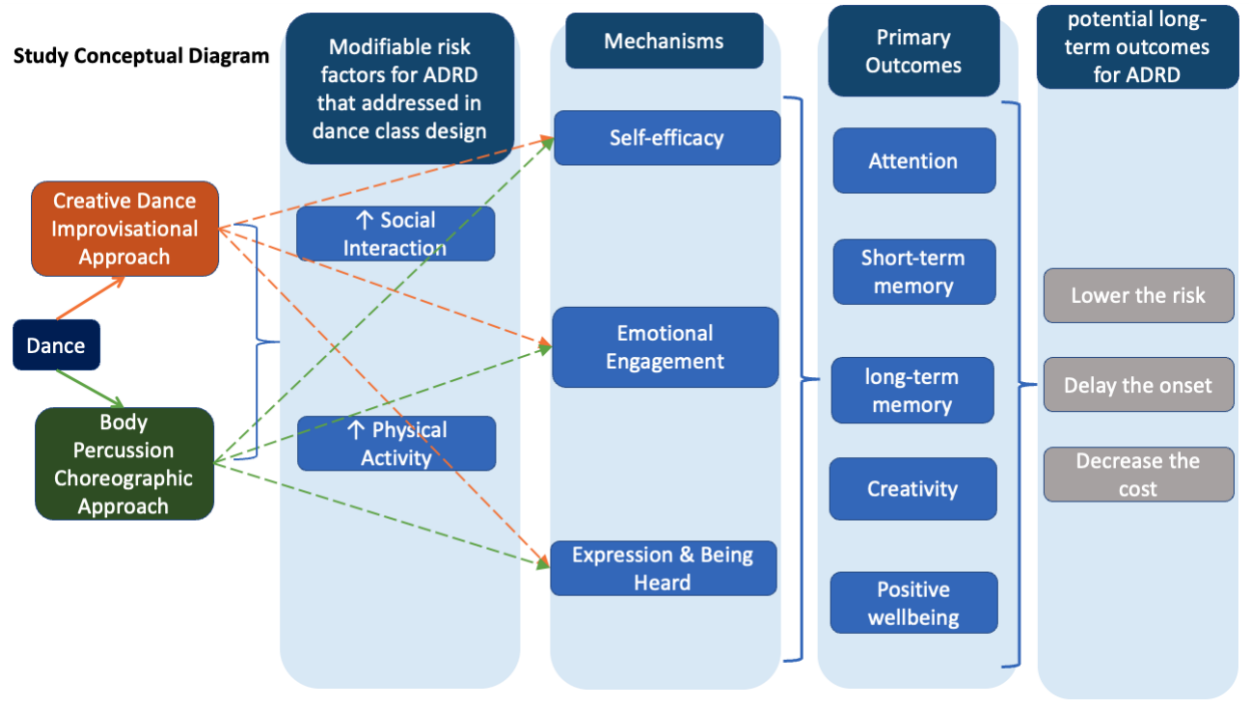
ACPH framework. This led me to develop the second research question: What are the potential mechanisms in the ACPH framework mediating or moderating the outcomes? Four of the seven mechanisms from the ACPH framework are not directly relevant to my study: personal and cultural resonance, aesthetic experience, meaning-making, and self-transcendence. Instead, I will focus on the three most relevant in this study's context: self-efficacy, emotional engagement, and expression. Furthermore, the ACPH framework helped me to design qualitative data collection strategies. The cognitive and psychological health outcomes and the three mechanisms offered me clues to design focus group interview questions and the observation tool (detailed further in Chapter 4 Methodology).

### 3.1. Study Conceptual Diagram

Based on the ACPH framework (Golden et al., 2024), together with the evidence-based modifiable risk factors (Livingston et al., 2020)and outcomes of dance for ADRD from the literature review, I developed a study design diagram as my study conceptual model (Figure 3-1). As mentioned earlier, dance has been shown to address modifiable risk factors for ADRD by reducing depression (Y. Wang et al., 2022; Wu et al., 2021), hypertension (Conceição et al., 2016; Mario, 2018; Peng et al., 2020; Sousa et al., 2016), obesity (Johar et al., 2017; Moreira-Reis et al., 2022; Murrock & Gary, 2008), and diabetes (Borges et al., 2019). Other risk factors affected are social interaction (Melhuish et al., 2017) and physical activities (Wu et al., 2021), both of which dance promotes. However, in this specific study, the design of dance classes mainly focuses on increasing social communication and physical activities. Both CD and BP include partner dance and group dance sessions to stimulate social interaction. In addition, both types of dance classes are intentionally designed to increase physical activity via movements engaged with

mobility, balance, and coordination. Controlling depression, hypertension, obesity, and diabetes are potential side benefits but are not the focus of this study.

*Figure 3-1 Study Conceptual Diagram*




The literature shows that both CD and BP lead to physical, psychological, cognitive, and social health benefits. This study tested the effects of CD and BP groups on attention, long-term and short-term memory, creativity, and positive well-being with quantitative and standardized assessments in this study.

In this study, I also explored how and why specific dance approaches may address targeted outcomes through qualitative methods based on the mechanisms in the framework. As mentioned, I focus on the three of the seven mechanisms most relevant to the study because they are the most plausible in both dance types. The three mechanisms are “self-efficacy,” “emotional engagement,” and “expression.” However, other potential mechanisms may be

embedded in these dances and connect to the outcomes. I added other possible mechanisms that emerge from the qualitative data analysis.

The three mechanisms in the ACPH framework may explain how CD and BP interventions work differently. Self-efficacy is "a person's belief in their ability to complete a task or achieve a goal(Cherry, 2022).” It is associated with a sense of confidence and competence and is closely connected with self-esteem. Many studies showed that self-efficacy is related to improvements in overall well-being (McRae et al., 2018). Nurlita et al., (2022) and Tokinan & BİLEN, (2011) presented that CD had a meaningful impact on self-efficacy, self-esteem, and self-transcendence when participants finished the movement prompts. BP also led to self-efficacy when participants gradually made more challenging and complicated movements. This information informed my development of the following questions: What are the practices via which the two dance classes lead to self-efficacy? What are the similarities and differences? Does self-efficacy connect to positive well-being, better attention, and short-term memory outcomes? These questions were addressed through observation and interviews.

Other mechanisms like emotional engagement and expression are also associated with positive well-being (Bailey et al., 2020; Coffey et al., 2022; Pietarinen et al., 2014). Emotional engagement and expression are highly related. Emotional engagement can be observed through facial and body expressions. At the same time, emotional engagement and expression are subjective feelings about which data can be collected through qualitative data.

CD involves emotional engagement in a partnership and group through specific themes. For example, participants express their feelings and are heard by others' responses, observe others' expressions, and respond to others via their body movements (Yoon Irons et al., 2020).

BP may also involve emotional engagement and make people feel included in a group when people make the same beats together. When participants show and perform the BP in groups and between groups, they express their feelings in the beats, and they echo to others in the group settings. However, would CD lead to more robust emotional engagement and expression than BP since it requires individual expressions and free movement? Are these two mechanisms potentially linked to long-term memory, creativity, and positive well-being? These questions were explored through class observation, verbal sharing at the end of the classes, participants' "thoughts and commons" survey, and focus group interviews.

This study investigates, compares, and contrasts CD and BP's cognitive and psychological health outcomes. The results will support the potential long-term consequences of dance interventions for ADRD, such as lowering the risk, delaying the onset, and decreasing the cost. In addition, each dance type's advantages and limitations will help inform future dance intervention designs intended to support people living with MCI and explore how specific dance approaches may be used to lower the risk and delay the onset of ADRD.

# Chapter 4 Methodology

This study evaluated and compared the impact of Creative Dance (improvisational approach) and Body Percussion (choreographic approach) on the cognition and well-being of older adults with MCI. A mixed-methods experimental design with a two-arm trail was used in this study. The two arms refer to two comparative groups: Creative Dance (CD) and Body Percussion (BP). Mixed methods provide more evidence and a more complete picture of the effects of dance and offer new insights beyond separate quantitative and qualitative results. Primary outcomes via quantitative and qualitative data were collected before, during, and after the intervention with all participants' cognition, attention, memory, creativity, and well-being. Secondary outcomes through qualitative data were collected throughout the study through focus group interviews, a survey of "comments and thoughts," and observations to understand how participants experienced the intervention and better understand why and how the primary outcomes may have occurred. The mixed methods may make up some disadvantages of the study's small sample size and increase the external validity.

The University of Arizona Institutional Review Board approved this study protocol (IRB ID: STUDY00001079).

## 4.1. Recruitment and Screening

20 Participants were recruited through flyers sent via email and social media, face-to-face interactions, and word-of-mouth in January and February 2023. After obtaining permission, the staff in charge of the recruitment sites helped forward the flyer that included essential study information to their members' email lists. The flyers were also shared on social media platforms, including Facebook and Instagram. We also encouraged participants to share the flyer or the

study information with others who might be interested in the study. The research team recruited participants face-to-face at a table in the Tucson Jewish Community Center twice weekly. For in-person recruitment, participants filled out the paper-based screening consent and surveys. Then, the research assistant inputted the handwritten data on paper to RedCap. Another research assistant checked the accuracy of the previous input. For online recruitment, participants could use their smartphones to scan the QR code on the flyer or click the link in email and social media to access the screening consent and survey on RedCap. The screening consent and survey included inclusion and exclusion criteria and demographic information to identify their qualifications.

The inclusion criteria were to:

(1) be age 55 years or older

(2) be able to read and speak English and sign the consent form

(3) be at risk of dementia, either:

   a. clinically diagnosed with Mild Cognitive Impairment

   b. or having a Clinical Dementia Rating (CDR-SOB) score of 0.5-4.0

(4) be receiving NO treatment nor taking medicine to treat cognitive impairment

(5) have enough visual and auditory acuity to properly be able to follow group physical sessions

(6) have no musculoskeletal disorders with imbalance and gait disturbances and be able to independently walk for at least 10 meters (33 feet)

(7) have no severe cardiovascular disease (e.g., heart or respiratory insufficiency)

The exclusion criteria were to:

(1) be age 54 years and younger

(2) be unable to read and speak English and sign a consent form

a. Diagnosed with any form of dementia

b. Or Clinical Dementia Rating (CDR-SOB) >4.0

(3) be receiving treatment or taking medicine to treat cognitive impairment

(4) not have enough visual and auditory acuity to properly be able to follow group physical sessions

(6) have musculoskeletal disorders with imbalance and gait disturbances or be unable to independently walk for at least 10 meters (33 feet)

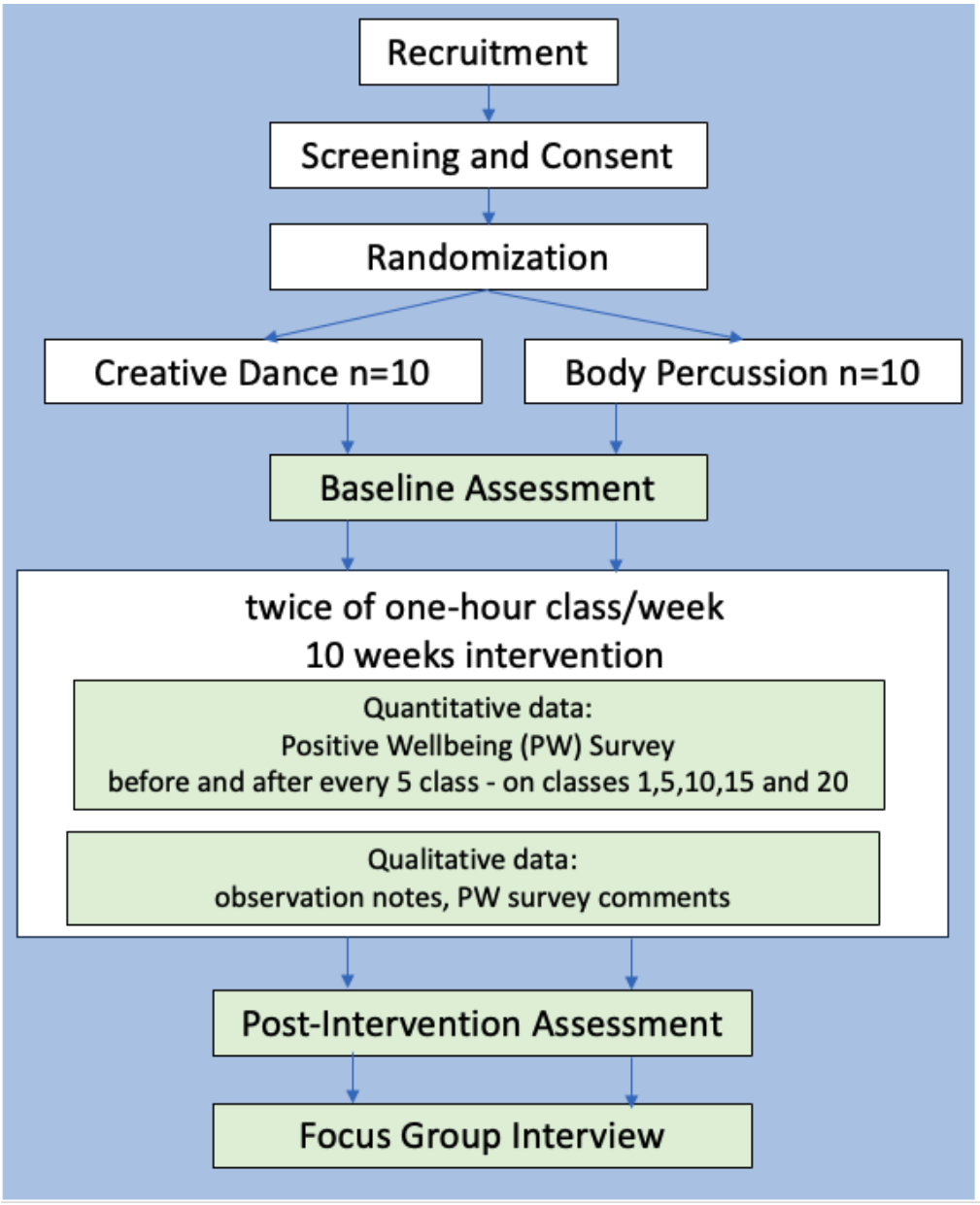
(7) have severe cardiovascular disease (e.g., heart or respiratory insufficiency)

The Clinical Dementia Rating (CDR-SOB) scale score of 0.5–4.0 was used to identify older adults with MCI. If a subject's CDR sum of boxes (SOB) score was over 4.0, indicating that they fell into the dementia category and were excluded from the study, we would inform the subject to discuss their rating with their primary healthcare provider. If the participants were eligible for the study, they were assigned to one of the two intervention groups according to the sequence in which they submitted the screening survey: participants with odd numbers in the sequence order were assigned to the CD group, while participants with even numbers in the sequence were assigned to the BP group. The participant then finished an intervention consent form at an appointment for an in-person assessment.

**4.2. Study Design and Data Collection**

This study used a mixed-methods experimental study design with a 2-arm trail. Figure 4-1 provides a flow chart of the study design.

*Figure 4-1 Study Design Flow Chart*




Participants were randomized into one of the two groups: CD and BP. The two dance interventions consisted of 10 weeks of two 60-minute in-person classes per week taught by me. Five research assistants were undergraduate and graduate students from the College of Public Health and the School of Dance who registered for research or practicum credits.

Quantitative data collection included the screening survey before randomization and an in-person cognitive health assessment for primary outcomes on attention/reaction time, short-term and long-term memory, creativity, and well-being from all participants before and after the ten-week intervention. The Attention/ reaction time (RT) and Word pair memory test (WPIR) are from the online Mindcrowd test (TGen, 2022). In-person tests included short-term memory Spatial Forward Memory Span (SFMS), long-term memory personhood-recall (PR), and creativity (ATTA) tests. A positive well-being (PW) survey was collected during the intervention before and after each class: 1,5,10,15, and 20 for the two intervention groups. Due to my multiple roles in this study, five research assistants collected quantitative data in person instead of myself to prevent potential bias in data collection.

For qualitative data collection, the "Comments and Thoughts" survey (Thomson & Chatterjee, 2013) was printed on the back of the PW survey and only sent out after every five classes. Besides the "comments and thoughts" survey, the research assistants and I collected qualitative data through observation during the intervention by observation notes, and two focus group interviews from the two intervention groups were conducted after the 10-week intervention. The dance classes were also video-recorded for later observation, coding, and analysis.

The participants from the CD and BP groups who completed all the pre- and post-assessments, surveys, interviews, and 75% or more of the classes received $25 Amazon gift cards as compensation. To encourage participants from intervention groups to complete all the classes, the participants who completed all 20 classes received additional compensation by evenly splitting the leftover money from those who didn't finish their basic assignments.

### *4.2.1. Quantitative Measurements*

#### 4.2.1.1. Clinical Dementia Rating- (CDR) Scale

The screening survey used self-reported CDR to identify eligibility. The CDR Scale is a commonly used measurement to help identify MCI and dementia and their severity (Huang et al., 2021). The five-point scale includes six cognitive and behavioral items (memory, orientation, judgment, problem-solving, community affairs, home and hobbies performance, and personal care), (Morris, 1993).

The CDR comprises two score methods: a global score (CDR-GS) and the sum of box scores (CDR-SOB), (Huang et al., 2021). Compared with the CDR global score, the CDR-SOB score is more useful for tracking changes within and between stages of dementia severity (O'Bryant, 2008). In addition, it shows good internal consistency and acceptable structural and convergent validity (Coley et al., 2011).

This study included people whose CDR-SOB scores were between 0.5 and 4.0, as people who score within that range are considered to have MCI (O'Bryant, 2008). If the subjects' CDR-SOB score was over 4.0, meaning they fell into the dementia category and were excluded from the study, we informed them to discuss their rating with their primary healthcare provider.

#### 4.2.1.2. Reaction Time (RT) and Word Pair Immediate Recall (WPIR)

The online MindCrowd® test includes a three-minute attention/reaction time test and a five-minute word pair test to assess short-term memory. MindCrowd® is a study data collection tool conducted by the Precision Aging Network (PAN) project, which aims to have at least one million people take the MindCrowd® test and find ways to optimize brain health across the lifespan (Huentelman et al., 2020; PAN, 2022). Because this study's participants took the MindCrowd® test, they also participated in PAN.

After the participants signed the study consent form and scheduled the in-person assessment, an email with the MindCrowd test link was sent to their email addresses. The participants clicked the MindCrowd test link to finish the attention and memory test online.

The first part of the MindCrowd® is a Reaction Time (RT) test used to test participants' attention: when a pink ball appears in the middle of the screen, the participant needs to press any letter (a-z) on the keyboard or tap on the touch screen as quickly as they can. The RT test takes around 2 minutes. The RT result is recorded as milliseconds of the participant's median RT. The second part of the MindCrowd® is a Word Pair Immediate Recall (WPIR) used to test short-term memory. The system shows the participant a list of word pairs. The participant's task is to remember the word pairs. Next, they see the first word in the pair, type the correct second word, and press ENTER. The WPIR result is recorded as the number of correct word pairs. After they finish the two MindCrowd tests, the participants can choose to see their results, with scores showing how they performed compared to those who have taken the MindCrowd memory and attention test so far (TGen, 2022).

#### 4.2.1.3. Spatial Forward Memory Span (SFMS)

One of the in-person assessments, the Spatial Forward Memory Span (SFMS), (Alves, 2013) tests a subject's short-term spatial memory. Four square pieces of 12 × 12 inches of foam panels in four colors (red, blue, green, and yellow) were used in this test (Figure 4-2). The research assistants followed two sequence patterns, A and B. Pattern A is shown in Table 4-1 as an example. The research assistants randomly picked a sequence pattern to test. The research staff presented the participants with a three-color sequence by pointing at the squares. Then, the participant was asked to repeat the sequence. After each correct response, an additional spatial location was

included in the sequence; the participant would repeat the sequence by starting from the first color each time, and the test would continue until they made a mistake. The number of spatial locations correctly remembered was recorded.

*Figure 4-2 Four-Colored Square Example*

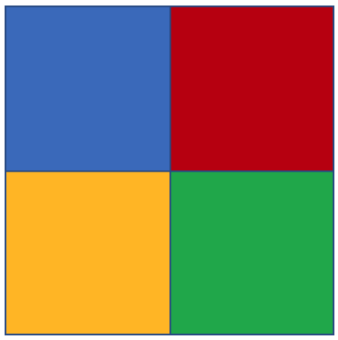


*Table 4-1 Spatial Forward Memory Span Sequence A*

| Sequence score | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | yellow | blue | green | | | | | | | |
| 4 | | | | red | | | | | | |
| 5 | | | | | yellow | | | | | |
| 6 | | | | | | blue | | | | |
| 7 | | | | | | | green | | | |
| 8 | | | | | | | | yellow | | |
| 9 | | | | | | | | | red | |
| 10 | | | | | | | | | | blue |
| 11 | red | | | | | | | | | |
| 12 | | yellow | | | | | | | | |
| 13 | | | blue | | | | | | | |
| 14 | | | | green | | | | | | |
| 15 | | | | | blue | | | | | |

The SFMS test relies on visuospatial working memory, which allows the brain to plan a route to a destination and recall an object's position or the scene of an event. The SFMS in this study is a simplified version of the Corsi block tapping task (Berch et al., 1998), a widely used tool in clinical neuropsychology to assess non-verbal memory deficits. The original task involves nine

pieces of irregularly arranged mounted wooden blocks, and the examiner taps out a sequence that the patient is required to repeat. I used the simplified version since it is easier to implement for older adults with MCI.

#### 4.2.1.4. Long-term Memory: Personhood Recall (PR)

Another in-person assessment, the personhood recall, tests long-term memory, a self-designed test. The data collector asked the participant the following questions: "I will ask you about one of your significant events or memories in your life. The more details you recall, the more credits you get. Can you please tell me one of your significant events (one the happiest, one the most challenging) when you were in your 40s? What was the event? Who was there? When was it? Where was it, and how was the setting?" The narrative scoring rubrics (Table 4-2) include four scales from 0 to 3 points. More points for each answer reflect more precise details. The sum of the points will be recorded.

*Table 4-2 Personhood Recall Rubrics*

| Narrative Quality Elements Scoring rubrics | 0 Point | 1 Point | 2 Points | 3 Points |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Who was there?<br><br>Character:<br>A character is any reference to the subject of a clause in a narrative | No identification (name or nickname) or only ambiguous | Includes at least one main character with no specific labels<br>(e.g., my daughter) | Includes one main character with specific identifications<br>(name or nickname)<br>(e.g., my daughter, her name is Amy) | Includes more than one main character with specific identification<br>(name or nickname)<br>(e.g., my daughter Amy, my son Bob…) |
| What's the event?<br><br>Event | No stated or understood event or problem likely to elicit the narrative. | Includes at least one stated event (e.g., birthday party) | Include one stated event that elicits a response from the character(s)<br>(e.g., my daughter's birthday party) | Include more details of the stated event that elicits a response from the character(s)<br>(e.g., my daughter's 18th birthday party) |
| When was it?<br><br>Time | No reference to a specific or general time | Includes reference to a general time.<br>(e.g., about 10 years ago) | Includes reference to specific date<br>(e.g., Jan1st, 1988) | Includes reference to specific time<br>(e.g., Jan1st, 1988, night) |
| Where was it and how was the setting?<br><br>Place and Setting | No reference to a specific or general place | Includes reference to a general place<br>(e.g., home, hospital, a park) | Includes reference to specific places<br>(e.g., in our dining room) | Includes reference to specific places With details<br>(e.g., we set around the table in our dining room) |

#### 4.2.1.5. Creativity

Creativity is a crucial psychological and cognitive process that engages with problem-solving and happens in daily life, and creative cognition is rooted in executive functions (Khalil et al., 2019). I hypothesize that CD and choreographic dance engage creativity differently, which has rarely been tested in previous studies. The Abbreviated Torrance Test for Adults (ATTA), (Goff & Torrance, 2002b) is a short version of the well-known creativity test - Torrance Tests of Creative Thinking (TTCT). The ATTA consists of one verbal response task and two figural response tasks. The experimenter reads aloud the instructions from the manual and gives exactly three minutes

to complete each activity. The first task asks the respondent to identify the troubles he or she might encounter in the image. The responses are scored for fluency (number of responses) and originality (number of uncommon responses, i.e., those not on the list of common responses for this task). The second task presents two incomplete figures and asks the respondent to draw pictures with these figures and attempt to make the pictures as unusual as possible. The third task presents a group of triangles and asks the respondent to see how many pictures or objects they can draw using them. The two drawings are graded on their fluency (the number of meaningful drawings), flexibility (the number of different categories of meaningful drawings), originality (the number of drawn objects not included on the list of common responses), and elaboration (the number of embellishments of the basic drawings, such as color, shading, and other added details), (Althuizen et al., 2010).

