NEUROEDUCATION AND EXERCISE: A TEACHING FRAMEWORK FOR MULTIDIMENSIONAL WELL-BEING AND EXERCISE SUSTAINABILITY

by
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Abstract

This case study examined the outcomes of using a novel brain-body teaching framework in group exercise classes at a Southwestern United States metropolitan YMCA. This mixed-methods needs assessment revealed that group exercise instructors lacked a teaching framework for scaffolding multiple dimensions of wellness into existing classes. The Brain-Body Fitness Framework (B-BFF) was created using literature from neuroscience, psychology, and the learning sciences to fill this gap. Three domains emerged as necessary for addressing mind-brain health and exercise sustainability—brain-body knowledge, unified mind-body perceptions, and intrinsic motivation during exercise. Mechanisms of change were neuroscience based—teaching neuroscience facts during classes and using the neuroscience of intrinsic motivation to guide instructor cues and methods. Group exercise participants' experiences were analyzed using qualitative data from 14 females (ages 18–74) during and after participating in six researcher-instructed exercise classes using the B-BFF. Triangulated data from journal entries, post-participation surveys, and focus groups suggests that teaching methods and cues in the B-BFF led to increased brain-body knowledge, intrinsically motivating experiences during exercise, and stronger unified mind-body perceptions. Findings reveal how methods in each of the three B-BFF domains reinforce and strengthen one another to support these proximal outcomes. Using the B-BFF supports enculturation of exercise for multidimensional well-being, increased physical activity levels, and progress toward better global mental health outcomes.

Keywords: neuroeducation, exercise, mental health, neuroscience, intrinsic motivation, exercise sustainability, mind-body, embodied cognition, fitness industry, physical education, exercise sustainability, behavior change, multidimensional well-being

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The student has made all necessary revisions, and we have read, and approve this dissertation for submission to the Johns Hopkins Sheridan Libraries as partial fulfillment of the requirements for the Doctor of Education degree.

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Dedication

This dissertation is dedicated to the beautiful pieces of my heart who live outside of my body—Lauren, Matthew, Andrew, Alessandra, and Gianluca. May this document serve as proof that one need never place an age limit on exploring new frontiers, taking creative risks, and pursuing their dreams. Go for it, my sweet angels.

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~Lisa

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Executive Summary

According to the World Health Organization (WHO, 2020b), depression affects more than 264 million people globally. Diseases of the mind-brain are globally the fastest growing and most economically, sociologically burdensome noncommunicable diseases (Chen et al., 2018). Though one in four people will be affected by neurological or mind-brain issues in their lifetimes, two-thirds of those affected will never seek treatments (Steinberg & Daniel, 2020; WHO, 2020b). Additionally, projections estimate that by 2050, 14 million people in the United States will live with dementia, a degenerative brain disease affecting thinking, memory, independence, economics, and social abilities (Carmona et al., 2019; Torpy et al., 2004). Dementia's heavy impact on lower socioeconomic and minority communities raises social justice concerns because poverty and social exclusion correlate with higher rates of mental health issues (Barbui & Albanese, 2019; Heinz et al., 2013, 2015; Livingston et al., 2017). This issue creates a social health problem because people with less access to mental health services are less likely to receive mental health care (Livingston et al., 2017).

Mind-brain problems exist in varying degrees of severity and duration, influencing a large percentage of the population (Hidaka, 2012; Steinberg & Daniel, 2020; WHO, 2020b). Social, environmental, and economic factors serve as health determinants (Patel et al., 2018). Furthermore, hormones, particularly estrogen, play crucial roles in brain health (Mosconi et al., 2017). Women account for two of three Alzheimer's disease patients, experiencing depression twice as often as men (Crowley, 2017). Women are also three times more likely to be diagnosed with autoimmune disorders that attack the brain, experience migraines at four times the rate of men, and are more likely than men to die from strokes (Mosconi et al., 2018).

Mind-Brain Health in Context: A Problem of Practice

Despite robust amounts of existing evidence that exercise provides protective and mitigating mind and brain benefits (Alty et al., 2020; Basso & Suzuki, 2017; Béland et al., 2019; Blumenthal et al., 2007; Budde et al., 2016; Frodl et al., 2019; Hayes et al., 2015; Lee et al., 2019; Li et al., 2019; Mikkelsen et al., 2017; Trivedi et al., 2011), exercise marketing and instruction does not yet fully reflect this message (Beauchemin et al., 2019; Markula & Chikinda, 2016; Segar et al., 2011). Further complicating matters is that the U.S. population's physical inactivity levels remain high (Katzmarzyk, 2022), and the primary domain of wellness connected with exercise is physical (Beauchemin et al., 2019). Alarmingly, current trends in exercise instruction and goal-setting methods may contribute to high dropout levels, exercise behavior unsustainability, and unpleasant experiences that thwart future participation (Hall et al., 2018; Segar et al., 2011; Swann et al., 2020).

The context of this study was a branch of a Southwestern United States metropolitan YMCA. There were no protocols regarding embedding mind-brain health instruction in group exercise classes. Nevertheless, there were many reasons to consider why the inclusion of mind-brain health in these classes would be beneficial to addressing the mental health crisis.

First, the inclusion of neuroscience in exercise instruction helps to thwart implicit mind-body dualism (viewing cognitive and affective states as disembodied or separate from the physical body). Reinforcing that the emergent properties of the brain (e.g., cognitive processes and emotions) are inseparable from the bodies that produce them and the environments in which they live works toward unifying mind-body perceptions (Burgmer & Forstmann, 2018, Di Paolo, 2017; Eagleman, 2020; Kiverstein & Miller, 2015; Mehta, 2011). The second is that the inclusion of mind-brain health education bolsters brain-body health literacy (Hurley et al., 2020;

Miller et al., 2018). The third beneficial reason is that including mind-brain health in group exercise offers a new exercise narrative—that physical activity is vital to multiple dimensions of well-being, including mental health (Mandolesi et al., 2018). Lastly, focusing on exercise's emotional, cognitive, and mood-boosting properties offers a new path for creating intrinsically motivating exercise experiences that lead to exercise sustainability (Beauchemin et al., 2019; Lee et al., 2016; Segar et al., 2011; Swann et al., 2020).

Needs Assessment

A literature search grounded in the ecological systems theory (Bronfenbrenner, 1994) identified several contributing factors to the problem of practice. These factors included evolutionary biology (Hidaka, 2012; Lee et al., 2016; Lieberman, 2015; Pontzer, 2018; Raichlen & Alexander, 2017), the medicalization of exercise (Furzer et al., 2021), implicit personal and cultural mind-body dualism (Burgmer & Forstmann, 2018; Mehta, 2011), technological impact on sedentary behavior (Huang et al., 2020; Jelić et al., 2016; Reyes-Molina, 2022), exercise instructor roles (De Lloyd & Payne, 2018; Garrin, 2014; Lyon et al., 2017; Zhou et al., 2019), and cultural focus on extrinsic physical aesthetic exercise goals (Rodriguez-Morales et al., 2020; Segar et al., 2011).

A mixed-methods needs assessment using a convergent-parallel design, with administration of quantitative questionnaires and a qualitative focus group, was designed and implemented to explore contributing factors in context. The following four literature and context-based research questions guided the needs assessment:

RQ1: Which domains of wellness do group exercise participants and instructors perceive as addressed in group exercise classes?

RQ2: What are the sources of group exercise instructors' health and fitness knowledge?

RQ3: How do group exercise instructors perceive their roles in the fitness industry?

RQ4: What are the perceived benefits and barriers group exercise participants attribute to exercise?

The quantitative strand assessed Research Questions 1 to 3. A qualitative strand assessed all four research questions. Each strand was analyzed separately and then triangulated to respond to each question comprehensively.

Three quantitative questionnaires were administered electronically. Thirty-one group exercise instructors (undisclosed gender) completed the Multidimensional Wellness (Beauchemin et al., 2019) and Instructor Knowledge (Bennie et al., 2017) Surveys. Forty-five female group exercise participants completed the Exercise Benefits and Barriers Scale (EBBS; Sechrist et al., 1987). Two female group exercise instructors participated in an online qualitative semi-structured focus group that addressed job perceptions and roles in the fitness industry (De Lyon & Cushion, 2013; De Lyon et al., 2017).

Quantitative findings showed that group exercise participants at the YMCA had firm beliefs (100% *agreed*/*strongly agreed*) about the benefits of exercise, experiencing no precluding barriers to exercise. However, the needs assessment aligned with literature showing both group exercise instructors and participants perceived that the predominant domain messaging in exercise instruction and goal setting was the physical domain of wellness (Beauchemin et al., 2019; Donaghue & Allen, 2016). These results were essential to interventional design because literature in Chapter 1 revealed that extrinsic physical goals were not autonomous and would quickly risk becoming unsustainable—even when exercise participants held positive beliefs in the value of exercise (Conner et al., 2015; DiDomenico & Ryan, 2017: Segar et al., 2011). Consequently, this finding suggested that an intervention focusing on intrinsic goal setting and multiple domains of wellness might reinforce participants' existing beliefs while potentiating the long-term sustainability of exercise habits.

Though participants and instructors agreed that the physical domain of wellness was the wellness domain most frequently messaged in classes, they differed on the perception of frequency. Sixty-three percent of group exercise participants perceived their instructors as messaging the physical dimensions of exercise "very often," while only 29% of instructors perceived themselves as messaging the physical dimensions of exercise "very often." This difference in perceptions between participants and instructors pointed toward an intervention focusing on instructor cueing and communication as a mechanism for change—education integrating the body's role in mental well-being (e.g., exercise's role in multiple dimensions of health and wellness).

Surveys indicated that sources of instructor knowledge came from industry workshops and popular Internet articles. The instructor’s focus group data further elucidated that instructors cared about their participants' multidimensional well-being. However, their workshops, continued education training, and online resources focused on body mechanics and class choreography, with no integration of mental well-being and exercise sustainability. The needs assessment concluded that instructors were interested in incorporating mind-brain health and wellness, but they lacked a framework to scaffold this material into classes. Thus, this dissertation's goal was to fill this gap.

Intervention

This needs assessment’s findings aligned with Chapter 1 literature. YMCA group exercise instructors and participants agreed that physical exercise was most often linked to physical bodily attributes (e.g., weight loss and aesthetics) and physical health goals

(Beauchemin et al., 2019). Training prepares instructors to lead safe classes, but they lack strategies for training client sustainability (Lee et al., 2016; Segar et al., 2011). Findings also indicated that group exercise instruction lacked explicit instruction connecting exercise to its mental health benefits (e.g., brain health, mood, and cognition) and exercise sustainability. Importantly instructors indicated they lacked a teaching framework to scaffold mind-brain-body well-being into their existing classes. Together, these findings prompted an investigation into how neuroeducation-inspired instructor messaging and cueing could connect biomechanical movement cues with mental, emotional, social, and cognitive health.

A synthesis of empirical literature in Chapter 3 was grounded in several theories. The theory of embodied enactive cognition emphasizes embodiment and social interactions as sources of human cognition (Di Paolo et al., 2017; Gallagher, 2017). The self-determination theory of intrinsic motivation posits basic needs as drivers of people's well-being and psychological growth (DiDomenico & Ryan, 2017; Ryan & Deci, 2000). Intrinsic motivation is the product of fulfilling those needs. Andragogy is an adult education theory that recognizes and utilizes peoples' experiences as rich resources brought to learning spaces (Knowles, 1980). Social constructivism recognizes instructors and students as knowledge co-constructors and scaffolds knowledge concerning learners' needs (Vygotsky, 1978). Lastly, the transformational learning theory utilizes critical self-reflection to analyze long-held viewpoints and habits of mind (Mezirow, 1997).

The complexity of the problem necessitated a multidimensional theoretical framework to lead to a complex solution addressing biological, psychological, sociological, and educational needs. Exercise mitigates issues of the mind-brain; with population physical activities already being low (Katzmarzyk, 2022), solution formation required addressing the problem of exercise sustainability and adherence alongside scaffolding mind-brain health into group exercise classes (Conner et al., 2015; Lee et al., 2016). Concomitantly addressing exercise sustainability is crucial because people cannot reap the mind-brain benefits of exercise if they do not exercise.

The three indicators emerging from the literature as supportive of improving mental health literacy, lifestyle health practices, and sustainable participation in physical activity consisted of brain-body knowledge, intrinsic motivation during exercise, and mind-body unity (Burgmer & Forstmann, 2018; Hurley et al., 2020; Segar et al., 2011). These three indicators became the three domains of a novel researcher-constructed teaching framework called the Brain-Body Fitness Framework (B-BFF). The framework integrates findings from (a) outcomes of mental health literacy programs; (b) the role of language, imagery, and metaphors in mind-body teaching techniques; and (c) the effects of goal setting and intrinsic motivation on exercise behaviors. Teaching methods in each domain integrate multiple behavioral, neurocognitive, and learning theories with exercise-related studies to shape instructional practices.

The B-BFF case study aimed to test a novel neuro-education-inspired group exercise teaching framework. Methods and messaging in the B-BFF would educate participants about the mind-brain benefits of exercise while using the neuroscience of imagery and reward to cultivate in-class motivation leading to sustainable exercise and physical activity behaviors. The study examined how instructing a group exercise class using the B-BF affected the exercise participants' perceptions of their (a) brain-body knowledge, (b) mind-body unity, and (c) intrinsic motivation during exercise. A theory of treatment posited that achieving the study's three proximal outcomes— increased brain-body knowledge, unified mind-body perceptions, and intrinsically motivating exercise experiences—would lead to three distal outcomes—enculturation of exercise for multiple dimensions of well-being, increased physical activity levels, and progress toward better global mental health outcomes. The following research questions guided the assessment of participants' experiences:

RQ1: To what extent was the intervention implemented as planned?

RQ2: What unique features differentiate instruction in this class from instruction in other group exercise classes?

RQ3: What were YMCA group exercise participants' experiences with the intervention?

RQ4: How did participation in the intervention change participants' knowledge of the benefits of exercise on the mind-brain?

RQ5: In what ways did participation in this intervention change participants' perceptions of their intrinsic motivation while exercising?

RQ6: How did the intervention change participants' mind-body relationship perceptions?

This intervention employed a qualitative case study design to (a) capture social-emotional data in a real-world context, (b) reflect and honor participants' unique voices and experiences, and (c) deeply explore and understand study constructs. Fourteen female volunteer participants with previous group exercise experience (ages 18 to 74) attended one online launch meeting and six existing onsite YMCA group exercise classes (formats = three barre, three cardio). The researcher—an AFAA/NASM certified trainer/instructor—instructed the classes using the novel B-BFF. Exercise neuroscience facts were interjected into each of the six classes. Topics included the effects of exercise on cognitive abilities, emotional health, neuroanatomy, neurochemicals, Alzheimer's disease, and connecting exercise to the brain. Data were collected via journal entries (Qualtrics) after each class, post-participation focus groups (Zoom recorded, Otter.ai transcribed), and a post-participation free-response differentiation survey (Qualtrics). A checklist of the B-BFF's teaching methods measured adherence to B-BFF protocols. Data were analyzed by triangulating inductive and deductive thematically coded data from the three qualitative tools.

Survey data demonstrated that all elements of the B-BFF checklist were implemented in each of the six researcher-led classes concluding that the study was implemented as designed (RQ1). Seven categories emerged from the data as notable differences between B-BFF classes and regular classes (RQ2): (a) brain-body content (“exercise encourages brain neuroplasticity and can delay Alzheimer's disease”); (b) educational versus solely performative instructional methods (“the educational aspect to what we are doing and the why behind it, is the biggest difference for me;” (c) “real-life” applicability of instructional methods (“I use many of these props and mental images in my daily life now, to improve my posture and position in everything that I do”); (d) asset-based and body aesthetic-free instructor language (not “assuming something was wrong” with their body “that needs fixing” and not cueing for “bikini bodies” and “looking better in pants”); (e) continual imagery-filled instructor cues (“I've never encountered this before. the cues are three-dimensional. I instantly understand them”); (f) asset-framed modifications rebranded as movement progressions (“the continuous use of positive talk about all of the levels and choice around picking and choosing what is right for us in class each day creates a sense of imaginative play that encourages fun and movement within ways that are biomechanically safe”); and (g) the starting point of instruction focused on emotions instead of the body (“you ask me how I'm feeling”).

Through detailed analysis of individual experiences, five categories emerged as essential shared engagement experiences (RQ3): (a) All were highly engaged with the study (all 14 members of the study completed every activity of this study minus one participant who backed out of the focus group at the last minute due to a family emergency); (b) the social media extension was useful (most reported visiting the Brain-Body-World Twitter account or intending to visit it in the future); (c) hearing that "all movement counts" was "game changing" ("it combats feeling of intimidation when you can't quite keep up in class," and "all or none" exercise mindsets about "what counts" toward health and well-being); (d) the B-BFF neuroscience lens increased curiosity and creativity ("The more I learn about this kind of stuff, the more I want to learn about this kind of stuff," "the use of imagery and metaphors made movement novel and interesting"); and (e) the group unanimously expressed enjoyment with study participation ("it felt like personal training in group exercise," "the cues and modifications make me feel respected," "I can do more because of the fun," "it's social," 'it's playful").

The change in knowledge of the brain benefits of exercise resulting from participating in exercise classes instructed using the B-BFF fell into five main categories (RQ4). Members disclosed that the neuroscience knowledge presented in class (a) increased their brain-body knowledge ("exercise helps with the buildup of stress chemicals and reduces catecholamines"); (b) boosted their desire to increase their physical activity/exercise ("well, it just really makes me want to keep doing it as I 'turn calendar pages'"); (c) concretely connected mental health and bodily movement ("I see that not all the benefits of exercise are visible and that perhaps the ones most beneficial are invisible, but measurable"); (d) increased their perception of exercise's immediate usefulness for mood ("it makes the workout feel more effective and rewarding," and "useful in my life" because the neuroscience knowledge made exercise "feel like it addresses [my] quality of life"); and (e) increased their perception of exercise as a cognitive pursuit ("learning about the effect of exercise on the mind-brain helped connect the dots and give real scientific backing to things").

In-vivo codes evidenced that all participants experienced increased perceptions of all seven antecedent subscales of intrinsic motivation while exercising (RQ5). Consistently using teaching methods from the B-BFF's three domains catalyzed participants' experiences of (a) body movement *competence* (imagery cues helped them “self-correct,” feel that they could “do movement correctly and in a more effective way” and “know exactly what the instructor was referring to”); (b) the *usefulness* of exercise (“it feels like an immediate reward; it makes me want to come back even when things are a little bit difficult. I carry those messages into my decision to exercise”); (c) cognitively *reappraised/reversed tension* (imagery and “noticing body sensations” “fostered intentionality and agency” to “juxtapose” tension in one area of the body “while relaxing another”); (d) *relatedness* to one another in class (the intentional interconnection between participants “makes me want to come, rain or shine,” makes a “huge positive impact on my day,” and “is my favorite part of returning”); the *importance* of exercise (“neuroplasticity and neurogenesis” was “far more important” than body aesthetics); *choice* in their movement (felt “empowering, accepted, respected, judgement-free” and “body ownership”); and *enjoyment* (“novel, fun, playful, creative, safe, successful”) during exercise.

Triangulated results from journals, post-participation surveys, and focus groups showed that intervention participation increased the perception of group exercisers' mind-body unity (RQ6). Three distinct categories emerged from the data as the contributing factors for this perceived increase. The first contributing factor was that the B-BFF neuroscience content, imagery, and instructional methods made the abstract 'mind-body' concept feel more concrete (“less hippie-dippie and woo-woo”). The second factor was that the B-BFF neuroscience content, imagery use, and instructional methods heightened participants' attunement to bodily sensations and feelings ("intentionally internalizing thinking about what/where/why we're feeling things" while moving). The final contributing factor was that the B-BFF neuroscience content, imagery use, and instructional methods expanded their ways of thinking about body movement and exercise ("seeing the connections between physical and mental health from a biochemical/neurological standpoint helped integrate how I view my life.")

Conclusions

Several conclusions were drawn from this study. This study's theory of treatment hypothesized that in the context of group exercise, intrinsic motivation-oriented imagery and metaphor cues, and brain-body facts delivered in class would serve as interventional mechanisms of change. These mechanisms—grounded in embodied enactive cognition, the self-determination theory of intrinsic motivation, neuroscience, and multiple learning theories—would produce three proximal outcomes—increased brain-body knowledge, improved intrinsically motivating exercise experiences, and an increased perception of mind-body unity. The study results adduced evidence supporting this theory as these mechanisms—central to the core of the B-BFF—led to all three proximal outcomes. The study results illustrated that the content and methods in the three domains of the framework—brain-body knowledge, intrinsic motivation, and mind-body unit—worked in tandem like gears, with the mechanisms in each domain strengthening and reinforcing changes in the others.

Implications for Future Practice

In practice, the stakeholders directly impacted by the results of this study are group exercise participants, group exercise instructors, and organizations that train and certify group exercise instructors. Group exercise participants participating in B-BFF-instructed classes have a new framework for thinking about the benefits of bodily movement in a sedentary world beyond the exercise class. This broadened mindset views physical exercise and bodily movement as an accessible mental health and quality of life tool for navigation in a stressful world. Because physical exercise and activity grounded in the B-BFF philosophy prioritizes co-constructing intrinsically motivating experiences during group exercise, self-reflection opportunities and progression choices targeting the antecedent subscales of intrinsic motivation improve the chances of a participant finding sustainable movement opportunities that resonate with personal needs, interests, and lifestyle. In summary, this study's findings suggest that a group exercise participant taking a class with content, cues, and messaging framed in the B-BFF philosophy may increase their odds of self-locating intrinsically motivating, sustainable, and personally meaningful movement possibilities in and outside of exercise classes. It is hoped that locating these possibilities may lead to an increase in overall physical activity levels and a decrease in sedentary behavior during the day.

The second stakeholder group—group exercise instructors—can use the B-BFF to broaden their practice by increasing participants' understandings of how and why we move our bodies and by expanding participants' movement possibilities and opportunities in and outside of class. Using the complementary B-BFF assists instructors in connecting kinesiology methods learned in fitness certification programs with their participants' social, emotional, and cognitive domains of well-being. Critically, group exercise instructors framing their teaching practice in the B-BFF offer hope, inclusion, and a feeling of achievable success to exercisers harboring unpleasant past experiences derived from unsustainable extrinsic or unrealistic aesthetic fitness, sport, or cultural body image messaging.

Study data indicated that fragile body image, low exercise self-efficacy, and negative physical education/body movement experiences serve as barriers to participation in physical activity. To borrow a popular idiom, instructors embedding B-BFF strategies into practice have a unique opportunity to preach to those who have felt physically, socially, and emotionally ostracized from the sport and exercise choir. The B-BFF expands Caspersen and colleagues' (1985) clinical definition of exercise (skeletal muscle movement producing energy expenditure) with Piggin's (2019) definition, which situates a person's movement within an influencing sociocultural context (see Chapter 3, p. 107). Consequently, instructors adopting the philosophy of the B-BFF reinforce to their participants the complexity of exercise behaviors in an ecological system and the inextricable entanglement of mind, brain, body, and environment. Embracing and explicitly teaching this element of exercise's complexity may empower clients to make informed decisions as they navigate the myriad over-simplified claims in exercise sales marketing.

The third stakeholder group this study impacts includes national organizations who certify exercise instructors and personal trainers. The study findings show that the B-BFF is compatible with industry standard physiology and kinesiology methods—scaffolding actionable strategies for including multiple domains of well-being into existing exercise formats. This study used barre (frequently labeled as a strength and flexibility format) and cardio (an aerobic format). The YMCA and similar national certifying entities could potentially effect change at scale by developing a curriculum or course that trains instructors on how to incorporate the B-BFF in existing classes and personal training sessions. This course could be part of certification training and/or continuing education courses. Since the B-BFF also addresses exercise sustainability, curriculum needs to help instructors develop the skill of teaching exercise movements and choreography (included in industry standard certification) with a keen sensitivity to the person doing the movement (philosophy of the B-BFF). Training instructors to understand and prioritize the foundational importance of emotion and affect on exercise participation and sustainability may longitudinally provide a path for increasing population physical activity levels via targeting, promoting, and measuring intrinsic motivation and mind-body unity instead of extrinsic goals.

Lastly, findings from this study have practical implications for future use in publications that disseminate knowledge and information to a broad array of readers. One possibility is publishing the study results, implications, and commentaries in scholarly academic journals that reach other scholar practitioners and academics who can further the research and upscale its impact. Another practical use of this study is sharing B-BFF strategies, reporting results, and expanding on implications in contemporary book, handbook, podcast, or mixed-media form. Rather than a solely academic audience, this publication could target a broader audience of parents, community leaders, health care workers, classroom teachers, and people interested in practical health and wellness. The B-BFF framework and its results might also be informative to physical education teachers in training and in the field. A presentation and practicum tailored to educators might be fruitful for expanding physical education practices. Finally, and perhaps importantly, these study results could be used to create an age-appropriate children's book that takes a proactive approach to teaching the mind-brain-body-environment connection and why movement matters to our feeling and thinking.

Implications for Future Research

In final analysis, this case study concluded that the B-BFF successfully scaffolded mind-brain health into group exercise classes. In this population and context, B-BFF-instructed classes qualitatively increased participants' (a) brain-body knowledge, (b) perceptions of intrinsic motivation during exercise experiences, and (c) perceptions of their mind-body unity. As such, results from the study open myriad possibilities for future research, from replicating the qualitative study in different contexts to quantitatively measuring pre- and post-participation constructs of brain-body knowledge, intrinsic motivation, and mind-body unity after taking B-BFF-framed exercise classes.

More practice-based/focused research is needed to improve, refine, codify, and design effective and adaptable B-BFF-inspired curricula. To accomplish these tasks, an appreciative inquiry model (Cooperrider & Srivastva, 1987) is recommended to co-produce new content in collaboration with context stakeholders (exercise participants, instructors, and certifying boards) and interdisciplinary experts (neuroscientists, psychologists, physiologists, and others) Rooted in social constructivist tradition, appreciative inquiry uses collective inquiry to generate new ideas, theories, and knowledge (Randall et al., 2022). Co-created ideas are generated from stakeholders' first-hand experiences and stem from "a relationship where professionals and citizens share power to plan and deliver support together—recognizing that both have vital contributions to make to improve quality of life for people and communities" (P. D. S. Ross et al., 2013, p. 7). These new ideas about the B-BFF and how best to implement it in practice can be further tested using implementation science Plan-Do-Study-Act" inquiry cycles (Bryk, 2015) where "each cycle builds on what was learned in previous cycles until a team has discerned how to effect improvements reliably under different conditions" (p. 122).

Chapter 1: Addressing Mind-Brain Health in Women's Group Exercise Classes

Depression and diseases of the mind-brain are the fastest growing and most economically and sociologically burdensome noncommunicable diseases (Chen et al., 2018). According to the World Health Organization (WHO, 2020b), depression affects more than 264 million people globally. Though one in four people will be affected by neurological or mind-brain issues in their lifetime, two-thirds of those affected will never seek treatment (Steinberg & Daniel, 2020; WHO, 2020b).

Additionally, projections estimate that by 2050, 14 million people in the United States will live with dementia, a degenerative brain disease affecting thinking, memory, independence, economics, and social abilities (Carmona et al., 2019; Torpy et al., 2004). Dementia's heavy impact on lower socioeconomic and minority communities raises social justice concerns because poverty and social exclusion correlate with higher rates of mental health issues (Barbui & Albanese, 2019; Heinz et al., 2013, 2015; Livingston et al., 2017). This issue creates a social health problem because people with less access to mental health services are less likely to receive mental health care (Livingston et al., 2017).

These complex issues surrounding mental well-being emphasize the importance of prioritizing mind-brain health education. Many mind-brain issues may be transient or mild enough to bypass clinical diagnosis or professional treatment. However, they may still adversely impact an individual's quality of life, including the ability to cope in family relationships, jobs, schools, and communities (Hidaka, 2012; Steinberg & Daniel, 2020). Thus, the rationale for using the context of group fitness classes to conduct research on accessible, functional, and sustainable strategies that support community multidimensional well-being is grounded in the research findings of exercise neuroscience (Lee et al., 2019). Research in brain science provides a growing body of evidence on the myriad ways exercise functions to (a) promote mental wellness, including the mitigation of depression, anxiety, and stress; (b) alleviate symptoms of social withdrawal and low self-esteem; and (c) protect against neurodegenerative problems, including cognitive decline, dementia, and Alzheimer's disease (Alty et al., 2020; Basso & Suzuki, 2017; Budde et al., 2016; Guszkowska, 2004; Konopka, 2015; Lee et al., 2019; Rabin et al., 2019; Stimpson et al., 2018).

Consequently, this chapter explores complex factors affecting mind-brain well-being, as well as the potential barriers obstructing mind-brain health inclusion in group exercise settings. The first section states the problem of practice in context. The next section uses the ecological systems theory (EST) as a framework to organize and understand the relationships between factors within the context of the problem of practice (Bronfenbrenner, 1994). Lastly, this literature synthesis concludes with a conceptual framework, illustrating the relationship between the factors chosen for further empirical examination in Chapter 2 and a summary of the rationale behind such choices.

Problem of Practice

Mind-brain problems exist in varying degrees of severity and duration and affect a large percentage of the population (Hidaka, 2012; Steinberg & Daniel, 2020; WHO, 2020b). Social, environmental, and economic factors serve as health determinants (Patel et al., 2018). Furthermore, hormones, particularly estrogen, play crucial roles in brain health (Mosconi et al., 2017). Women account for two out of three Alzheimer's disease patients, experience depression twice as often as men (Crowley, 2017), are three times more likely to be diagnosed with autoimmune disorders that attack the brain, experience migraines at four times the rate of men, and are more likely than men to die from strokes (Mosconi et al., 2018). Despite robust amounts of existing evidence that exercise provides protective and mitigating mind and brain benefits (Alty et al., 2020; Basso & Suzuki, 2017; Béland et al., 2019; Blumenthal et al., 2007; Budde et al., 2016; Frodl et al., 2019; Hayes et al., 2015; Lee et al., 2019; Li et al., 2019; Mikkelsen et al., 2017; Trivedi et al., 2011), exercise marketing and instruction does not yet fully reflect this message (Beauchemin et al., 2019; Markula & Chikinda, 2016; Segar et al., 2011). The omission of neuroscience from the exercise instruction paradigm risks perpetuating implicit mind-body dualism—viewing cognitive and affective states as disembodied or separate from the physical body (Burgmer & Forstmann, 2018). Consequently, treating the mind-brain as disembodied has physiological, psychological, educational, and policymaking consequences (Di Paolo et al., 2017; Fugate et al., 2019; Varela et al., 1991).

In the context of this study, a branch of a southwestern U.S. Young Men's Christian Association (YMCA), there are currently no policies or protocols regarding the explicit and regular instruction of mind and brain health in group exercise classes. Excluding mind-brain health from these classes discounts that brains are embodied and that emergent properties of the brain, including cognitive processes and emotions, are inseparable from the bodies that produce them (Kiverstein & Miller, 2015). The omission of mind-brain health education also deprives current exercise participants from improving brain-body health literacy needed for making informed decisions about mental health wellness (Miller et al., 2018). Lastly, excluding the brain's relationship with movement misses an opportunity to reframe the exercise narrative and co-construct new meaning about why movement, physical activity, and physical exercise are important to human well-being (Mandolesi et al., 2018).

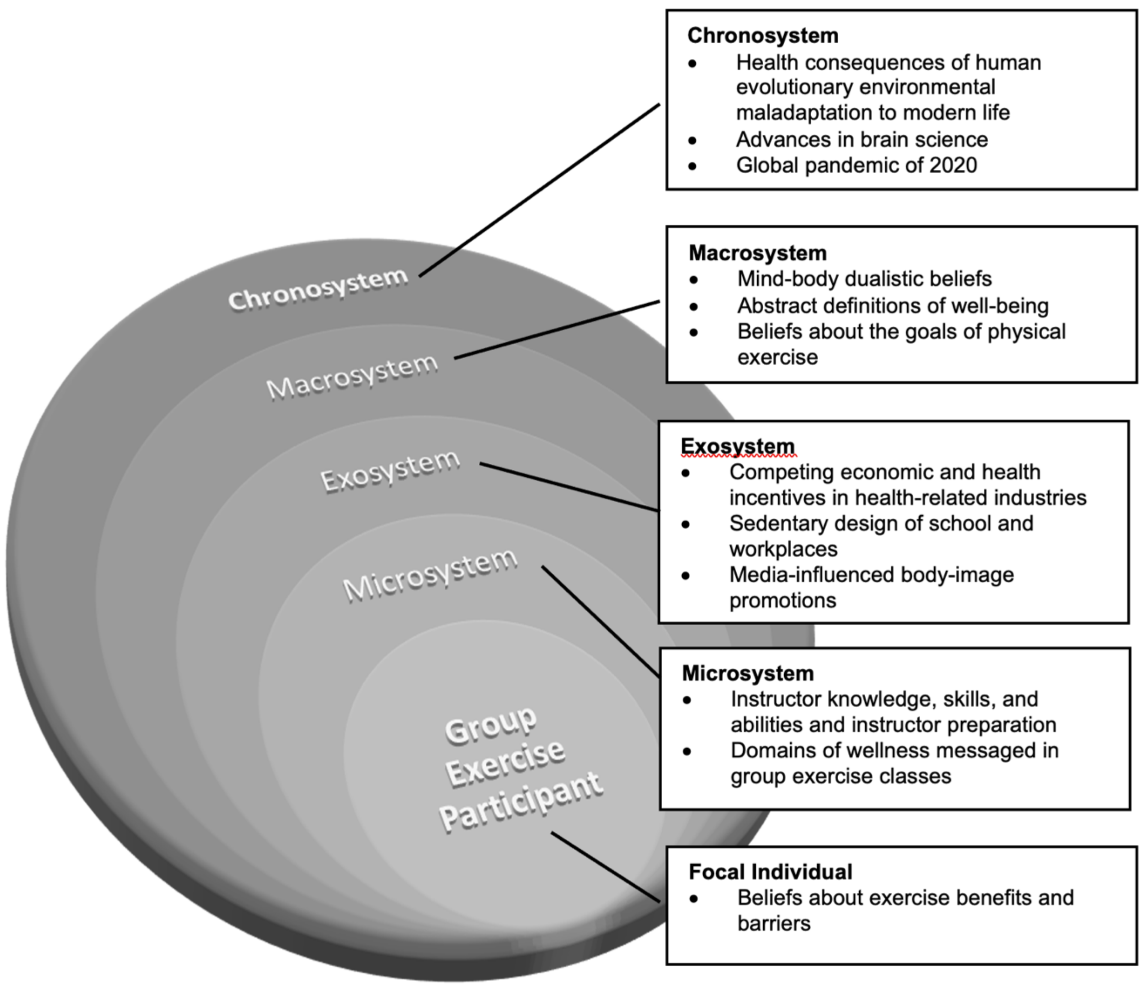
Without increasing brain-body knowledge and mind-body unity, participants holding negative exercise associations—formed by poor previous physical education (PE) experiences or the enculturation of exercise as a tool for unrealistic, socially constructed, body images—miss an opportunity to reappraise the intrinsic joy of movement (Cardinal et al., 2012; Markula & Chikinda, 2016; Segar et al., 2011). Focusing on the emotional, cognitive, and mood-boosting properties of exercise may provide this population more intrinsically motivating, enjoyable, amenable, and sustainable reasons to return or begin to exercise than before (Beauchemin et al., 2019; Segar et al., 2011; Swann et al., 2020).

Theoretical Framework

The following literature synthesis uses Bronfenbrenner's (1994) ecological systems theory (EST) to ground factors related to the (a) reasons the physical domain of wellness continues to dominate group exercise settings, (b) reasons instruction of mind and brain health is absent from them, and (c) potential barriers impeding the future inclusion of mental health. This systems approach allows complex sociocultural, sociocognitive, and sociotemporal relationships to emerge in one picture (Bronfenbrenner, 1994; Hoare, 2009; von Glasersfeld, 2005; Vygotsky, 1978). Seeing the systems that contribute to the exclusion of mind and brain wellness instruction in group exercise settings informs future interventional strategies by identifying high points of leverage in the contributing factors' levels of origin (Bronfenbrenner, 1994; Bryk et al., 2015; Eriksson et al., 2018). Figure 1.1 depicts the focal individual as a YMCA group exercise participant with EST systems represented in concentric circles around the participant.

Figure 1.1

Bronfenbrenner's Ecological Systems Theory



Note. Bronfenbrenner's (1994) ecological systems theory representation. Concentric circles represent systems of contributing factors that influence the rise in mental health issues and the barriers that impede the inclusion of mind and brain health instruction in group exercise classes.

In this study's context, the group exercise participant (heretofore called participant) was at the center of a nested microsystem, exosystem, macrosystem, and chronosystem (Bronfenbrenner, 1994). The microsystem, where face-to-face (FTF) interactions with group exercise instructors (heretofore called instructors) occur, is most proximal to the individual. This system also includes influencing factors of participants' home, work, family, friendships, volunteer/civic settings, church groups, and classes (Bronfenbrenner, 1994). The microsystem factors explored in this literature synthesis include participants' beliefs about exercise's benefits and barriers and instructors' sources of fitness knowledge, job role perceptions, and wellness domains addressed in classes.

The next level, the exosystem, comprises the larger institutions with which participants indirectly interact. This system includes the economy, media, educational systems, government, and organized religion (Bronfenbrenner, 1994). The institutional factors explored in this study included the competing economic and health incentives within the fitness, medical, pharmaceutical, and media industries and the implicit institutional reinforcement of sedentary behaviors that further detached cognition and emotion from the body.

The macrosystem contains the sociocultural environment of the participant. Although seemingly more distal, the ideologies, mores, customs, and folkways of the macrosystem influence participant behaviors by serving as invisible cultural blueprints (Bronfenbrenner, 1994). Cultural determinants explored in this study included the changing and elusive definition of health, mind-body dualism (seeing the mind and body as distinctly separate entities), and the cultural socialization of reasons for exercise.

The temporal component of the EST, the chronosystem, represents transitions and impactful moments in time. Factors that shape an individual over a lifespan include family dynamics, physiological changes, and sociohistorical changes and events (Bronfenbrenner, 1994). In this study, literature on how the arc of history turned toward enculturating exercise for physical properties explored exercise's roots in antiquity, the origins of PE in the United States, the origins of the YMCA, and the history of the popularization of aerobic exercise for cardiovascular (heart) health (Bronfenbrenner, 1994). Studies reviewed in this system also explored how the role of technology and the delay in understanding brain structures as early as understanding other biological processes (e.g., the circulatory system) would delay the connection of exercise benefits to the brain—placing mind and brain education in a position of playing "catch-up" with habituated practices of exercising for other more widely accepted reasons (Glasser et al., 2016).

Though not delineated as a separate structure, the mesosystem illustrates the interactive nature between microsystem factors. In this study, mesosystem interactions indicated bidirectional, reciprocal relationships between participants and instructors (Bronfenbrenner, 1994; Eriksson et al., 2018; Hoare, 2009). Factors from these mesosystem interactions provided the constructs operationalized in the needs assessment. Using the EST, the next section organizes a review of the literature on causal and correlational factors contributing to the barriers to addressing mind and brain health in group exercise classes.

Factors Affecting Mind and Brain Health Instruction in Group Exercise Classes

This section explores contributing and correlational factors associated with reasons instructors do not address the mind and brain benefits of exercise. The review begins with examining a broad scope of factors within the outermost system, the chronosystem, then works its way inward through the macro and exosystems. The section concludes with a detailed investigation of factors within the microsystem.

Chronosystem Factors

Reciprocal processes among historical transitions, technological inventions, and the transmission of disease shape human behaviors and progress (Lieberman, 2015). The chronosystem contains historical and technological factors contributing to the problem of practice. This section also includes the temporal effects of the 2020 coronavirus global pandemic on global mental health and reinforces the timely nature of discussing mental health (Morrey et al., 2020; Vieira et al., 2020).

Evolutionary Biology. Social, environmental, and economic health determinants factor into why humans live longer but not necessarily healthier (Ahmed, 2020; Bandura, 1998; Corden & Hirst, 2013; Karel et al., 2012; Kramer & Erickson, 2007; Lund, 2020; Lobb & Colditz, 2013; Patel et al., 2018). Technological advances outpace human bodies' functional designs (Hidaka, 2012; Lee et al., 2016; Lieberman, 2015; Pontzer, 2018; Raichlen & Alexander, 2017). For some, this mismatch between structures in modern living and evolutionary biology leads to chronic states of anxiety characterized by "apprehensive expectation or fear" (APA, 2013, p. 542; Hidaka, 2012). Chronic anxiety and the cumulative effects of stress lead to structural changes in the brain, which, in a continuous feedback loop, adversely affect coping behaviors (Bloomfield et al., 2019; Laine et al., 2017; Patel et al., 2018). Ambiguity of diagnostic tools, social stigmas, fear of discrimination, the invisible nature of mental health, and cultural discomforts with engaging in mental health conversations challenge empirical assessment of the extent of mental health issues (Rottenberg, 2017; Steinberg & Daniel, 2020).