#### 4.2.1.5.1. ATTA creative ability score

The fluency, flexibility, originality, and elaboration ratings of the responses to each task are summed across tasks to obtain total scores for the four subskills. These raw total scores are then converted into four normalized standard scores and are rescaled so that 11 = low and 19 = high. The rescaled scores for fluency, flexibility, originality, and elaboration are then summed to form the ATTA Creative Ability score (ranging from 44 to 76).

#### 4.2.1.5.2. ATTA creativity level score

In addition to the subskills scores, there is a second set of creativity judgments of the answers to the three tasks, called the creativity indicators. There are 15 indicators (e.g., richness and colorfulness of imagery, combination or synthesis of two or more figures, and abstractness of titles for the drawings). The summed score for the absence (0), moderate presence (1), or

strong presence (2), of the 15 creativity indicators, with the sum ranging from zero to 30, is added to the creative ability score to form the Creativity Index (range: 44 to 106). The Creativity Index score is then rescaled (by contraction) and reported as the ATTA Creativity Level score (range and interpretation: 1 = minimal to 7 = substantial), (Althuizen et al., 2010; Goff & Torrance, 2002a).

The objective ATTA test has proven to be an adequate predictor of creative performance with good predictive and discriminant validity (Althuizen et al., 2010) and reliability (Goff & Torrance, 2002a).

#### 4.2.1.6. UCL Generic Positive Wellbeing (PW)

The PW is a measurement tool used to assess levels of well-being in the UCL Museum Wellbeing Measures Toolkit (Thomson & Chatterjee, 2013). PW consists of a hexagonal shape with six sections of different colors. Each section contains one of six words (‘enthusiastic,’ ‘excited,’ ‘happy,’ ‘inspired,’ ‘active,’ and ‘alert’) and numbers from one to five. Participants are required to rate the extent to which they feel each word of well-being at that moment by circling the appropriate number (Figure 4-3). The sum of the scores will be recorded. The PW umbrella is shown to be a valid and reliable test for adult and older adult participants (Thomson & Chatterjee, 2013).

*Figure 4-3 UCL Generic Positive Wellbeing Umbrella (PW)*

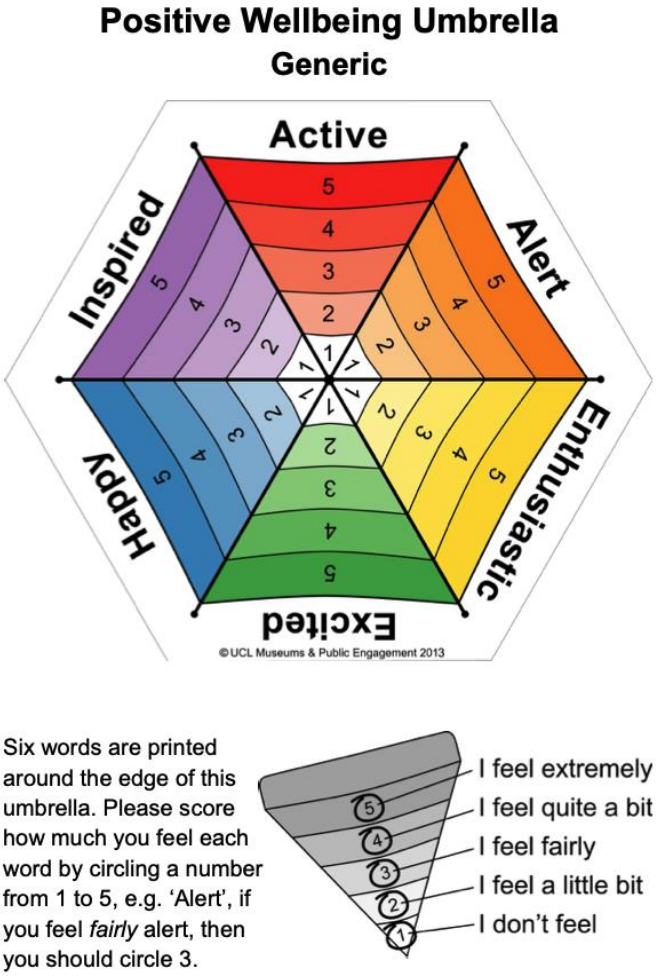



Table 4-3 summarizes all quantitative tests, providing information about the assessments and the well-being domain they address.

*Table 4-3 Quantitative Tests*

| **Wellbeing domain** | **Measurements** | **details** |
|---|---|---|
| 1. Cognition | CDR-SOB | RedCap online survey |
| 2. Attention & short-term memory | Online MindCrowd test:<br>(1) reaction time (RT)<br>(2) word pair immediate recall (WPIR) | Online test<br><br>Pre-and post- intervention test |
| 3. Short-term memory | Spatial Forward Memory Span (SFMS) | In-person assessment |

| | | |
|---|---|---|
| | | Pre-and post- intervention test |
| 4. Long-term memory | Personhood recall (PR) | |
| 5. Creativity | the Abbreviated Torrance Test for Adults (ATTA), (Goff & Torrance, 2002) | |
| 6. Overall wellbeing | UCL positive wellbeing umbrella (PW) | Participants self-reported survey pre- and post each of the 1,5,10,15, and 20 classes |

### *4.2.1. Qualitative Tools*

#### 4.2.1.1. Focus Group interviews

I conducted the two focus group interviews to understand participants' experiences after the ten-week intervention in each group separately. Everyone who finished the intervention was invited to the focus group interviews. Eventually, five participants in the CD group and six participants in the BP group joined the focus group interviews. Each focus group lasted for 1.5 hours. Table 4-4 shows the focus group interview questions.

*Table 4-4 Focus Group Interview Questions*

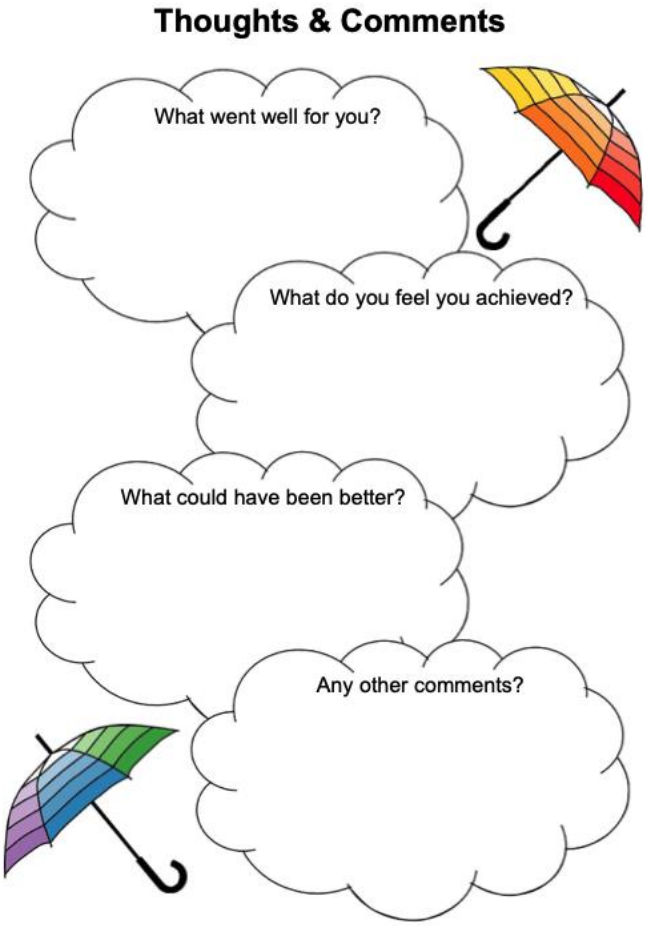
| |
|---|
| 1. Can you please tell me how you have felt since participating in our dance sessions? (Positive wellbeing)<br>• What's your emotional state during the dance class? (Emotional engagement); (Prompts: happy/ excited/ stressful/ empathetic) How do you generally feel since participating in this dance class over time?<br>• Can you express yourself through this type of dance? If yes, how? (expression)<br>• How do you feel when you move individually and interact with others in partner and group dance? Have you noticed any changes in relationships in general since participating in this dance class? (Social interaction)<br>• Have you noticed any changes in your perception of your dance ability? Do you progress in accomplishing something that makes you feel confident in general/out of the dance classes? (self-efficacy)<br>• What practices in the class may bring these outcomes? |
| 2. What kind of practice in the class helps with practicing your brain? |

| |
|---|
| • Have you noticed changes in attention, reaction time, alertness, focusing, and remembering in our dance sessions?<br>•Have you noticed changes in attention, reaction time, alertness, focusing, and remembering in general/out of the dance classes?<br>• What practices in the class may bring these outcomes? |
| 3. Have you noticed any changes in your sense of humor, doing things in funny ways, and solving problems creatively in class? (Creativity)<br>• Have you noticed any changes in your sense of humor, doing things in funny ways, solving problems creatively in general/out of the dance classes?<br>• What practices in the class may bring these outcomes? |
| 4. What is your favorite part of the dance classes? |
| 5. Do you have any activities or experiences in the dance class that you did not care for? |
| 6. What could have been better in the dance sessions? How can we improve the dance program experience for future participants? |

#### 4.2.1.2. Thoughts and Comments

Another instrument from the UCL Wellbeing Measures Toolkit(Thomson & Chatterjee, 2013), the four optional open-ended questions about Thoughts and Comments, was used to assess the participants' experience in the class The questions were printed on the back of the positive well-being umbrella. The questions were (1) what went well for you? (2) What do you feel you achieved? (3) what could have been better? (4) Any other comments? The questions were shown in thought bubbles rather than rectangular boxes as it was felt these were visually more attractive (Figure 4-4).

*Figure 4-4 UCL Thoughts and Comments Survey*




All intervention group participants filled out the UCL generic positive well-being umbrella before and after classes 1, 5, 10, 15, and 20 to test changes in short-term well-being changes. Thoughts and comments were printed on the back of the after-class PW umbrella for participants to fill out only after those five classes.

#### 4.2.1.3. Observation

The observational data came from two sources: the research assistants' observations in dance classes and my observations from viewing video recordings after the classes. The research assistants and I used the observational form below (Table 4-5) to record the natural occurrence

of expressions, movements, behaviors, and attitudes from observations in every class. We wrote observation notes when something related to the items in the form caught our attention. The items in the form are organized into a table and defined below for the observation purpose in this study, and they were defined beforehand as a way to work toward reliability. Column headings include "movement practice," "observed/assumed trigger," "individual reaction," and "reaction in general." "Movement practice" refers to the practice or dance combination that is happening (e.g., opening and closing movements in partner dance). Researchers also need to mention if any mobility, coordination, and balance are required in the activity. The heading "observed/assumed trigger" refers to a trigger observed or assumed to lead to people's reactions. For example, it can be prompted by the instructor, a peer member, music, or self-discovery through movement. "Individual reaction" refers to someone's reaction being unique or outstanding. "Reaction in general" refers to the common response in the group during that practice.

Row headings in the form include "attention/ alertness/ reaction time," "memory," "creativity/imagination," "dance ability," "emotional engagement," "expression," and "social interaction." "attention/ alertness/ reaction time" refers to the degree of focus in the class and the degree of speed with which people respond to the prompts or the movement. "Memory" has two categories: short-term and long-term. "Short-term memory" refers to people needing to use short-term memory to finish the dance task. "Long-term memory" refers to people engaging in their long-term memory, story, or experience while dancing. The category "creativity/ imagination" refers to people engaging creativity and imagination to dance. "Dance ability" refers to the participant's confidence to finish the dance task. "Emotional engagement" refers to

whether people have emotional reactions, such as happiness, sadness, excitement, nervousness, or frustration. "Expression" includes an individual's facial, body, and verbal expression during the class. "Social interaction" is the reaction when people interact with others.

*Table 4-5 Observational Notes*

| ☐ Creative dance<br>☐ Body percussion | | Date: | Class #: | | Note taker: |
|---|---|---|---|---|---|
| | | Movement Practice | observed/ assumed trigger | Individual reaction | Reaction in general |
| Attention/ alertness/ reaction time | | | | | |
| Memory | Short-term | | | | |
| | Long-term | | | | |
| Creativity/imagination | | | | | |
| Dance ability (self-efficacy) | | | | | |
| Emotional engagement | | | | | |
| Expression | Facial | | | | |
| | Body | | | | |
| | Verbal | | | | |
| Social interaction | | | | | |
| Other observation or reflection: | | | | | |

**4.3. Dance Interventions**

In this study, I implemented two interventions for people at risk for ADRD: Creative Dance (CD) uses an improvisational approach, and Body Percussion (BP) uses a choreographic approach.

The materials in both classes were presented in a bottom-up strategy (Kassing & Jay, 2003, p.187) in every session and over the 10 weeks. The content is progressively built from simple to complex exercises, steps, elements, and activities, which employed the part-whole or the add-on method, in which after the students have learned the first part, the dance teacher adds another

part, and so on to create either an extended combination or an entire dance (Kassing & Jay, 2003, p.58) Both CD and BP classes had the same structure: warm-up (5-10mins), main body (40-45mins), cooling down (5mins), and sharing (5mins). Table 4-6 presents the class structure of the two dance classes.

*Table 4-6 Class Structure*

| | **Creative Dance** | **Body Percussion** |
|---|---|---|
| 2 classes per week *10weeks=20 classes | | |
| Warm-up: (5-10mins) | ● improvisation movements (e.g., bending, stretching, twisting, shaking)<br>● And some movement that could prepare for the session's theme | ● choreographic warm-up |
| Main body (40-45 mins) | ● 10 themes with Individual dance, Partner dance, and Group dance | ● 10 short combinations with Individual dance, Partner dance, and Group dance<br>● The participants will learn something new and review previous lessons in each class |
| Cool-down: (5 mins) | ● Slow, relaxing movements with breath | ● Slow Stretching and self-massage with breath |
| Sharing (5mins) | ● verbal and movements sharing<br>● express their feelings | |

### *4.3.1. Creative Dance*

Creative Dance (CD), also called Creative Movement, is an improvisational approach to dance. It refers to a dance practice in which the students are responsible for creating movement in response to prompts. Exploration and improvisation are essential components of CD while

simultaneously playing around with and refining the thoughts with feedback from peers and the instructor (Pierce-Master, 2022). Typically, CD focuses on “the development of motor skills and emotional expression as opposed to the more aesthetics-based focus of dance in a more traditional arts-structured setting” (Dow, 2010). CD’s effects share many of the same results as improvisational approaches to dance, as mentioned in the 2.6. Improvisational and Choreographic Approaches to Dance, since most of the improvisational dance studies use CD as their intervention.

The creative dance (CD) class used Mettler-based dance as its foundation. Mettler-based dance, developed by Barbara Mettler in the 1960s, is a popular improvisational dance method that offers equal access opportunities for all ages. The creative intervention materials in the study were selected from Mettler's two books, *Materials of Dance as a Creative Art Activity* (Mettler, 2006) and *Group Dance Improvisations* (Mettler, 1975), which cover time, space, force, and Shape Elements and use visual design and sounds to explore movement expression. I selected these materials for the following reasons. First, Barbara Mettler identified a democratic philosophy of dance techniques based on equal opportunity for participation. She created the techniques to assist people of various ages and capacities in finding ways to move alone and with others(Goehring, 2015). Mettler-based dance offers a friendly, non-judgmental, and supportive environment for all kinds of people in various situations. They are easy to follow and are great for beginners and older adults with MCI or other dementia risk factors. Second, I had had Mettler-based dance teacher training over the past two years and thus was very familiar with this CD material.

The original Mettler-based dance materials do not use music as the accompaniment. However, I used compatible music to warm up and cool down, as well as some of the main body parts in this CD intervention. I chose music that matched the dance themes and the elements. For example, for up-and-down movements, I chose music with high-pitch and low-pitch contrast and fast and slow contrast music for fast and slow movements. I used music in the CD intervention because (1) music can strengthen and activate the themes and the feelings we want to explore, (2) music can help participants to draw attention in the class, (3) it can be more fun to have music in the dance class.

The improvisational movements went through every part of the structure in the class, from the warm-up, main body, and cooling down to sharing. For the warm-up, I invited participants to explore different movement qualities, such as stretching, bending, twisting, dropping, flopping, shaking, rising, sinking, bouncing, swinging, and moving through space (walking, jogging). Some movements could be emphasized to prepare for the session's theme.

Each class had a focused theme for the main body part of the CD class. There were ten themes, each repeated twice in the 20 classes: forms and shapes, forcefulness and forcelessness, fast and slow, directions, moving social and clap dance, circle dance, line dance, visual designs with movements, props with movement, and sounds with movement. The main body session had individual dance, partner dance, and group dance. The individual movement aimed to stimulate participants' kinesthetic senses, enlarge their movement range, and promote creativity. Partner dance and group dance helped members shift their attention from awareness of their individual movements to the partner and the group body's movements and promoted group coordination and social interaction. Every class applied two to three themes and started with individual

practice. The later classes reviewed previous themes and added partner and/or group dance based on previous themes. As the class progressed, more themes were added. In the cool-down part, the participants did some slow, relaxing movements with breath, using the session's theme and improvising with soft music.

### *4.3.2. Body Percussion*

The other intervention, body percussion, is a type of choreographic repetitive movement. Body Percussion (BP) produces sound through the human body. Traditionally, the four main BP sounds are patting, clapping hands, snapping fingers, and stomping. BP is a more accessible repetitive dance format for older adults to remember the beats and movements than other, more complicated choreographed dance formats. It is very straightforward for older adults to locate and move their hands and feet in BP choreography routines. A.A. Romero-Naranjo and F.J. Romero-Naranjo are the most influential figures who conducted many BP intervention studies that showed physical, mental, and social health benefits, as well as improvements in quality of life, self-esteem, identity, and various personal aspects (A. A. Romero-Naranjo et al., 2014; F. J. Romero-Naranjo et al., 2014).

The BP class is based on the book Body Beats: An Easy and Fun Guide to the Art of Body Percussion (Tunmer, 2020). I chose this teaching material because it is easy to follow and accessible, and previous research has shown that BP has physical, mental, and social benefits for older adults (Romero-Naranjo, 2013, 2014).

The participants followed the choreographic movement throughout every part of the class, from warm-up and main body to cool-down. In the warm-up, I led participants in activating their joints and muscles all over the body with a choreographic routine. There were ten short

combinations in total for the BP class's main body part. The short combinations stimulated attention, reaction time, and coordination. Besides individual BP, there was also partner and group BP to promote social interactions. The participants started to learn three simple versions of the combinations. Besides reviewing the old combinations, every class added something new based on the previous one. It could be a harder version of the old combination or a simple version of a new combination. After participants had learned all the combinations, we reviewed them and made the movements a little bit more complex according to the participants' reactions. Slow stretching and self-massage with breath were incorporated into cooling down at the end of each class.

I used compatible music throughout both dance interventions, even though the original teaching materials of Mettler-based dance and Tunmer's book don't use accompaniment music. I used music as the accompaniment because (1) music can offer a steady beat and help participants to draw attention in the class, (2) using music matches with CD class, which is ideal since this is a comparative study, and (3) it was more fun to have music in the dance class. I used old songs with steady beats that older adults may like and some percussive music without lyrics to support the BP beats.

Finally, in the last three to five minutes of both CD and BP classes, we used verbal sharing as a group discussion. All participants were invited to discuss what they liked and disliked about the dance session. Additionally, they were encouraged to express their feelings about the dance session through words or movement or to say something supportive or caring to each other. This encouraged participants' articulation and mutual support.

## 4.4. Data Analysis

Quantitative data analysis includes (a) preliminary data analysis of sample demographics and primary outcomes at baseline and (b) primary outcome analysis of within-group and between-group effects on attention, creativity, memory, and well-being. Qualitative data was gathered in focus group interviews, the "Comments and Thoughts" survey, and observation notes. Results reported from the qualitative data include the thematic analysis of (a) primary outcomes on attention, creativity, memory, and well-being from both quantitative and qualitative results; (b) secondary outcomes, which are physical activity and social interaction; and (c) mechanisms of how the intervention impacted the outcomes according to the Arts and Culture in Public Health Framework (Golden et al., 2024).

### *4.4.1. Quantitative Analysis*

#### 4.4.1.1. Preliminary Data Analysis

The preliminary data analysis involved examining demographic information from the screening survey and primary outcome variables at baseline to describe the characteristics of the two study groups. The screening survey collected data on age, gender, race, years of education, dementia risk factors, physical activity levels, cognition-related medications, and a self-reported Clinical Dementia Rating (CDR) scale. Descriptive statistics were used to present the primary outcome variables at baseline, with continuous variables reported as mean ± standard deviation (SD), and categorical variables as numbers and percentages. Independent t-tests were conducted for continuous variables and Chi-square tests for categorical variables to assess comparability between the two groups (Rosner, 2016).

#### 4.4.1.2. Primary Outcomes Data Analysis

Student t-tests for paired samples were used to evaluate the changes within each group (before and after interventions) and examine the intervention effects inside each group. An analysis of variance (ANOVA) was used to compare the between-group effects (Rosner, 2016).

In most health and social science fields, a p-value of less than or equal to .05 is considered statistically significant. The lower the p-value, the more likely an effect occurred in a study (Rosner, 2016). I used Stata 14.1 (Stata, 2015) software to analyze quantitative results.

### *4.4.2. Qualitative Analysis*

I used thematic analysis for the qualitative data (Azungah, 2018). The nature and occurrence of verbalization, facial expressions, movements, behaviors, and attitudes from observation were recorded in observation notes during the 10-week intervention. The research assistants typed the handwritten answers from the "Comments and Thoughts" survey into a Word document. All the observation notes were merged into a Word document. Focus group interviews were audio recorded and auto-transcribed using Otter.ai (Otter.ai, 2024).

I used Atlas.ti software (Atlas.ti, 2023) to conduct qualitative data management and thematic analysis. Deductive analysis was my primary qualitative analysis approach, applying the keywords of primary outcomes (attention/reaction time, memory, creativity, and well-being) from research questions to be able to compare the quantitative results. It was a "top-down" approach. The qualitative thematic analysis procedure involved the following steps:

(1) I read through all the documents, cleaned the data, and sorted it into CD and BP categories.

(2) I applied my predetermined codes to the data. The predetermined codes were consistent with the primary outcomes of my research questions (attention/reaction time, short-term memory, long-term memory, creativity, and well-being). I organized the data into categories to maintain alignment with the research questions. I adjusted the sub-themes and created third-layer themes after reading through the documents.

(3) After the deductive coding cycle, in which I sorted the data into different health themes, I performed inductive analysis as my secondary approach to prevent filtering out important information in the first coding cycle. Inductive analysis is an emergent strategy where I read through the data and allow codes to emerge as concepts. The purpose of the inductive analysis was to dig into what was happening in the data without forcing it into what I expected to see, to understand the themes present in the data, and to produce findings that answered my research questions. I created and applied codes and identified emerging topics or concepts as I read to develop third-level themes. Inductive analysis is a complement to deductive analysis.

(4) I identified participants' own words ("quotes") that were representative of the findings.

(5) I compared the findings between CD and BP to identify common themes and different themes to answer my research questions.

(6) I applied hypothesis theory to explain the findings.

### *4.4.3. Integration of Quantitative and Qualitative Results*

After analyzing quantitative and qualitative data, I compared and integrated them by looking for areas of convergence (common results) and comparing divergence (different results), (Creswell & Clark, 2017, p.227) in a side-by-side table. I presented the quantitative results about

a health domain followed by qualitative results about the same topic. After merging the results in a side-by-side comparison narrative in a table, I interpreted how the findings answered the research questions by representing the merged integration results in a narrative discussion.