The History of Exercise. An abbreviated sociohistorical perspective provides a temporal backdrop to explore the changing role of exercise and its relationship with the health paradigm. Archeological excavations trace the earliest prescriptions for exercise as prevention and treatment of disease to India in 1500 BCE (Tipton, 2008). Susruta, an Indian physician (c. 600 BCE), prescribed regular exercise to minimize obesity and diabetes in his patients and to bring their *humors* or life forces into balance (Tipton, 2008). Carbon dating places Susruta's texts as the world's oldest recorded medical practices (Tipton, 2015).

Physical Education. The first official U.S. PE program also finds roots in medicine (Cardinal et al., 2012). This mandatory 4-year university program began in 1860 at Amherst College in Massachusetts under the direction of Harvard-trained Physician Edward Hitchcock, Jr. (Cardinal et al., 2012). The program's sole purpose was maintaining student health and the relief of stress caused by rigorous coursework. In an inauguration speech, Amherst University President William Augustus Stearns claimed the health of the students as a top priority: "Of one thing I am certain. The highest intellectual efficiency can never be reached; the noblest characters will never be formed, till a greater soundness of physical constitution is attained" (Cardinal et al., 2012, p. 503).

The Young Men's Christian Association. Additionally, toward the end of the 19th century, the Young Men's Christian Association (YMCA) launched its first PE program in London. By the 1900s, the YMCA had already pivoted from its emphasis on religious proselytization to a new emphasis on the physical, social, spiritual, and intellectual goals of character development (Zald & Denton, 1963). The YMCA viewed physical exercise as a necessity for the development of health in spirit, mind, and body. The physicians of antiquity, the professors at Amherst, and the YMCA leaders believed that exercise's mental benefits were equal to its physical benefits, and the concept of prevention was deeply valued (Cardinal et al., 2012; Tipton, 2015; Zald & Denton, 1963).

Aerobics Classes and Cardiovascular Disease. In 1968, Dr. Kenneth Cooper, known worldwide as the "father of aerobics," first introduced aerobic activity as a strategy in the prevention and mitigation of cardiovascular disease (Zhu, 2018). It immediately became widely accepted in the medical and public mindset that regular physical activity (particularly classes designed to improve the absorption and transporting of oxygen) was required to maintain cardiovascular health (Cooper, 2018; Zhu, 2018). The universal acceptance was evidenced by modern classes still bearing the names of the aerobic-heart health connection. Gyms and studios worldwide labeled these classes “aerobics” and “cardio” (Cooper, 2018; Zhu, 2018). The universally ubiquitous nomenclature reinforced the class objective and the importance of the organ for which the class was designed.

However, the connection between exercise and brain health has not been able to gain similar traction in the fitness world even with the rapid growth of new scientific understanding of the specific effects and neurobiological mechanisms of exercise on brain health (Lee et al., 2019). Brain health has not achieved the same kind of strong cultural association with exercise as the association between heart health and exercise (Basso & Suzuki, 2017; Y. K. Chang et al., 2017; Frodl et al., 2019; Gligoroska & Manchevska, 2012; Hayes et al., 2015; Pena et al., 2020; Pontifex et al., 2019). This failure of association may be rooted in social stigmas that make discussing mental health less comfortable than discussing cardiac health (Steinberg & Daniel, 2020). An argument may be made that brain health should be prioritized because hearts can be transplanted and artificially kept pumping while brains cannot (Pontifex et al., 2019).

The Nascence of Neuroscience as a Discipline. Arguably, the strongest reason for the arc of history shifting toward exercise being best understood for its physical benefits is rooted in the social history of medicine (Porter, 1999). Empirical science and technological inventions now allow scientists to comprehend complex bodily processes that were once held as mysterious or relegated to intellectual speculation (Porter, 1999). Advances in scientific technology also allow the empirical measurement and testing of the effects of exercise on bodily systems, allowing exercise instructors to teach connections between physical exercises and their corresponding physical benefits (American College of Sports Medicine [ACSM], 2021).

Furthermore, the advent of scientific empiricism allows exercise participants to comprehend exercise movements in prescriptive terms, matching physical activity to desired physical or metabolic outcomes.

However, the brain, unlike other bodily organs, has physical substrate and emergent mental properties (Eagleman & Downar, 2016). These complexities make the brain more challenging to study than other bodily organs, and neuroscientists agree that what is unknown about brain functioning still vastly outstrips what is known (Eagleman & Downar, 2016). Additionally, empirically connecting exercise and brain activity was not possible until the invention of technology that could measure it (Glasser et al., 2016; Sheline, 2003). The recent ability to collect noninvasive brain data adds to reasons why exercise is not yet as habituated in practice and culture for brain benefits as it is for heart health (Glasser et al., 2016; Sheline, 2003).

The Acceptance of Brain Neuroplasticity. In 1964, a paradigm-shifting study altered Western medicine's understanding of the brain. M. C. Diamond et al. (1964) demonstrated at a microscopic level that the brain was not only able to reorganize connections but was also able to generate new neurons (neurogenesis) in the hippocampus—a deep brain structure involved in memory and learning (Anand & Dhikav, 2012; M. C. Diamond et al., 1964). Experimenting with rats in impoverished and environmentally enriched cages, then measuring slices of their postmortem brains, replications of M. C. Diamond et al.'s (1964) studies consistently showed measurable changes in brain chemistry and brain weights between rodents in the two environments. One of the variables manipulated in the environments in M. C. Diamond et al.'s rodent study was exercise. The study showed that voluntary exercise wheel running was the environmental factor most closely correlated with neurogenesis (M. C. Diamond et al., 1964).

Before M. C. Diamond et al.’s (1964) discovery, medical scholars believed that the brain’s abilities were immutably fixed. M. C. Diamond et al. demonstrated that environmental factors physically altered brain structures, adding empirical evidence to the hotly debated nature versus nurture argument. Such groundbreaking research upended the medical world by empirically proving that brain functioning relied on both.

The Invention of Functional Magnetic Resonance Imaging. Nevertheless, even M. C. Diamond et al.’s (1964) research was done on postmortem rat brains. After 1991, almost two decades later, that the invention of functional magnetic resonance imaging provided scientists with a noninvasive method of visualizing activity in living human brains (Glasser et al., 2016). Neuroimaging techniques now allows scientists to map blood flow following neuronal brain activity. This technology opened a noninvasive path to empirically studying diseases of the brain, changes within the brain associated with mental conditions, and the effects of various activities on the brain such as music and exercise (Glasser et al., 2016; Sheline, 2003). Despite the rapid growth of scientific evidence of the specific effects of exercise on the brain, neuroscience is still new when compared with other fields, such as cardiovascular science (Budde et al., 2016). Additionally, due to the complexity of the brain, many underlying neurobiological mechanisms are still not fully understood (Budde et al., 2016).

Psychological Consequences of the COVID-19 Pandemic. The final factor in the chronosystem concerns the psychological effects of diseases. At the beginning of March 2020, the WHO (2020b) declared the infection spread of the novel SARS-CoV-2 (COVID-19) virus a pandemic. By month’s end, COVID-19 had globally infected more than three quarters of a million people and killed 39,000. By August, those numbers escalated to 18,609,287 confirmed cases with 702,164 deaths (Vieira et al., 2020). With no available vaccine until Year 2 of the pandemic, the virus continued to spread, and the only available nonpharmacological preventive practice was social or spatial distancing and mask-wearing (Vieira et al., 2020).

The spread of misinformation, particularly in the United States, had profound consequences on psychological well-being (Motta et al., 2020; Vieira et al., 2020). In January 2020, only 1 month after the first reported COVID-19 case and 1 month before the declaration of the pandemic, a 2-week study was conducted in China on a popular social network. The researchers found that the number of posts talking about anxiety, indignation, and depression significantly increased, and the expression of positive emotions significantly decreased (Li et al., 2019).

The WHO (2020b) first focused its attention on mental health well-being in 2001 with its *New Understanding, New Hope* initiative that tasked governments to increase their policies and funding of mental health issues (Gil-Rivas et al., 2019; Lund, 2020). Nineteen years later, the WHO (2020d) braced itself for a potentially unprecedented scale, and the surge of mental health crises related to the COVID-19 global pandemic (Torales et al., 2020). Researchers predicted that the aftermath of the novel coronavirus would usher in different permutations of posttraumatic disorder as people coped with life disruptions, the death of loved ones, job losses, relationship strains, self-isolation, and forced isolation (Taylor & Asmundson, 2020).

In its wake, the pandemic ushered in what researchers called COVID stress syndrome (Taylor & Asmundson, 2020). The symptoms include fear of infection, fear of touching objects that might be contaminated with the virus, obsessive-compulsive disinfecting, reassurance-seeking, intrusive thoughts, nightmares, and xenophobia (fear that foreigners are virus-infected). Symptoms also include fear of future hugging or touching and anxiety-induced reluctance to leave home (Taylor & Asmundson, 2020). The positive news is that research in resilience suggests that many people will transition from the pandemic with renewed purposes and life meanings (Galatzer-Levy et al., 2018). However, there is a growing concern that there may be insufficient mental health resources for people suffering from mild to severe mental unwellness (Galatzer-Levy et al., 2018).

In the nascent stages of the pandemic, health officials looked toward physical exercise as an available nonpharmacological therapy to combat the negative psychological effects of COVID-19 lockdown, social distancing, and feelings of uncertainty (Jiménez-Pavón et al., 2020). The implication for this dissertation is that facilities offering exercise programs now have an opportunity to address the WHO's (2020d) mental well-being call to action by explicitly reinforcing the neurological, psychological, and emotional benefits of exercise during regular class instruction.

Macrosystem Factors

The macrosystem factors affecting the inclusion of mind and brain health in exercise classes are embedded in the sociocultural environment of the exercise participants. Culture shapes abstract definitions of health and wellness, the separation or connection of the mind and body, and how exercise is enculturated. The following factors address the indirect influence of culture on health and exercise practices.

The Abstract Definition of Health and Wellness. Health is a multidimensional construct and includes the domains of physical, mental, and social wellbeing (Prescott et al., 2019). The WHO (2020a) defined health as "a state of complete physical, mental, and social wellbeing and not merely the absence of disease or infirmity" (para. 2). Though the physical realm represents only one domain of wellness, it is the predominant focus of Western biomedicine (Hettler, 1980; Prescott et al., 2019). A seminal author of wellness research, Dunn

(1959) laid the foundation for the multidimensional wellness movement in the United States (Ardell, 1977; Hettler, 1980; Myers & Sweeney, 2004; Witmer & Sweeney, 1991; Zhu, 2018). Dunn (1959) defined high-level wellness as "an integrated method of functioning which is oriented toward maximizing the potential of which the individual is capable, within the environment where he is functioning" (p. 447). Dunn proposed that a person's health integrated spirit, mind, and body, and subsequent theorists added emotional, social, purpose, occupational, and intellectual domains (Ardell, 1977; Hettler, 1980; Myers & Sweeney, 2004; Witmer & Sweeney, 1991).

Despite sociological trends focusing on factors that create good health instead of solely factors that cause disease, a person's perception of health still determines if they approach their health management proactively or reactively (McCuaig & Quennerstedt, 2018; Mittelmark & Bull, 2013). At the start of a pilot intervention in Leicester, UK, designed to improve young peoples' understanding of health and well-being, 218 13-year-old boys and girls were asked what being healthy meant to them in anonymous surveys. Results revealed that 100% responded that being healthy meant being physically healthy (Singletary et al., 2015). A narrow conceptualization of health as solely physical risks failure to take proactive measures to ensure mental health (Beauchemin et al., 2019). This narrow conceptualization may be inadvertently perpetuated by fitness industry trends, as discussed in more detail in the exosystem (Beauchemin et al., 2019; Markula & Chikinda, 2016; Segar et al., 2011).

Mind-Body Dualism. Another factor affecting mind and brain health is the construct of mind-body dualism. Dualism, a perception of one's mind and body existing as two separate entities, pervaded most human cultures for centuries (Forstmann et al., 2012). In 16th-century France, Philosopher René Descartes argued that minds and physical bodies, though causally interacting, were two distinct entities (Forstmann et al., 2012). In the health realm, metaphysical beliefs and how individuals conceptualize physical antecedents to mental well-being influence health-related behavioral outcomes (Forstmann et al., 2012). A pictorial one-item dualism measure and a health-behavior questionnaire were administered to 304 participants recruited through Amazon's Mechanical Turk website (147 females, 157 males, controlling for education) by Burgmer and Forstmann (2018). Two columns of circles represented the body (left) and the mind (right) in gradually decreasing space intervals. Participants were asked to indicate which constellation best represented their idea of their bodies related to their minds. The dualism measure was coded so that high scores reflected a strong belief in dualism. The health questionnaire was coded so that high numbers represented health-sustaining behaviors. Belief in dualism negatively predicted health-sustaining behaviors, meaning the stronger a person's beliefs in mind-body dualism, the less likely they were to engage in health-sustaining behaviors. This study's results robustly replicated a smaller study conducted 6 years earlier using the same measurement tools in online data collection from 66 German-speaking adults (40 females, 26 males; Forstmann et al., 2012).

This dualism study had educational implications on health outcomes. When participants construed their minds as entirely separate entities from their bodies, their intuition was that mental well-being lacked material substrate (Burgmer & Forstmann, 2018). Consequently, they did not deem health-sustaining physical behaviors necessary and were more likely to report compromises of physical health (Burgmer & Forstmann, 2018). A different extrapolation of the Burgmer and Forstmann (2018) data suggested that mind-body dualists tended to neglect to care for their minds *by* neglecting to care for their bodies. The empirical relationship between beliefs and health outcomes highlighted a possible negative outcome when exercise instructors did not engage with exercise participants' beliefs about and perceived barriers to exercise in fitness settings (Cerin et al., 2010).

The Burgmer and Forstmann (2018) study indicated that belief systems affected individual health behaviors. A disconnect between how the mind affects the body and vice versa is a possible barrier to addressing mind and brain health in group fitness classes. Some participants may intrinsically believe that a healthy physical body is essential to take care of one's mind. Conversely, others may believe that healthy minds do not require healthy physical bodies. Certain religious beliefs on death, heaven, hell, reincarnation, and spirits of deceased family members share dualistic views of how a mind can exist beyond the body it formerly inhabited (Burgmer & Forstmann, 2018). A potential mind-body dualism existing in religious belief systems is one example of how individual beliefs may be rooted in larger cultural belief systems. These systems may unconsciously affect individual health behaviors and outcomes (Burgmer & Forstmann, 2018).

The Social Enculturation of Exercise. Two sociocultural aspects show why mind-brain health instruction is absent from group exercise instruction. These factors include the culture of medicine and the culture of the body (Segar et al., 2011). Western medicine practices influence how people are socialized to exercise (Segar et al., 2011). Physicians often base referrals to exercise in the context of diet and weight loss rather than as an effective way to enhance mood and quality of life. This prescriptive nature implicitly characterizes exercise as medicine for the body (Segar et al., 2011).

The findings in a mixed-methods study by Segar et al. (2011) showed that most of its 226 female participants (ages 40 to 60) were culturally socialized to value exercise for body-shaping and weight-related benefits. The participants attributed a perceived socially normative core value—to look better—as their reason for exercising. Qualitative results from this study revealed a salient consequence of an exercising for looks goal. Exercise goals were accurate predictors of participants' long-term adherence. The participants who set exercise goals to lose weight or mitigate health problems negatively perceived those goals as controlling, so the motivation was extrinsic. Consequently, physical goals did not produce sustainable motivation, self-regulation, or commitment to exercising.

Conversely, the group citing the enhancement of daily life as their primary exercise goal was most committed to regular exercise. Mental and emotional goals compelled these participants to add exercise despite reporting busy schedules because they felt the inclusion of exercise improved their well-being and their lives (Segar et al., 2011). Unlike the group with physical goals who felt controlled, this group reported feeling autonomous (Segar et al., 2011). The implications are that rebranding exercise—socializing people to consider exercise as a quality-of-life enhancer rather than a body sculpting tool—may improve long-term adherence (Segar et al., 2011). Integrating mind-brain health into exercise settings, connecting exercise to "feeling good," and teaching participants how to use exercise as a self-help tool to "feel good" may reinforce this sustainable adherence (Swann et al., 2020). Like a rising tide, it may lift all boats because other metabolic processes will also benefit from chronic exercise (Swann et al., 2020).

Exosystem Factors

Industries and systems, such as medical, pharmaceutical, fitness, media, education, and places of employment, indirectly influence exercise attitudes, beliefs, practices, goals, and adherence (Engeln et al., 2018; Jain & Jadhav, 2009; Pojednic et al., 2018). The literature in the next section explores the tension between competing incentives (profit and care) in health and wellness industries. The literature reveals how marketing strategies subliminally affect how and why people exercise (Prescott et al., 2019). This section also explores how sedentary practices in schools and places of employment implicitly reinforce mind-body dualism and contribute to stress and depression (Burgmer & Forstmann, 2018; Eanes, 2018; Huang et al., 2020; Kilpatrick et al., 2013; O'Donoghue et al., 2016). From a consumer standpoint, this explains why people are not conditioned to value or even consider proactive mental health strategies (Segar et al., 2011).

The Competing Incentives of Economic Profit and Health-Related Care. Western medical practices are in the business of treating disease and illness, not in fostering good health (Prescott et al., 2019). Some attribute this inclination to the lack of profit in health (Cooper, 2018). The health care and pharmaceutical industries help humans but are in the business to profit from services rendered. Wellness's entanglement in business presents a complex, if not ethical, conundrum. Dual incentives raise ethical questions when the service of helping human beings does not guarantee a profit margin (Cooper, 2018). For example, doctors and pharmaceutical representatives may find it economically more incentivizing to promote pills for anxiety and depression than to promote aerobic exercises on par with the efficacy of popular and antidepressant medications (Baker et al., 2003; Blumenthal et al., 2007, 2012; Cooney et al., 2013; Jain & Jadhav, 2009; Trivedi et al., 2011).

Six in 10 Americans take at least one prescription drug, and one in 10 uses five or more prescription drugs, leading one researcher to refer to Americans as "suffering from a culture of taking pills" (Kelley, 2017, p. 1). The reality is that disease prevention is not as financially lucrative as the treatment of disease (Kelley, 2017). Taking pills also requires less effort than engaging in proactive healthful behaviors, allowing the medical and pharmaceutical industries to capitalize on a cultural and evolutionary biological preference for quick fixes (Cheval et al., 2018; Kelley, 2017; Pontzer, 2018). The intricate interaction between physicians, pharmaceutical representatives, individuals, and culture illustrates how systemic forces shape mental health literacy and practices. Financially lucrative systems designed to treat mind and brain diseases may intentionally or unintentionally underprioritize promoting mind and brain wellness (Baker et al., 2003; Blumenthal et al., 2012; Cooney et al., 2013; Jain & Jadhav, 2009; Trivedi et al., 2011).

The Fitness Industry's Competing Incentives. The fitness industry is a health business with competing interests in promoting health and profit. Like the medical and pharmaceutical industries, these competing incentives present business and ethical challenges: serving humanity and fiscal needs (Parviainen, 2011; Smith et al., 2012). The economic necessity of maintaining enough paying memberships to run a fitness facility sometimes requires implementing popular packaged programs that attract customers but do not always align with optimal teaching practices (Parviainen, 2011). One example is the globally popular Les Mills exercise franchise that uses slick marketing and sync licensing rights to popular tunes to attract memberships and appeal to instructor convenience (Parviainen, 2011). Facility leaders purchase licenses to use the Les Mills class packages, including music, choreography, and instructor scripts. These products are sold to fitness facilities, with the caveat that all classes must legally use the Les Mills music, choreography, and cues without alteration (Andreasson & Johansson, 2016).

One problem with this one-size-fits-all system is that these exercise routines may not accommodate the actual biological, psychological, sociological, cultural, or functional needs of the participating participants in the room (Andreasson & Johansson, 2016). The second problem is that Les Mills's nomenclature explicitly focuses client attention on the physical domain of wellness with course names beginning with the word "body": Body Pump, Body Jam, Body

Flow, Body Attack, and Body Balance. The Les Mills franchise has been equated with "The McDonaldisation" model of society because predesigned classes mirror the fast-food chain's organizational structure (Ritzer, 2011). Like McDonalds, the Les Mills classes follow four principles: (a) "efficiency" in a predesigned product; (b) "calculability," so one knows how much time is needed; (c) "predictability" that all classes everywhere will be the same; and (d) "controlled space," where workers and customers "subordinate to a carefully controlled system" (Andreasson & Johansson, 2016, p. 150; MacFarlane et al., 2019). These principles are only one example of how the competing incentives of providing what is best for health, and what is best for profit presents a potential barrier to integrating mind and brain health in group exercise classes. In standardizing exercise practices, franchises, such as Les Mills, also contribute to constructing a global body ideal (Andreasson & Johansson, 2016). The next subsection discusses the resulting detrimental health repercussions of this construction.

The Media Promotion of the Culture of the Body. The media industry affects people's mental health and fosters exercise for body sculpting and aesthetics (Rodgers et al., 2015, 2017). Visual and social media's ability to shape and be shaped by culture gives it tremendous cumulative socio-cultural power (Donaghue & Allen, 2016). False realities, unrealistic images, and hierarchical cultural structures that define the "ideal" body type contribute to body dysmorphia and depression (Darmon, 2012). The media's entanglement with the health and wellness industry encourages looks-driven reasons for exercise (Donaghue & Allen, 2016). When the physically fit (by media standards) enter the foreground of cultural consciousness on airbrushed sports and fitness magazine covers, a toxic relationship between media ideals and high rates of body dissatisfaction forms, especially among females (Rodgers et al., 2015).

Social media present similar abilities to construct false realities through narratives and meticulously touched-up and filtered visuals in the news feed. In an experience sampling study conducted on 125 undergraduate psychology students (87 females, 38 males), passive social media use (scrolling through news feeds) was associated with loss of interest, concentration problems, fatigue, and loneliness (Aalbers et al., 2018). A relationship between social media use and depression was found when individuals believed their lives or appearances fell short of what they assumed was "better" in the news feeds of peers.

Despite exercise's modest role in weight loss, Google Trends reports that exercise and weight loss searches spike on January first, and weight-loss resolutions fuel January gym memberships (Cloud, 2009; Pontzer et al., 2016; Poon, 2019). Unrealistic media images perpetuate the culture of the *ideal* body and contribute to perpetuating the cultural promotion of exercise for weight loss and body sculpting (Darmon, 2012; Donaghue & Allen, 2016). The fitness and media industries' dominant marketing of exercise for weight loss is crucial to this study because it contributes to a potential barrier to ushering exercise's mind and brain benefits into the foreground of exercise's importance (Darmon, 2012; Donaghue & Allen, 2016; Pontzer et al., 2016; Rodgers et al., 2015). Energy expenditure (i.e., calories burned) related to the complexity of obesity is a critical factor to consider because the fitness and media industries profoundly yet erroneously advocate exercise as a primary weight-loss tool (Gaudet et al., 2019; Pontzer et al., 2016).

Research backs essential benefits of exercise for Type-2 diabetes, cardiovascular disease, dementia, mental health, and cancer, yet many individuals still cite weight loss as their primary goals when joining a gym (Andreasson, & Johansson, 2016; Mahtani et al., 2015). This objective is problematic. If weight loss goals are unmet, discouragement over exercise's inability to produce physical/aesthetic results can leave individuals skeptical of exercise's value, as well as at risk for body dissatisfaction, dysmorphia, or a feeling of personal failure (Darmon, 2012; Donaghue & Allen, 2016; Rodgers et al., 2015). This frustration may lead people to abandon exercising altogether, thus missing the myriad metabolic, mind, and brain benefits of exercise (Donaghue & Allen, 2016). Alternatively, it may lead to obsessive and compulsive exercising or eating disorders (Donaghue & Allen, 2016).

Evolutionary Anthropologist Pontzer (2018) conducted energy expenditure studies that revealed that biology works within certain physiological constraints. In a protective measure designed to sustain hunter-gatherer ancestors during food scarcity, human bodies evolved to maintain energy expenditure within a narrow range (Pontzer, 2018). A human's total energy expenditure plateaus above moderate activity levels to conserve the necessary energy required to sustain life (Pontzer et al., 2016). Total energy expenditure does not increase linearly with physical activity and adapts to the higher levels (Pontzer et al., 2016). This finding means more exercise does not necessarily generate higher caloric expenditure for exercisers.

Oversimplified fitness and media industries' exercise/weight-loss narratives do not factor in that supermarket shopping, and food delivery services have replaced hunting and gathering as humans' secure means of finding energy. Nevertheless, biological evolution has not caught up with this change (Pontzer et al., 2016). Human beings' narrow ranges of energy expenditure clash with this ease of food consumption, and highly palatable and processed foods create addictions (Cloud, 2009; Fazzino et al., 2019). Unexpended energy is stored as fat (Luke & Cooper, 2013). Therefore, solely focusing on exercising more to lose weight will not solve the obesity epidemic, but it may backfire and promote dropout of exercise altogether (Gaudet et al., 2019; Segar et al., 2011).

Hyper-palatable foods, gut microbiomes, endocrine functioning, preservatives in food, smoking, and the marketing practices of food and tobacco make weight loss a far more complex matter than what the under complexified exercise-for-weight-loss message implies (Cloud, 2009; Fazzino et al., 2019; Gaudet et al., 2019; Kelley, 2017; Luke & Cooper, 2013; Mahtani et al., 2015; Malhotra et al., 2015; Pontzer et al., 2016; Watanabe & Riddle, 2019). This important metabolic understanding from the discipline of evolutionary biology supports that using scientific evidence to reframe the narrative surrounding the benefits of exercise is ethically responsible. Research from evolutionary biology and endocrinology also highlights that the January push for exercise facilities to market for weight loss is more likely tied to increasing revenue than genuinely helping people lose weight (Cloud, 2009; Gaudet et al., 2019; Pontzer et al., 2016). Because failure to reach extrinsic goals can have long-lasting psychological consequences about attitudes toward exercise and health-promoting behaviors, media marketing campaigns have ethical implications (Gaudet et al., 2019; Segar et al., 2011).

Sedentariness in School and Workplace Design. The final correlational factors in the exosystem are sedentary behaviors promoted by and built into institutional systems (Jelić et al., 2016). The structure of educational and workplace systems requires and reinforces sitting (Kilpatrick et al., 2013). Students and office workers sit for much of the time. They receive instruction, work on computers, read, and hold meetings (Huang et al., 2020). Sedentary behaviors are frequently yet erroneously equated to the obesity epidemic (Pontzer et al., 2016). However, the sedentary behavior of prolonged sitting is now classified as a risk factor for other diseases, regardless of whether a person exercises regularly (Eanes, 2018). Even a vigorous 1-hour exercise session will not compensate for uninterrupted sitting for the rest of the day (Eanes, 2018). Sedentariness is a correlational and causal factor in cancers, cardiovascular diseases, diabetes, stress, dementia, sleeping problems, and mental health damage (Huang et al., 2020; O'Donoghue et al., 2016). Arguably, schools and workplaces, two of society's most influential institutions, are structured around excessive sitting and contribute to the depression crisis (Kilpatrick et al., 2013). These structures may reinforce mind-body dualism or at least a mind-body choice (Burgmer & Forstmann, 2018). Like a zero-sum game, ignoring the body is acceptable collateral damage to elevate the mind (in scholarship or productivity; Huang et al., 2020; O'Donoghue et al., 2016). An implicit institutional devaluing of the association between movement and mental health implicitly and explicitly contributes to the complexity of fostering multidimensional public health and wellness (Cardinal et al., 2012).

Microsystem Factors

The microsystem includes interactions closest to the focal individual, the group exercise participant. Interactions in this system most salient to the context of this study are those between group exercise participants and group exercise instructors. The following section explores factors directly impacting these stakeholders' beliefs and behaviors. The literature synthesis explains how these factors may address mind and brain health in group exercise settings.

The Knowledge and Preparation of Group Exercise Instructors. Group exercise instructors are tested on basic exercise science competencies (ACSM, 2021). National exercise governing boards include the ACSM (2021), the Athletic and Fitness Association of America (AFAA), the National Academy of Sports Medicine (NASM), the American Council on Exercise (ACE), the International Dance-Exercise Association (IDEA), the International Sports Sciences Association (ISSA), and the YMCA. These certification organizations integrate evidence-based scientific research from physiology, kinesiology, exercise science, and sports medicine in their certification programs (ACSM, 2021). The objectives of these national certifications are to prepare group exercise instructors and personal trainers practically and theoretically to lead safe and effective classes (Amonette et al., 2010; De Lyon & Cushion, 2013).

Group exercise instructors' continuing education is not standardized (Bennie et al., 2017). Consequently, the quality of instructors' sources of knowledge may not reflect the most current evidence-based fitness practices (Amonette et al., 2010; Bennie et al., 2017). Training protocols in certification organizations hold instructors accountable for addressing client metabolic, cardiovascular, bone density, muscular strength, and aesthetic needs but not mind-brain health (ACSM, 2021). However, as with any science-based field, the evolution of knowledge presents unique challenges for instructors to practice with incomplete knowledge that is ever-changing (Amonette et al., 2010). Results of scientific empirical studies are potentially outdated once another study proves something new (Amonette et al., 2010). This finding means that all scientific work, by nature, is incomplete. In the context of group exercise, this finding means that, if classes are evidence-based, then the best practices of 10 years ago may not reflect current best practices (Ku & Hsieh, 2020).

Continuing education in the fitness profession is unstandardized; therefore, instructors are free to choose any courses to fulfill certification requirements (ACSM, 2021; Stacey et al., 2010). Because course choices are predicated on instructor interests, continuing education sources may come solely from "exercise-to-music" (Andreasson & Johansson, 2016, p. 154) courses that focus on matching choreography to music but omit updated evidence-based knowledge (Bennie et al., 2018; Stacey et al., 2010). In a Taiwanese mixed-methods study on the professional competencies of 184 personal trainers and 140 group fitness instructors, knowledge of exercise physiology, human anatomy, kinesiology, and pathology were considered a high priority in the personal trainer group and a low priority in the group instructors (Ku & Hsieh, 2020). Similarly, qualitative data from a year-and-a-half-long ethnographic study of 15 health multinational fitness professionals (7 men, 8 women, 4 American, 2 Spanish, 8 Swedish) aligned with Ku and Hsieh (2020). The study indicated that the instructors perceived that fitness industry training promoted marketing appeals over content knowledge (Andreasson & Johansson, 2016; Bennie et al., 2018; Stacey et al., 2010). One female respondent with several years of experience revealed discouragement over the trend of training instructors to teach programmed classes instead of a breadth of knowledge:

> Everything is pre-packaged. You actually get like a list of fun things that you can say during a workout. It can be like "we cruise our way in, but the back bites hard" (laughing) meaning something like "it's gonna be quite easy in the beginning but then we give it everything we got," so even that is pre-choreographed. So then, you're down to the fact that you hardly need to be a human in the end; it is waterproof. (Andreasson & Johansson, 2016, p. 155)

This and other participants expressed how the expertise required to be a group exercise instructor had changed over the years. The study's respondents shared a sense of the devaluation of individual instructor knowledge who felt that focusing on prepackaged choreography "impoverished the occupation" (Andreasson & Johansson, 2016, p. 157).

The combination of exercise neuroscience being a relatively nascent field (in comparison with cardiovascular science) and group fitness instructors underprioritizing the scientific component of fitness education may account for why mind and brain science is not yet part of group exercise instruction, conversation, and culture. The omission of connecting exercise benefits to mental health may result from an education or training gap.

An exercise instructor's practice knowledge has public health implications due to fitness instructors' considerable societal reach (Ku & Hsieh, 2020; Stacey et al., 2010; Zenko & Ekkekakis, 2015). In 2019, an estimated 64.2 million U.S. people belonged to a gym (Ku & Hsieh, 2020). This number translates to over one in five Americans. The average American receives more health information from their exercise instructors than their doctors (Ku & Hsieh, 2020; Zenko & Ekkekakis, 2015). This finding represents both an enormous educational opportunity and a potential risk (Ku & Hsieh, 2020; Zenko & Ekkekakis, 2015). In a study to assess the level of knowledge of ACSM exercise guidelines, 1,808 ACSM certified professionals (with varying levels of education, including doctorate) were given an online, 11-item survey testing their knowledge of the ACSM's guidelines for recommended exercises (Zenko & Ekkekakis, 2015). The median was five correct responses out of 11, indicating room for instructor knowledge improvement (Zenko & Ekkekakis, 2015).

The quality of practice knowledge an instructor chooses for training and continuing education impacts class instruction. Bennie et al. (2017) conducted a two-part study and surveyed academics and university professors ($N = 27$). The professors, affiliated with a large university in Australia, were asked to rank the sources typically available for an instructor's continuing education. The expert panel included exercise-prescription fitness professionals holding PhDs and 20+ years of undergraduate and graduate teaching experience in Australia. The expert panel of professors rated academic textbooks, workshops and specialized courses, and scientific journals related to exercise science as high-quality sources of information. Conversely, the panel also ranked ideas garnered from a fitness instructor's peers, the instructors' personal experiences, standard online web searchers, and popular fitness magazines as low-quality sources of information (Bennie et al., 2017). Using the knowledge-source rankings, the second part of the same study administered an online Likert-rated frequency survey of 9,100 certified Australian fitness instructors' sources of information and found that 73% of the instructors reported "always" using high-quality sources for continuing education. In contrast, 27% reported "always" using low quality.

Zenko and Ekkekakis (2015) conducted an online study. The researchers reported similar findings, with 70% of instructors indicating "always" using high-quality sources for continuing education and 30% indicating "always" primarily using low-quality sources. Scientific journals, the sources that might reflect the most current scientific findings, were used only a third to a quarter of the time by both study populations (Bennie et al., 2017; Zenko & Ekkekakis, 2015). It was not indicated why journal use was low, but one potential explanation was that many scientific journals were behind "pay walls," where access was only granted for a fee (Baffy et al., 2020). Low instructor pay might account for the inability to access high-quality sources (De Lyon et al., 2017).

Of particular interest to this inquiry into the exercise integration of mind-brain health is that the literature reveals a gap in translating evidence-based science and fitness instructor knowledge into practice (De Lyon et al., 2017). Little is known about what influences instructor uptake and use of information. The previously cited study identified the sources of knowledge and the quality of those sources; however, they did not evaluate how those findings translated into practice (Bennie et al., 2017; Zenko & Ekkekakis, 2015). Furthermore, in a qualitative study by Stacey et al. (2010), findings showed that using high-quality sources of information or having advanced degrees did not ensure content proficiency, leaving a question about the point of understanding how knowledge translates to practice (Ku & Hsieh, 2020; Stacey et al., 2010; Zenko & Ekkekakis, 2015).

Domains of Wellness Instructed in Group Exercise Classes. The next factor in the microsystem that affects the inclusion of mind and brain health in group exercise classes concerns the domains of wellness addressed during instruction. The ambiguity of what it means to be "well" or "healthy" may influence promoting wellness beyond its traditional physical focus (Dunn, 1959; Hettler, 1980). As discussed in the macrosystem factors, developing consensus in a definition for health and wellness is abstract (Ardell, 1977; Dunn, 1959; Hettler, 1980; Myers & Sweeney, 2004; Witmer & Sweeney, 1991; Zhu, 2018).). The Five-Factor Wellness of Lifestyle Scale identifies five primary domains of wellness: the physical, social, emotional, intellectual, and spiritual (Ardell, 1977; Dunn, 1959; Hettler, 1980; Myers & Sweeney, 2004; Witmer & Sweeney, 1991; Zhu, 2018). The scale is accepted as a reliable and validated tool for measuring the most recognized domains of wellness (Beauchemin et al., 2019).

In group exercise classes and personal training sessions, instructor knowledge is actualized to support the physical domain of client wellness (Beauchemin et al., 2019; Donaghue & Allen, 2016). This aspect can be attributed to fitness instructors' physical domain-based training perhaps inadequately preparing them to meet the multidimensional wellness needs of their clients (ACSM, 2021; Darmon, 2012; Donaghue & Allen, 2016; Gonzalo-Encabo et al., 2019; Markula & Chikinda, 2016; Vega et al., 2017). Additionally, once instructors are certified in basic exercise science skills, continuing education quality is neither standardized nor monitored for content (Bennie et al., 2017; De Lyon & Cushion, 2013; De Lyon et al., 2017; Lloyd & Payne, 2017).

A study of 185 primarily college-educated, nationally certified fitness professionals in the Midwestern United States (ages 30 to 39) identified a relationship between industry role and the frequency of promoting various domains of wellness (Beauchemin et al., 2019). Personal trainers, individuals who work one-on-one with exercise clients instead of working with groups of people, indicated discussing physical wellness most often 84% of the time. Those who identified as having multiple job roles in the fitness industry (as personal trainers and group exercise instructors) also reported discussing the physical domain most of the time (98%). Study results also indicated that participants who had one industry role (either a personal trainer or a group exercise instructor) discussed emotional wellness 40% more often than 72% who reported multiple roles. Instructors having multiple industry roles also reported addressing lifestyle change with clients most often (98%). No significant results were found for gender except in the emotional domain, where 68% of female professionals reported addressing it compared with 42% of their male colleagues (Beauchemin et al., 2019).

In the Beauchemin et al. (2019) study, 90% of study respondents reported addressing the physical domain of wellness most often, regardless of industry role. These findings aligned with semi-structured interviews obtained from a Rosado et al. (2014) study enlisting 16 Portuguese male fitness instructors (*M* age = 28). Reasons given for most frequently addressing the physical domain of wellness was attributed to there being “more and more of a body cult” that accounted for why “people are becoming more interested in exercise” and because “we are becoming an old and obese population” (Rosado et al., 2014, p. 28).

The quantitative findings from the Beauchemin et al. (2019) study showed that instructors with multiple roles consistently scored higher in all domains of wellness compared with colleagues holding one industry role. These findings raise the question of whether single certifications expose instructors to enough holistic or comprehensive education and if multiple outlets offer more integrative training that fosters holistic teaching (Ardell, 1977; Dunn, 1959; Hettler, 1980; Myers & Sweeney, 2004; Witmer & Sweeney, 1991; Zhu, 2018). Continuing education training in certification-specific integrative approaches may be more influential in promoting multidimensional wellness than formal academic study (Beauchemin et al., 2019).

However, bringing the qualitative interview data from the Rosado et al. (2014) study into a systems conversation with the quantitative data reveals an ecologically complex intersection of factors (Beauchemin et al., 2019). Although the Beauchemin et al. (2019) findings interject instructor knowledge preparation into the equation of the frequency with which domains of wellness are addressed in fitness settings, Rosado et al. (2014) used data from the macrosystem factors of cultural beliefs on body image into why instructors might favor including the physical domain of wellness in classes: The clients want and expect it. Rosado et al. also gathered qualitative data that united the exosystem factor of competing industry incentives with domains of wellness addressed in classes (Engeln et al., 2018; Jain & Jadhav, 2009; Pojednic et al., 2018). Instructors discussed how managing and offering clients the services they wanted (e.g., weight loss) was important to the economic necessity of attracting business (Rosado et al., 2014). The implications from these two studies are that integrating mind and brain health into socially enculturated beliefs about the physical benefits of exercise is more complex than just teaching instructors new evidence-based knowledge about mind and brain health (Parviainen, 2011; Smith et al., 2012).

Group Exercise Instructor Perception of Job Role. The role of a fitness instructor is as ambiguous as the definition of wellness (Garrin, 2014; De Lyon et al., 2017; Lloyd & Payne, 2018; Zhou et al., 2019). Researchers have categorized instructors as “Jacks/Jills of all trades,” fulfilling roles of “teacher, trainer, counselor, coach, supervisor, supporter, nutritionist, biomechanist, bodybuilding evaluator and consultant, life management advisor, weight controller, personal life consultant, businessperson, and physical fitness advocate” (De Lyon et al., 2017, p. 319). An instructor's perception of their job roles directly influences class instruction, content, and methods (De Lyon & Cushion, 2013; Zhou et al., 2019). However, it is unclear if fitness instructors view themselves as teachers of health information, guides of movement, adjunct healthcare professionals, or all the above (De Lyon et al., 2017; Garrin, 2014; Lloyd & Payne, 2018; Rosado et al., 2014; Zhou et al., 2019). Instructors serve as valuable public health stakeholders capable of promoting multiple dimensions of health and wellness, assessing instructors' perceptions of job roles factors into this study's problem of practice (Donaghue & Allen, 2016; Pojednic et al., 2018; Zhou et al., 2019).