# Chapter 5 Results

This chapter presents the study's quantitative, qualitative, and integrative results. Quantitative data includes (a) preliminary data of sample demographics and baseline values of primary outcomes variables and (b) primary outcomes data of within-group and between-group effects on attention, creativity, memory, and well-being. Qualitative data was gathered in focus group interviews, thoughts and comments surveys, and observation notes. Results reported from that data include the thematic analysis of (a) primary outcomes on attention, creativity, memory, and well-being; (b) secondary outcomes, which are physical activity and social interaction; and (c) mechanisms of how the intervention worked on the outcomes according to the Arts and Culture in Public Health Framework (Golden et al., 2024), which are self-efficacy, emotional engagement, and expression, and other emerging themes.

## 5.1. Preliminary Data Analysis

There were 20 participants recruited in this study, 10 for each intervention group. Considering the various participation rates and the reliability of the data, the participants who finished 75% (15 classes) or more of the intervention classes were included in the data analysis. The participant rates of the participants who finished at least 15 classes are 89% in the Creative Dance (CD) group and 90% in the Body Percussion (BP) group. After 10 weeks (20 classes) of intervention, 13 participants met the study requirements (finishing 75% or more classes) and completed the post-assessments. In the CD group, five participants dropped out or attended less than 75% of classes. In the BP group, two individuals dropped out or took less than 75% of classes. Eventually, five participants in the CD group (attrition rate 50%) and 8 participants in the BP group (attrition rate 30%) finished at least 75% of classes and completed the post-assessments. The

main reasons for dropping out and not finishing enough classes were health issues, family affairs, travel, time conflicts, and forgetting classes. The independent t-test was used for continuous variables, and the Chi-square test was used for categorical variables for the demographic characteristics and primary outcome variables at the baseline pre-intervention of the participants who finished the study, which revealed no statistically significant differences ($p > .05$).

Table 5-1 presents demographic characteristics from initial screening and baseline assessment values for all participants who met all the study requirements and completed the post-assessments. The average age of the participants was 69.2 years ($SD$ =4.9), ranging from 60 to 77, with the majority being White (86.6%) and female (76.9%). There were no significant differences between the CD and BP groups in age ($t(10) = 1.16$, $p = .271$), gender ($\chi^2(1) = 0.04$, $p = .835$), race ($\chi^2(1) = 1.48$, $p = .224$), or ethnicity ($\chi^2(1) = 1.73$, $p = .188$). In terms of modifiable risk factors for dementia, there were no significant ($p > .05$) differences between the two groups in hypertension, obesity, depression, diabetes, or physical inactivity; neither group had anyone with low social contact. 69.2% of them had very mild cognitive impairment with Clinical Dementia Rating (CDR) of 0.5, and the remaining (30.8%) having a mean CDR of 2.4. There were no significant differences ($p > .05$) between the two groups in health measurements: Clinical Dementia Rating - Sum of Boxes (CDR-SOB), reaction time (RT), Word Pair Immediate Recall (WPIR), Spatial Forward Memory Span (SFMS), Personal Recall (PR), Creativity, or Positive Well-being.

*Table 5-1 Demographic Characteristics and Baseline Values of Analyzed Participants*

| | | All Participants N=13 | CD group n = 5 | BP group n = 8 | Test | *p*-value |
|---|---|---|---|---|---|---|
| Age: mean (SD) | | 69.2 (± 4.9) | 71.2 (± 3.9) | 68 (± 5.1) | $t$ = 1.16 | .271 |
| Gender(F): n (%) | | 10 (76.9%) | 4 (80%) | 6 (75%) | $X^2$ = 0.04 | .835 |
| Race | White: n (%) | 11 (84.6%) | 4 (80%) | 6 (75%) | $X^2$ = 1.48 | .224 |
| | Asian: n (%) | 2 (15.4%) | 0 (0%) | 2 (25%) | | |
| Ethnicity- Hispanic: n (%) | | 1 (7.7%) | 1 (10%) | 0 (0%) | $X^2$ = 1.73 | .188 |
| Modifiable Risk Factors for Dementia: n (%) | Hypertension | 4 (30.1%) | 3 (60%) | 1 (13%) | $X^2$ = 3.26 | .071 |
| | Obesity | 3 (23.1%) | 1 (20%) | 2 (25%) | $X^2$ = 0.04 | .835 |
| | Depression | 3 (23.1%) | 1 (20%) | 2 (25%) | $X^2$ = 0.04 | .835 |
| | Diabetes | 2 (15.4%) | 2 (40%) | 0 (0%) | $X^2$ = 3.78 | .052 |
| | Physical inactivity < 90 mins per week | 3 (23.1%) | 0 (0%) | 3 (38%) | $X^2$ = 2.44 | .118 |
| | Low social contact | 0 (0%) | 0 (0 %) | 0 (0 %) | $X^2$ = 0 | 1 |
| CDR-SOB: mean (SD) | | 1.07 (± 1.25) | 0.7 (± 0.25) | 1.3 (± 1.5) | $t$ = -1.03 | .335 |
| RT: mean (SD) | | 587.7 (± 284.1) | 566.7 (± 156.9) | 607.1 (± 338.8) | $t$ = -0.34 | .744 |
| WPIR: mean (SD) | | 18.8 (± 9.1) | 18 (± 10.14) | 19.4 (± 8.3) | $t$ = -0.23 | .824 |
| SFMS: mean (SD) | | 7.4 (± 2.4) | 7.6 (± 1.9) | 7.3 (± 2.6) | $t$ = 0.26 | .802 |
| PR: mean (SD) | | 7.6 (± 2.0) | 7 (± 2.4) | 8 (± 1.6) | $t$ = -0.73 | .491 |
| Creativity: mean, (SD) | | 76.3 (± 11.9) | 69.8 (± 13.1) | 80.4 (± 8.9) | $t$ = -1.44 | .200 |
| Wellbeing: mean, (SD) | | 22.6 (± 7.8) | 22 (± 5.9) | 23 (± 3.9) | $t$ = -0.13 | .902 |

*Note.*
CDR-SOB: Clinical Dementia Rating – Sum of Boxes
RT: Reaction Time
WPIR: Word Pair Immediate Recall (short-term memory)
SFMS: Spatial Forward Memory Span (short-term memory)
PR: Personal Recall (long-term memory)
*ATTA: The Abbreviated Torrance Test for Adults*
*ULC-PW: UCL Generic Positive well-being*

The modifiable risk factors of Dementia (i.e., hypertension, obesity, depression, diabetes, physical inactivity, and social contact) may affect the primary outcomes. Table 5-2 shows the Pearson correlation coefficient between the modifiable risk factors and the changes in the primary outcomes before and after the ten-week intervention. In the CD group, no one had physical inactivity; in the BP group, no one had diabetes; and no one in either group claimed to have low social contact. The data shows none of the correlations were statistically significant. Therefore, these modifiable dementia risk factors were not controlled in the quantitative data analysis.

*Table 5-2 Correlations between the Modifiable Risk Factors for Dementia and the Primary Outcomes Changes in Ten Weeks Intervention*

| Primary Outcomes Changes in 10 Weeks / Modifiable Risk Factors for Dementia | Δ RT | | Δ WPIR | | Δ SFMS | | Δ PR | | Δ Creativity | | Δ Well-being | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | r | p | r | p | r | p | r | p | r | p | r | p |
| Hypertension | -0.50 | .082 | 0.34 | .254 | -0.30 | .318 | 0.22 | .464 | 0.33 | .269 | 0.46 | .114 |
| Obesity | 0.03 | .927 | -0.31 | .297 | -0.38 | .197 | 0.20 | .519 | 0.50 | .079 | -0.08 | .805 |
| Depression | 0.31 | .309 | 0.23 | .446 | -0.09 | .777 | -0.08 | .791 | 0.06 | .834 | 0.00 | .991 |
| Diabetes | 0.45 | .121 | 0.00 | .991 | -0.11 | .730 | 0.11 | .720 | -0.08 | .798 | 0.45 | .125 |
| Physical Inactivity | 0.09 | .761 | -0.04 | .894 | 0.01 | .971 | 0.48 | .100 | -0.27 | .377 | -0.24 | .439 |
| Low Social Contact | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |

*Note.*

Δ: Changes before and after the ten weeks
r: Correlation
p: p-value
RT: Reaction Time
WPIR: Word Pair Immediate Recall
SFMS: Spatial Forward Memory Span
PR: Personal Recall

## 5.2. Primary Outcomes from Quantitative Data

### *5.2.1. Within-Group and Between-Group Effects*

Student t-tests for paired samples were conducted to evaluate the within-group changes (before and after interventions in each group), and an analysis of variance (ANOVA) was conducted to evaluate the between-group effects. Table 5-3 demonstrates the pre-post intervention differences within and between the two groups. Figure 5-1 presents changes in reaction time, word pair memory, spatial memory, and personal recall before and after interventions for the two groups.

#### 5.2.1.1. Significant Within-Group Intervention Effects

In the creativity test (ATTA), the CD group's growth was statistically significant $t(4) = -2.77$, $p = .05$, demonstrating a 28% average improvement from ATTA pre-intervention 69.8 ($SD = 14.7$) to ATTA post-intervention 89.4 ($SD = 4.9$). In short-term (before and after 1-hour class) positive well-being scores, the t-test for paired samples showed statistically significant improvements in both groups. The CD group improved significantly from pre-class 23.14 ($SD = 5.75$) to post-class 26.86 ($SD = 3.33$), $t(21) = -5.4$, $p = <.001$. The BP improved significantly from pre-class 22 ($SD = 3.27$) to post- class 26.17 ($SD = 2.65$), $t(35) = -7.4$, $p = <.001$. The BP group also showed long-term (10 weeks) statistically significant improvement in positive well-being from pre-intervention 22.4 ($SD = 3.8$) to post-intervention 27.1 ($SD = 2.0$), $t(7) = -3.21$, $p = .015$.

#### 5.2.1.2. Significant Between-Group Difference

A two-way analysis of variance showed the Creativity score improved statistically significantly higher in the CD group than in the BP group, $F(1, 11) = 0.13$, $p = .021$.

#### 5.2.1.3. Other Observed Changes

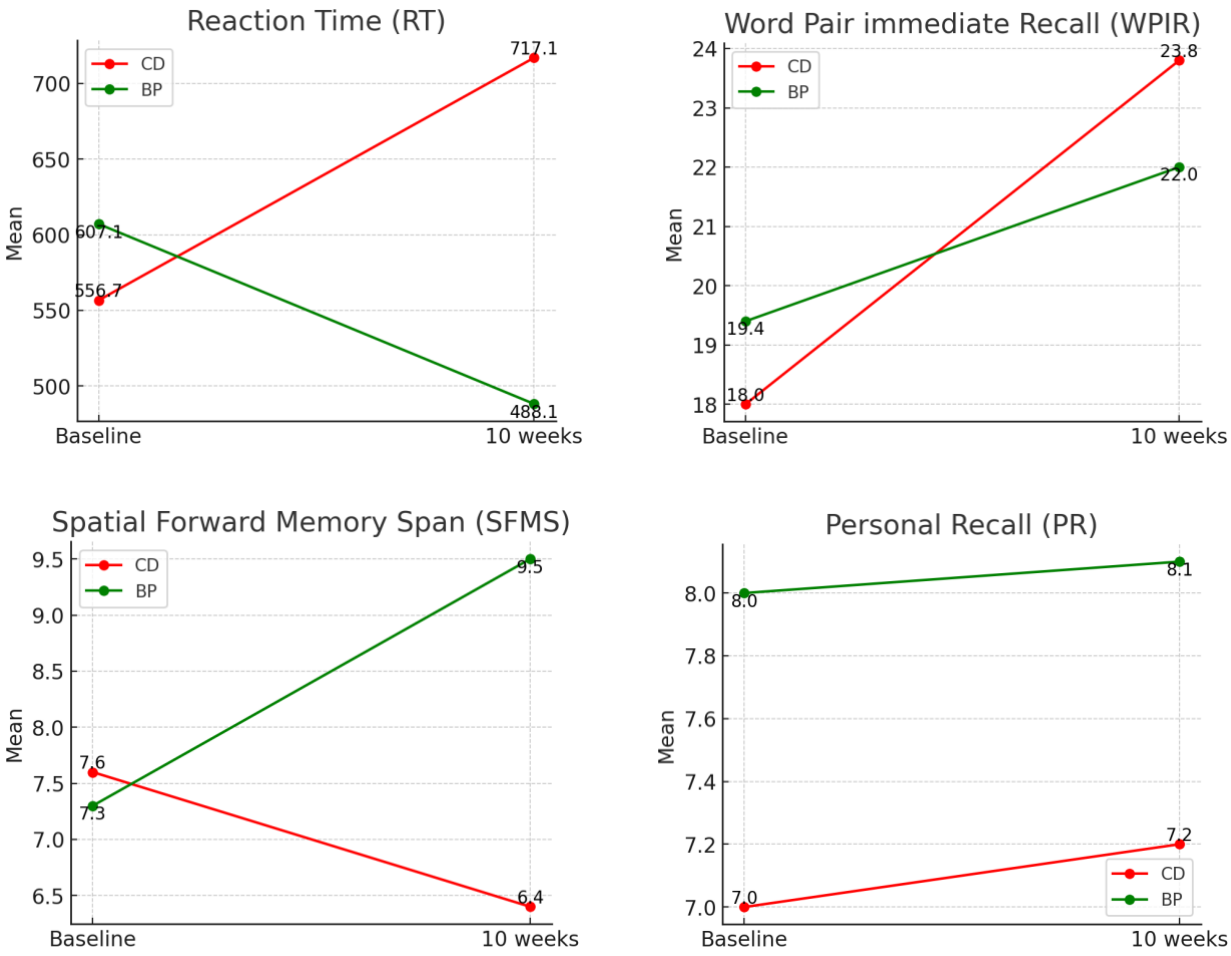
Although no statistically significant differences were detected within each group or between groups on RT, WPIR, SFMS, and PR *(p> .05),* the results show interesting between-group and within-group differences. The RT results are recorded as milliseconds of the participant's median RT. The data showed that the mean RT improved by 19.2% in the BP group from 607.1 (*SD* = 362.2) to 488.1 (*SD* = 45.6) and declined by 28.8% in the CD group from 556.7 (*SD* = 175.5) to 717.1 (*SD* = 267.1). The WPIR results were recorded as the number of the word pairs were remembered. The average WPIR improved by 32.2% in the CD group from 18 (*SD* = 11.3) to 23.8 (*SD* = 7.9) and improved from 13.4% in the BP group from 19.4 (*SD* = 8.9) to 22 (*SD* = 9.4). The SFMS results were recorded as the number of the correct spatial squares was remembered. The average SFMS score increased 30% in the BP group from 7.3 (*SD* = 2.8) to 9.5 (*SD* = 2.3). However, it declined by 15.8% in the CD group from 7.6 (SD = 2.1) to 6.4 (SD = 0.9). In the PR, both groups slightly improved. The CD group increased by 2.8% from 7 (*SD* = 2.7) to 7.2 (*SD* = 2.6), and the BP group increased by 1.3% from = 8 (*SD* = 1.7) to 8.1 (*SD* = 2.0). Nonetheless, In the creativity test (ATTA), the BP group improved 3.2% from 80.4 (*SD* = 9.5) to 83 (*SD* = 13.9), without significant changes *(p> .05)*.

*Table 5-3 Pre-Post Intervention Differences*

| Category | tests | Creative Dance (CD) *n*=5 | | | | Body Percussion (BP) *n*=8 | | | | CD vs BP | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Baseline (mean, SD) | 10 weeks (mean, SD) | *t* | *p* | Baseline (mean, SD) | 10 weeks (mean, SD) | *t* | *p* | *F* | p |
| Attention | RT | 556.7, ±175.5 | 717.1, ±267.1 | -1.6 | .184 | 607.1, ±362.2 | 488.1, ±45.6 | 1.03 | .337 | 0.62 | .123 |
| Short-term memory | WPIR | 18.0, ±11.3 | 23.8, ±7.9 | -2.58 | .061 | 19.4, ±8.9 | 22.0, ±9.4 | -0.92 | .389 | 0.00 | .457 |
| | SFMS | 7.6, ±2.1 | 6.4, ±0.9 | 1.04 | .358 | 7.3, ±2.8 | 9.5, ±2.3 | -1.59 | .155 | 2.86 | .116 |
| Long-term memory | PR | 7.0 ±2.7 | 7.2, ±2.6 | -0.1 | .925 | 8.0, ±1.7 | 8.1, ±2.03 | -0.14 | .893 | 1.43 | .969 |
| Creativity | ATTA | 69.8, ±14.7 | 89.4, ±4.9 | 2.77 | **.05*** | 80.4, ±9.5 | 83.0 ±13.9 | -1.07 | .322 | 0.13 | **.021*** |
| Well-being | ULC-PW | 22, ± 6.6 | 27.8, ±2.5 | -1.82 | .143 | 22.38, ±3.8 | 27.1, ±2.0 | -3.21 | **.015*** | 0.01 | .741 |
| | | Each class pre | Each class post | *t* | *p* | Each class pre | Each class post | *t* | *p* | *F* | *p* |
| | | 23.1, ±5.8 | 26.9, ±3.3 | -5.4 | **<.001**** | 22, ±3.3 | 26.2, ±2.7 | -7.4 | **<.001**** | 11.35 | .745 |

Note.
* Statistically significant $p < .05$
** Statistically significant $p < .001$
CDR-SOB: Clinical Dementia Rating – Sum of Boxes
RT: Reaction Time
WPIR: Word Pair Immediate Recall
SFMS: Spatial Forward Memory Span
PR: Personal Recall
*ATTA: The Abbreviated Torrance Test for Adults*
*ULC-PW: UCL Generic Positive well-being*

*Figure 5-1 Changes RT, WPIR, SFMS, PR, and Creativity Before and After Interventions in The Two Groups*



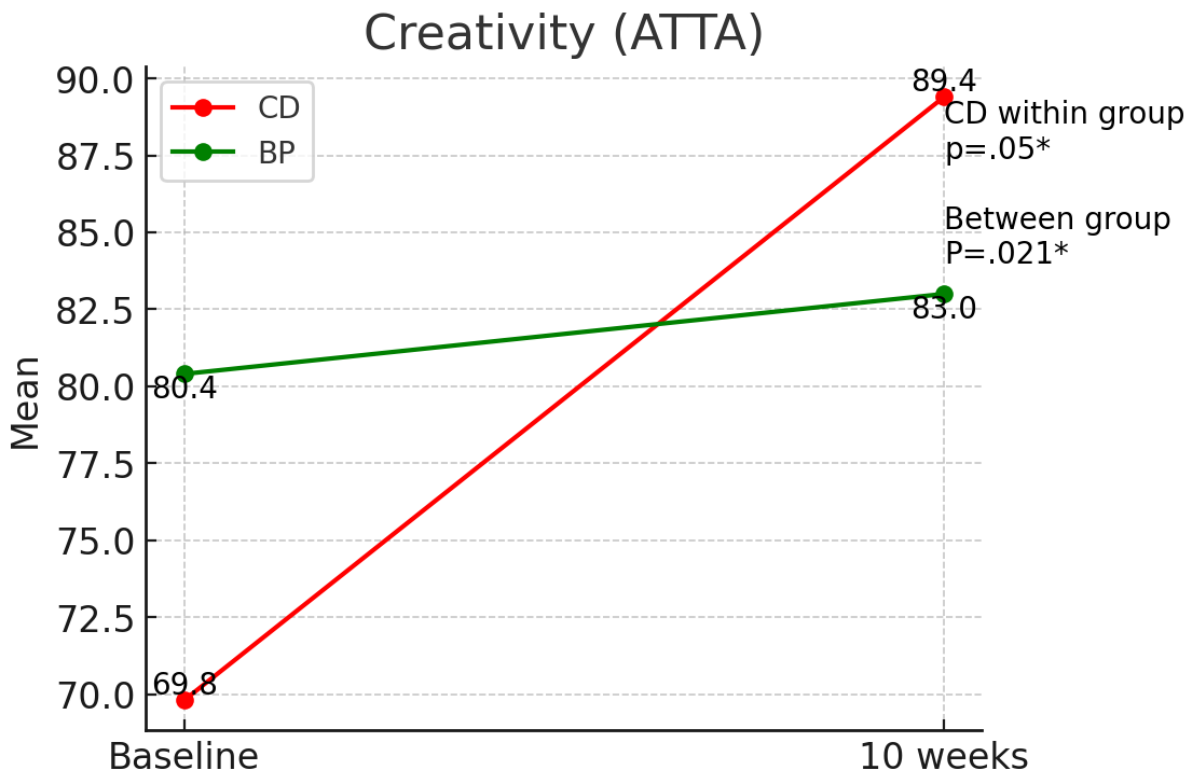
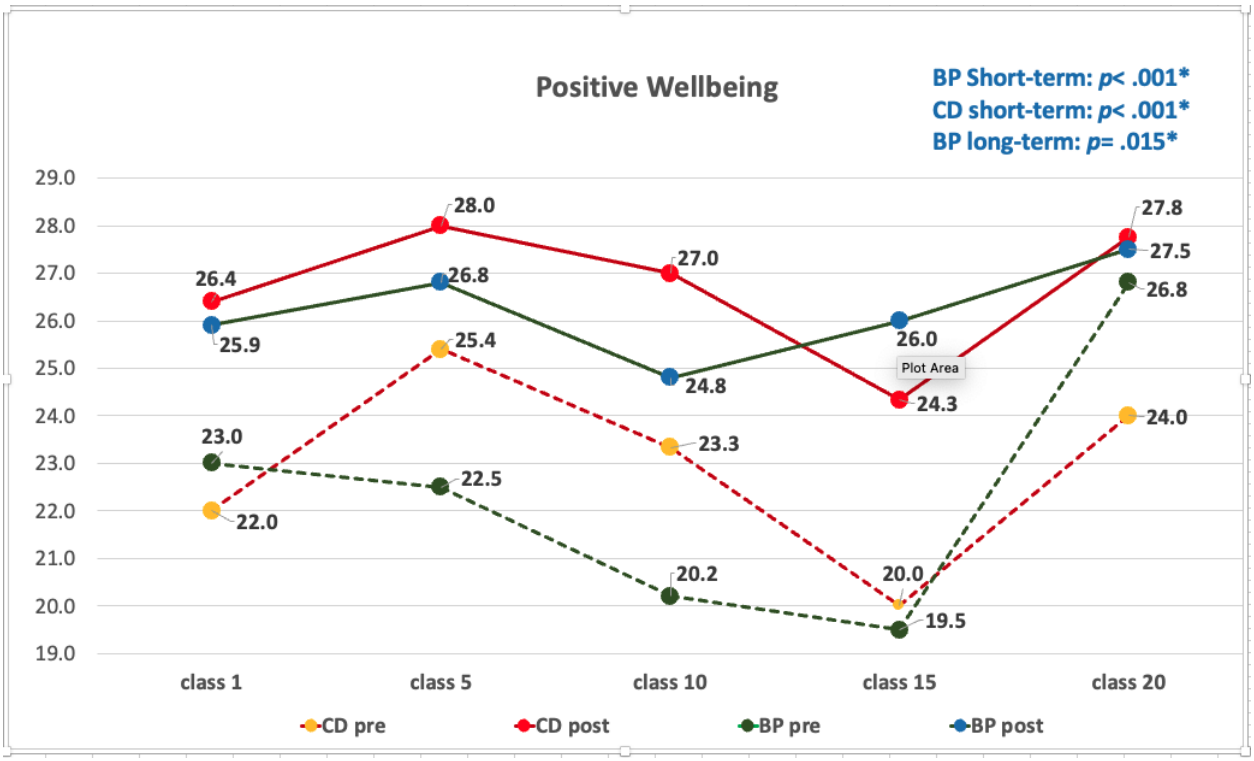



Figure 5-2 presents positive well-being scores and the trend. The participants took a positive well-being survey (ULC-PW) before and after every five classes. The CD group had long-term (10 weeks) improvement in positive well-being from 22 (*SD* = 6.6) to 27.8 (*SD* = 2.5), while the improvement was not statistically significant *(p> .05)*. In terms of enhancing well-being, there was not a statistically significant difference between the two groups in both long-term and short-term *(p> .05)*. The primary trend of the positive well-being scores in both groups was consistent; they went up in class 5, started to go down in class 10 and 15, and then up again in class 20.

*Figure 5-2 Positive Well-being Scores and Trend*




**5.3. Primary Outcomes from Qualitative Data**

While quantitative data provide a broad baseline measurement of improvements, enriching qualitative insights reveal significant experiences and subtleties that quantitative measures may overlook. All the group members were invited to join in the focus group interviews, with one interview in each group. Five participants in each group joined in their focus group interview. To better understand primary outcomes, I developed qualitative analysis codes based on "Attention/Reaction Time," "Short-term memory," "Long-term memory," "Creativity," and "Positive well-being." Each participant's data was de-identified and referred to by a study ID code composed of a letter and number, such as A1. The CD group's study ID code began with the letter A, and the BP group's study ID code began with the letter B.

The primary outcomes in qualitative data include “Attention/Reaction Time,” “Short-term memory,” “Long-term memory,” “Creativity,” and “Positive well-being.” Concerning the attention outcome, both groups mentioned that they experienced attention or reaction time while dancing. However, the BP group had a deeper or more sound experience in attention or reaction time. Observers saw that the BP group was getting faster in picking up the new movements in later classes than in the earlier classes. However, compared to the BP group, neither observers nor participants observed short-term memory changes in the CD group. In terms of long-term memory, CD group prompts can trigger and recall long-term life memories. Innovative and creative ideas are based on individuals past experiences. BP group remembered dance routines after repetition over weeks. Music played a significant role in long-term memory in both groups. In the next outcome, Creativity improvements were attested by both observers and participants in the CD group, but no changes were noticed in the BP group. For the outcome, the participants in both CD and BP groups had overall positive experiences and improved positive well-being. Below, each primary outcome and related participants' quotations are presented and discussed.

### *5.3.1. Attention (Reaction Time)*

In the qualitative data, participants from both groups mentioned that they were involved in their attention/reaction time while dancing. In the CD group, I identified three sub-themes: “Opposite Movement,” “Different Planes,” and “Didn’t observe changes.” Class activities like opposite movements, different planes, and utilizing imagination positively challenged participants’ brains, but participants also reported they didn’t see any changes in attention.

In the BP group, participants reported that the timing and beats required them to focus, react fast, and be mindful. Some participants seem to have picked up new movements faster in the later classes in the BP group. Therefore, sub-themes of "Improved timing, reaction and concentration" and "Eight points in planes" emerged from the BP group.

We also observed different facial expressions and body language between the groups. Table 5-4 presents the selected quotes of attention/reaction time in the two groups.

*Table 5-4 Thematic Quotes and Observations of Attention/ Reaction Time*

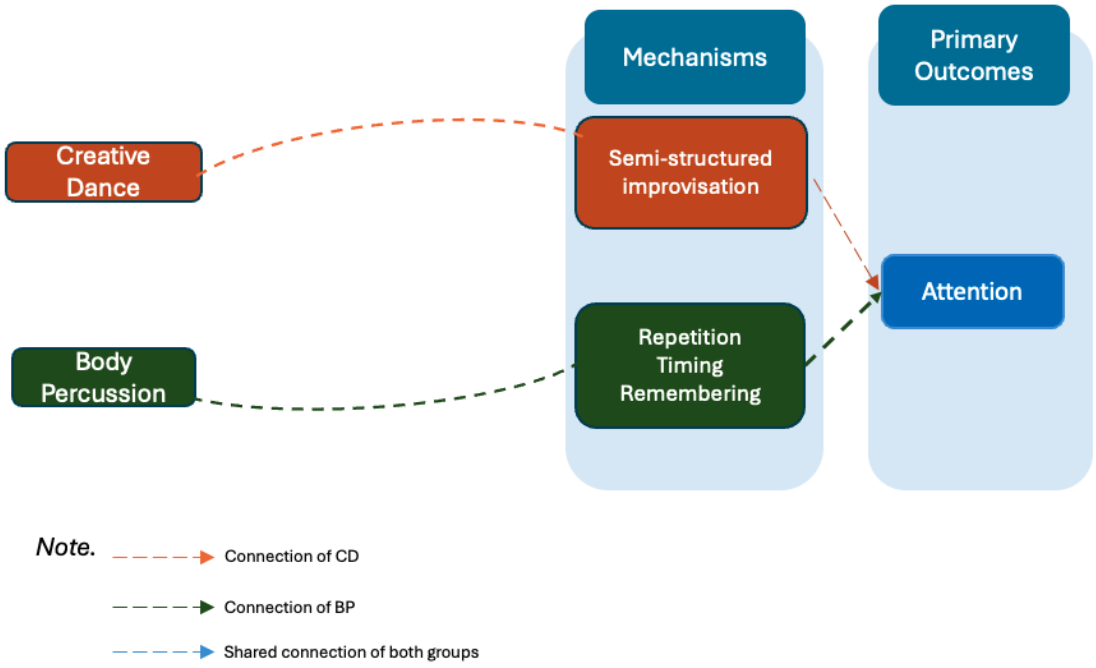
| **Themes** | **CD group** | **BP group** |
|---|---|---|
| Both groups were involved in their attention/reaction time while dancing. BP group report more about improving attention or reaction time. | **1."Opposite Movement,"** which requires a participant to react to their partner's movement oppositely, such as when partner A waves their hands up, and partner B needs to react by waving their hands down.<br>Participant **A5** said: "Using focus concentration to make opposite movements from the leading dancer…The mirror people are doing the opposite. I mean, doing the same thing the person in front of me was doing, I found a little bit easier, but trying to do the opposite of what they were doing. That was a real brain (exercise)."<br><br>**2."Different Planes"**<br>Another practice the participants mentioned that can improve or practice attention was doing movements on different levels or planes, such as horizontal planes (table plane), vertical planes (door plane), and sagittal planes (wheel plane).<br>Participant **A1** explained**:** "I found that doing things on different levels was a bit of a challenge for me. I | **1. Improved timing, reaction and concentration**<br>**B9** said*:* "It's a focus issue because you have to focus.....This was something that you couldn't do mindlessly…Whether you did it right or wrong, there was a focus to it."<br>**B4**: "(I felt I improved) some timing. (class 5)"<br>**B9**: "This was a very valuable study for focus & attention. (class 20)"<br>**B5**: "React Fast. (class 20)"<br><br>**2**<br>**"Eight points in planes"**<br>The exercise was a tapping and clapping practice at eight points on a circle that engaged three space planes: the vertical (door) plane, the horizontal (table) plane, and the sagittal (wheel) plane. Each plane has 8 points on the clock. Feet are tapping one point at a time in the horizontal (table) plane on the ground, and hands are clapping |

| | | |
|---|---|---|
| | learned something that I had never thought of before about levels and designing the things around me, how they can affect how I move, and how I can change my movements to reflect those things around me."<br><br>**3.Didn't observe changes**<br>Participant **A5** said: "I don't see anything outside of class. I don't know that I've seen any changes. My husband's in the other room. I could ask him if he thinks I'm more focused. But since I don't listen to anything he says anyway." | one point at a time in the vertical (door) plane or the sagittal (wheel) plane in the air. At the same time, participants need to speak out loud about the numbers they are pointing to. This practice may benefit their attention, balance, and sense of visual-spatial capacity according to participants' feedback and observations.<br>**B8** said: "I would think the thing just off the top of my head, I guess, was the dial. And we had to deal with your hands and your feet and go backward. And I mean, there were so many different aspects to that, and then you switched it to the wheel. I feel that it was the most beneficial in terms of focus. It really had to focus.<br>**B12:** Yeah, I agree. That was because you have to be in the moment. You just can't be thinking about other things. |
| Observations | We observed that CD participants engaged in the class and were alert and attentive when they were learning the prompts, and CD group members were more relaxed and smiled most of the class compared to BP group. | Participants picked up new movements faster in the later classes.<br>We also observed the BP group members displaying serious facial expressions and paying close attention to learning the new movements. One observer's note reads:<br>"People are quite concentrated on getting it correct. The group was serious and watched the instructor closely, and people did not talk during the dance. But laugh a lot when they make mistakes. Participants were able to change movements when they were prompted to do so |

| | | |
|---|---|---|
| | | quickly. The group enjoyed the challenge of remembering the dance and having to coordinate as a group.” |

I made a Study Conceptual Diagram (Figure 3-2) based on the ACPH Framework (Figure 3-1) to visualize the connections between potential mechanisms and primary outcomes. Figure 5-3 is an excerpt from the Study Conceptual Diagram (Figure 3-2), depicting potential specific factors through which CD and BP relate to attention based on the qualitative analysis results.

*Figure 5-3 Attention connections in the study diagram*




### *5.3.2. Memory*

Short-term memory changes were not observed or reported in the CD group. BP group participants showed mixed perceptions about changing short-term memory. Under the theme of short-term memory, “noted increased memory” and “hard to recognize the impact” emerged as sub-themes in the BP group. Some participants noted increased memory and confidence due to

repetition. Participants in the BP group mentioned memory a lot in the "*Commons and Thoughts*" survey taken after every five classes. However, one participant expressed that it seems to be hard to recognize the impact on short-term memory.

In CD's long-term memory, I identified two sub-themes: "Innovative and creative ideas often tapping past experiences" and "Music." CD engages long-term memory by tapping into past experiences, such as recalling childhood games or favorite activities like golf or baseball. Imagination and creativity are stimulated through CD that engages with long-term memory. Innovative and creative ideas may often be based on individuals past experiences. In BP's long-term memory, "Remember old movements," "Repetition helped long-term memory and build confidence," and "Music" were identified as its sub-themes. Music played a significant role in evoking memories in both groups, enhancing the connection to the dance and activities. Table 5-5 presents the thematic quotes and observations of memory in the two groups.

*Table 5-5 Thematic Quotes and Observations of Memory*

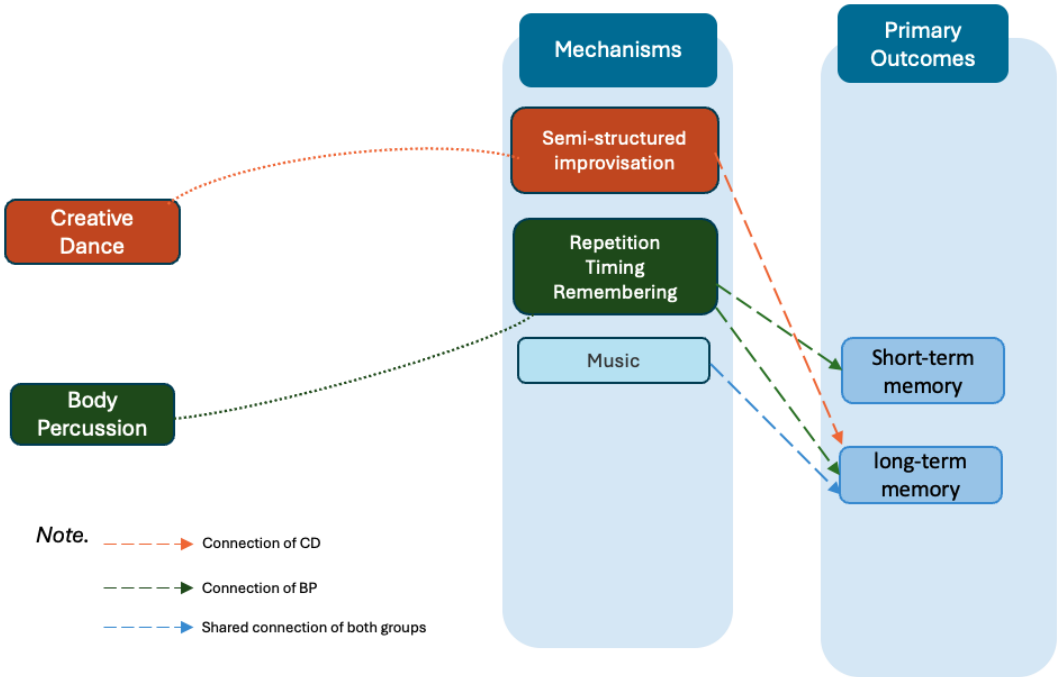
| **Themes** | **CD group** | **BP group** |
|---|---|---|
| **Short-term memory** | Changes were not observed or reported. | **Mixed perception**<br>**1. Noted increased memory**<br>**B10**: "I do a memory test on a web study every three months. And on the memory portion of that, I did better this time. I took it yesterday [after the ten-week class], and I did better than I have in the past. Very nice. So maybe it did help."<br>Survey Question: "What do you feel you achieved?"<br>**B5**: "Improve memory, (class5)"<br>"Improved memory and sense of RHYTHM. (class20)"<br>Participant **B7** shared**:** "I actually memorized Most of the step yay! (class20)" |

| | | |
|---|---|---|
| | | Participant **B9** stated: "I feel I achieved learning current/ new exercise & remembering. (class20)"<br><br>**2. Hard to recognize the impact**<br>**B9** said: "It's hard to say this seemed reinforcing for the short-term (memory). But I bet if you invited me back in two weeks and wanted me to do this, it'd be gone. Maybe I'm wrong." |
| **Long-term memory** | **1.** Innovative and creative ideas often **tapping past experiences.**<br>Example one: in one of the partner dances, A1 and A5 were partners. A1 made a fishing movement, and then A5 danced like a fish that was on A1's hook. Then A1 started to share some beautiful memories with her daughter. They loved fishing, and they always went fishing together back in the day.<br>Example two: when the task requires making swaying movements, one did golf, and one did baseball movements since they played those sports in the past; someone else does swing movements like a child, recalling the memory of their children swinging at a playground.<br>**2. Music**<br>Music seems to play a significant role in long-term memory in CD class.<br>**A3** said: "I remember when you played the old music. Those of us recognize this, like tunes that were | **1. Remember old movements**<br>**B7** said: "I actually did remember the old steps. (class10)"<br><br>**2. Repetition helped long-term memory and build confidence**<br>**B10:** "I have evidence of that because I was out of town, So I missed two weeks, and I didn't practice. Then, when I came back. The one that we did from the beginning over and over. I remembered it pretty quickly… I have to say that I liked the repetition... Because finally, I can say, Oh! there's what I can do easily. And actually, it wasn't that easy. I kept forgetting pieces. So, the repetition was very helpful…I am very uncoordinated…The repetition really gave me some confidence…"<br><br>**3.Music**<br>Participants in the BP group also mentioned that music is crucial for them, bringing about old memories of people and activities they used to participate in.<br>Participant **B10** shared: "There was one move where we used the Beatle's song Ob-La-Di, Ob-La-Da. I liked the Beatles, you know, and that's the kind of being able to connect with the music is very helpful. And about the Macarena. You know, my kids used to do that. And I could never understand how they did it. So well, their generation, how do they do that? So being able to practice it with you was kind of fun. |

| | | |
|---|---|---|
| | familiar. You did Elvis and songs that we knew from our growing-up years. That was special, that particular time, but we all joyfully reacted to what we knew about the music." | It was like, Oh, I understand a little more now. It just takes me 10 times longer to learn it than I took them."<br><br>Participant **B4** echoed B10 by recalling past memories in music: "That part brought back the fact that I was a high school principal. Well, for their homecoming week, they had a raffle to see which one the principal would do for the Macarena." |
| **Observation** | CD Participants could remember the prompts right after the instructor gave them. | We noticed the BP group was getting faster in picking up new movements in later classes than in earlier classes. |

Figure 5-4 is an excerpt from the Study Conceptual Diagram (Figure 3-2), depicting potential specific factors through which CD and BP relate to memory based on the qualitative analysis results.

*Figure 5-4 Memory Connections in The Study Diagram*



### *5.3.3. Creativity*

In the BP group, no participants noticed any changes or evoked creativity, such as doing things in creative ways, their sense of humor, and solving problems creatively in or out of the class. However, changes in creativity were noticed in the CD group. Group cohesiveness and dynamics positively impacted creativity through positivity and humor. They also valued uniqueness in the creative process. The instructors' prompts helped participants improve problem-solving skills by mastering perspective shifts. They liked contributing creatively and freely to group dances, which they found stimulating and enjoyable. They emphasized the importance of using imagination when dancing, suggesting that considering various perspectives beyond one's own can lead to more creative outcomes. They liked the process of creating dance moves and the desire to be original rather than imitating others. They highlighted the importance of thinking creatively and staying true to oneself. Some participants liked imagination stimulations, especially the "sculpture practice." I identified two sub-themes under the theme of Creativity: "Thinking creatively and staying true to oneself" and "Imagination Stimulation." Observations showed the CD participants were getting creative and mentally flexible over time in the class progression. Table 5-6 presents the thematic quotes and observations of Creativity in both groups.

*Table 5-6 Thematic Quotes and Observations of Creativity*

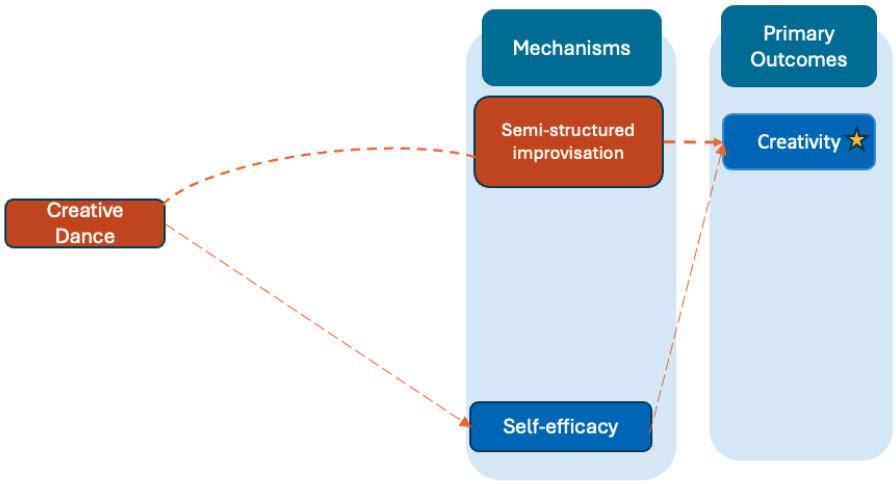
| Creativity | CD group | BP group |
|---|---|---|
| **Thinking creatively and staying true to oneself** | Participant **A3** reported:<br>"I think my brain had to work on, I had to come up with something for everyone else to do. I have to think I didn't really want to copy anybody else moves. But I wanted to be creative and just be myself." | No BP participants noticed any changes or evoked creativity. |

| | | |
|---|---|---|
| | Another interviewee, **A5**, felt more relaxed and creative during the dance exercises, particularly when they changed their perspective:<br>"Well, I noticed when I went to take the post-test yesterday that I was much more relaxed. I didn't feel the performance anxiety. I am definitely not an artist. This time, I just kind of was like, I'm just gonna make stuff up. And, I think I did it. I had one moment where I was much more creative than I was the first time with regard to perspective because before, I was drawing things, as if I was looking at something and then trying to sketch it. And when I changed my perspective to an aerial view, it changed how I approached that project, or drawing project. So I think in that regard, I felt more creative."<br><br>Participant **A8** stated:<br>"I like when we did have to come up with something for the group to do. Because it did. Okay, what something it did got my brain really working, thinking ahead of time, I'm going to do this. And then when I got my turn, it would fall on my head. And I'd have to come on, I usually come up with something different. But just having that opportunity, I guess you'd call it to come up with something, and then something semi-creative anyway. What a spectacular thing to do! This whole class has just been great." | |
| **Imagination Stimulation** | **The "sculpture" dance** was mentioned to stimulate imagination, in which partner A freezes on a movement like a "sculpture" during improvisation and partner B moves according to what they think A looks like. For example, when B interprets A as holding a basket, B can react like playing basketball.<br>Participant **A9** shared: "Imagination with the sculptures that was fun, using your imagination to recall. And think about all the different things that could have been and not just what you thought. But other people did think other things." | |
| **Observation** | **Participants getting creative and mentally flexible in the later classes.**<br>In the earlier classes, CD group members followed the instructor's movements a great deal instead of coming up with their own creative interpretations of their movements. As the class progressed, however, they | |

| | | |
|---|---|---|
| | became more comfortable and came up with their movement and more creative interpretations of the prompts (such as shapes, spaces, music, images, etc.). | |

Figure 5-5 is an excerpt from the Study Conceptual Diagram (Figure 3-2), depicting potential specific factors that CD and BP relate to creativity based on the qualitative analysis results.

*Figure 5-5 Creativity Connections in The Study Diagram*




### *5.3.4. Positive Well-being*

Four sub-themes were identified under positive well-being: "Positive emotions," "Performance anxiety," "Social connection," and "Other elements affected well-being."

In "Positive Emotions," participants in both CD and BP groups had overall positive experiences and improved their well-being during the intervention. CD group Participants felt more creative and enjoyed the energy in the class over time. In the BP group, participants found the individual practice, partnering, and group structure invigorating and energizing.

In the sub-theme of "Performance anxiety," members in both groups felt challenged and experienced performance anxiety initially. One reason was that most participants did not have

much dance experience and were unfamiliar with the other group members. Before the dance intervention started, data collectors asked about the participants' previous dance experiences. None of the participants had professional dance training. About half of the participants had never had dance experiences before, and the other half had random dance experiences such as social dance. Both types of dance intervention in the present study were relatively new to most participants. Only one to two people had previously heard of the dance type they would do in the intervention. However, they had positive experiences and improved well-being over time as the classes progressed.

In the CD group, the class involved improvisational dance, which some found challenging. Improvisational dance caused performance anxiety at first because CD requires people to express themselves openly. Participants weren't familiar with each other or the dance-type experiences at the beginning weeks of the classes. Once they felt comfortable with each other and let go of self-consciousness, however, they found it fun and enjoyable. Prior exposure to CD helped the participants feel comfortable right away.

Some in the BP group initially felt stressed about remembering the movements to join a partner or group dance. However, the supportive group atmosphere, repetitive movements, and movement videos helped boost confidence and create a positive emotional state.

Social interaction is also a key factor in promoting positive well-being in both groups. Through the dance, participants felt heard and understood, particularly in interactions with others. They became more comfortable with others and developed trust, enjoying partner and group dances.

In the last sub-theme, “Other elements affected well-being,” the CD group highlighted the comfortable atmosphere and lack of judgment as crucial factors for a positive experience. In the BP group, the repetitive elements in the program were met with mixed emotions. Most participants found repetition essential for learning the steps and helping them build confidence. However, one participant felt the repetitive movements got boring over time.

Overall, participants found the creative dance experience enjoyable, inclusive, and beneficial for their well-being and in various aspects of their lives, especially in positive emotions and social interaction. Engaging in individual, partner, and group dances provided varying levels of comfort and enjoyment, with interactions enhancing relationships and overall experience. It shows that emotional engagement and social connection are the key factors that benefit well-being. Table 5-7 presents the thematic quotes about Positive Well-being in both groups.