Learning goals in health and fitness settings affect participant adherence, influencing individual and public health outcomes (Lloyd & Payne, 2018; Swann et al., 2020). Instructors' perceptions that exclude envisioning themselves as health educators serve as barriers to addressing mind and brain health (Garrin, 2014; Lloyd & Payne, 2018). Teachers' mental health literacy correlates with students' mental health literacy; hence, implementing mind and brain health in group fitness settings requires additional training for new content and practice application (Burau et al., 2018; Miller et al., 2018). However, a fitness professional who does not identify as both a learner and an educator may not be amenable to the strategies required to implement change (Burau et al., 2018).

Using semi-structured interviews of 16 male, college-educated, urban health club instructors (ages $M = 28$; $SD = 6.3$), Rosado et al. (2014) conducted an exploratory study and analyzed instructors' perceptions of their job roles. Key findings included that fitness instructors valued acquiring scientific knowledge, educating people on taking care of their health, and improving their participants' quality of life. The instructors also cited creativity, the dynamic working environment, and the social importance of their work as key motivations. Negative perceptions of job roles included low pay and the hectic work schedule required to piece together multiple jobs necessary to earn a sufficient living wage (Rosado et al., 2014).

Most fitness industry studies tend to focus on research in the fitness industry, such as training skills, characteristics of successful trainers, and sociocultural aspects of sports and leisure industries (De Lyon et al., 2017; Ku & Hsieh, 2020; Lloyd & Payne, 2018). As a result, empirical evidence is scarce on fitness professionals' roles in impacting public health (De Lyon et al., 2017; Garrin, 2014; Sparling, 2005; Stacey et al., 2010; Way et al., 2018). The fitness profession's impact on public health is speculative because much of the research focuses on analyzing individual programs and not the practices and effectiveness of the practitioners implementing them (Markula & Chikinda, 2016).

In the first of its kind, a global survey by Pojednic et al. (2018) was electronically administered to primary care and sports medicine doctors worldwide to understand the relationship between the medical profession and the fitness industry. Data revealed that physicians only recommended exercise at health club facilities to 41% of patients and personal training to 21% of patients (Pojednic et al., 2018). The main reasons cited for not recommending fitness facilities were cost and convenience (78%), not poor perception or trustworthiness of the quality of the exercise professional or fitness settings (Pojednic et al., 2018). Conversely, the overall perception of the fitness industry by physicians was positive, contrasting some fitness professionals' skepticism about how other health professionals perceived fitness instructors' knowledge, credibility, and level of professionalism (Beauchemin et al., 2019; De Lyon et al., 2017; Pojednic et al., 2018; Zhou et al., 2019).

Group Exercise Participant Beliefs About Exercise Benefits and Barriers. The focal individual, the group exercise participant, is at the center of the EST's microsystem. Group exercise instructors help these individuals improve their proximal and distal health outcomes. Though it seems obvious, receiving the mental health benefits of exercise requires the actual execution of physical exercise. The ACSM (2021) defined physical exercise as “a type of physical activity consisting of planned, structured, and repetitive bodily movement done to improve and/or maintain one or more components of physical fitness" (para. 2). Group exercise participants have individual beliefs about the benefits and barriers to exercise that significantly impact their exercise participation and adherence; therefore, understanding participant beliefs is necessary before planning an intervention (Herazo-Beltrán et al., 2017; Rodriguez-Morales et al., 2020).

A variety of factors serve as either motivators or barriers to exercise participation, including age, gender, level of education, socioeconomic level, time, motivation, skill, energy, physical and mental health, social support, resources, previous experiences, and fear (Herazo-Beltrán et al., 2017; Sechrist et al., 1987). In a study of 157 Polish fitness center-attending females aged 17 to 83, health and revitalization were the most common motivations for exercising (Sas-Nowosielski et al., 2017). The study divided the women into five groups: early adulthood, middle adulthood, late adulthood, and old age. Avoiding disease, health pressures, and enjoying companionship were main motivators in older women. The main perceived barriers shared by older and younger women were physical limitations and time constraints; however, the barrier of time decreased with age while physical limitations increased (Sas-Nowosielski et al., 2017). Limitations to this study included convenience sampling and lack of control for exercise formats (e.g., aerobics, yoga, and Pilates); however, participants' ages factored into perceptions of barriers and benefits. Additionally, participants’ motives and barriers were essential to predicting and maintaining adherence (Herazo-Beltrán et al., 2017; Sas-Nowosielski et al., 2017).

The demands of midlife present another barrier to exercise. A qualitative study of 53 Canadian women, ages 40 to 62, who reported routinely exercising cited disruptions in daily structure, competing demands, and self-sacrifice as their top barriers to exercise (McArthur et al., 2014). As in the Sas-Nowosielski study (2107), time was not considered a significant barrier to exercise in this group. Extrinsic factors outside of the programs offered in group exercise classes greatly affect exercise participation and adherence. Consequently, assessing participants' biopsychosocial factors and creating wellness strategies that account for these barriers is necessary for encouraging participation and adherence (Borrell-Carrió et al., 2004; McArthur et al., 2014).

One final but important barrier to consider is participants' past experiences. Data were from surveys and computerized gym attendance records of 437 Portuguese gym exercisers (female = 235, male = 202), ages 18 to 53 (M = 31.14; SD = 9.47). Data showed that past experiences were motivational determinants or barriers to future exercise adherence (Rodrigues et al., 2020). In this study, barriers from past experiences included two determinants from Bandura's (1997) self-determination theory, considering motivational factors serving as agents for behavioral outcomes (Ryan & Deci, 2017). The barriers reported by study participants included two factors that adversely influenced basic psychological needs required for exercise participation: feelings of low competence and frustration from perceptions of imposed pressure, demands, and guilt (Rodriguez-Morales et al., 2020).

A similar study on past experiences affecting future health behaviors revealed that even the act of being chosen last for a team in an earlier life was associated with reducing weekly energy expenditure later in life (Cardinal et al., 2012). The important implication in these studies is that emotional experiences with exercise have long-term consequences on exercise behaviors and, potentially, long-term health outcomes (Cardinal et al., 2012; Hardiman, 2012; Rodrigues et al., 2020; Ryan & Deci, 2017). Learning and acquiring new information and skills requires setting an emotional climate for the learner (Hardiman, 2012). Thus, group exercise participants' beliefs about exercise's benefits and barriers must factor into potential barriers to integrating mind and brain health in group exercise settings (A. M. Ross & Melzer, 2016).

Conceptual Framework

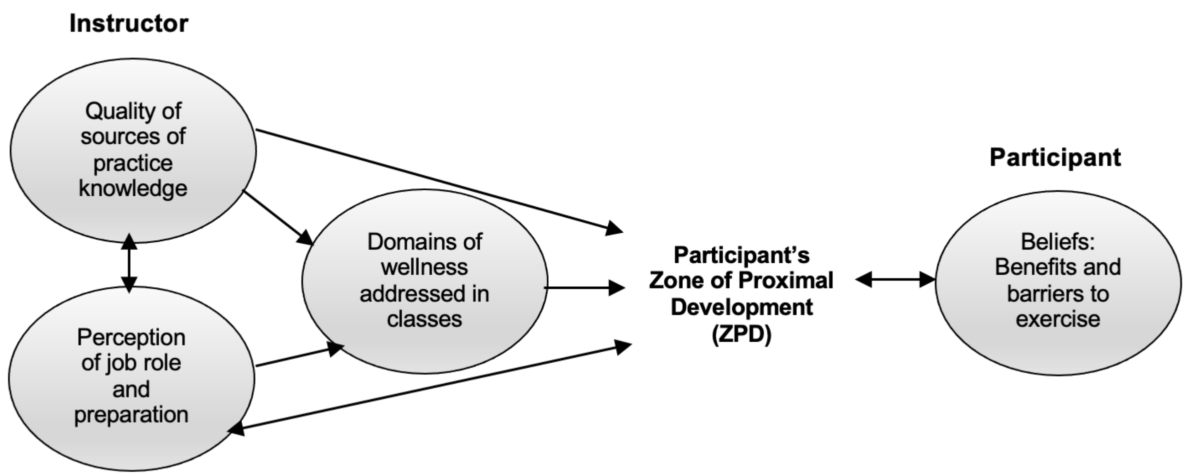
A conceptual framework using factors from the microsystem guided the needs assessment study. The chosen factors warranted further empirical investigation because each might serve as either a barrier or facilitator to integrating mind and brain health in group exercise settings at the YMCA. The following are the factors:

- Perceived benefits and barriers group exercise participants attribute to exercise,
- domains of wellness group exercise participants and instructors perceive as addressed in group exercise classes,
- sources of group exercise instructors' health and fitness knowledge, and
- group exercise instructors' perception of their roles in the fitness industry.

The synthesis of research literature and social constructivist theory (SCT) justified and grounded the factors chosen for the conceptual framework (von Glasersfeld, 2005; Vygotsky, 1978). In SCT, learning occurs in the interactions within a person's zone of proximal development (ZPD). ZPD "is the distance between the actual developmental level" of a person and "the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). Following this definition, group exercise classes represent an educational space where new information from instructors assimilates with a participant's prior knowledge and experiences. The goal is to foster meaning-making and create new knowledge and practices with a participant's ZPD (Brown et al., 2014). Figure 1.2 illustrates how the factors relate to one another within SCT.

Figure 1.2

Conceptual Framework



Note. Shaded ovals depict EST microsystem factors chosen for simultaneous qualitative and quantitative data collection. Arrows show relationships between factors and a group exercise participant's zone of proximal development (Vygotsky, 1978).

Participant beliefs about the perceived benefits of and barriers to exercise are strong determinants in their participation and adherence to exercise programs (Beauchemin et al., 2019; Howle et al., 2017; Segar et al., 2011). These beliefs affect exercise goals and are directly impacted by instructor knowledge (De Lyon & Cushion, 2013; Swann et al., 2020). The quality of instructor knowledge and their perceptions of their roles as instructors affect which domains of wellness are addressed in classes (Beauchemin et al., 2019; De Lyon & Cushion, 2013; De Lyon et al., 2017). If instruction skews toward the physical domain of wellness without integrating mind-brain well-being—as is the tendency in group exercise classes—mental health literacy and well-being outcomes are impacted (Beauchemin et al., 2019; Markula & Chikinda, 2016). Furthermore, an instructor's perception of their job role determines if they consider exercise classes educational spaces where learning, and not just performance, impacts participant multidimensional wellbeing (De Lyon et al., 2017; MacFarlane et al., 2019). For these reasons, a needs assessment was conducted to determine if these contributing factors existed in the context of the YMCA.

Summary

A systems-based literature review using the ecological systems theory provides a thorough, multidisciplinary, and ecological rationale behind why addressing mental health is timely while also providing empirical evidence explaining why exercise as a mitigating mental health strategy is worthy of further investigation (Chen et al., 2018; Lee et al., 2019; Livingston et al., 2017; Mikkelsen et al., 2017; WHO, 2020b). After placing factors related to mind and brain health into the EST, three trends emerged: (a) the promotion and enculturation of exercise gradually skewed from multidimensional wellness toward physical and aesthetic goals (Ardell, 1977), (b) exercise promotion began to mirror Western biomedicine's practice of treatment over wellness's practice of prevention (Beauchemin et al., 2019; Mittelmark & Bull, 2013), and (c) for-profit industries began to influence the marketing, messaging, and content of exercise instruction (Andreasson & Johansson, 2016; Markula & Chikinda, 2016). The ACSM (2021) defined exercise as "a type of physical activity consisting of planned, structured, and repetitive bodily movement done to improve and maintain one or more components of *physical* fitness" (para. 2). Even such a definition excludes exercise's benefits on mental health. Subtle omissions of this type may contribute to the unidimensional construction of the purposes and values of exercise.

This literature synthesis established plausible reasons why mind-brain health is lacking from group exercise inclusion. Two groups of stakeholders emerged from the literature review as valuable sources of needs assessment data: group exercise instructors and participants. For the reasons explained in the conceptual framework, the factors chosen to guide the Chapter 2 needs assessment consisted of

- the perceived benefits and barriers group exercise participants attribute to exercise,
- the domains of wellness group exercise participants and instructors perceived as addressed in group exercise classes,
- the sources of group exercise instructors' health and fitness knowledge, and
- group exercise instructors' perception of their roles in the fitness industry.

Data collected and analyzed determined how these factors manifested in the context of the YMCA and may inform future interventional strategies. Chapter 2 presents a thorough description of the needs assessment.

Chapter 2: Needs Assessment

The prevalence of mind and brain health issues affecting women indicated a relevance for studying how the physical, social, emotional, cognitive, and lifestyle domains of wellness were addressed in group exercise classes. The literature in Chapter 1 revealed how the intertwining of cultural, economic, and historical trends served to socialize and enculturate exercise for its physical health benefits, weight loss, and body aesthetics. Although exercise neuroscience provided clinical and behavioral evidence of exercise's benefits on women's mind and brain health, there was a gap in the literature on how this research manifested in the messaging and instructing women's group exercise classes. In the following sections, the study's context, purpose, research design, method, procedure, and findings are presented. The chapter concludes with a discussion of the study's implications for designing an interventional strategy.

Study Rationale

The rationale behind conducting this needs assessment study was that mind and brain health problems were a growing global health crisis (WHO, 2020a). Moreover, exercise was an evidence-based mitigating strategy (Basso & Suzuki, 2017; Lee et al., 2019). However, group exercise instructors might feel unprepared to teach multiple dimensions of health and wellness (Beauchemin et al., 2019; Segar et al., 2011).

Context of the Study

The context of this study was a suburban branch of the YMCA in a large metropolitan city in the southwestern United States. The greater metropolitan YMCA served over 600,000 people annually. The local branch under study annually served approximately 40,000 people.

Statement of Purpose

The increased prevalence of depression, stress, anxiety, cognitive decline, dementia, and Alzheimer's disease presented a growing global health crisis (Carmona et al., 2019; Livingston et al., 2017; WHO, 2020a). Furthermore, hormonal fluctuation and decline in women at midlife presented an extra risk factor for mind and brain health issues (Mosconi et al., 2018). The purpose of this study was three-fold: (a) to gain a deeper understanding of what ways, if any, mind and brain health are addressed in group exercise settings at the YMCA; (b) to identify barriers to addressing mind and brain health in group exercise classes; and (c) to contribute to scholarly discussion on the education of mind and brain health.

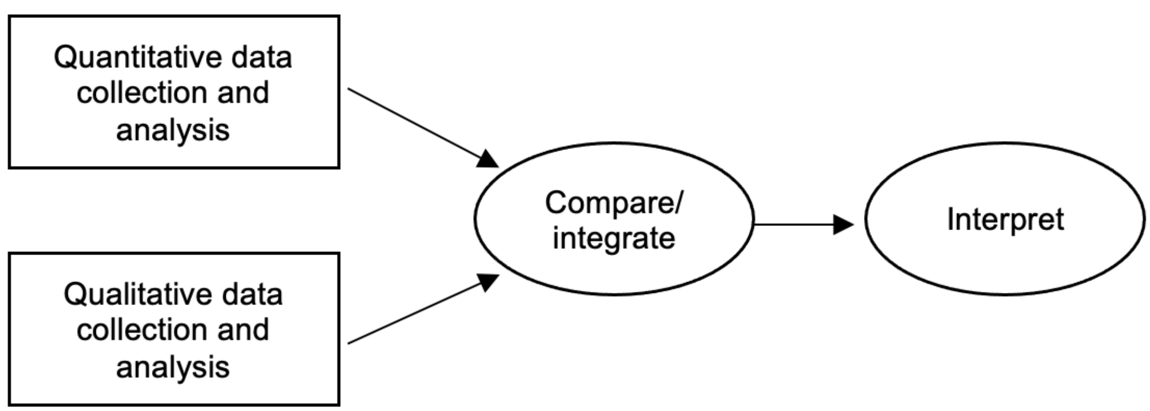
Research Design

A convergent parallel mixed-methods design was used to link quantitative and qualitative data strands in this needs assessment (see Johnson & Onwuegbuzie, 2004; Lochmiller & Lester, 2017). In a convergent parallel design, quantitative and qualitative data strands were concurrently collected, equally weighted in value, and interpreted together (see Figure 2.1; Creswell et al., 2011). The rationale for conducting mixed-methods studies is that statistical likenesses and differences do not live in a vacuum isolated from the psychosocial influences creating them (Creswell et al., 2011). Furthermore, statistical significance and practical significance connote different meanings that require a nuanced approach to data interpretation (Creswell et al., 2011; Johnson & Onwuegbuzie, 2004; Miles et al., 2013). A mixed-methods study creates an opportunity for the social science researcher to understand quantitative data within the contextual realities of human interactions that produce those data results (Johnson & Onwuegbuzie, 2004). Although quantitative data from surveys reveal *what* is happening, qualitative data from focus groups can uncover *why* it may happen. While comprehending the *why*, meaningful and effective intervention can either efficiently address and mitigate problems or conversely support and share what is working and why it is working.

Quantitative questionnaire survey data and qualitative semi-structured focus group interview data were concomitantly collected and analyzed. A mixed-methods approach was used in this study due to its strength in converging and corroborating quantitative and qualitative findings to provide more profound meaning and insight into the phenomena (see Johnson & Onwuegbuzie, 2004). The descriptive statistics and inductive qualitative synthesis informed the intervention design to address mind and brain health in group exercise classes.

Figure 2.1

Convergent Parallel Design



Note. In a convergent parallel design, quantitative and qualitative data strands are concurrently collected, equally weighted in value, and interpreted together (Creswell et al., 2011). Triangulated data were used to inform the intervention.

Methods

The exploratory needs assessment was conducted to understand how mind and brain health education manifests within the context of group exercise classes at a YMCA branch. This section describes the methods used to answer the following research questions:

RQ1: Which domains of wellness do group exercise participants and instructors perceive as addressed in group exercise classes?

RQ2: What are the sources of group exercise instructors' health and fitness knowledge?

RQ3: How do group exercise instructors perceive their roles in the fitness industry?

RQ4: What are the perceived benefits and barriers group exercise participants attribute to exercise?

Participants

Two stakeholder populations were recruited for data collection: group exercise instructors and group exercise participants from the local YMCA branch. All study participants were adults (> 21) and participated voluntarily. None were in special-consideration populations, as identified by the Johns Hopkins Homewood Institutional Review Board (HIRB). All group exercise survey participants (N = 45) identified as female.

Table 2.1 contains descriptive statistics for group exercise participants. Surveys sent to group exercise instructors (n = 31) did not ask participants to specify age or gender. Both focus group participants (n = 2) were female.

Table 2.1

Descriptive Statistics: Group Exercise Participants

Age group	Frequency	Percent	Valid percent	Cumulative percent
30-39	1	2.2	2.2	2.2
40-49	2	4.4	4.4	6.7
50-59	7	15.6	15.6	22.2
60+	35	77.8	77.8	100.0
Total	45	100.0	100.0	

The three criteria for inclusion in this study were that instructors must (a) be currently employed by the YMCA branch under study, (b) hold a national group exercise certification, and (c) be 21 or older. Inclusion in the study required that group exercise participants must be (a) current members of the local YMCA branch under study, (b) attendees of any format of group exercise classes offered at the YMCA, and (c) 21 or older.

Measures or Instrumentation

Data for the quantitative strand of the needs assessment study were collected from pre-existing validated survey instruments, assessing the constructs of the quality of sources of instructor knowledge, the perceived frequency of inclusion of multiple domains of wellness in group exercise classes, and beliefs about benefits and barriers to exercise (Table 2.2). The Quality of Sources of Knowledge Survey was administered to instructors. The Exercise Benefits and Barriers Scale was administered to group exercise participants. The Multiple Domains of Wellness Survey was given to instructors and group exercise participants.

Data for the qualitative strand of the needs assessment study were collected from an instructor focus group using two volunteer participants who had also completed the quantitative surveys. Semi-structured focus group questions were adapted from previous empirical research (see De Lyon & Cushion, 2013; De Lyon et al., 2017) and measured the construct of perception of job role in the fitness industry. Table 2.2 includes constructs, the operational definitions, indicators, and citations for instruments used.