*Table 5-7 Thematic Quotes and Observations of Positive Well-being*

| **Positive Well-being** | **CD group** | **BP group** |
|---|---|---|
| **Positive emotions** | CD participation potentially improves the mood of participants, even if they started with a bad one. Participant **A5** reported: “Always got a chuckle out of the action dance. It always made me laugh. And there were days when I showed up, I was going through a little difficult situation with our neighbor. And there were days when I showed up, and I wasn't in the best mood. And I felt much better after I left the class. And I think on one of those days, maybe we filled out that rainbow circle (the well-being survey). And I think it was clear from when I started the class to when I ended the class that I was in a much better place.” | Participant **B8** stated: “I generally enjoyed the class. It was fun, and there was very happy energy. And I have to say, (when) we're driving home, especially the evening one, I was always energized and kind of bouncing around in my car, you know, singing or something. So, yeah, I felt that way.”<br><br>Participant **B12** stated: “I found it very invigorating. And I enjoyed it every single week.” |

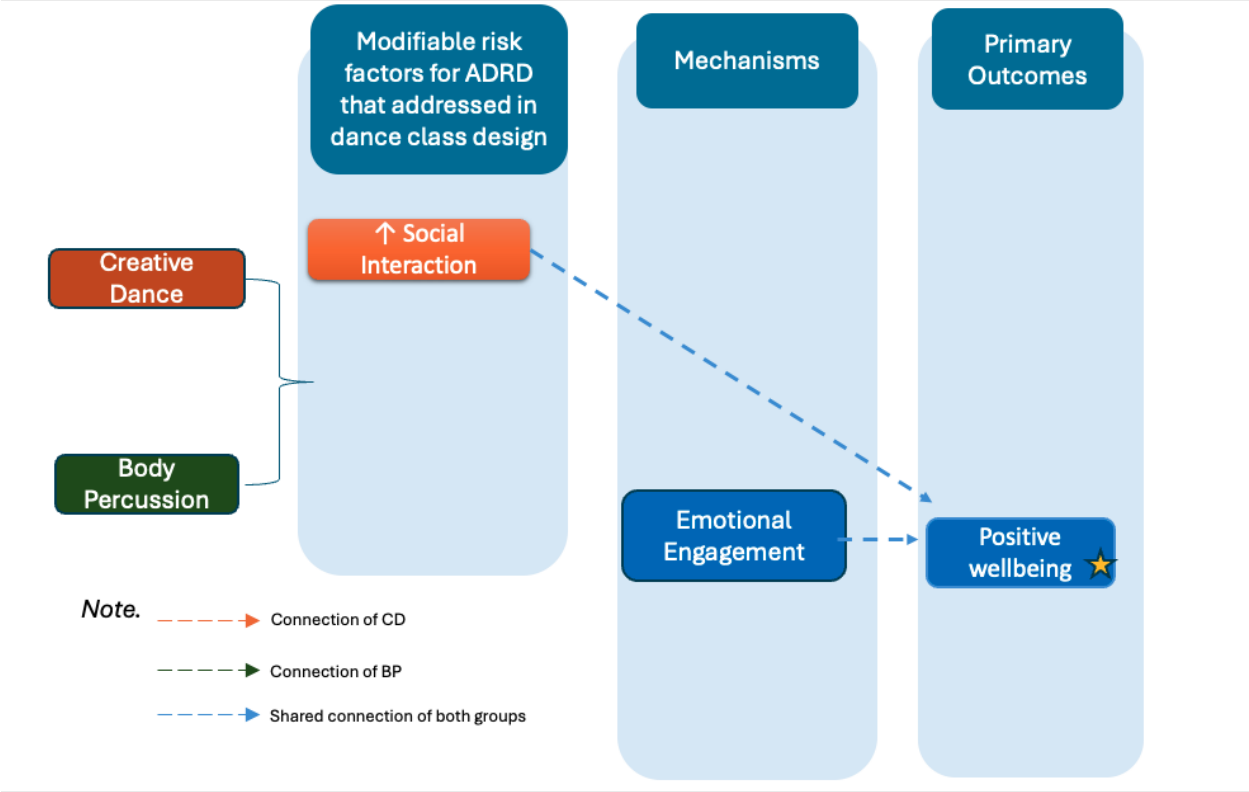
| | | |
|---|---|---|
| | Participant **A9** also expressed positive emotions:<br>"I thoroughly emotionally enjoyed every movement, every time I watched the other participants enjoying themselves also. I loved every part of it. It was very encouraging. And it made me feel good that everybody was partaking in the creative dance that we were doing. It was wonderful." | |
| **Performance anxiety** | Participant **A5** said:<br>"I mean, it felt awkward at first, who are these people? There was some performance anxiety in the beginning. But that went away pretty quickly. You know, and then it just somehow something shifted. I can't tell you which session just became okay, to be silly and to be more playful. And that was really fun."<br><br>Participant **A9** shared:<br>"I know (I'm an) overweight old lady. And when I was in high school, believe it or not, I was on the dance squad, where we danced at the football games and all that with the band, I really could get kicked over my head……I can't do that anymore. But I came very self-conscious. But it became fun."<br><br>Prior exposure to CD helped the participant feel comfortable right away. Participant **A8** stated:<br>"From the very first class because I have no inhibitions when it comes to doing stuff in front of other people. I had a roommate in college who was a dancer, so I knew about creative dance and freeform dance | Participant **B8** spoke:<br>"By the time you got to number three, I couldn't remember number one anymore. So I just thought that was painful. It was hard. We didn't do that at the end." And "I have to say my expectation of myself was it would be much easier than it was. After that first class, I definitely felt quite stressed. Um, but I have to say the class videos that you did really helped me gain that much confidence. So that I could come to the class and not be scared that (I) gonna mess up." |

| | | |
|---|---|---|
| | and did a little bit about that. Not that I'd ever done that, but if people don't like how I do things the way I look, they can look elsewhere. But I enjoyed the class from the beginning, and it was great fun every time we got there. I wish we would have been able to make every class." | |
| **Social connection** | **A3** stated:<br>"We all kind of connected, I feel like… I think it was good that you had us change partners. Because then you got exposure to everyone in the group, and we got to know each other more through the creative part, but then the real part."<br>Participant **A1** expressed similar feelings about enjoying the partner and group dances:<br>"I enjoyed all of that, especially the interaction with my new friends. It's a wonderful way to be a part of them, and they are with us. I've truly enjoyed it. And we were able to be with each other throughout this time. It was wonderful. My perspective is that I was thoroughly enjoying it more and more as I continued to learn and be more accepting of all the movements, and just all the energy came, and it just was flowing naturally. And it happened just naturally and being with everybody. I felt very comfortable with each and every person in that class of ours. It was wonderful. Thoroughly enjoyed each person. Its individuality. The movements were fun, and I felt the energy throughout. Very enjoyable." | Participant **B7** shared:<br>"I noticed I was much more at ease. And probably that's just because we got to know each other a little bit better. And so I was laughing a lot. By the end, I didn't care. if I wanted to do a silly dance, I'd do a silly dance. And I felt very comfortable in the group and with myself. And I think the sense of humor, we were all in there together, we're all different levels. I think you could tell that it was having fun. So, it made me more comfortable than leaving the class. Knowing that things that I don't do well, just laugh about it, you know, it's okay. And I kind of got that from this class as well. That supports having fun with yourself, and who cares?"<br><br>Participant **B8** confirmed:<br>"Yeah, I really, I loved the camaraderie, I did not realize that I would gain five new friends through this. So that was a real positive thing for me." |
| **Other elements affected well-being** | **Non-judgmental environment** | People had different perceptions about **Repetition.** |

| | | |
|---|---|---|
| | Participants like **A3** believed the non-judgmental environment helped them to enjoy the dance and promote well-being:<br>"I feel like I was judging myself. I felt no judgment from you or anyone else. I just had to stop thinking so much about it in the beginning, anyway. But no one judged us. You know, we did our own thing." | Most people believed the repetition helping **build confidence.**<br>**B10** explained:<br>"I have to say that I liked the repetition. I liked it when we came back to the same one that we learned from the beginning. Because finally, I can say, Oh! there's what I can do easily. And actually, it wasn't that easy. I kept forgetting pieces. So, the repetition was very helpful. And I liked how you actually changed it. For example, the beginning part stayed the same, but you changed the second part or the ending part. And so that kind of gave it a little more newness to it."<br><br>One participant felt the repetitive movements got **boring**.<br>Such as participant **B8** said:<br>"And I guess my criticism would be that the one exercise we did where it was throughout the entire thing where we started with the, you know, touching and tapping and I mean, I found that as it as the weeks went on, that got kind of boring, even though it was difficult, you know, the first part was solid, pretty solid. But then there was always that at the end that was different. And it seemed, I sort of dreaded having to do the whole thing all over again. Again, so it just kind of felt repetitive to me." |

Figure 5-6 is an excerpt from the Study Conceptual Diagram (Figure 3-2), depicting potential specific factors through which CD and BP relate to Positive Well-being based on the qualitative analysis results.

*Figure 5-6 Well-Being Connections in The Study Diagram*




**5.4. Integration of the Quantitative and Qualitative Data in Primary Outcomes**

Table 5-4 integrates quantitative and qualitative results. The first column treats the primary outcomes of health domains; the second column treats quantitative results; the third column shows the similarities and differences of qualitative results between the CD group and BP group; and the fourth column compares convergence and divergence between quantitative

and qualitative results. "↑" means improving, and "↓" means declining. "*" represents statistically significant change ($p \leq .05$). "**" represents statistically significant change ($p < .001$).

*Table 5-8 The Integration of Quantitative and Qualitative Results in Primary Outcomes*

| **Primary Outcomes** | | **Quantitative results** | **Qualitative results: between the two groups**<br>Study ID start with A come from CD group, start with B from BP group | **Comparison results: between quantitative and qualitative results** |
|---|---|---|---|---|
| **Attention/ Reaction Time (RT)** | | CD group ↓<br><br>BP group ↑<br><br>No statistically significant differences within either or between the two groups ($p$> .05). | **Similarity:** both groups mentioned that they were involved in their attention/reaction time while dancing<br><br>Subthemes<br>CD:<br>• Opposite Movement<br>• Different Planes<br><br>BP:<br>• Improved timing, reaction and concentration<br>• Eight points in planes<br><br>**Differences:**<br>CD group found some exercises engage with their attention, but they didn't observe improvements.<br>BP group had more examples and experiences about improvement in attention. Some participants seemed to pick up new movements faster in the later classes. | **Convergence:**<br>BP group improved the attention/reaction time.<br><br>**Divergence:**<br>Quantitative data showed CD group declined, but some of the participants felt the training helped their attention and reaction positively. |
| **Short-term memory:** | **Word Pair Immediate Recall (WPIR)** | CD group ↑<br><br>BP group ↑<br><br>No statistically significant differences within either or between the two groups ($p$> .05). | **Similarity:**<br>Both groups had some participants didn't notice any changes in short-term memory.<br><br>**Differences:**<br>Short-term memory was rarely mentioned or observed in the CD group.<br><br>BP group noted increased memory. | **Convergence:**<br>Both quantitative and qualitative results showed the BP group had more evidence of improving short-term memory than the CD group.<br><br>**Divergence:**<br>In the CD group, WPIR improved but neither observers nor participants observed short-term memory changes in the CD group. |
| | **Spatial Forward Memory Span (SFMS)** | CD group ↓<br><br>BP group ↑ | | |

| Primary Outcomes | | Quantitative results | Qualitative results: between the two groups<br>Study ID start with A come from CD group, start with B from BP group | Comparison results: between quantitative and qualitative results |
|---|---|---|---|---|
| | **Spatial Forward Memory Span (SFMS)** | No statistically significant differences within either or between the two groups ($p > .05$). | | |
| **Long-term memory: Personal Recall (PR)** | | CD group ↑<br><br>BP group ↑<br><br>No statistically significant differences within either or between the two groups ($p > .05$). | **Similarity:** Music played a significant role in long-term memory in both groups.<br><br>**Differences:**<br>CD:<br>Innovative and creative ideas often tapping past experiences.<br><br>BP:<br>• Remember old movements<br>• Repetition helped long-term memory and build confidence | **Convergence:**<br>Both quantitative and qualitative results showed that long-term memory was triggered in both groups.<br><br>Qualitative results showed that music played a crucial role in long-term memory.<br>CD triggered long-term memory by prompts and music, but BP did it by repetition and music. |
| **Creativity (ATTA)** | | CD group ↑ *<br><br>BP group ↑<br><br>CD's creativity statistically significantly within the group and higher than in the BP group (***p*≤ .05***). But no statistically significant changes within the BP group ($p > .05$) | **Similarity:**<br>The CD group members and observers found the class improved their creativity. No observers or participants in the BP group noticed any changes in creativity.<br><br>Subthemes for CD group:<br>• Thinking creatively and staying true to oneself<br>• Imagination Stimulation | **Convergence:**<br>The CD group improved the creativity better than the BP group. |

| **Primary Outcomes** | **Quantitative results** | **Qualitative results: between the two groups**<br>Study ID start with A come from CD group, start with B from BP group | **Comparison results: between quantitative and qualitative results** |
|---|---|---|---|
| **Positive well-being (PW)** | Short-term PW<br>CD group ↑ **<br>BP group ↑ **<br><br>Long-term PW<br>CD group ↑<br>BP group ↑ *<br><br>No statistically significant difference between the two groups in long-term and short-term (p> .05). | **Similarity:**<br>The participants in both CD and BP group had overall positive experiences and improved positive well-being. Emotional engagement and social connection are the key factors that benefit well-being.<br><br>Subthemes for both groups:<br>• Positive emotions<br>• Performance anxiety<br>• Social connection<br>• Other elements affected well-being<br>○ CD: Non-judgmental environment<br>○ BP: Repetition | **Convergence:**<br>The participants in both CD and BP group had overall positive experiences and improved positive well-being. |
| Note.<br>"↑" means improving,<br>"↓" means declining<br>* Statistically significant $p < .05$.<br>** Statistically significant $p < .001$ | | | |

### 5.4. Results of Secondary Outcomes from the Qualitative Data

The secondary outcomes in the qualitative data include two risk factors for ADRD and three mechanisms for the primary results. Table 5-9 presents the qualitative analysis codes in secondary outcomes. Risk factors that were addressed in the interventions are "Physical activity" and "Social interactions." Under the theme of "Physical activity," specific physical benefits were identified from the qualitative data: "Balance," "Mobility," and "Coordination." Under the theme of "Social interactions," subthemes were identified from the qualitative data: "Being Connected," "No judgment," and "Making Friends." According to my study conceptual diagram (see Chapter

3, Figure 3-2), I also created codes for mechanisms of interest: "Self-efficacy," "Emotional Engagement," and "Expression."

*Table 5-9 Qualitative Analysis Codes in Secondary Outcomes*

| Main themes | Subthemes | CD group | BP group |
|---|---|---|---|
| Physical Benefits | Subtheme1: Balance | | |
| | Subtheme2: Mobility | | |
| | Subtheme3: Coordination | • New perspective to body coordination. | • Coordination improvement and gaining confidence.<br>• Application of BP in more contexts beyond aging population. |
| Social Interaction | Subtheme1: Being Connected | • Like to be part of the partner and group dance.<br>• Strengthen their close relationships. | • Like to be part of the partner and group dance. |
| | Subtheme2: No Judgement | | |
| | | Subtheme3: Making Friends | N/A |
| Self-efficacy | | Self-efficacy | Subtheme1: Boost confidence and accomplishment<br><br>Subtheme2: Preference for Class Structure<br><br>Subtheme3: Repetitive Elements |
| Emotional Engagement | Subtheme1: Improved Mood & Enjoyment<br><br>Subtheme2: Emotional Engagement Through Social Interaction | | |
| Expression | | Subtheme 1: Freedom of Expression<br>Subtheme 2: | N/A |

| | | | |
|---|---|---|---|
| | | Embracing Imperfection Subtheme3: Feeling Supported | |

The qualitative data showed both groups improved balance, mobility, and coordination, but more BP group members reported achievements in physical benefits. In terms of social interaction, participants in both groups expressed a sense of connection and enjoyment in interacting with others because they could be connected, make friends, and have no judgment. Observation data indicated that participants in CD group had more social interactions and verbal and non-verbal communication and were closer than the BP group in and out of the class. Both group members felt more confident and competent over time. The participants' feedback and researcher observations showed that the BP group had increased self-efficacy. Participants in both dance groups noted improved mood, enjoyment, and relationships with others in the class, and no apparent differences were observed between the two groups. Due to the nature of repetitive movement routines in the BP, not many participants felt personal expression. In contrast, participants in the CD group showed the class helped them overcome inhibitions, promote personal expression, and improve communication.

### *5.4.1. Physical Benefits*

Physical benefits were investigated, and the qualitative data in both groups revealed sub-themes of balance, mobility, and coordination. Some also mentioned improvements in flexibility and strength. The data showed that more BP group members reported more experience with physical benefits. Table 5-10 presents the thematic quotes about Physical Benefits in both groups.

#### 5.4.1.1. Subtheme1 of Physical Benefits for Both Groups: Balance

Participants in both CD and BP group activities reported improved balance, highlighting the benefits of the movements that were beyond their expectations. These findings suggest that both dance forms can serve as practical tools for enhancing balance and overall physical well-being, surpassing the benefits of traditional therapy methods for some individuals. However, more participants from the BP group reported balance improvements. In the BP group, I designed many small step movements that required changing weights and tapping the floor in different directions. Some participants with balance issues emphasized the importance of balance in their daily activities and how the BP group movements helped them feel more grounded and aware of their surroundings. Several participants attributed their improved balance to the specific exercises, such as foot placement and maintaining rhythm.

#### 5.4.1.2. Subtheme2 of Physical Benefits for Both Groups: Mobility

Both group participants expressed a sense of achievement in their increased mobility and motivation to move, as well as a positive experience with the physical exertion and flexibility gained. Both activities provided unexpected physical benefits and energizing experiences to the participants, demonstrating the power of dance to engage participants and enhance physical well-being. In the CD group, most of the feedback about mobility improvement comes from the Commons and Thoughts survey questions. In the BP group activity, participants were pleasantly surprised by the aerobic intensity and the motivation to move or have more exercise, which boosted their confidence despite initial concerns.

#### 5.4.1.3. Subtheme3 of Physical Benefits for Both Groups: Coordination

The body coordination within the group was highlighted as a positive aspect of the experience. More participants in the BP group highlighted improvements in coordination than in

the CD group. In the CD group, participants expressed gaining a new perspective on dancing, focusing more on specific body parts during movement. In the BP group, participants found the exercise improved their body coordination and built their confidence. Participants also noted the applicability of BP in various contexts beyond just aging individuals.

*Table 5-10 Thematic Quotes of Physical Benefits*

| Main themes | Sub-themes | CD group | BP group |
|---|---|---|---|
| **Physical Benefits** | **Subtheme1: Balance** | **A8** noted that the balance improved more than expected in the CD class compared to his balance-focused therapy class:<br>"Well, I've found that my balance is better. And I didn't expect that… I was taking a balanced class. It was a therapeutic kind of thing that my doctor sent me to. And I found that, with this physical therapist and doing all these balance things, my balance improved more doing the dance and things that we did. So, I was really surprised." | **B4**, who was diagnosed with Parkinson's disease, expressed how this intervention benefitted his balance:<br>"For me, balance is very important because that's what I was doing in any physical activity; it is wrapped around Parkinson's in balance and stuff like that. So the whole program is very important. This is really, really helpful for me. It does (for) me because that's what I want. (For) example, I was doing weights—machines—not for this class but for another one. I tripped and fell getting up. Well, I wasn't nearly as worried about it as everybody else was up there."<br>**B9** said: "This kind of (dance) gave (me) the strength to be grounded. And this really helped with, I know, there's a word for knowing your surroundings."<br><br>After we finished the intervention about a month later, **B9** wrote me an email talking about the noticeable balance improvement afterward, which is a potential long-term benefit.<br>"I wanted to share one more aspect of the body percussion study that I attended. I've noticed a marked improvement in my balance, which I'm very happy about! I took balance-related physical therapy last fall for the series of falls I had in the prior months. Foot placement (the clock exercise), the side steps of the main routine, and maintaining |

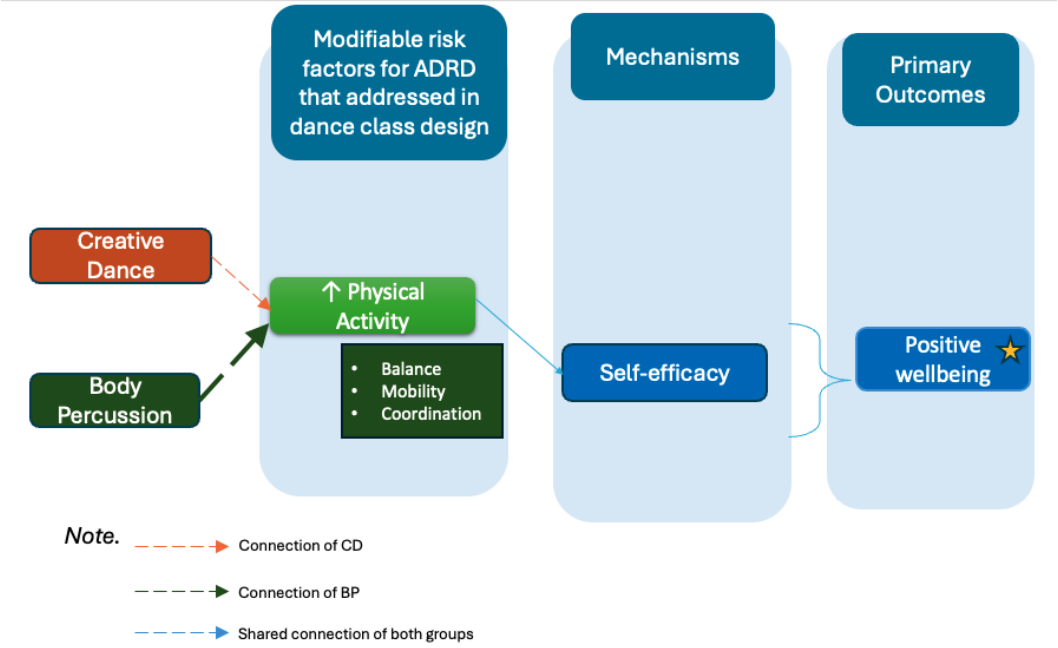
| | | | |
|---|---|---|---|
| | | | rhythm through all the exercises have impacted my steps at home--better than the physical therapy I've had (which created frustration)." |
| | **Subtheme2: Mobility** | **A1 said**: "More motivation to move."<br><br>A8 and A9, who had their anniversary trip during the class, found the class made them more physically active than before. **A9** said:<br>"And I think for us, at least for me, I feel like it helps with us going on our trip because we were much more active over the last eight weeks, and we walked a lot on our trip. And I think it was helpful for us to have been more active before we went." | **B10**: "I mean, I really hate exercising. But I found that this class, I didn't dread going to it…Actually, it was really positive for me in a way that most exercises have not been……That might motivate me to try more exercise classes and involve dance of some kind."<br><br>**B9** was happy about the aerobics the class, and it made her move more energized:<br>"I'm still working and have a lot of obligations; I was concerned about the schedule, you know, and being able to attend. And especially at seven o'clock, I'm tired, or, you know, it's the end of the day, and yet, it would be really energizing. And I was surprised I have a little watch, it counts your steps and stuff. So you really put the mileage in the class. So yeah, that was a surprise. I didn't expect to do as much aerobic with it. So there was good stuff by enjoyed it too……I enjoy the aerobics of it. Like I said, that was a surprise, so that worked out well." |
| | **Subtheme3: Coordination** | **New perspective to body coordination.**<br>They develop a new perspective on dancing and focusing more on specific body parts.<br>**A5**: "I think I've always liked to go dancing. I don't do it very often. But I think now I'll have a different | **Coordination improvement and gaining confidence.**<br>To answer the survey question "What do you feel you achieved?" and "What went well for you?" **B4 s**aid: "Strength and Coordination," **B6** responded: "coordination, memory" and **B2** expressed their coordination with other participants improved: "Coordinate with the group of four worked well."<br>**B10** said the straightforward BP class gave her confidence, although she thought she was uncoordinated: |

| | | | |
|---|---|---|---|
| | | perspective when I go. You know, I'll think more about which body parts." | "My expectation was to have more activity, and it definitely was that. Also, I am very uncoordinated. I've never been any good at dancing. I was hoping this would be an opportunity for me to do simple dancing, you know, very straightforward. And it really was, and it really gave me some confidence……"<br><br>**Application of BP in more contexts beyond just aging population**<br>B7's husband, B4, had been involved in sports all his life as a coach and a player. **B7** recalled the conversation with her husband after the first several classes: "He came home and immediately said that repetition (movements in the) group made sense. He could see how it could work with other situations, other than just aging people, and trying to get the team to come together." Then **B4** echoed his wife:<br>"I think coordination is going to be important if you're teaching younger kids, as opposed to teaching it to 35-year-old adults or many years older than that. It is set up so that the group can help and be intertwined with that person……I kept thinking because I was a former coach and did a lot of those kinds of exercises for the basketball team. How would this work for some basketball coaches at the high school or college level? Good. Would that be included in those programs for their conditioning? And it could, I mean, there's just no doubt in my mind that it would make kids really get a big check as they would enjoy." |

Overall, both group participants reported improvements in balance, mobility, and coordination as physical benefits, then built confidence and self-efficacy, which further influenced positive wellbeing. More BP group members reported more experience of physical

benefits. Figure 5-7 is an excerpt from the Study Conceptual Diagram (Figure 3.2), depicting potential specific factors through which CD and BP relate to physical activity based on the qualitative analysis results.