Table 2.2

Operationalizing Constructs

Construct	Operational definition	Indicator	Citations
Exercise beliefs about benefits and barriers	Benefit- an advantage or profit gained from something Barrier- a circumstance or obstacle that keeps people or things apart or prevents communication or progress Belief- trust, faith, or confidence in someone or something	Health Promotion Model - Instruments to Measure HPM Behavioral Determinants: Exercise Benefits/Barriers Scale (Adult Version)	Sechrist et al., 1987
Domains of wellness	Physical, social, spiritual, emotional, intellectual, lifestyle change (See Appendix A for detailed definitions.)	Multidimensional Wellness Survey	Beauchemin et al., 2019
Perceptions of job role	A way of regarding, understanding, or interpreting their position as an instructor of fitness.	Focus Group Semi-Structured Interview: Perceptions of fitness professionals regarding fitness occupations and careers	De Lyon & Cushion, 2013; De Lyon et al., 2017
Sources of knowledge	Sources where an instructor would find information relevant to the classes they instruct.	Instructor Sources of Practice Knowledge Questionnaire	Bennie et al., 2017

The following subsections list the instruments used in the needs assessment study. The subsections also contain details on each tool. The goal is to present a rationale on why data collected from each instrument provide answers to the research questions.

Multidimensional Wellness Survey. The Multidimensional Wellness Survey was a 6-item survey used to collect quantitative data on the construct of domains of wellness (Beauchemin et al., 2019). The survey was adapted from previous models of wellness, including the high-level wellness model (Dunn, 1959), Ardell's (1977) components of wellness model, the hexagonal model of wellness (Hettler, 1980), the wheel of wellness (Witmer & Sweeney, 1991), the indivisible self-wellness model (Myers & Sweeney, 2004), and the five-factor wellness evaluation of lifestyle (Myers & Sweeney, 2005). Though the concept of wellness had numerous interpretations, researchers agreed the multidimensional construct had the most common components: physical, social, emotional, intellectual, and spiritual (Abrahams & Balkin, 2006; Beauchemin et al., 2019; Roscoe, 2009).

According to Hettler (1980, p. 78), operational definitions derived from five primary domains. The *physical domain* “measures the degree to which one maintains cardiovascular fitness, flexibility, and strength. Measures the behaviors that help one to prevent or detect early illnesses” (Hettler, 1980, p. 78). The *social domain* “measures the degree to which one contributes to the common welfare of one’s community. This emphasizes the interdependence with others and with nature” (Hettler, 1980, p. 78). The *spiritual domain* “measures one’s ongoing involvement in seeking meaning and purpose in human existence. It includes a deep appreciation for the depth and expanse of life and natural forces that exist in the universe” (Hettler, 1980, p. 78). The *emotional domain*

> measures the degree to which one has an awareness and acceptance of one’s feelings. This includes the degree to which one feels positive and enthusiastic about oneself and life. It measures the capacity to appropriately control one’s feeling and related behavior, including the realistic assessment of one’s limitations. (Hettler, 1980, p. 78)

The *intellectual domain*

> measures the degree to which one engages his or her mind in creative, stimulating mental activities. An intellectually well person uses the resources available to expand his or her knowledge in improved skills, along with expanding potential for sharing with others. (Hettler, 1980, p. 78)

Per Bloom et al.’s (1956) taxonomy of learning, this study substituted the word cognitive for intellectual (see Adams, 2015). *Lifestyle change* refers to “establishing healthy behaviors to improve multiple domains of wellness that result in wellness promotion, and ultimately decreased chronic illness and death" (Beauchemin et al., 2019, p. 149).

The objective of the Multiple Domains of Wellness survey was to rank the frequency (e.g., *never = 1* to *very often = 5*) with which group exercise instructors would address the wellness domains in their group exercise classes (Beauchemin et al., 2019). This instrument addressed the Chapter 1 microsystem factor of *domains of wellness* instructed in classes, which might be a contributing factor to integrating mind and brain health in group exercise classes. The literature revealed that instructors tended to address the physical domain of wellness most in their classes (Beauchemin et al., 2019; Darmon, 2012; Donaghue & Allen, 2016; Gonzalo-Encabo et al., 2019; Markula & Chikinda, 2016; Vega et al., 2017). Data from this instrument answered RQ2: Which domains of wellness do group exercise participants and instructors perceive to be addressed in group exercise classes? Both group exercise participants and instructors were administered the survey to compare responses from each group.

Instructor Sources of Practice Knowledge Questionnaire. The 7-item Sources of Practice Knowledge survey measured the construct of exercise instructor knowledge. Its design assessed the rate of frequency with which instructors used specific high-quality or low-quality sources of practice knowledge (Bennie et al., 2017). The survey began with the following question: "How frequently do you use the following resources when looking for new exercises, programs, or ideas?" (Bennie et al., 2017, p. 742). Response choices included eight common source items previously chosen from the literature on fitness instructor knowledge translation (Stacey et al., 2010). Frequency was rated on a 4-point scale from 1 (*never*) to 4 (*often*). The scale consisted of the following: academic textbooks (exercise/sports science-related), workshops or specialized courses, scientific journals (exercise/sports science-related), ideas from other instructors, generally develop my own ideas, online/internet search for fitness training-related websites, and popular fitness magazines (Bennie et al., 2017).

The instrument was validated for test-retest reliability using a subset of the original survey-takers. The quality of sources was determined by 27 university professors and academic experts in the professional field of exercise prescription who rated the sources of practice knowledge as high-quality or low-quality (Bennie et al., 2017). High-quality practice knowledge sources included (a) exercise/ sports-related academic textbooks, (b) workshops or specialized courses, and (c) scientific journals: exercise/sports science-related. Low-quality sources of instructor knowledge included (a) ideas from other instructors, (b) own ideas, (c) online fitness training-related forums or fitness training-related websites, and (d) popular fitness magazines. Respondents must report "often" or "sometimes," using all three high-quality sources to be classified as a "user of high-quality sources" (Bennie et al., 2017, p. 745). If the above criteria were not met, respondents were classified as "users of low-quality sources" (Bennie et al., 2017, p. 745). For the sake of respondent clarity, but without changing construct validity or instrument reliability, this study combined the low-quality options of online fitness training-related forums and online fitness training-related websites into one construct of "online/internet search" for fitness training-related websites.

The data obtained from this questionnaire addressed the Chapter 1 microsystem factor of *instructor knowledge*. Low-quality sources of practice knowledge might not reflect the most current evidence-based science and serve as a barrier to addressing mind and brain health in group exercise classes (Amonette et al., 2010; Ku & Hsieh, 2020; Stacey et al., 2010). Answers from this questionnaire provided data for RQ3: What are sources of group exercise instructors' health and fitness knowledge?

The Exercise Benefits/Barriers Scale. The 43-item Exercise Benefits/Barriers Scale (EBBS; adult version) quantitatively measured the constructs of beliefs about benefits and barriers to exercise. The operational definition of an *exercise benefit belief* is a person's faith, trust, or confidence that exercise is advantageous to them and provides a profitable gain or experience (Sechrist et al., 1987). An *exercise barrier belief* is faith, trust, or confidence in a circumstance or obstacle that prevents a person from exercising or benefitting from exercise (Sechrist et al., 1987). Because beliefs about the benefits and barriers to exercise were determinants in understanding health behaviors, the instrument was originally designed for nurses to use when counseling their patients about healthy lifestyles (Palank, 1991). Because this study also sought to understand the exercise beliefs of the study participants, the EBBS provided the needed data.

The EBBS was tested for validity of constructs, internal consistency, and test-retest reliability in a sample of 650 adults (age > 18; Sechrist et al., 1987). Items were created from literature and inductive interviews and subdivided into benefit and barrier subscales (Sechrist et al., 1987). The survey questions asked participants to indicate the degree to which they agreed or disagreed with 43 statements relating to ideas about exercise (Sechrist et al., 1987). Choices in a 4-point Likert scale ranged from 1 (*strongly disagree*) to 4 (*strongly agree*). Examples of benefits questions included, "I enjoy exercise," and "exercise decreases feelings of stress and tension for me" (Sechrist et al., 1987, p. 20). Examples of barrier questions included, "Exercise takes too much of my time" and "exercise tires me" (Sechrist et al., 1987, p. 20). The scale could be used as one tool or subdivided into two scales. If the full scale were used, scores would range from 43 to 172. A higher score correlated with a positive perception of exercise.

Data from this instrument addressed the Chapter 1 microsystem factors of *group exercise participants' beliefs about exercise's benefits and barriers*. These beliefs affected exercise adherence, motivation, and participation (Borrell-Carrió et al., 2004; Herazo-Beltrán et al., 2017; McArthur et al., 2014; Rodriguez-Morales et al., 2020; Sas-Nowosielski et al., 2017). Thus, data from the EBBS answered RQ1: What are perceived benefits and barriers group exercise participants attribute to exercise?

Group Exercise Instructor Focus Group Semi-Structured Interview. Semi-structured interview questions (Appendix B) examined the construct of *perception of job* role in the health and wellness industry. Questions were adapted and modified from De Lyon et al. (2017), De Lyon and Cushion (2013), and Rosado et al. (2014) to provide qualitative data to analyze, contextualize, and synthesize alongside the quantitative data strand in a mixed-methods analysis. For example, instructor focus group participants were asked which of these domains of wellness they were most comfortable incorporating into their group exercise classes and why, with a goal to expand the quantitative Multidimensional Wellness Survey constructs (Beauchemin et al., 2019, p. 153).

Other focus group questions probed how and why instructors chose the fitness profession. Participants were asked about perceptions of their job roles, primary job functions, job credibility in the health and wellness industry, and most important contributions as fitness instructors. Ambiguous or negative *perceptions of job role* were Chapter 1 microsystem contributing factors that adversely affected group exercise instruction (De Lyon et al., 2017; Donaghue & Allen, 2016; Pojednic et al., 2018; Swann et al., 2020; Zhou et al., 2019). Consequently, instructor focus group questions were designed to provide qualitative data to answer RQ4 of this study: How do group exercise instructors perceive their roles in the fitness industry?

Procedures

This section contains details on the needs assessment procedures. The procedures are explained for group exercise instructors, group exercise participants, and instructor focus group participants.

Group Exercise Instructor Sample

Approval to conduct the study was obtained from the HIRB and the YMCA's branch executive director. Using instructor email addresses provided by the executive director, an online Qualtrics survey link to the Instructor Knowledge and Multidimensional Wellness Surveys was sent to all group exercise instructors ($N = 90$). The instructor email included a letter of consent adapted from the JHU IRB website stating the study's purpose, participant anonymity, voluntary participation, and the ability to stop the survey at any time (Appendix C). The survey's first question documented participants' voluntary consent. A 2-week deadline was given to complete the survey. A reminder email of the study's deadline date was sent to instructors 1 week after the initial email was sent. Of the 90 instructors invited to participate, 31 completed the survey and were included in the study ($n = 31$).

Group Exercise Participant Sample

After HIRB approval, group exercise participant volunteers were recruited by word of mouth in group exercise classes. Due to YMCA facility closures required by Texas during the global coronavirus pandemic of 2020, group exercise classes were conducted via the Zoom platform. Volunteers from these online Zoom classes submitted their email addresses to the study researcher. The EBB and Multidimensional Wellness Surveys were subsequently administered electronically through Qualtrics. In compliance with ethical protocols, the email sent to each participant contained a letter of voluntary consent adapted from the JHU EdD program website.

In addition to the survey link, each participant's email contained the study's purpose, reassurance of anonymity, a reminder that participation was voluntary, and explicit messaging that participation could cease at any time. The first survey question verified participants' voluntary consent.

A total of 103 electronic surveys were emailed to group exercise participants interested in study participation. In addition to this convenience sampling, snowball sampling was incorporated by embedding a verbal offer in the body of each email to forward the survey to other YMCA member friends who might wish to participate but were not included in the original email list. The final survey question asked for a "yes" or "no" response about participants' current YMCA membership statuses to control for keeping the study context-specific to YMCA members. Including the snowball sampling, 56 people completed the survey. Six surveys were excluded from the study for not meeting YMCA membership criteria, leaving the final participant count at 50.

Group Exercise Focus Group Sample

A focus group using the Zoom platform was convened online to gather qualitative data from instructors. Volunteers for the small focus group (n = 2) were recruited from instructors who participated in the survey. Communication between instructors and the researcher agreed on a date and time. Respondents were informed that the interview would last approximately 45 minutes to 1 hour. An email with a Zoom link was then sent to each volunteer. The session proceeded with (a) introductory statements on the nature and purpose of the research, (b) assurance of the confidentiality and anonymity of data and participants, (c) an explicit statement that the session is being audio recorded for later transcription and coding, (d) an explicit statement about their right to withdraw at any time, and (e) audio documentation of participant oral consent (see Appendix B for focus group questions). Qualitative data from the focus group were coded and triangulated with instructor surveys to provide context and nuance to the quantitative data.

Data Collection

The following sections explain needs assessment data collection. Quantitative survey data were collected from group exercise instructors and participants. Focus group data were collected from group exercise instructors.

Data From Group Exercise Instructors

After receiving HIRB approval (Appendix D), the Instructor Sources of Knowledge Practice Questionnaires and Multidimensional Wellness Surveys were electronically administered to group exercise instructor volunteers using the Qualtrics platform (Appendix E). Instructor email addresses were obtained from the YMCA branch executive director. The body of the email sent to every instructor employed at the branch YMCA ($N = 103$) included (a) consent language adapted from the Johns Hopkins School of Education EdD program, (b) the study's purpose, and (c) the link to the study. The instructor list included male and female instructors; however, gender was not included as a survey variable. The email wording stated that survey responses were anonymous, participation was voluntary, and participants could quit at any time. The first question on the instructor survey also verified voluntary consent. A 2-week deadline was given to complete the survey, and a reminder email was sent at the end of Week 1. When the survey closed, 31 instructors had elected to participate, and data from all 31 returned surveys were included in the study.

Data From Group Exercise Participants

Upon receiving Johns Hopkins's HIRB approval (Appendix D), group exercise participant volunteers were verbally recruited to participate in the study during group exercise classes they were currently attending at the branch YMCA. Email addresses were collected from the researcher, and the Exercise Benefits/Barriers Scale and Multidimensional Wellness Surveys were administered electronically via Qualtrics to these volunteers (Appendix F). In addition, a survey link was sent via an email containing the study's purpose, survey link, and consent language adapted from the standard Johns Hopkins School of Education EdD program consent protocols.

The recruitment email explicitly stated that survey responses would remain anonymous, participation was voluntary, and participants could quit at any time. The first question on the group exercise participant survey also verified voluntary consent. Next, participants were asked to forward the study participation/consent email to other YMCA group exercise participants to recruit more volunteers (snowball sampling). The final survey question asked each volunteer for their current participation status in YMCA-group exercise classes to control for inclusion of YMCA-only group exercise participants. A 2-week deadline was given to complete the survey.

At the end of the first week, a reminder email was sent. Including the snowball sampling, 103 emails were sent to group exercise participants. Fifty-six people completed the online surveys. Six surveys were excluded for not meeting YMCA membership criteria. The final sample included 50 group exercise participants.

Data From Focus Group Semi-Structured Interview

A focus group was convened online using the Zoom platform to gather qualitative data from instructors. Volunteers for the focus group were recruited from group exercise instructors participating in the surveys. Two volunteers were recruited, and the date and time for the meeting were agreed upon via email communications. Respondents were informed that the interview would last approximately 1 hour or less as per HIRB protocols. A Zoom link was emailed to each volunteer explaining the following five interview protocols: (a) introduction to the nature and purpose of the research, (b) assurance of data and participant confidentiality and anonymity, (c) explicit statement of audio recording of session for later transcription and coding, (d) explicit statement about the right to withdraw at any time, and (e) audio documentation of participant oral consent. Qualitative data were coded and themed. Lastly, qualitative data were analyzed with survey quantitative data. Appendix B shows the semi-structured focus group questions.

Data Analysis

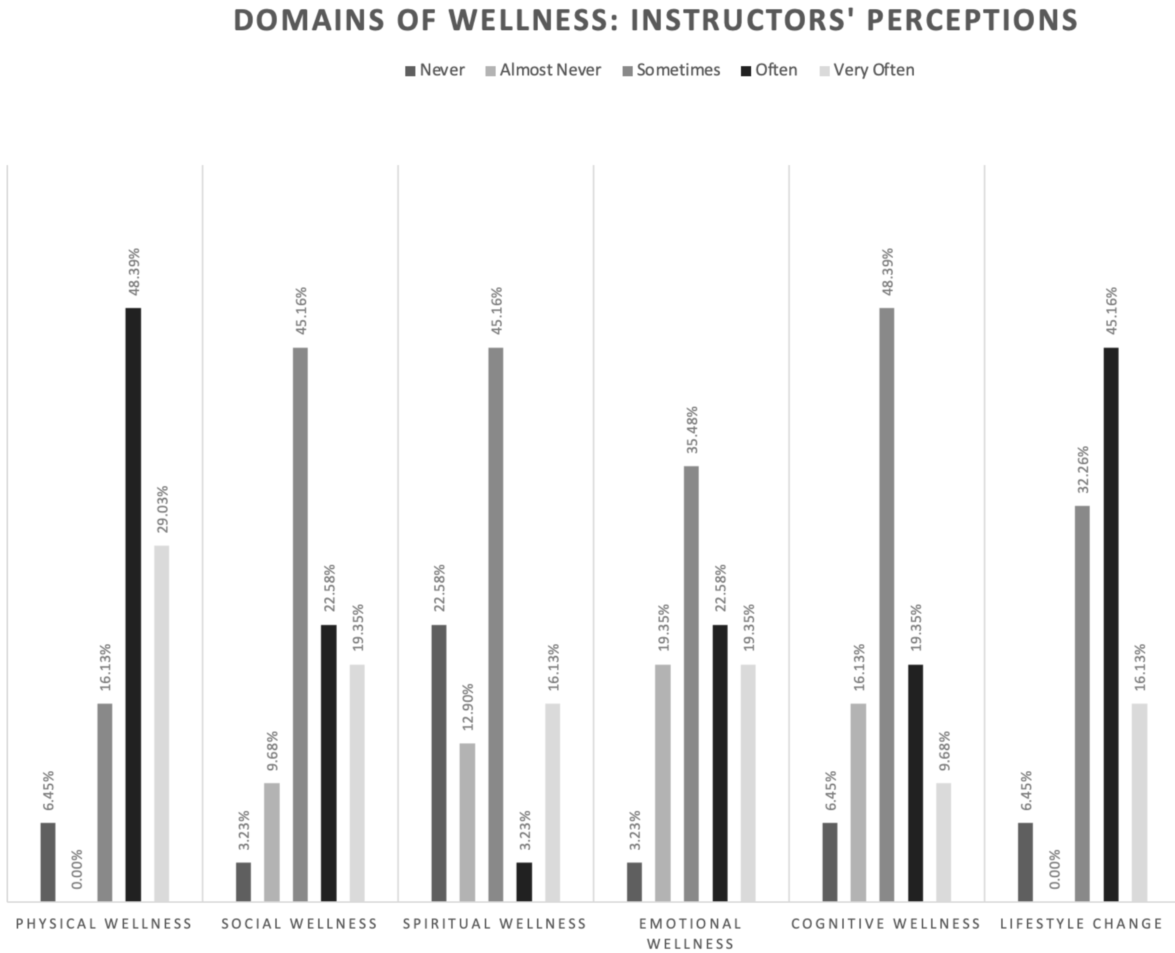
This section includes a mixed-methods data analysis. The quantitative survey data strand was triangulated with the qualitative focus group strand to analyze findings.

Domains of Wellness Addressed in Exercise Classes

Figure 2.2 depicts YMCA group exercise instructors' responses (n = 31) to their perceptions about the domains of wellness that were addressed during classes. Responses were recorded on a 5-point Likert scale ranging from 1 (*never*) to 5 (*very often*). The prompt for the survey asked the following: "How frequently do you discuss the following during the instruction of your group exercise classes?" The wellness domains included physical, social, spiritual, emotional, cognitive, and lifestyle change.