*Figure 5-7 Physical Activity connections in the study diagram*




### *5.4.2. Social Interaction*

In both groups, participants expressed a sense of connection and enjoyment in interacting with others because they could be connected, make friends, and feel no judgment in the class. They appreciated the social aspect of the classes and the opportunity to make new friends. Both classes followed a structured progression, starting with individual exercises before moving to partner and group activities. This progression allowed participants to build confidence, gradually work collaboratively with others, and build up social cohesion. Observation data showed that CD group participants had more social interactions and verbal and nonverbal communication and were closer than the BP group in and out of the class. Both groups shared the same subthemes,

"Being Connected" and "No Judgment," but only the CD group emerged with the subtheme of "Making Friends." Table 5-11 presents the thematic quotes of social interaction in both groups.

#### 5.4.2.1. Subtheme1 of Social Interaction: Being Connected

There was a great deal of feedback and many observations of social interactions and close relationships in the dance groups. Participants highlighted feelings of comfort, camaraderie, and partner and group dance throughout the sessions. Suggestions were made to expand such programs to assisted living or senior living facilities, emphasizing the potential benefits for older adults regarding social engagement and activity participation.

Participants in the CD group shared how they like to be part of the partner and group dance, emphasizing the development of relationships, trust, and comfort among participants. There was a sense of unity during group activities, with enjoyment derived from both the creative and social aspects of the class. Some participants also expressed that the CD class helped them strengthen their close relationships with their partners.

Like the CD group, the partner dance and the group dance in the BP group made the group members feel connected. Participants appreciated the structured progression of the class, starting with individual exercises, which would make them confident before moving on to partners and then the whole group. The social aspect of the class was delightful for many, contributing to a sense of community and shared achievement.

#### 5.4.2.2. Subtheme2 of Social Interaction: No judgment

At the beginning of each class, I told the participants it would be a non-judgmental class. There's no right or wrong to move your body. Everyone could enjoy moving their body regardless

of age, gender, body type, aesthetic value, and dance experiences. I keep reminding them of the non-judgmental rule in the class.

The CD class participants appreciated the non-judgement from the instructor and the group members in the class. Participants highlighted the supportive and non-judgmental atmosphere of the class, enabling them to explore and grow without fear of criticism and to express themselves creatively without pressure.

Similarly, the BP group appreciated the understanding and support among members, fostering a comfortable and enjoyable group dynamic. In BP class, I told the participants not to worry or stop if they made a mistake to remember and repeat the movement. Instead, focus on the effort, keep trying, and the improvement. I never correct people if they are doing the wrong movement. Instead, I would slow down and encourage them to repeat the movements until they were correct. I also offered different difficulty levels to let them choose to meet people in different situations and learning curves. The group dynamic was seen as beneficial, offering non-judgmental understanding and support among group members and promoting fun and positive experiences.

#### 5.4.2.3. Subtheme3 of Social Interaction for CD group: Making friends

Based on the observation, both group's members developed new friendships throughout the class. However, The CD group members hung out and visited each other outside the class, which didn't happen in the BP group. It is probably because when the class themes or the elements triggered their life memories and thoughts, the nature of CD encourages people to express themselves freely, and so they share many personal experiences about their family members, backgrounds, hobbies, and careers. Personal sharing brought people closer. Since the

BP group didn't talk much about making friends in the focus group interview, only the CD group's quotes are included in this part.

CD Group members expressed gratitude for interacting with others and developing friendships. The responses highlighted the initial apprehension towards dancing with others due to a lack of familiarity, but this was overcome by the enjoyable atmosphere of the class. Participants appreciated the camaraderie and friendships they developed, noting the contrast with their usual family-centric social life.

*Table 5-11 Thematic Quotes of Social Interaction*

| Main Themes | Sub-themes | CD group | BP group |
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| **Social interaction** | **Subtheme1: Being Connected** | • Like to be part of the partner and group dance<br>**A5** expressed how the partner dance and the group dance promote trust and relationships between the group members:<br>"I certainly saw changes in my relationships with people in the classes; we got to know each other. And the trust we developed over time, you know, which you facilitated and enabled us to do those partner dances and group dances, you know, in a more comfortable way. When I was partners with any of you, as time went on, it just was more comfortable. And I was always impressed when we did the group dances. Like how creative other people were thinking of things to do that I had never even entered my head…… I would agree that I like to partner dances, and the group dance is more than just trying to figure it | • Like to be part of the partner and group dance<br>**B9** said:<br>"I liked having at least a little basis of feeling comfortable dancing by myself first, and stuff. And then it was kind of fun as you take cues from the other person (in partner dance). I mean, you could both be wrong, but, you know, there weren't cues and watching their hands, and kind of being half a step behind if you weren't sure where we were at. And then laughing when you were both wrong. So yeah, I still needed it anyway. I still needed to be enough of the initial dancing alone to feel confident doing that."<br><br>**B12** said: "I like the four (people as a) group. I thought |

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| | | out on my own. I felt like I had partners in the struggle."<br><br>**A3** talked about how pairing with different group members in the partner dance helped them know each other better and strengthened the sense of unity:<br>"We all kind of connected…… I think it was good that you had us change partners. Because then you got exposure to everyone in the group and we got to know each other more through the creative part, but then the real part…… I liked the group dances because I felt like we were all one."<br><br>**A1** shared the enjoyment of being connected with other group members:<br>"I enjoyed the interaction with my new friends. I think it's a wonderful way to be a part of them. I've truly enjoyed it. And we just were able to be with each other throughout this time. It was wonderful…... I felt very comfortable with each and every person in that class of ours."<br><br>• Strengthen their close relationships<br><br>Two couples (A1 & A2 and A8 & A9) expressed that the CD class helped them strengthen their close relationships with their partners. **A8** said:<br>"I think it helped in the relationship between A9 and me because it's very easy and can be really stressful being in the car for a long time (while on their vacation in Hawaii). We did drive all the way around the island. | that was fun." B8 shared how the class changed her relationships in and out of the class, and it is good for our brain:<br>"I think in terms of my outside life, I was just shocked at how much I became attached to our group and felt such comfort and warmth with them. And I just think that's always helpful for all of us in terms of stimulating our brains and stuff. I see that I'm different now, or my relationships are different. I think I still argue with my husband. But I just think it's been a bright spot in my life."<br><br>Participant **B9** agreed with the social connection in the class, saying: "There was a nice sociableness to this. Even in the beginning……It became part of my schedule, and I really enjoyed it. So yeah. Good sociability scores on the test." Overall, the BP class was perceived as a positive and enriching experience, providing social benefits to the participants. |

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| | | So, we were in the car quite a bit, and we got along better than we normally did. So it's been a lot of that class where we've looked forward to it……Now she proceeded to just feel comfortable in the class, and I could be here as I wanted it to be. She'd say, Hey, knock it off, buddy."<br>**A1** responded to A8 and shared how this class influenced their relationship with her husband:<br>"It is also with my husband. He is his own man. He is definitely stubborn. So, I'm trying to really relax a little bit more with him and not be so demanding of him. Maybe that's my issue. But I am trying to lighten up with my husband. That's what I'm trying to do during this timeframe." | |
| | **Subtheme2: No Judgment** | **A3** spoke: "I feel I was judging myself. I felt no judgment from you or anyone else. I just had to stop thinking so much about (it) in the beginning anyway. But no one judged us. We did our own thing." **A8** added to the idea:<br>"We had to pay attention and still be free to do whatever we wanted and not be judged. That was good, and I could see how being hesitant at first and thinking, Oh, am I goofy? No, I'm good. I'll be goofy tomorrow." | **B4** said:<br>"I felt stressed when I did badly or wasn't very good, but I enjoyed it a great deal, and I enjoyed the diversity of the groups. I feel positive for myself…… I laughed a lot. And enjoyed it. Those are some of the things that I did as a group."<br>**B7** responded to B4 (B7's husband who diagnosed with Parkinson's disease), expressing that group support and adaptability to different levels are important:<br>"You felt like people understood B4's difficulties. And it didn't seem to matter. I have never heard B4 complain about that at all. He just felt very comfortable. And so, thank you to everybody, you know. I think |

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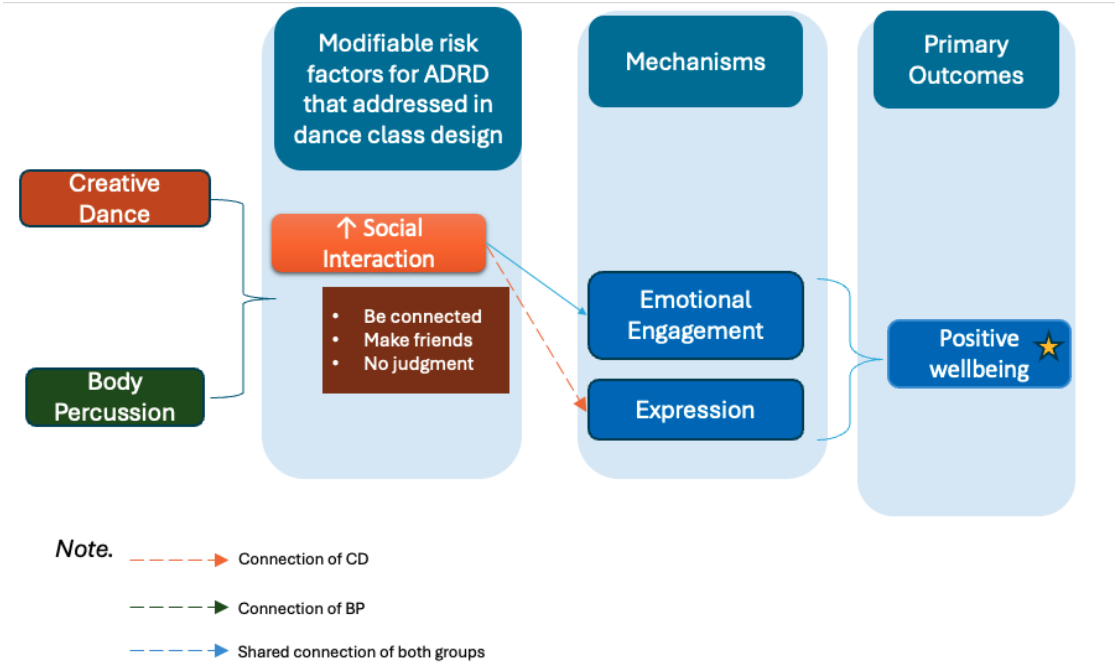
| | | | it was just a good area where all levels could enjoy it, but that repetition is extremely important for us, so I appreciate that." |
| | **Subtheme3: Making Friends** | **A9** spoke:<br>"I think before we came, (I) really didn't know what was happening. I told my husband that I wouldn't dance with others because I didn't know what (I) was gonna do. You know, once, it just seemed like everybody was having fun. I mean, our social life is pretty much around our family. We don't really go do things with other people. Because We barely got home from our trip and had to hop in the car and go to Phoenix. And our life revolves around our family. So we don't do a lot of things with other people except interact with our friends at church, so it was fun to know that I can still make friends."<br>Overall, a sense of newfound friendship and enjoyment derived from interacting with others in the class. Participant **A5** spoke to that idea, saying: "I really liked the camaraderie that developed over time, you know, the friendship, comfort, or ease? It just made it more fun to come to class." Participant **A8** added to the idea, saying: "Like, **A5**, would you say just the friendships that we developed and people to interact with? I would never have gotten to know any of you, and that is sure." The diversity of backgrounds among participants was also mentioned as a positive aspect of the friendship. Participant **A9** said: "We all came from different kinds of backgrounds." | |

Overall, both groups' participants expressed a sense of connection and enjoyment in interacting with others because they could be connected, make friends, and feel no judgment in the class. Observation data showed that CD group participants had more social interactions and verbal and nonverbal communication and were closer than the BP group in and out of the class. Social Interaction addresses the ADRD risk factors and has some overlapping codes of "Emotional Engagement," "Expression," and "Positive well-being." Figure 5-8 is an excerpt from the Study Conceptual Diagram (Figure 3-2), depicting potential specific factors through which CD and BP relate to social interaction based on the qualitative analysis results.

*Figure 5-8 Social Interaction Connections in The Study Diagram*



### *5.4.3. Three Mechanisms for Primary Outcomes*

The following qualitative results examined the mechanisms for the primary outcomes based on the Study Conceptual Diagram (Figure 3.2). The qualitative data shows self-efficacy, emotional engagement, and expression were the key mechanisms for positive well-being. The BP group had more evidence of self-efficacy improvement. Increased self-efficacy and decreased self-awareness and inhibition may be the factors that promote creativity in the CD group. Participants in both dance groups noted positive emotional engagement, enjoyment, and relationships with others in the class, and no apparent differences were observed between the two groups. in the BP class, not many participants felt personal expression. but the CD group showed the class helped them promote personal expression and communication.

#### 5.4.3.1. Self-efficacy

Self-efficacy is an individual's belief in their capacity and ability to complete a task or achieve a goal (Cherry, 2022) and people gain a sense of efficacy through gaining confidence. Self-efficacy is highly related to positive well-being, according to the qualitative analysis, since the quotes in the two codes (self-efficacy and Positive Well-being) overlapped a lot. At the beginning of the class, most participants in both groups experienced a feeling of uncertainty due to unfamiliarity with the dance form, performance anxiety, and self-awareness. However, these observations started to change in the second to third week. Both group members felt more confident and competent over time.

The CD group members looked more confident in expressing themselves and had better control over their bodies. Decreased self-awareness and inhibition and increased self-efficacy may be the factors that improve their creativity. However, there only are few quotes about self-

efficacy in the CD group. The participants' feedback and observations showed that the BP group had more evidence of self-efficacy improvement.

The BP group members shared much more regarding self-efficacy and gaining confidence and accomplishment. There were three sub-themes emerging under BP self-efficacy's main theme: "Boost confidence and accomplishment," "Class Structure Helped with Building Confidence," and "Mixed Feelings About Repetitive Elements." Table 5-12 presents the thematic quotes of self-efficacy for both groups.

#### *5.4.3.1.1. Subtheme 1 under Self-efficacy in BP: Boost Confidence and Accomplishment*

Participants acknowledged their individual learning curves and self-consciousness about their abilities compared to others but gained confidence in the accomplishments they have made in learning BP.

BP participants believed that the class helped them build confidence in their dancing abilities as well, which can be seen their responses to the survey questions. The BP class helped boost participants' confidence in dancing, particularly for those who felt uncoordinated or inexperienced, and the class was supportive and helpful in accommodating their pace.

#### *5.4.3.1.2. Subtheme 2 under Self-efficacy in BP: Class Structure Helped with Building Confidence*

There was a consensus among participants to introduce new steps earlier in the class, review the old movements, and then revisit new routines towards the end, allowing for a sense of accomplishment and satisfaction. The right pace and the right level of difficulty in the class can help participants feel a sense of accomplishment and satisfaction.

#### *5.4.3.1.3. Subtheme 2 under Self-efficacy in BP: Mixed Feelings About Repetitive Elements*

One participant expressed feelings of repetition in BP, which could feel monotonous over time. However, others appreciated the repetition as a means of building confidence and solidifying their learning. They found value in revisiting familiar movements, which allowed them to feel more confident and proficient in executing them. Additionally, some participants noted that repetition helped them remember and internalize the movements more effectively.

Overall, while there were differing views on the subjects, the consensus seemed to lean towards acknowledging the benefits of repetition in remembering the movement routine, enhancing learning outcomes, and building confidence, although with a recognition of the potential for monotony.

*Table 5-12 Thematic Quotes of Self-efficacy*

| | CD group | BP group |
|---|---|---|
| **Self-efficacy** | Participants mentioned feeling self-conscious about their abilities initially but gained confidence through practice and the supportive class environment. As a professional swimming athlete, **A3** shared that she gained confidence and self-efficacy over time in the CD class:<br>"I was nervous in the beginning; I was so self-conscious because of my background that I was doing everything right. And then it looked good. It took me about half the time. And [the instructor] | **Subtheme 1: Boost confidence and accomplishment.**<br>Participants noted progress in learning longer and more complicated dance routines, with increased confidence, fluidity, and memorization of steps over time. Participants acknowledged their individual learning curves and self-consciousness about their abilities compared to others but gained confidence in the accomplishments they have made in learning BP. As **B8** said:<br>"I'm in a chorus, and our creative director has chosen for us to do a couple of different songs that have body percussion. And they seemed so overwhelming when we started that it was just like, 'No, no, I am not going to be able to do it.' And I think this class, along with practicing with my other chorus members on those, I've really seen my ability to do it. I've actually volunteered to be one of the half dozen that's going to do the body percussion. And it was just a goal, and I think this did help give me that confidence that, okay, and I didn't have it at first, but I'm getting there each day a little better." |

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| | kept encouraging us, so thank you. All of a sudden, it became fun. And I stopped worrying about not balancing enough or doing something silly. It became much more comfortable. Part of that is due to the instructor, and you kept reinforcing that." | To answer the survey question "What went well for you?" **B9** wrote: "Comfortable with the new assignments." **B10** said: "Remembered most of the moves (class 20)" To answer the question "What do you feel you achieved?" **B10** said: "Confidence with movement (class 20)."<br><br>**B10** expressed how the class gave her confidence to dance in the interview:<br>"I am very uncoordinated. I've never been any good at dancing. And I was hoping this would be an opportunity for me to do simple dancing, you know, very straightforward. And it really was, and (the class) really gave me some confidence."<br><br>**Subtheme 2: Class Structure Helped with Building Confidence**<br>**B9** shared:<br>"When you are showing us something new, I just kind of "Oh, that didn't happen." the fact that we did the dance consistently, and usually, at the end of the class, I got to end on a happier and more familiar note, that I felt good. and we'd be doing the new thing again next time. And then, feeling a sense of satisfaction, and yet, to be able to hit it again the next time. So, yeah, I'd like that timing or that structure to the class."<br>**B8** responded: "Yeah, I agree with B9 100% that ending on something where we feel like we've been able to do it and yeah, a sense of accomplishment is a great way to end the class."<br>The right pace and the right level of difficulty in the class can help participants feel a sense of accomplishment and satisfaction, just as **B7** shared her thought:<br>"I thought it was just the right pace because you don't want it too easy. But you don't want it too hard. I think when someone uses the word sweet spot, you hit that just right. And we can get reinforced with what we have learned previously. And then we were ready to try something a little more difficult."<br><br>**Subtheme 3: Mixed Feelings About Repetitive Elements**<br>One participant, **B8**, expressed feelings of repetition in BP, which could feel monotonous over time: |

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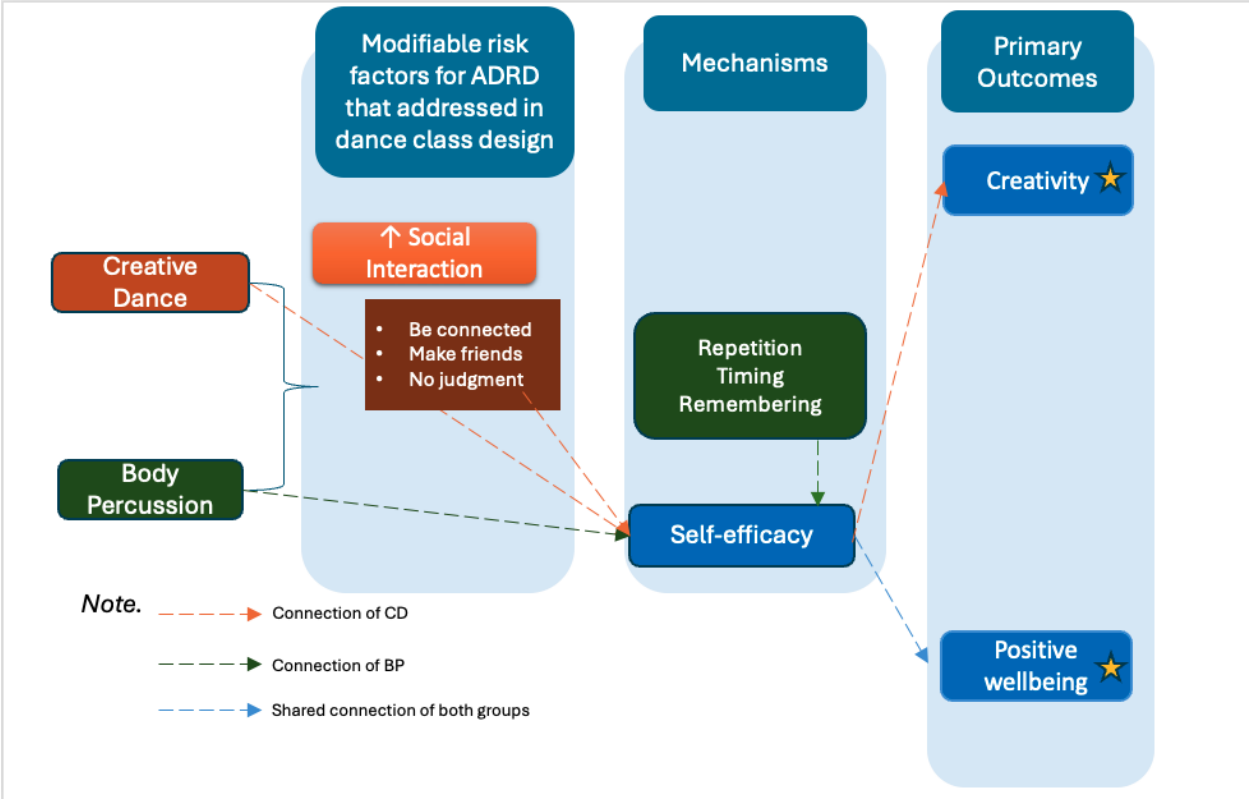
| | | "I guess my criticism would be that the one exercise we did where it was throughout the entire thing where we started with the, you know, touching and tapping and I mean, I found that as it as the weeks went on, that got kind of boring, even though it was difficult, you know, that you Okay, the first part was solid, pretty solid. But then there was always that at the end that was different. And it seemed I sort of dreaded having to do the whole thing all over again. Again, so it just kind of felt repetitive to me."<br><br>**B10** raised a different opinion than B8, saying:<br>"I have to say that I liked the repetition. I liked it when we came back to the same one that we learned from the beginning. Because finally, I can say, Oh, there's one I can do and easily. And actually, it wasn't that easy. I kept forgetting pieces. So, the repetition was very helpful with memory. And I liked how you actually changed it. For example, the beginning part stayed the same, but you changed the second part or the ending part. And so that kind of gave it a little more newness to it." Then B9 responded to B10, said: "I also like the repetition insofar as confidence and (it) help (with) memory. Even as recently as last night, yeah, I'm all set."<br>**B12** particularly acknowledged the importance of repetition in reinforcing learning and remembering, especially as we get older: "I agree with B10. Um, I think as we get older, repetition really helps you solidify in your brain—what and how to move." |

In conclusion, the qualitative data highlight the positive impact of the BP class on self-efficacy, including participants' confidence and sense of accomplishment. The supportive environment, structured progression, and repetition contributed to their memory of the movements and the self-efficacy they gained in BP group. Increased self-efficacy and decreased self-awareness and inhibition may be the factors that released creativity in CD group. Self-efficacy is a key mechanism to Positive Well-being in both groups. However, the connection between Self-

efficacy and Attention and Short-term memory is unclear. Figure 5-9 is an excerpt from the Study Conceptual Diagram (Figure 3-2), depicting potential specific factors through which CD and BP relate to self-efficacy connection based on the qualitative analysis results.

*Figure 5-9 Self-Efficacy Connection In The Study Diagram*




**5.4.3.2. Emotional Engagement**

Participants in both dance groups noted improved mood, enjoyment, and relationships with others in the class, and no apparent differences were observed between the two groups. Two subthemes are identified under emotional engagement: "Improved Mood & Enjoyment" and "Emotional Engagement Through Social Interaction." Table 5-13 presents the thematic quotes of emotional engagement.

***5.4.3.2.1. Subtheme 1 for Both Groups: Improved Mood & Enjoyment***

Both group members found the class fun, energizing, and a source of joy and improving their mood and well-being. Laughter was a prominent feature of both classes, with participants frequently mentioning how the opportunity to be silly and laugh with each other contributed to their enjoyment.

The CD group participants shared positive emotional engagement from their involvement in the classes. Initially, some expressed feelings of nervousness and self-consciousness, as mentioned in the "Positive Well-being" section earlier. However, as the classes progressed, they reported a shift towards enjoyment and comfort, attributing this change to the supportive atmosphere created by the instructor and fellow participants.

The emotional engagement in the BP class was also overwhelmingly positive. Participants expressed enjoyment, a positive mood, an energy boost, and a sense of upliftment throughout the sessions. They described feeling happy, comfortable, and at ease. They appreciated the supportive environment created by both the instructor and fellow participants, which allowed them to let go of inhibitions and have fun.

#### *5.4.3.2.2. Subtheme 2 for Both Groups: Emotional Engagement Through Social Interaction*

Participants appreciated the opportunity to interact and connect with others, finding enjoyment in partner and group dances and the laughter and joy that emerged from shared experiences. Participants felt positive and satisfied partially because of the social interaction of the group.

*Table 5-13 Thematic Quotes of Emotional Engagement*

| | **CD group** | **BP group** |
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| **Subtheme1: Improved Mood & Emotional Enjoyment** | **A9** shared her emotional enjoyment throughout the CD class:<br>"I thoroughly emotionally enjoyed every movement, watching the other participants enjoy themselves. I loved every part of it. It was very encouraging. And it made me feel good that everybody was partaking in the creative dance that we were doing. It was wonderful."<br><br>Many highlighted the therapeutic and emotional benefits they experienced, including improved mood and stress relief. For example, **A3** said: "I laughed a lot more as the class went on. I'm so serious, sometimes about what I'm doing, but they got to be like, oh, who cares? Just enjoy it and get along with everybody else. Enjoyable."<br><br>Other participants had similar positive comments in the survey, such as A1, who said: "The company's natural movements are fun," **A4**, who said: "Fun movements," and **A3**, who noted: "It was finally more relaxed!" In that same vein, **A5** enjoyed: "Being silly & playful," **A8** said: "I love this!", and A9 reported: "Had fun." | **B8** shared:<br>"I think I generally enjoyed the class, just it was fun. Very happy energy there. And I have to say, when we're driving home, especially in the evening class, I am always energized and kind of bouncing around in my car, you know, singing or something."<br><br>**B10** said: "It was really positive for me in a way that most exercises have not been. So my mood was always good."<br><br>**B9** added details: "When I was talking about being tired, you know, because of a work schedule and stuff. The class, without exception, did Energize. Whether it was the afternoon or even the evening class, because we were done at eight. And it bought me a good hour. So, good time, quality time."<br><br>**B2** shared: "All the laughter makes it fun."<br><br>In the survey responses, **B5** wrote: "Feel happy;" **B7** said: "It's enjoyable, fun & makes me smile;" **B9** said: "No stress, fun and satisfied. I always feel better at the end of class." **B6** wrote: "Very Happy." |
| **Subtheme2: Emotional Engagement Through Social Interaction** | In the survey feedback, **A4** noted: "lighthearted fun group." and **A1** said: "I truly enjoyed the group! The instructor is amazing!"<br><br>In the focus group interview, **A3** stated: "I liked the group dances because I felt like we were all one" and "A comfort level with others and with me." **A5** stated: "I would agree that I like to partner dance, and the group dance is more than just trying | **B7** shared: "I sure had fun and was laughing at how goofy I was …… I just loved he (her husband) enjoyed it and made me want to go." **B9** said: "There was a lot of giggling, so I guess that's communication. You were laughing with each other." **B10** said: "In the class as time went on, it was much easier to laugh with each other and ourselves. laugh with each other, not 'at' with each other." **B7** then shared |

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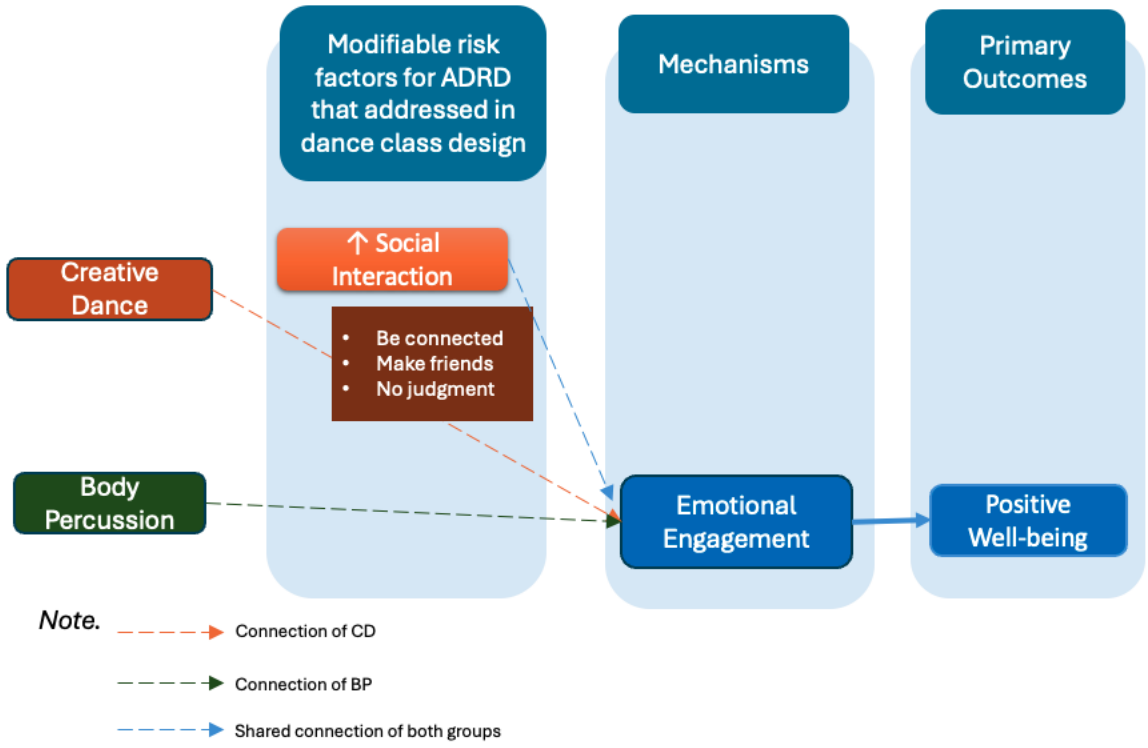
| | to figure it out on my own. I felt like I had partners in the struggle."<br><br>**A1** said:<br>"Talking about our sculptures we laugh continuously with those because we thought one way, and then the thoughts were different and that they made us happy though. They were exciting new additions from other people, and it was fun. Yeah, we could be anything we want to be and do anything we want to be. Yeah, so that was the fun part. Very creative. We could be very creative and laugh at each other. That's the best part." | more details about why people laugh a lot in the class:<br>"I noticed for myself it was I was much more at ease. And probably that's just because we got to know each other a little bit better. And so that I was laughing a lot. By the end, I didn't care. if I wanted to do a silly dance, I'll do a silly dance. And I felt very comfortable in the group and with myself. And I think the sense of humor, we were all in there together, we're all different levels. I think you could tell that it was having fun. And so, it made me more comfortable than leaving the class. Knowing that things that I don't do well just laugh about it, you know, it's okay. And I kind of got that from this class as well. That supports having fun with yourself, and who cares?" |

Overall, participants in both dance groups noted improved mood, enjoyment, and relationships with others in the class, and no apparent differences were observed between the two groups. Ultimately, the class was a source of joy and positivity for them, improving their mood and well-being. Emotional engagement overlapped a lot with the "Positive Well-being" and "Social Interaction" codes. Figure 5-10 is an excerpt from the Study Conceptual Diagram (Figure 3-2), depicting potential specific factors through which CD and BP relate to Emotional engagement based on the qualitative analysis results.

*Figure 5-10 Emotional Engagement Connections in Study Diagram*




#### 5.4.3.3. Expression

Due to the nature of repetition movement routines in the BP class, not many participants felt personal expression. In contrast, participants in the CD group showed the class helped them overcome inhibitions, promote personal expression, and improve communication. The participants expressed a journey of self-expression and understood within the group dynamic. Participants appreciated the supportive atmosphere created by the instructor and fellow classmates. They felt encouraged and understood, even when facing challenges or difficulties in expressing themselves.

This sense of self-expression occurred because people experienced the “Freedom of Expression,” “Embraced Imperfection,” and “Felt Supported,” which are the three subthemes

under “expression” in the CD group. Table 5-14 presents the thematic quotes of expression in the CD group.

*Table 5-14 Thematic Quotes of Expression*

| Expression | CD group |
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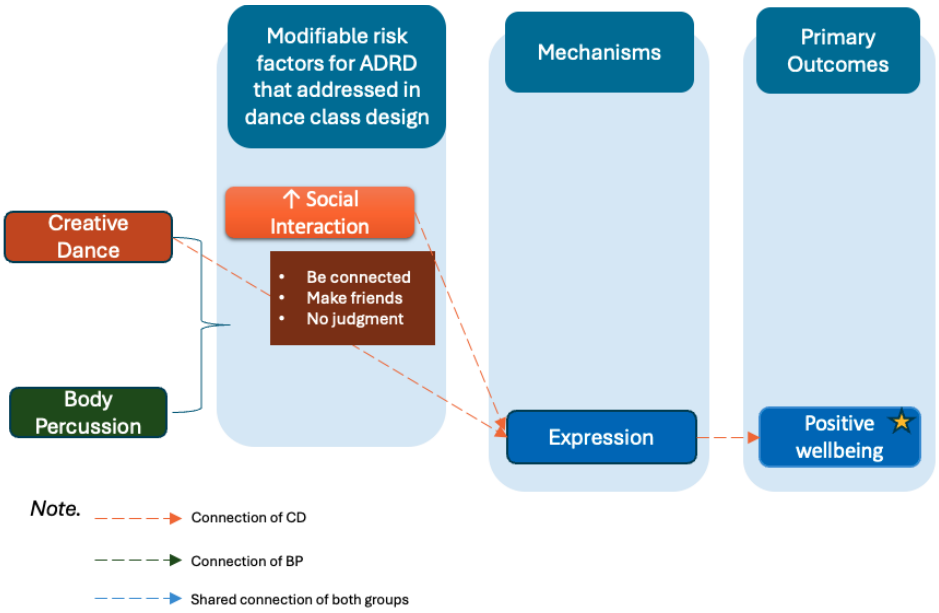
| **Subtheme 1: Freedom of Expression** | The class provided a space for participants to express themselves through movement without feeling pressured or being judged. To respond to the survey question “What do you feel you achieved?” **A3** responded: “Freedom of movement.” **A8** wrote: “Better cognitive expression.” To answer the survey question, “What went well for you? **A5** said: “Free dance at the end - This was lots of fun but didn’t force me to think like a structured exercise.” **A8** talked in more detail about freedom of expression in the focus group interview:<br>“I think I was born goofy. A Human that I've ever known was extremely funny and cute…I think what I've learned through the class is not to be quite so well……If I make a mistake here. It's okay. I can correct myself……I think the class helped you with that because we had to pay attention and still be free to do whatever we wanted. And not be judged. That was good, and I could see how being hesitant at first and thinking about, oh, am I goofy? No, I'm good. I'll be goofy tomorrow.”<br>They enjoyed the opportunity to explore and experiment with different movements and gestures, just as **A9** said: “I also remember the drawing parts everybody interpreted differently. The interpretation and the way you use movement to express it are very different. That was Fantastic.” |
| **Subtheme 2: Embracing Imperfection** | Embracing imperfection helped participants overcome Inhibition. **A3** said: “I was less inhibited.” Initially, participants felt self-conscious and awkward. Through laughter and shared experiences, participants learned to embrace imperfection and let go of inhibitions. They gradually became more comfortable, embracing silliness and playfulness and enjoying expressing themselves freely as the sessions progressed. To respond to the survey question: “What went well for you?” A5 said: “Being silly & playful." **A8** said: “It has been wonderful having a place to act silly!” They found joy in being themselves and expressing their individuality within the group setting. |

| | |
|---|---|
| **Subtheme3: Feeling Supported** | **A9** said: "I was thinking that sometimes, when we had to come up with a move for everybody else to do, I just couldn't think of anything, but I didn't feel pressured that I had to come up with an idea." Interacting with others in the class was both challenging and rewarding. Participants learned to communicate and connect with each other, fostering a sense of being heard, seen, and understood, as **A5** shared:<br>"Initially, it was a little bit of a challenge for me to interact with S (who was not part of the study but joined the classes. She was diagnosed with dementia). I know she's not part of the study, but, you know, trying to figure out how much she could comprehend. And so, communication with her in terms of being able to express myself and feeling heard or understood was sometimes a challenge until I just kind of relaxed about that a little bit and realized, you know, that her capacity. It was somewhat diminished in that regard. But I felt comfortable talking with everyone else. I hope I listened when people said things to me. I certainly felt listened to and understood by the other participants." |

Overall, the CD class provided a platform for participants to express themselves authentically, feel heard and understood, and build connections with others in a supportive and encouraging environment. Figure 5-11 is an excerpt from the Study Conceptual Diagram (Figure 3-2), depicting potential specific factors through which CD and BP relate to Expression based on the qualitative analysis results.

*Figure 5-11 Expression Connections in Study Diagram*



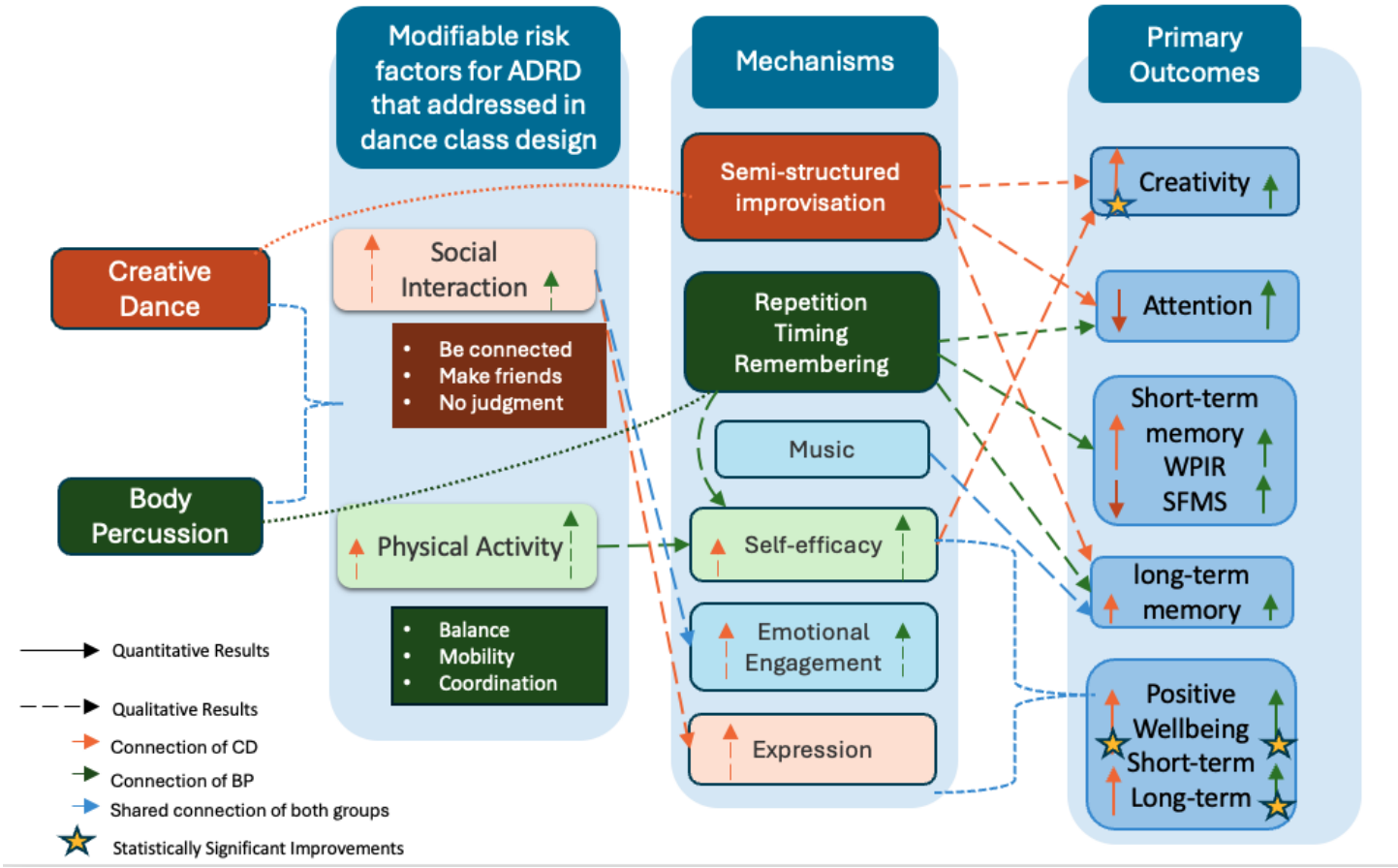
# Chapter 6 Discussion

## 6.1. Updated Study Conceptual Diagram Based on Results

In this study, I have compared the effects of Creative Dance (CD) and Body Percussion (BP) on attention, short-term and long-term memory, creativity, and positive well-being for older adults living with mild cognitive impairment (MCI), which are important cognitive and psychological health factors among this population. Furthermore, this study explored the potential mechanisms of how and why the dance intervention impacts participants and leads to the results.

According to the quantitative and qualitative results and discussion, I updated the study conceptual diagram from Figure 3-2 to Figure 6-1, which developed from the Arts & Culture in the Public Health framework (Golden et al., 2024). In the diagram, solid arrows represent the quantitative improvements, and longer arrows mean more improvements than shorter ones. The dotted arrows show the qualitative results. Stars represent statistically significant improvements. Orange represents Creative Dance connections, green represents Body Percussion connections, and blue represents shared connections for both groups.

*Figure 6-1 Updated Study Conceptual Diagram Based on Results*




In the primary outcomes measured in this study, the CD group significantly improved and was significantly better than the BP group in creativity. Both groups significantly improved short-term (before and after one-hour class) Positive Well-being, and the BP group also significantly improved long-term (ten weeks) positive well-being. Besides Attention and SFMS declined in the CD group, other measurements improved in both groups but were not statistically significant within and between groups. The qualitative data showed that the BP group improved Attention, Short-term memory, Physical benefits, and Self-efficacy more than the CD group. The CD group improved social interaction and personal expression more than the BP group. There were no obvious differences in emotional engagement between the two groups.

Among the mechanisms for the primary outcomes, semi-structured improvisation is the key factor for significantly improving creativity, which also triggers attention and long-term memory in the CD group. Timing, remembering, and repeating in the BP group are the potential key factors for improving attention and memory. Music is an important factor that triggers long-term memory in both groups. The qualitative results showed that self-efficacy, emotional engagement, expression, and social interactions contribute to Positive Well-being. Self-efficacy is important to creativity in the CD group, as increased self-efficacy and decreased self-awareness and inhibition may be the factors that released creativity in the CD group. The supportive environment, structured progression, and repetition contributed to their memory of the movements and the self-efficacy they gained in BP group.

Among the connections between the modifiable risk factors of dementia and the factors of mechanisms, social interactions benefit emotional engagement and expression, while physical benefits promote self-efficacy. In both groups, participants express a sense of connection and enjoyment in interacting with others because they can be connected, make friends, and feel no judgment in the class. From observation, participants in creative dance had more social interactions and verbal and non-verbal communication and were closer than the body percussion group in and out of the class. Both groups improved balance, mobility, and coordination, which were perceived as physical benefits. However, more BP group members reported achievements in physical benefits.

### *6.1.1. Attention/Reaction Time*

Attention and reaction time functions are vital in detecting and responding to environmental hazards, such as obstacles, uneven surfaces, or moving objects. Individuals with

MCI or Alzheimer's disease and related dementia (ADRD) often experience impairments in attention and slower processing speeds, making them less aware of potential dangers and slower to react, thereby increasing their risk of falls and accidents. For older adults with MCI or ADRD, maintaining or even improving attention and reaction time can keep cognitive engagement, contributing to a better quality of life.

Reaction time (RT) is a way to measure Attention. In this study, the quantitative results showed the BP group improved reaction time, but the CD group declined, though there were no statistically significant differences within or between the two groups. Qualitative data revealed that participants in the BP group showed improvements in attention, supported by observation of faster acquisition of new movements and many opportunities to practice attention or reaction time. This result may indicate a better potential for the choreographic dance that requires timing and beats in movements to improve attention and reaction time, which matches those observed in prior studies. Naranjo et al. (2023) and Lazarou et al. (2017), who used choreography as an intervention, also found statistically significant improvement in attention. Kimura and Hozumi (2012) investigated the reaction time of two styles of aerobic dance exercises on executive cognitive function: freestyle (FR) and combination style (CB) - a choreographic repetitive routine among older adults. The study found that the CB group's switch cost (the difference between the RTs under the repeated and switch conditions, which was used as an indicator of computational speed in the brain circuit) became significantly smaller compared to the FR group between pre- and post-exercise, despite participants in both programs performing the same dance elements at the same exercise intensity. Switch cost is another measurement of reaction time. In my current study, I used the reaction time by clicking a ball appearing on a screen to measure

reaction time, which is a more straightforward test. But we also acknowledge a difference between fine and gross motor skills. Clicking a ball appearing on a screen is more for fine motor skills. The future studies may test the reaction time on gross motor skills.

Even though the study conceptual diagram's three mechanisms (self-efficacy, emotional engagement, and expression) didn't show connections to attention, the qualitative data explained why body percussion improves attention/reaction time better. The focus group and observation noted that body percussion requires specific timing and beats with body parts, which may help with attention/reaction time. To respond to the timing and changing movement, people have to be focused on the beats and movements and try to react as fast to follow the beats.

The observed improvement can be attributed to the motor-cognitive dual-task theory (Bayot et al., 2018), which involves performing two independent tasks simultaneously. This approach has proven effective in enhancing cognitive function, including attention (Hamacher et al., 2015; Mancioppi et al., 2021; Murillo-Garcia et al., 2021). In the body percussion intervention, participants engaged in cognitive tasks while dancing, such as counting, naming the body parts they were moving, or taking turns as a group leader to guide the next move. The eight-point in-plane exercise, specifically highlighted for its benefits in attention and brain-body coordination, requires visual-spatial skills, timing, motor skills, and vocalizing numbers in rhythm. These cognitive tasks also demand synchronization with the timing and beats, which aligns with the motor-cognitive dual-task theory and explains the BP group's improvement in attention and reaction time. Additionally, other arguments suggest that physical activities enhance cognition by promoting neural plasticity (Hertzog et al., 2008).

Attention and reaction time are crucial components of sequence learning (Clegg et al., 1998), which involves understanding and remembering a series of steps or actions. The sequence learning was engaged in the BP group throughout the class. Attention is necessary to focus on each sequence movement, ensuring that individuals accurately perceive and process the order of actions or information. Smoother transitions between movements in the BP dance routine require faster reaction times.

Embodied cognition (Foglia & Wilson, 2013) suggests that our thoughts, decisions, and understanding are deeply linked to our bodily interactions with the environment. Attention and reaction time are critical in how the body and mind work together to perceive and interact with the environment. It reflects how quickly an individual can respond to environmental stimuli, integrating sensory input with motor output. Faster reaction times can improve embodied cognition by allowing more immediate and accurate adjustments to physical movements or environmental changes.

Although the present study showed less impact on reaction time and attention in the creative dance group, participants still experienced some exercise challenges or engaged their attention. Still, they were not sure about the improvements in the qualitative data. Other work has seen more creative dance interventions make a difference in this area. Coubard et al. (2011) showed that a contemporary dance intervention with an improvisational approach improved switching attention, using rule shift cards to test attention. The rule shift cards test has two conditions. In condition 1, participants need to respond “Yes” to a red card and “No” to a black card. In condition 2, participants had to respond “Yes” if the card was the same color as the previously displayed card and “No” if it was a different color. Responding following the first rule

in condition 2 resulted in a switch error. They measured the switch error rate of failure in switching items and the execution time of condition 2. The author argued that the mechanism of their result was the improvisational approach, which facilitated participants' discovery of their body movement potential through experience and sensations, determining infinite possibilities of perceiving and acting. This phenomenon, as described by Coubard et al. (2011) results and discussion, may explain the qualitative results in the CD group, where despite a decline in the RT test, participants still experienced challenges that engaged their attention but were not sure about the improvement. As we are working with a population who experience chronic cognitive decline, we do not always expect improvement in outcome measures.