Figure 2.2

Domains of Wellness: Instructors' Perceptions



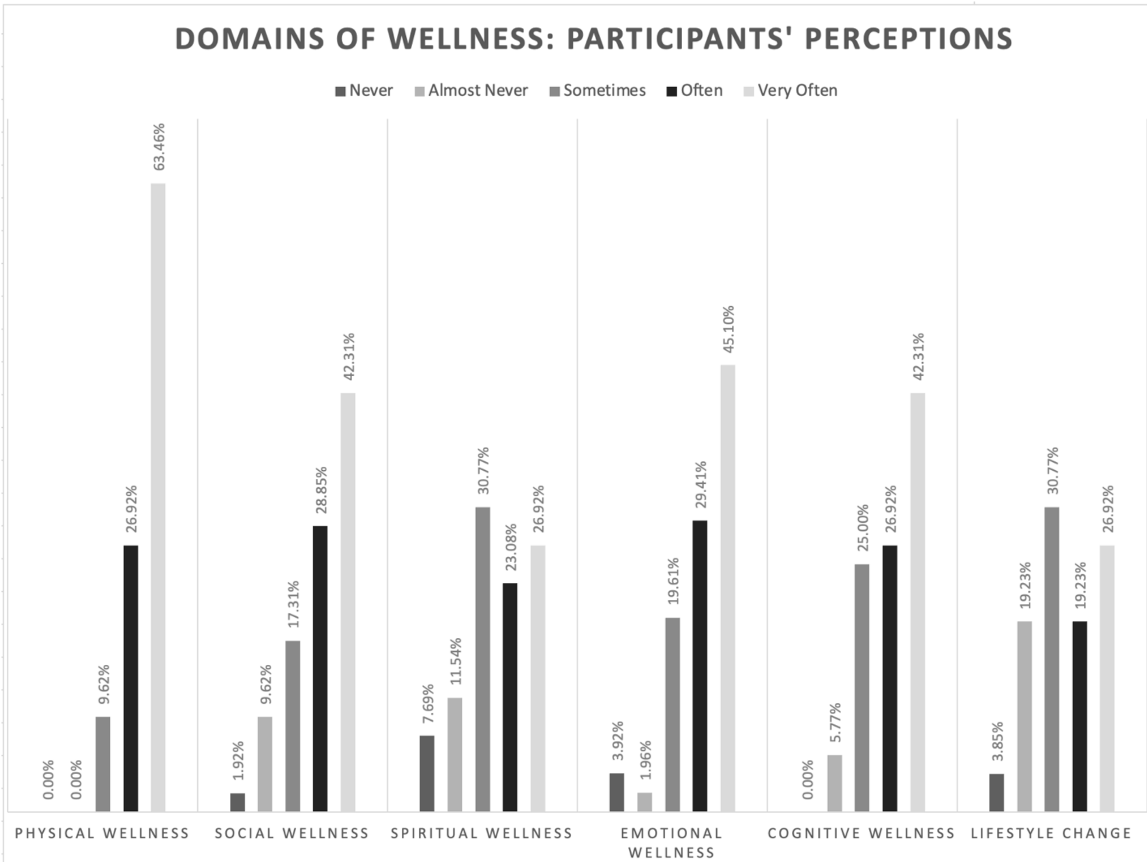
Note. Domains of wellness: Instructors' perceptions of the frequency with which they address the different domains of wellness in their group exercise classes.

The data revealed that instructors perceived themselves as addressing all the wellness domains at varying frequencies. When "often/very often" frequency responses were combined, the domain frequency percentages from highest to lowest were physical (77%), lifestyle change (61%), social (42%), emotional (42%), cognitive (29%), and spiritual (19%). When "sometimes/almost never/ never" frequency responses were combined, the domain frequency percentages from highest to lowest were spiritual (80%), cognitive (71%), social (58%), emotional (58%), lifestyle (54%), and physical (22%). The valuable information for this dissertation's problem of practice—addressing mind-brain health in group exercise classes—was that instructors reported a lack of frequency in consistently addressing cognitive and emotional health.

The data also revealed that participants ($n = 45$) perceived their instructors as addressing all wellness domains at varying frequencies. Group exercise participants also cited the physical domain of wellness as the domain most frequently addressed. However, Figure 2.3 shows that participants' frequency perceptions are different from instructors' perceptions. When participants' "often/very often" frequency responses were combined, the domain frequency percentages from highest to lowest were physical (90%), emotional (75%), social (71%), cognitive (69%), spiritual (50%), and lifestyle change (61%). When "sometimes/almost never/never" frequency responses were combined, the domain frequency percentages from highest to lowest were lifestyle (54%), spiritual (50%), cognitive (31%), social (29%), emotional (26%), and physical (10%).

Figure 2.3

Domains of Wellness: Group Exercise Participants' Perceptions



Note. Domains of wellness: Group exercise participants' perceptions of the frequency with which they address the different domains of wellness in their group exercise classes.

Table 2.3 shows a side-by-side comparison of group exercise instructors' and participants' frequency responses of domains of wellness addressed "very often" in classes. The contrast of perceptions is interesting to note. The higher percentages in domains cited by participants (compared to instructors) may be attributed to participant exposure to the researcher's classes where education from doctoral research is reflected in instruction. This study limitation is discussed later in the chapter.

Table 2.3

Frequency Responses of Domains of Wellness Addressed "Very Often" in Classes

Wellness Domain	Group exercise instructors	Group exercise participants
Physical	29.03%	63.46%
Social	19.35%	42.31%
Spiritual	16.13%	26.92%
Emotional	19.35%	45.10%
Cognitive	9.68%	42.31%
Lifestyle Change	16.13%	26.92%

Sources of Instructor Knowledge

Table 2.4 depicts frequency responses to the 7-item questionnaire stem from the following: "How frequently do you use the following resources when looking for new exercises, programs, or ideas?" Frequency was rated on a 4-point scale from 1 (*never*) to 4 (*often*).

Table 2.4

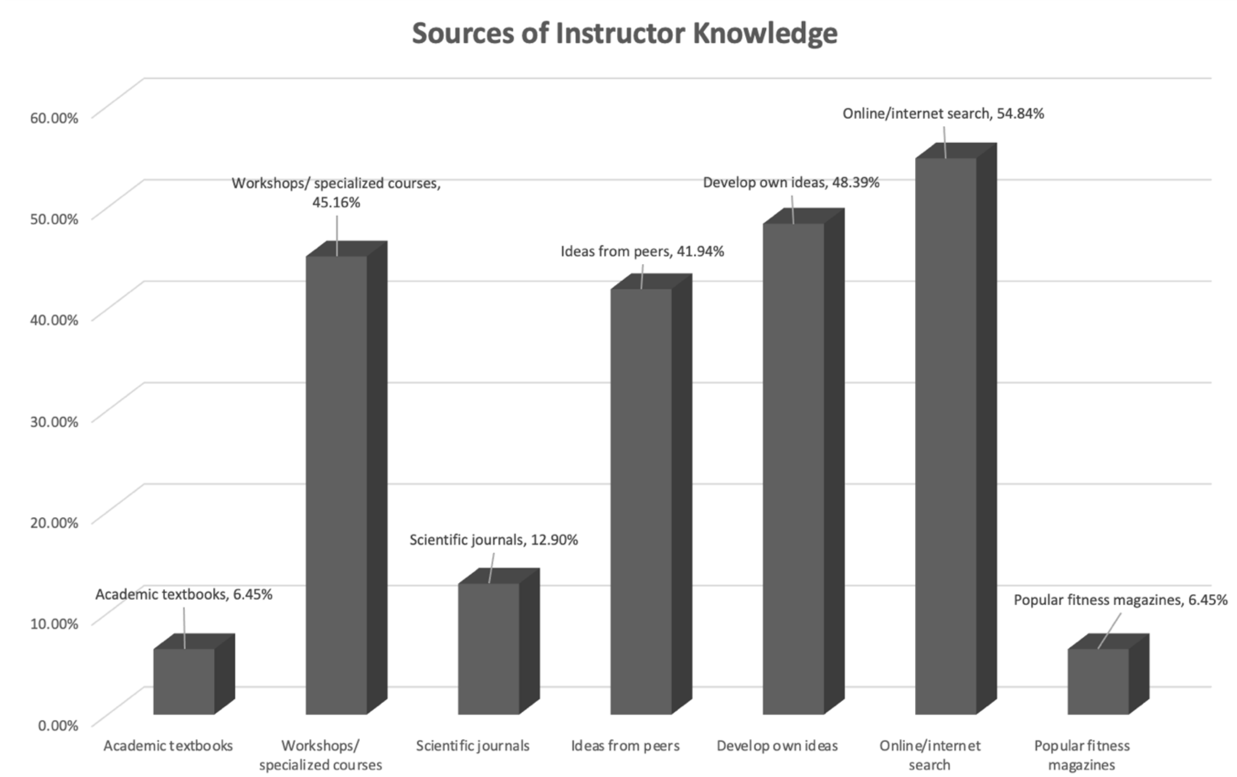
Sources of Instructor Knowledge: Percentages of Frequency of Use

Sources	Never	Rarely	Sometimes	Often
Academic textbooks	19.35	32.26	41.94	6.45
Workshops/Specialized Courses	0.00	3.23	51.61	45.16
Scientific journals	22.58	16.13	48.39	12.90
Ideas from other instructors	0.00	6.45	51.61	41.94
Own ideas	0.00	12.90	38.71	48.39
Online/internet searches	0.00	16.13	29.03	54.84
Popular fitness magazines	38.71	29.03	25.81	6.45

The eight sources of instructor practice knowledge were determined and ranked by university professors in fitness and exercise science fields as low-quality or high-quality resources. High-quality practice knowledge sources included exercise/sports-related academic textbooks, workshops or specialized courses, and scientific journals. Low-quality sources of instructor knowledge included ideas from other instructors, own ideas, online fitness training-related forums or fitness training-related websites, and popular fitness magazines. Figure 2.4 shows that the most often cited resource for new ideas is internet searching (54.84%). According to professor rankings, this source was considered low quality because websites were not fact-checked nor peer-reviewed. Some internet resources might be high-quality; however, this survey did not scrutinize to that level of granularity.

Figure 2.4

Sources of Instructor Knowledge Used "Often"



Note. Sources of Instructor Knowledge Survey. Depiction of self-report of YMCA group exercise instructors most "often" used sources of professional continuing education knowledge.

High quality sources of knowledge—academic texts and scientific journals—were "often" consulted only 6.45% and 12.90% of the time, respectively. The high-quality knowledge sources most "often" used by instructors were workshops and specialized courses (45.16%). Instructors developed their own ideas and borrowed ideas from peers 48.39% and 41.94% of the time, respectively.

Beliefs About Benefits and Barriers to Exercise

Appendix G contains the full results of the 43-item EBBS. The reason for administering this survey was to capture an overall picture of group exercise participants' beliefs about exercise. The prompt asked study participants to indicate the degree to which they agreed or disagreed with statements made about exercise. The 4-point Likert-style scale responses ranged from 1 (*strongly disagree*) to 4 (*strongly agree*). This sample showed an extraordinarily high belief in the benefits of exercise and virtually no barriers. Table 2.5 shows the prompts where 100% of the sample "agreed/strongly agreed" to exercise benefits and "disagreed/strongly disagreed" to exercise barriers.

Table 2.5

Percentage Frequency of Beliefs About Benefits and Barriers to Exercise

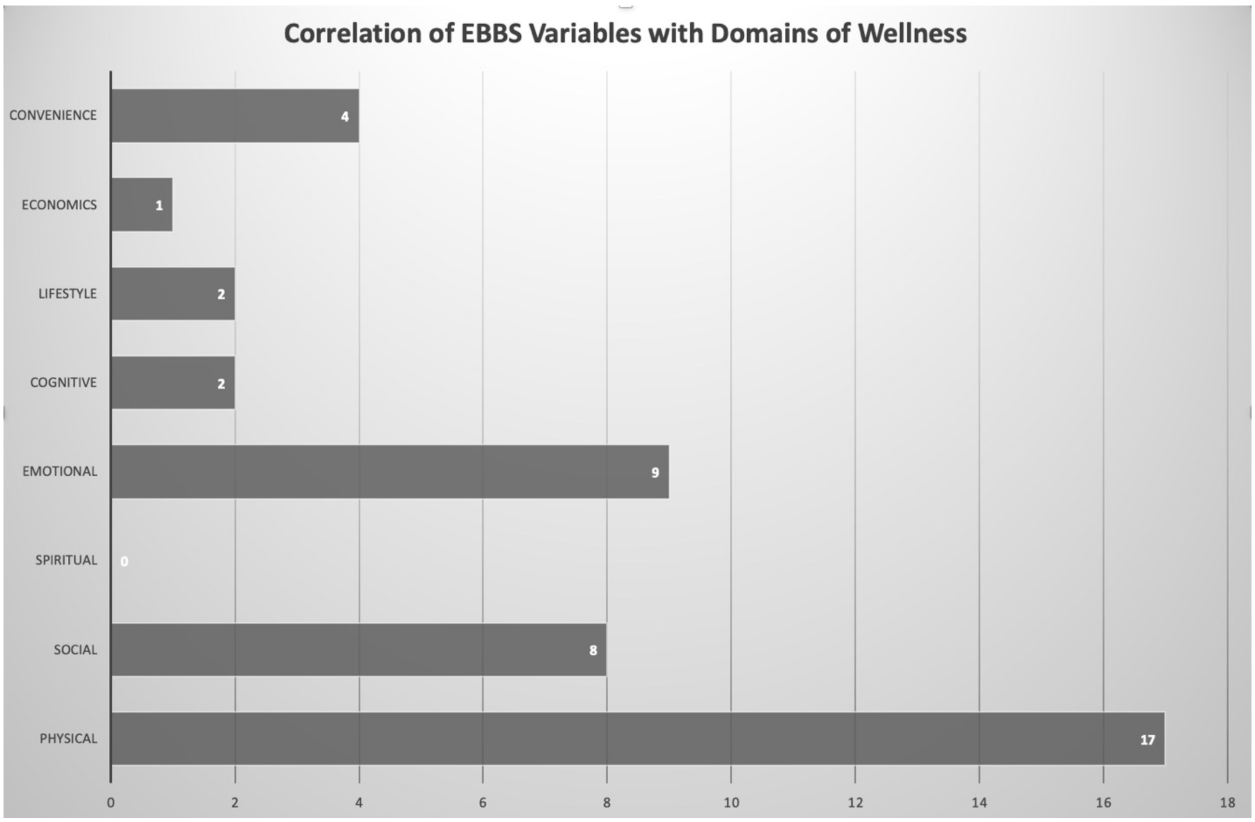
Statement	Agree/ Strongly Agree	Disagree/ Strongly Disagree
I enjoy exercise.	100	0
Exercise improves my mental health.	100	0
Exercise reduces my chance of heart attacks.	100	0
Exercise gives me a sense of personal accomplishment.	100	0
Exercise can help me control high blood pressure.	100	0
Exercise increases my level of physical fitness.	100	0
My muscle tone is improved with exercise.	100	0
Exercise improves the functioning of my cardiovascular system.	100	0
I have improved feelings of well-being from exercise.	100	0
Exercise increases my stamina.	100	0
My disposition is improved with exercise.	100	0
My physical endurance is improved by exercise.	100	0
Exercise increases my mental alertness.	100	0
Exercise takes too much time from family relationships	0	100

Figure 2.5 illustrates how the 43 EBBS variables correlate with the six domains of wellness. The items from the questionnaire were categorized by domain. In addition, two new categories—convenience and economics—were added to reflect the item topic. Seventeen of 43

items were related to physical well-being, nine were related to emotional well-being, eight were related to social well-being, and only two were related to cognitive and lifestyle.

Figure 2.5

Correlation of Exercise Benefits/Barriers Scale Variables With Domains of Wellness



Note. The figure illustrates how the 43 EBBS variables correlated with the six domains of wellness. The items from the questionnaire were categorized by domain. Convenience and economics were added.

Instructor Perceptions of Job Roles

Concurrent with the previous surveys, two group exercise instructors from the same sample participated in a qualitative focus group. The first instructor had three decades of teaching experience in the fitness industry. The second instructor had one decade of teaching experience. Semi-structured questions and prompts adapted from the literature guided the conversation. Convening the focus group achieved the objective of learning how instructors perceived their job roles. Furthermore, qualitative data from the focus group provided additional insights into the meaning of quantitative survey data and validated survey findings.

Because the focus group was small, the researcher hand coded and themed data transcribed from Zoom audio recordings. Otter.ai, an online technology platform that used machine learning and artificial intelligence to transcribe voice to text, was used to convert the original audio file. First, the researcher developed a priori codes before the focus group meeting convened (see Lochmiller & Lester, 2017). These codes came from the literature and included dimensions of wellness, beliefs about the benefits and barriers to exercise, instructor sources of professional knowledge, and perceptions of their job role. Next, the raw data were interpreted using inductive coding to develop themes from a priori codes and descriptive codes emerging from the transcriptions (see Lochmiller & Lester, 2017). The two descriptive codes emerging from the data were economics and marketing/branding. The following subsections include descriptions of qualitative data codes relating to the four research questions and the literature.

Beliefs About Exercise Benefits and Barriers. The instructors' strong beliefs in the benefits of exercise aligned with participants' strong beliefs. One instructor stated, "I am taking care of all these people and trying to get them to be safe and healthy." The other instructor added to this finding by giving an example of how they promoted the benefits of strength training for increasing bone density and mitigating osteoporosis during classes with women. Both focus group respondents aligned with the literature and indicated that "overweight" participants came to classes in hopes of losing weight (De Lyon et al., 2017). Respondents discussed the importance of motivation but did not specify how motivation actualized in classes, other than indicating a strong desire for their participants' health and wellness by providing more health-related information.

Goal setting and cueing in classes were extrinsically grounded in the physical domain of health. The literature showed the unintended consequence of setting health goals was that people felt controlled by them—even if the health goals were noble and necessary (Segar, 2015; Segar et al., 2011; Sperandei et al., 2016). Empirical evidence revealed that it was difficult for people to view health goals as enjoyable or intrinsically motivating (Segar, 2015). Furthermore, health was an abstract concept, with goals not immediately apparent (Swann et al., 2020). Consequently, instructors who used health goals might not help class members find immediately rewarding goals that could promote long-term sustainability (Teixeira et al., 2012).

Domains of Wellness. The focus group responses spontaneously included mention of all the domains of wellness included in the survey except for the cognitive domain. Furthermore, instructors' descriptions of participant health included describing attributes in the client's physical wellness domain. Verbalized health cues were related to musculoskeletal movement (e.g., the muscle action used to move a joint) and how that movement benefited health problems (e.g., osteoporosis). Cognitive wellness and the brain never spontaneously came up in instructor focus group conversation until prompted by the final researcher-guided question.

It was noted that when focus group participants discussed mental well-being, it was addressed as standing apart from physical health, aligning with implicit mind-body dualism findings in the literature (Burgmer & Forstmann, 2018). However, mental and physical health were given equal importance. One instructor stated, "I want to nurture them. I want to push them to be their personal best. I have such gratitude that I've been able to be on the front line all these years and just, you know, witness that joy."

When the topic of COVID-19 arose, and focus group members agreed that mental health awareness was in the public mindset more so than before the pandemic, one instructor noted that they needed to "do more classes with stretching." The ensuing conversation implied that the pace should be slow and deliberate with stretching to be considered a mind-body class. This ideology was of interest to this study because, currently, the narrative surrounding exercise might implicitly suggest that exercise for mental well-being should downtempo or even "still" (e.g., hold a pose). This exercise conflation with meditation practices might confuse people by inadvertently associating stillness with handling stress, anxiety, or depression when all forms of voluntary movement would promote mental well-being (Teychenne et al., 2020). Furthermore, associating decreased movement with mind-body classes might subliminally automatize sedentariness as a go-to stress reducer instead of promoting increased movement. The current literature showed that aerobic activity, which was unlabeled as a mind-body class in the fitness industry, had the most efficacy in brain wellbeing (Basso & Suzuki, 2017; Lee et al., 2019). Thus, these data from the focus group presented two interesting entry points for further research—explicitly equating more movement with mental well-being and explicitly broadening class descriptions to include all forms of exercise as mind-body classes.

Sources of Professional Knowledge. Both focus group instructors stated that their primary source of professional continuing education was obtained through the recently merged national organization, The Athletic and Fitness Association of America/National Academy of Sports Medicine (AFAA/NASM). These data aligned with the survey results. However, it was evidenced that many continuing education courses from AFAA/NASM were delivered online when triangulating qualitative data with the surveys. This finding was supported as many learning platforms pivoted to an online presence during the global pandemic when this survey was administered. The survey item asking instructors to rate frequency of use of workshops and specialized courses did not specify whether the workshops or courses were conducted online. It was then conceivable that the survey item inquiring about using online/internet searches for fitness training-related websites was construed by instructors as a source of workshops and specialized courses. Because online learning could yield both high- and low-quality resources, lack of clarity might have affected survey results. Future researchers of the survey should make the proper distinctions.