### *6.1.2. Short-Term Memory*

Short-term memory is important for older adults with MCI or ADRD because it is critical in maintaining independence, everyday functioning, safety, and activities that need to be completed shortly, such as taking medications, turning off the stove, or locking the door. In people with MCI or ADRD, impairments in short-term memory can make it challenging to learn new skills or remember new experiences.

In this study, I hypothesized BP would be better in short-term memory. However, it is partially true according to the quantitative and qualitative data, which shows the BP group has more potential only in visual-spatial short-term memory growth than the CD group, even though changes were not statistically significant within or between the groups in this study. Spatial forward memory span (SFMS) scores increased by 30% in the BP group while declining by 15.8% in the CD group. It is probably because the BP class requires pat, tap, and clap in specific spatial locations, such as the "Eight points in planes" practice mentioned in 5.2.1.2. In the CD group, one

session theme was about directions and spatial exploration, such as up-down, left-right, front-back, and diagonals. However, the directions and spatial exploration were not as detailed and specific as the BP group required, as CD encourages free movement. In addition, the BP group engaged the spatial location with movements in every class throughout the ten weeks. However, in the CD group, only one session theme was about directions and spatial exploration. This allowed the participants to develop the spatial awareness and movement vocabulary.

I am surprised to see the average Word pair immediate recall (WPIR) improved by 32.2% in the CD group, more than the BP group's improvement by 13.4%, as SFMS declined in the CD group to be short-term memory as well. WPIR improvements were noted in both groups in the quantitative data, even without statistical significance within and between groups. It is hard to explain why the CD group improved in WPIR more than the BP group in this study, which is not predicted as my hypothesis since the CD group was not required to remember any movement routines like the BP group. However, a meta-analysis examining 525 correlations from 79 studies datasets found a significant correlation between memory and creative cognition. "But semantic memory – particularly verbal fluency, the ability to strategically retrieve information from long-term memory – was found to drive this relationship (Gerver et al., 2023)." This meta-analysis may explain why the CD group improved word-pair memory as it connects with semantic memory, and the CD group significantly improved creativity and showed more long-term memory engagement.

The literature shows evidence in favor of the choreographed group for short-term memory. A study comparing choreography and creative dance in 6-7-year-old children showed that the choreography-dance group improved short-term working memory capacity more than

the creative dance group but without a statistically significant difference (Rudd et al., 2021). In that same vein, a systematic review and meta-analysis (Wu et al., 2021) included seven choreographic dance interventions that showed the overall positive effects on memory, which was significantly improved.

Though the study conceptual diagram's three mechanisms (self-efficacy, emotional engagement, and expression/being heard) didn't show any connections to short-term memory, the requirement of remembering new pieces of movements, timing, and repetition in BP classes engaged with the motor-cognitive dual-task (Bayot et al., 2018) and enhancing neural plasticity(Hertzog et al., 2008). These theories can also explain the improvement in short-term memory in the BP group, which proved to be an effective way to improve cognitive function (Hamacher et al., 2015; Mancioppi et al., 2021; Murillo-Garcia et al., 2021).

Some choreographic dance intervention studies showed significant short-term memory improvement with more frequent classes over a longer period of time. Kropacova et al. (2019) found a significant improvement in short-term memory after a six-month (three times/week) choreographic dance intervention. Zhu et al. (2018) noted a significant improvement in short-term memory after a three-month choreography routine (three times/week) involving people with MCI memorizing complex movements. Other longer choreography interventions showed significant improvement in short-term memory after 12 weeks of sessions (Bisbe et al., 2020; Qi et al., 2018) and 10 months of international Ballroom Dancing Intervention (Lazarou et al., 2017). These choreography interventions required participants to remember movements like those in the body percussion group of the present study. This may indicate that the intervention needs to last at least three months at a frequency of three times per week to be effective.

### *6.1.3. Long-Term Memory*

Even though long-term memory is often less affected in the early stages of cognitive decline, long-term memory plays a vital role in maintaining identity, independence, social connections and relationships, emotional well-being, and quality of life for older adults with MCI or ADRD. Even when other cognitive abilities decline, preserving long-term memory can help mitigate some of the challenges associated with cognitive impairment and contribute to a more positive and engaging life experience.

In this study, quantitative results showed slight improvements in long-term memory in both groups without significant differences. Qualitative Results showed that both groups recalled long-term memories of their personal lives from the old music in the classes. Musicians and scholars have widely explored music and long-term memory connections (Halpern & Bartlett, 2002; Peck et al., 2016; Simmons-Stern et al., 2012). Music contributes to constructing autobiographical memories throughout life by giving these specific recollections a deep emotional and personal significance. This result informs dance instructors to pay more attention to collecting information and asking for participant feedback on choosing music in dance classes for older adults.

The CD group had more creative and personal recollections and old memories triggered by the prompts. These results are consistent with a study (Holmes, 2015) showing that creative dance presented positive findings on long-term memory and the participants “uncovering hidden memories and learning new things” through creative dance. Little quantitative study about dance in Personal Recall long-term memory was found in the current literature.

### *6.1.4. Creativity*

Creativity often involves problem-solving skills, decision-making, and mental flexibility planning. This cognitive stimulation can help keep the brain active and engaged, potentially delaying cognitive decline. Creative expression can also give caregivers valuable insights into the thoughts, feelings, and preferences of older adults with MCI or ADRD, helping them personalize care and better understand their emotional needs. Creativity offers a holistic approach to supporting older adults with MCI or ADRD by enhancing cognitive function, emotional well-being, and social engagement while fostering a sense of identity, purpose, and dignity.

Results in the present study are consistent with the hypothesis that the CD group would have a stronger potential to improve creativity than the BP group. According to qualitative data, the CD group participants became more comfortable with the environment and developed their own movements and more creative interpretations of the prompts over time. They liked the process of creating dance moves and the desire to be original rather than imitating others. Participants highlighted the CD class promoted playfulness, fun activities, confidence, and comfort in the environment in the class, allowing them to release self-consciousness and then promote creativity.

Similar results were reflected in an experimental study of creative dance among college students (Richard et al., 2024). The results demonstrated that creative dance significantly affected creative self-efficacy, ideational behaviors (e.g., “like to play around with ideas for the fun of it”), tolerance to ambiguity, and improved emotional creativity (Richard et al., 2024). Another experimental study presented that improvisational dance positively affects innovative thinking and creative ability, and limited improvisation dance or semi-structured improvisation

(limiting the basic conditions such as theme, body part, shape, or music) had a more significant effect than unlimited improvisation (Dou et al., 2021). It's worth mentioning that the creative dance intervention in this study was semi-structured improvisation with a theme in each class, including forms, shapes, spaces, timing, forces, music, visual design, storytelling, and so on as prompts, instead of unlimited improvisation. The details of creative dance teaching material refer to Chapter 4.3.1.

The qualitative results of Richard et al.'s (2024) the study also match the present study, which shows that creative dance expands a person's possibilities to express ideas and emotions through body movement and that self-efficacy, confidence, and comfort in the environment are important for participants to express themselves freely.

### *6.1.5. Well-being*

Promoting well-being is vital for older adults with MCI or ADRD because it enhances their quality of life, supports cognitive and emotional health, fosters independence and social connections, and helps them adapt to the challenges associated with cognitive decline. Positive well-being benefits the motivation to keep engaging in dance interventions and potentially change long-term behavior and daily functions. Focusing on well-being can help these individuals live more fulfilling, meaningful, and enjoyable lives and benefits caregivers and healthcare providers.

The qualitative and quantitative data in this study align well with well-being, indicating that both dance styles effectively improve participants' positive well-being (PW), which includes six items: Active, Alert, Enthusiastic, Excited, Happy, and Inspired. This is consistent with the results of many systematic review studies about dance and well-being for all age populations (Bai

et al., 2022; Koch et al., 2014; Sheppard & Broughton, 2020), especially in the psychological and cognitive aspects.

The qualitative results showed that positive well-being is related to self-efficacy, emotional engagement, expression/being heard, and social interactions, consistent with other studies exploring dance and well-being. A systematic review of 24 papers(Chappell et al., 2021), which included an in-depth analysis, found seven interrelated contributors to the benefits of dance to well-being: self-worth, affective responses, embodiment, identity, belonging, aesthetics, and creativity. Among them, self-efficacy parallels self-worth, emotion and expression parallels affective responses, and social interaction corresponds to identity and belonging.

#### *6.1.6. Other Benefits*

The qualitative data shows that both groups improved physical activity and social interaction, which are modifiable dementia risk factors, although in different manners. The BP group reported more evidence of physical benefits, especially in balance, coordination, and mobility, whereas CD participants had more social engagement. Future studies may measure whether body percussion or other choreography brings more physical benefits than creative dance or improvisation. Future studies may also explore what made creative dance bring more benefits to social engagement. It is worth exploring whether combining the advantages of the two types of dances would bring more health benefits for older adults with MCI.

### 6.2. Reflection on the Interventions

I learned valuable lessons from teaching these two intervention classes, which would be helpful to other instructors who will offer dance classes for older adults at risk for dementia.

### *6.2.1. Emotional Support in The Class*

The emotional support from the instructor of the first several dance classes for older adults with limited experience of the dance type is essential. Both group participants reported performance anxiety in the early stage of the intervention, especially in the CD group, which had more self-consciousness and hesitated to move their body freely. Participants need to develop enough trust in the environment to express themselves freely in creative dance. The creative group had higher attrition in this study. It is important for the dance instructor to provide more emotional support, create a non-judgmental environment, provide more interactive and simpler guidance, and encourage those new to creative dance to build trust and the willingness to express themselves. Copying and mirroring movement is a common approach to building trust and creating empathy in dance/ movement therapy (McGarry & Russo, 2011). Reduced performance anxiety, self-awareness, and inhibition significantly lead to creativity and positive well-being. Some people naturally don't get used to freely moving their bodies and showing their expressions to strangers, which may be one of the reasons that the CD group had higher attrition. Most participants said that performance anxiety was gone after the second and third weeks, and they enjoyed the class. Still, it may take longer for more introverted participants with more inhibition. In addition, the CD group offered an opportunity to expand their movement vocabulary, and I kept encouraging participants to find unique and different ways to move their bodies. This is important to promote creativity and mobility.

### *6.2.2. Privacy In the CD Group*

The group's privacy is also essential. In one creative dance class, a facility member requested to use a corner of the dance room for workouts. Since I had an agreement with the

facility that the facility member could join the class without being in the study as they provide the dance room to the study for free, I agreed for the facility member to use a corner of the dance room. However, after that class, one participant told me she was uncomfortable that an "outsider" of the group was in the dance room. After that class, the participant quit the study for reasons related to family affairs. But I feel that her discomfort also played a part in her quitting. So, I learned that keeping the group's privacy is essential in creative dance.

### *6.2.3. Balance Between Repetition and New Elements in the BP Group*

The BP group felt stressed if they couldn't remember the movement. In the body percussion intervention, balancing repeating the old routine and adding new elements is crucial. Repetition helps participants remember the routine and gain confidence. However, too much repetition may lead to a tedious feeling. New elements trigger attention and short-term memory but may lead to performance anxiety. In addition, group participants were at different reaction time, memory, and coordination levels. My strategy to balance this dilemma was carefully observing participants' progress and developing two difficulty levels. Fast learners would do advanced movements based on the basic routine. The participants could choose to do advanced or basic movements.

### *6.2.4. The Structure of The Class*

I structured each class into three segments: individual dance, partner dance, and group dance. Many of the partner and group interventions are based on Social Cognitive Theory(Schunk & Usher, 2012), which emphasizes learning in a social environment. According to this theory, individuals are active agents who both influence and are influenced by their surroundings. The individual-partner-group structure was designed to enhance group members' social interaction,

self-efficacy, and motivation. The theory identifies key motivational processes, including goal setting, self-evaluation of progress, outcome expectations, values, social interactions, and self-efficacy. Individuals are motivated to act under their values and pursue desired outcomes.

Participants appreciated having the opportunity to learn and feel comfortable with the movements individually before progressing to dancing with others. Subsequently, partner and group dance activities fostered emotional engagement and social cohesion. Social interactions provided valuable feedback on learning and goal attainment. Thus, the individual-partner-group structure was an effective model for classes targeting older adults with MCI.

#### *6.2.5. The Role of Music*

As I mentioned in the session 4.3. Dance Interventions, in this study, the original teaching materials don't use accompaniment music. However, I found it beneficial to use music in the intervention classes for older adults with MCI. First, the old music can bring participants' life memories that they may share with the group, which not only triggers their long-term memory but also promotes social connection and emotional engagement. As the class went on, I asked them about their music preferences and considered balancing the different cultural influences of the music to adjust the music playlist.

In addition, in the CD class, the music can help participants understand the quality of the movement or the practices. For example, I can find the same quality of music to help the movement contrast, such as "slow and fast," "light and heavy," "circle and triangle," or have sound effects to stimulate the imagination, such as "travel in a jungle," or "travel to outer space." The music is another layer of stimulation besides the verbal requests.

Furthermore, I used old songs with steady beats and some percussive music without lyrics to support the BP beats. The music helped the BP group keep in the rhythm and beat. I believe it's very helpful for beginners who lack the sense of beats.

### *6.2.6. Combining The Advantages of The Two Dance Types*

It is worthwhile to develop a dance intervention combining the advantages of the two dance types: not only the outcomes presented in this study but also the different feelings brought to people. As the classes progressed, I had the impulse to combine the advantages of the two dances. Creative dance fosters creativity, emotional engagement, self-expression, and social interaction better. To apply this finding, Instructors might incorporate creative dance during warm-ups to energize participants, promote enjoyment, and help new members quickly feel at ease and connect with others. This approach is also well-suited for situations requiring enhanced creativity, emotional expression, and interaction. However, participants may need more time to become fully comfortable, express themselves authentically, and establish deeper connections with others.

In contrast, choreographed routines (BP) show greater potential for improving attention, visual-spatial short-term memory, and physical benefits. To apply this finding, instructors may use choreographed routines to support individuals or groups who need to enhance these specific factors. Additionally, choreography offers a structured option for participants struggling to independently generate new movement ideas.

Here are some ideas for combining approaches that may maximize participants' health outcomes, blending each method's strengths for a more holistic impact. For example, the semi-structured improvisation warm-up can make people enlightened and active in a fun way. The

“eight-point clock” tap and clap challenges participants’ motor-cognition. One way to combine the advantages of the two dance types is to start with improvisation, picking up one movement from each participant, connecting their movements in a sequence, and repeating them. The other way is to start with a repetitive choreography routine and turn part of the movement into improvisation. For example, make footsteps follow a choreography routine and make the upper body free movements.

**6.3. Limitations and Future Study**

Even though this mixed-method experimental study with two-arm randomization reveals many valuable results, there are still limitations. First, the small sample size and low diversity limit the generalizability of this study. A larger sample size with more diverse participants is needed for future studies. Another limitation of the study is the higher attrition in the CD group, which lost five participants, as compared to the BP group, which only lost one. The main reasons for dropping out and not finishing 75% of classes were health issues, family affairs, travel, time conflicts, and forgetting classes. Performance anxiety and self-consciousness might be the factor for higher attrition in the CD group. The five individuals dropped out or stopped coming to class on session 1, 3, 8, 8, and 9, respectively, which was half of the CD group members. In contrast, the one individual whose data was not used in the BP group kept coming until the last class but missed over 5 courses in the middle. Then she didn’t finish 75% of the class.

Third, even though I tried to avoid bias as much as I could, and only the research assistants did the quantitative data collection, I couldn’t blind myself as an intervention teacher, qualitative data collector, and data analyst at the same time in my dissertation study, which may lead

unaware bias. However, I also found the benefits of combining roles. I can reflect more on the dance intervention classes while doing data analysis than just teaching the class.

Future studies are warranted in several areas. For example, some past studies tested delayed recall (recall after 30 minutes) in their dance interventions as one of the memory tests, and participants showed significant improvement (Bisbe et al., 2020; T. Doi et al., 2017; Kropacova et al., 2019). Delayed and immediate recall significantly impact people's daily lives, giving us a comprehensive understanding of memory. However, only immediate recall was measured in the current study. Thus, delayed recall is worth testing in future studies.

Unexpectedly, the CD group showed more improvements in word-pair short-term memory than the BP group, but the CD group declined in visual-spatial short-term memory. This observation highlighted the correlation between semantic memory and creativity in previous literature. Future studies may explore whether creative dance can promote semantic memory through creativity stimulation.

Future studies may apply more measurements. For example, participants mentioned physical benefits in the focus group interview, such as Balance, Mobility, and Coordination. It would be nice to measure these differences in physical benefits between the two groups in a future study. Future studies may measure the effects of two dance types on other modifiable risk factors for ADRD, such as depression, hypertension, obesity, and diabetes, besides social interaction and physical activity. Future studies should also explore the potential of online class interventions. This is particularly important given that older adults may face challenges commuting to in-person classes due to declining physical and cognitive function and reduced independence.

Furthermore, as mentioned before, exploring whether an intervention combining improvisation and choreography would lead to better results in preventing ADRD in older adults is worthwhile. As many pharmacological treatments develop, it may be worth exploring whether combining the non-pharmacological intervention (dance) and pharmacological treatments would have better health effects for People living with MCI and ADRD and if the non-pharmacological intervention may mitigate the side effects of the pharmacological treatments.

## Chapter 7 Conclusion

This experimental mixed-methods study provides preliminary but solid evidence of the different impacts of improvisational dance (creative dance) and choreographic dance (body percussion) on participants with Mild Cognitive Impairment (MCI). Using dance interventions, this study explored important preventative factors for Alzheimer's Disease and Related Dementia (ADRD) and their potential mechanisms.

The primary outcomes addressed research question 1: what are the different effects of creative dance (CD) and body percussion (BP) on attention, short-term and long-term memory, creativity, and positive well-being for older adults living with MCI? The CD group showed a significant improvement in creativity ($p = .05$), with greater gains compared to the BP group ($p < .05$). Both groups experienced a significant increase in short-term positive well-being after the 1-hour class ($p < .001$); however, only the BP group demonstrated significant long-term improvement over ten weeks ($p < .05$).

Although the quantitative data did not reveal statistically significant differences in other areas, qualitative results indicated that the BP group showed improvements in

attention/reaction time, visual-spatial short-term memory, physical benefits, and self-efficacy compared to the CD group. On the other hand, the CD group reported more experiences that enhanced social interaction and personal expression. These findings highlight the need for further research with larger sample sizes.

Creative prompts (e.g., images, stories, sounds) appeared to stimulate long-term memory in the CD group. At the same time, the BP group benefitted from repetition in long-term memory. Music played a key role in triggering long-term memory for both groups. Additionally, both groups showed signs of improvement in word-pair memory and emotional engagement, with no notable differences in emotional involvement between the two groups.

The secondary outcomes addressed research question 2: What are the potential mechanisms by which dance intervention affects well-being, and how and why do the interventions lead to the results? The qualitative results showed that self-efficacy, emotional engagement, expression, and social interactions contributed to positive well-being. Semi-structured improvisation significantly improved creativity in the CD group. Remembering, timing, and repeating the movements in the BP group were potentially vital factors for improving attention and memory.

This study examines the strengths and limitations of two dance approaches for older adults with mild cognitive impairment (MCI), aiming to prevent or delay the onset of dementia. The findings have the potential to enhance the quality of life for individuals living with MCI while informing public health efforts in ADRD prevention and well-being promotion.

Moreover, the results offer valuable guidance for dance instructors, enabling them to design programs that better address participants' needs. Creative dance is more effective in

fostering creativity, emotional engagement, self-expression, and social interaction. Instructors can use creative dance to energize participants, enhance enjoyment, and help new members feel comfortable while building connections with others. This approach is particularly beneficial in settings where creativity, emotional expression, and interaction are priorities. On the other hand, choreographed routines (BP) are better suited for improving attention, visual-spatial short-term memory, and physical fitness. Instructors can use choreographed routines to support individuals aiming to develop these specific skills. Moreover, choreography provides a structured framework that can benefit participants who initially find it challenging to create new movement ideas independently.

Importantly, the benefits observed in both creative and choreographic dance suggest that a combined approach may maximize participants' health outcomes, blending each method's strengths for a more holistic impact.

# Appendices

**Screening Survey**

Please answer the following questions to see if you are a good match for the study:

1. Age (years)_____

2. Gender
☐ Female
☐ Male
☐ Other Please specify _____
☐ Prefer not to answer

3. Ethnicity

☐ Hispanic or Latino
☐ NOT Hispanic or Latino
☐ Unknown / Not Reported

4. Race
☐ American Indian/Alaska Native
☐ Asian
☐ Native Hawaiian or Other Pacific Islander
☐ Black or African American
☐ White
☐ Unknown / Not Reported

5. Are you able to read and speak English and sign a consent form?
☐Yes
☐No

6.Are you taking medicine to treat cognitive impairment?
☐ Yes
☐No

7. Do you have enough visual and auditory acuity to properly be able to follow group physical sessions?
☐Yes
☐No

8. Can you independently walk for at least 10 meters (33 feet)?

☐Yes
☐No

7. Do you have severe cardiovascular disease (e.g., heart or respiratory insufficiency)?
☐ Yes
☐ No

8. Are you clinically diagnosed with?
☐ Mild Cognitive Impairment
☐ Dementia
☐ None of them
☐ I don't know

9. Clinical Dementia Rating

Subject Initials _____

# CLINICAL DEMENTIA RATING (CDR)

| CLINICAL DEMENTIA RATING (CDR): | 0 | 0.5 | 1 | 2 | 3 |
|---|---|---|---|---|---|

| | Impairment | | | | |
|---|---|---|---|---|---|
| | None<br>0 | Questionable<br>0.5 | Mild<br>1 | Moderate<br>2 | Severe<br>3 |
| Memory | No memory loss or slight inconsistent forgetfulness | Consistent slight forgetfulness; partial recollection of events; "benign" forgetfulness | Moderate memory loss; more marked for recent events; defect interferes with everyday activities | Severe memory loss; only highly learned material retained; new material rapidly lost | Severe memory loss; only fragments remain |
| Orientation | Fully oriented | Fully oriented except for slight difficulty with time relationships | Moderate difficulty with time relationships; oriented for place at examination; may have geographic disorientation elsewhere | Severe difficulty with time relationships; usually disoriented to time, often to place | Oriented to person only |
| Judgment & Problem Solving | Solves everyday problems & handles business & financial affairs well; judgment good in relation to past performance | Slight impairment in solving problems, similarities, and differences | Moderate difficulty in handling problems, similarities, and differences; social judgment usually maintained | Severely impaired in handling problems, similarities, and differences; social judgment usually impaired | Unable to make judgments or solve problems |
| Community Affairs | Independent function at usual level in job, shopping, volunteer and social groups | Slight impairment in these activities | Unable to function independently at these activities although may still be engaged in some; appears normal to casual inspection | No pretense of independent function outside home<br>Appears well enough to be taken to functions outside a family home | Appears too ill to be taken to functions outside a family home |
| Home and Hobbies | Life at home, hobbies, and intellectual interests well maintained | Life at home, hobbies, and intellectual interests slightly impaired | Mild but definite impairment of function at home; more difficult chores abandoned; more complicated hobbies and interests abandoned | Only simple chores preserved; very restricted interests, poorly maintained | No significant function in home |
| Personal Care | Fully capable of self-care | | Needs prompting | Requires assistance in dressing, hygiene, keeping of personal effects | Requires much help with personal care; frequent incontinence |

Score only as decline from previous usual level due to cognitive loss, not impairment due to other factors.

10. Do you have one or more following modifiable risk factors for dementia?
☐ hypertension
☐ obesity
☐ depression
☐ physical inactivity (less than 90 minutes of moderate activity per week)
☐ diabetes
☐ low social contact

11. How often do you do Physical activities?
Note: Moderate activities such as pleasure walking, climbing stairs, gardening, yard work, moderate-to-heavy housework, slow movement dancing, and home exercise. Vigorous aerobic activities, such as brisk walking running, swimming, bicycling, roller skating, jumping rope, aerobic dancing (e.g. Zumba).

☐ Less than 60 minutes of moderate or vigorous activity per week
☐ 60-90 minutes of moderate or vigorous activity per week
☐ 90-150 minutes of moderate or vigorous activity per week
☐ Over 150 minutes of moderate or vigorous activity per week

12. Your email address:

---

13. Your Phone number:

---

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