Aside from being required to take a minimum of 15 continuing education credits every 2 years to maintain certification, both focus group instructors indicated a love of learning and desired to continue learning beyond what was required for employment. One instructor said, “I think it’s so important that we stay abreast and up to date because it’s [the fitness industry] constantly evolving, and we’re learning more about the body and the reactions of exercise and movement and things like that.”

Instructors also stated that continuing education offered them new “techniques, tips, and ideas” to keep members safe, especially seniors who might “easily be hurt.” However, neither instructor had taken a continuing education course that talked about exercise neuroscience. The brain did not seem associated with exercise, though instructors explicitly associated the brain and the heart with feelings. Jokingly, one instructor talked about “the 18 inches between the brain and the heart” and the importance of “tapping into that emotionally and spiritually.” The instructor did not expound on what “tapping into that” 18-inch distance meant or how it would actualize in the form of cues, words, or images.

Both instructors also perceived that AFAA/NASM’s continuing education course selections did not seem to prioritize physical and mental health equally because there were more course offerings and certifications in kinesiology and choreography than behavioral and mental health. However, both instructors agreed that post-COVID-19 would likely usher in more conversation about mental well-being.

An interesting point to note was that both instructors talked about being interested in learning about ways to improve mental health but in ways detached from “the physical.” For example, one instructor mentioned, “I’m always interested, you know, not only in the physical but anything that helps the mind … that’s not specifically for exercise.” The other agreed. This comment reflected a detachment of the mind from the body and illustrated an implicit dualism. It presented an entry point into further research on how instructors perceive embodied enactive cognition (EEC)—understanding the mind-brain-body-environment as intertwined and interdependent (Di Paolo et al., 2017; Fugate et al., 2019).

Even though the instructors agreed about the importance of mental well-being, their verbalized cues in an actual class did not explicitly show that exercise and movement were connected to mental well-being. Cues were biomechanically oriented because instructors were trained to cue movement to teach a class. The primary use of biomechanically oriented class cues might explain the difference in frequency perceptions between instructors and participants on the Domains of Wellness Survey. Results showed that group exercise participants perceived their instructors as using physical domain cues “very often”—63.46% of the time. Conversely, instructors perceived themselves cueing the physical domain “very often” only 29.03% of the time. This perception difference between instructors’ intentions and participants’ takeaways provides an interesting entry point for further research on instructor cueing and messaging.

Perceptions of Job Role. The focus group data indicated at these instructors were committed professionals and sincerely believed in the good they were doing for their clients. However, both instructors felt “a bit taken for granted” and that they “wear a lot of hats.” As the people with the most FTF contact with members at this facility, instructors believed they were an essential part of community-building at the YMCA. This importance was not always perceived as appreciated. Both instructors were college-educated. However, they both believed that the job title of group exercise instructor was not fully appreciated as a professional service. One instructor stated,

> As far as being totally respected, they probably don't know everything we go through. And you know, as far as profession, I don't know if anyone says, "Oh, that's an awesome profession!" They may say, "Oh, that's cool and fun!" ya' know—instead of totally being respected in the professional world.

The other instructor chimed in, "People think that just because we get paid less, that we're not good enough." Despite this feeling, both admitted to loving their work and believed their commitment to helping others superseded any feelings of inferiority.

Economics. The first descriptive code to emerge from the data was the burden of economics on instructors' continuing education. Instructors were responsible for costs associated with continuing education. A willingness to keep learning came with a steep price tag for quality courses. In exasperation, one instructor stated the following:

> It costs a ton to get these certifications that sometimes aren't really worth, you know … I think sometimes in the fitness world, it is a money-making business. I really wish there was a better way to do it, because I mean, you put down hundreds and hundreds of dollars for these certifications. We don't make enough and we're pouring so much money into our certifications and into our tennis shoes and into our music. And then there's insurance and music royalties.

This steep price tag and low hourly wages required instructors to become creative consumers of affordable and reliable information. Scientific journal articles were often behind paywalls, and continuing education beyond what was required was costly. Thus, the internet and peer support held a wealth of information that might or might not be evidence based. Social media outlets could offer a variety of choreography options and workout plans that instructors might incorporate into their teaching. However, with no peer-reviewing or quality control, the consumer should become a healthy skeptic while sifting through the morass and abundance of free information. This topic of information consumption opens an entry point for research on ways to train instructors and group exercise participants to become healthy consumers of information.

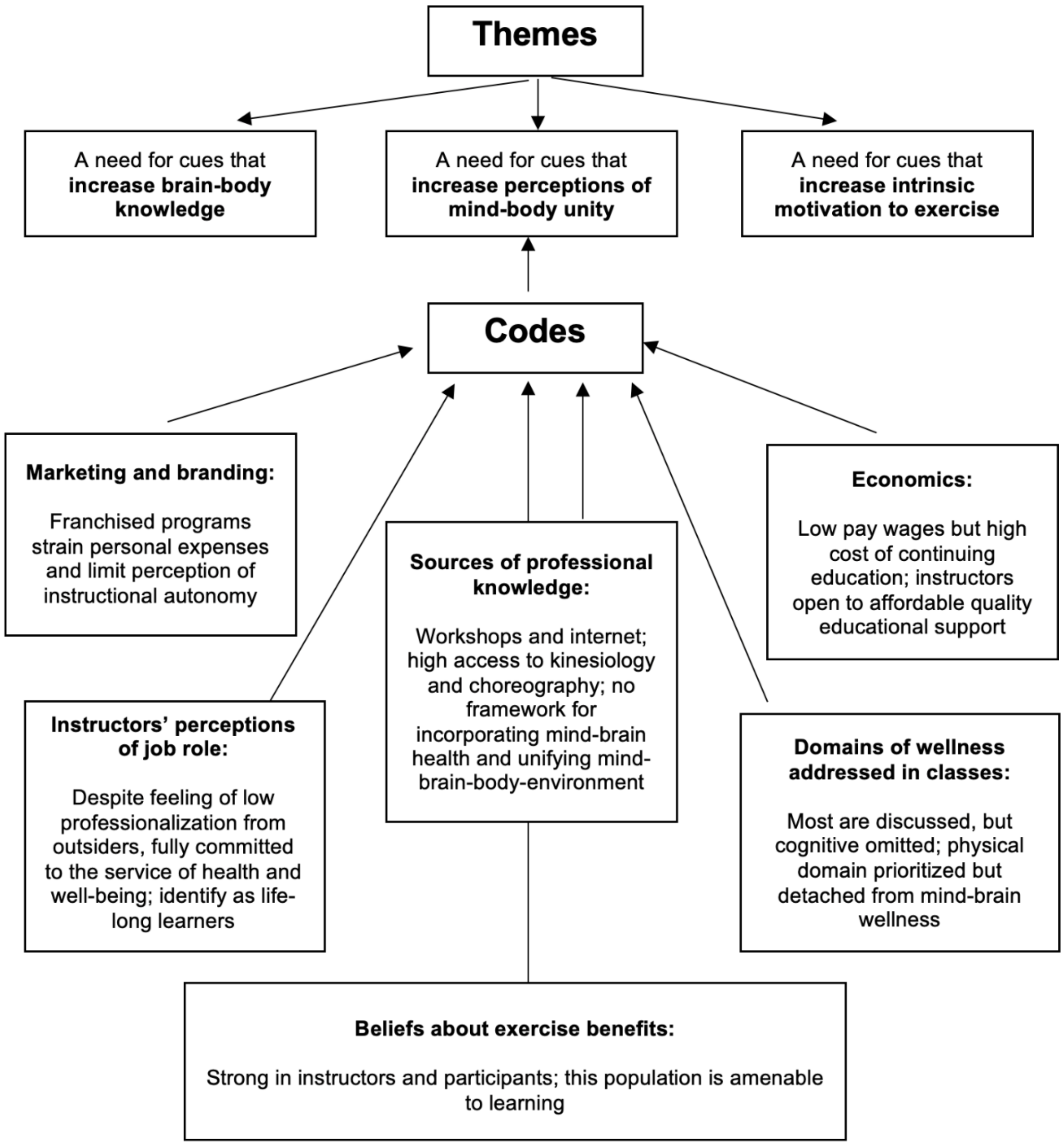
Marketing and Branding. The final descriptive code to emerge from the data organically dealt with marketing and branding impact on group exercise instruction. The focus group instructors tied marketing and branding into continuing education, class content, and economics. The conversation surrounding the Les Mills exercise franchise supported the literature in Chapter 1 (Andreasson & Johansson, 2016). One instructor laughed, "Whoever's popping these things up (i.e., creating and marketing the content) is making a lot of money!" As a 3-decade veteran of the industry, one instructor believed that new franchises compromised the core values of teaching. In speaking of the new programs in comparison with their previous experience, the participant said, "We weren't robots. Like, we had *real* connection [with participants]. I find I struggle a smidge against the fight. I want the whole picture instead of just killing yourself with jumping jacks and stuff."

Both instructors were concerned that the trend toward prepackaged programs with prescripted choreography lessened the efficacy of the instructor-participant relationship and pushed participants to work beyond safe and reasonable personal boundaries. The instructors acknowledged that even a nonprofit, such as the YMCA, must operate as a business. Consequently, the instructors felt pressured to recruit more members and compete with local exercise facilities. There was a perceived pressure to comply with industry trends, such as a professional "keeping up with the Joneses." Additionally, instructors discussed how franchised programs tended to promote the Western culture of the body, shaping the kinds of cues used in classes based on phrases, such as "getting ready for sleeveless season," while doing overhead arm presses.

The six codes from the focus group included beliefs about exercise benefits and barriers, domains of wellness addressed in classes, sources of instructor professional knowledge, instructor job role perception, economics, and marketing and branding. Codes were analyzed with quantitative surveys and grouped into three overarching themes that served as drivers for the theoretical and intervention literature in Chapter 3. These themes included (a) a need for instructor cues that increased brain-body knowledge, (b) a need for instructor cues that increased perceptions of mind-body unity, and (c) a need for instructor cues that increased intrinsic motivation to exercise. Figure 2.6 illustrates codes and themes. The final section of Chapter 2 contains a discussion of needs assessment findings.

Figure 2.6

Themes Generated From A Priori and Emergent Descriptive Codes



Note. Qualitative data analysis revealed three themes that guide the intervention literature synthesis in Chapter 3.

Findings and Discussion

The needs assessment empirically assessed how or if research from exercise neuroscience manifested in YMCA group exercise classes. Data were concurrently collected and analyzed on sources of instructor knowledge, domains of wellness discussed in classes, exercise beliefs of class participants, and instructors' perceptions of their job roles. Mixed-methods data analyses integrated quantitative and qualitative data strands to provide an overview of the group exercise context at the YMCA.

The needs assessment showed that group exercise participants at the YMCA had firm beliefs in the benefits of and few beliefs in the barriers to exercise. However, the needs assessment aligned with literature showing both group exercise instructors and participants perceived that the physical domain of wellness was predominantly messaged during class instruction and goal setting (Beauchemin et al., 2019; Donaghue & Allen, 2016). These results were important because literature in Chapter 1 revealed that extrinsic goals in the physical domain were not perceived as autonomous and eventually become unsustainable—even for exercise participants holding positive beliefs in the value of exercise (Segar et al., 2011). Consequently, this finding suggested that an intervention focusing on intrinsic goal setting and multiple domains of wellness might reinforce participants' existing beliefs while potentiating long-term sustainability of healthful exercise habits.

Though both participants and instructors agreed that the physical domain of wellness was most messaged in classes, they perceived the percentage of frequency differently. Of the surveyed group exercise participants, 63% perceived their instructors as messaging physical wellness "very often." Only 29% of instructors perceived themselves as messaging physical wellness "very often." This difference in communication perceptions between participants and instructors pointed toward an intervention focusing on instructor cueing and communication as a mechanism for change.

The instructor focus group data further elucidated that although participant multidimensional well-being was crucial to them, their immediate objective was to lead participants through motoric and joint actions safely. Instructors attributed narrowly focused physical cueing to their training in the mechanics, repetitions, and choreography of movements. This narrow focus on musculoskeletal and choreographic cues inhibited instructors' from including cues for other dimensions of wellness. Additional cues in other domains of wellness would allow participants a real-time or immediate analysis of intrinsic experiences with their movements at a time when their instructors could assist them with cognitive reappraisal (reframing) or reinforcement strategies (Baldwin et al., 2016). The implication for intervention formation is that future studies should investigate how cueing techniques could simultaneously connect biomechanical movement *with* intrinsic mind-body experiences. This section specifies how empirical findings from the needs assessment generated the three factors chosen for empirical study in the intervention literature in Chapter 3: brain-body knowledge, mind-body unity, and intrinsic motivation to exercise.

A Need for Cues That Increase Brain-Body Knowledge

Three reasons emerged from the needs assessment data to explain why instructor cues remained physically oriented. The first reason was that group exercise instructors trained to understand and cue the biomechanics of body movements. Accurate knowledge in kinesiology—the biomechanics of body movements (ACSM, 2021)—was critical for the safe execution of an exercise. One argument raised in this dissertation was that adding brain-body knowledge to instructor's kinesiology training would strengthen exercise instruction by addressing multiple dimensions of participants' health and wellness needs (Basso & Suzuki, 2017; Beauchemin et al., 2019; Lee et al., 2019). Adding this dimension of knowledge to instructor preparation and class instruction would also reframe the group exercise class as a social space for constructing knowledge on the body's integral role in cognitive, emotional, and social well-being (Di Paolo et al., 2017; Froese & Di Paolo, 2011; Kiverstein & Miller, 2015; Shapiro & Stolz, 2019).

A Need for Cues That Increase Mind-Body Unity

The second reason cited in the needs assessment for the mechanical orientation of instructor cues was that popular franchised exercise programs trained instructors to teach trending choreographed routines without instructing them on how to extend choreographic cues into learning-enhancing cues (Andreasson & Johansson, 2016; Felstead et al., 2007). Thus, cueing *how* to do a movement did not necessarily translate to participants' understanding of *why* it was valuable or relatable. A mind-body disconnect risked weakening participants' feelings of autonomy—the sense of volition that intrinsically feels valuable and integrated into the self (Deci & Ryan, 2008; Segar, 2015).

Another argument raised by this dissertation was that cognitively reappraising (subjectively interpreting or reframing) mechanical teaching cues with imagery, metaphor, personal salience, and participant life experiences would provide an opportunity for instructors to co-construct intrinsic, unified brain-body experiences (Giles et al., 2018; Picó-Pérez et al., 2017). Experiencing stronger mind-body connections promoted multidimensional well-being (Burgmer & Forstmann, 2018). Stronger mind-body connections also increased the probability of experiencing perceived choice, competence, movement usefulness, and enjoyment (Larson et al., 2018; Leotti et al., 2010).

A Need for Cues That Increase Intrinsic Motivation to Exercise

The third and final reason cited by the focus group for the physical domain's predominance in group exercise cueing was the deleterious effect that Western body image culture had on shaping why people should exercise. Focus group participants perceived that prevailing cultural body image ideologies biased exercise toward physical body aesthetics. These data aligned with literature showing culture's explicit and implicit promotion of exercise to manage physical appearance (Donaghue & Allen, 2016; Mailey et al., 2018).

Exercise franchises were economically incentivized to deliver media- and culture-driven consumer needs and wants, even when those needs and wants were not best practices for well-being (Andreasson & Johansson, 2016). Exercise advertising frequently contained deficit language that persuaded consumers that because something was wrong with their bodies, they needed to work on those issues by exercising (Darmon, 2012; Donaghue & Allen, 2016; Petrzela, 2019). Prevailing body culture consequently seeped into the fitness industry and instructor language, where physical movement cues (e.g., abdominal flexion) became attached to cosmetic and colloquially expressed extrinsic goals (e.g., *Abs in! Bikini season's coming!*; Petrzela, 2019). Consequences of extrinsic exercise goals, such as body aesthetics, were body dissatisfaction, dysmorphia, and high rates of exercise dropout—not just from group classes but from exercise participation in general (Donaghue & Allen, 2016; Segar et al., 2011).

Exercising for body aesthetic goals and weight loss produced high rates of exercise attrition due to complex factors, including unsustainability and negative body image (Fardouly & Vartanian, 2015; Segar et al., 2011). A longitudinal study monitored 5,240 members of a downtown Rio de Janeiro fitness center for 12 months or until membership cancellation from January 2005 to June 2014. The study showed that 63% of new members abandoned activities before the third month (Sperandei et al., 2016). Fewer than 4% remained for more than 12 months. Of 5,240 study participants, 75% reported being inactive for at least 30 days before joining the fitness center located near the workplaces of most of its users. All these new members canceling their membership had cited weight loss as their overall exercise goals during their membership enrollments. Consequently, the third argument raised for intervention was that reframing the group exercise narrative from body aesthetics to mind-brain intrinsic benefits offered a possible solution to the complex problem of the high rate of exercise attrition (Segar et al., 2011). The argument proposed that a brain-body approach to exercise instruction would build intrinsic motivation by promoting learning and well-being goals over extrinsic goals, such as weight loss (Mailey et al., 2018; Swann et al., 2020).

Limitations and Strengths of the Needs Assessment

There were limitations and strengths in this needs assessment. The first limitation was that this study sample was small compared to the total number of instructors and participants in the entire metropolitan YMCA. The second limitation was that the study did not control for demographic variables that might affect the generalizability of results from this suburban sample to urban or rural populations. A third limitation was that although surveys offered empirical snapshots of descriptive statistics, the statistics could not flesh out details on precisely why the numbers occurred. A fourth limitation was that the group exercise participants volunteering for the surveys might not be participants of the instructors who volunteered. This potential mismatch could explain why perceptions of domains of wellness addressed in classes varied. The fifth limitation was that participating group exercise volunteers likely had exposure to some of the researcher's classes where the cognitive and emotional domains of wellness were frequently discussed due to the nature of the researcher's doctoral studies. A sixth limitation was that this study was conducted right at the start of the global pandemic of 2020. Businesses, travel, and schools were closed. Fitness classes had been moved to online formats for the first time, and instructors were furloughed without pay. People's lives were physically, psychologically, and socially upended by health restrictions, the loss of loved ones, and the uncertainty of the future. Lastly, because the researcher was the instrument in qualitative data collection, and the area of research had personal meaning, the researcher wished to remain transparent and declare the possibility of researcher positionality.

The strength of the needs assessment was the use of mixed methods. Qualitative data from the focus group combined with the literature was instrumental in making inferences. However, the focus group was small and included only instructors. Capturing participant voices and experiences would strengthen future research. Despite the limitations, the triangulated data was sufficient to identify variables for intervention research. Based on these strengths and limitations, the researcher acknowledged that exercise represented a complex construct. Continuing to acknowledge the complexity of this problem of practice was required to avoid oversimplifications and overgeneralizations.

The following chapter contains an exploration into theoretical frameworks and empirical evidence. The goal is to address the three identified intervention factors. Those factors consist of brain-body knowledge, mind-body unity, and intrinsic motivation to exercise.

Chapter 3: Review of the Intervention Literature

Chapter 1 included a discussion surrounding the complex ecological relationship between the rise in mind-brain problems and the various mechanisms for mitigating them (Lee et al., 2019). A growing body of empirical research indicated that physical activity conferred biochemical, physiological, and psychological benefits on the brain (Alty et al., 2020; Basso & Suzuki, 2017; Béland et al., 2019; Blumenthal et al., 2007; Budde et al., 2016; Frodl et al., 2019; Hayes et al., 2015; Lee et al., 2019; Li et al., 2019; Markula & Chikinda, 2016; Mikkelsen et al., 2017; Segar et al., 2011; Trivedi et al., 2011). Thus, exercise had gained the attention of prominent exercise physiologists who had advocated for including exercise as adjuvant therapy for treating clinically diagnosed mental illnesses (e.g., schizophrenia, bipolar disorder, and posttraumatic stress disorder; Stubbs & Rosenbaum, 2018; Teychenne et al., 2020).

Similarly, clinical neuroscientists and neuropsychiatry experts advocated for using exercise as an evidence-based tool for the mitigation and prevention of mental unwellness, such as depression, anxiety, mood disorders, and cognitive decline (Basso & Suzuki, 2017; Ratey & Loehr, 2011; Stubbs & Rosenbaum, 2018; Teychenne et al., 2020). In addition, these clinical researchers advocated for the explicit promotion of exercise for its benefits on mind-brain well-being (Basso & Suzuki, 2017; Harvey et al., 2018; Mandolesi et al., 2018; Mikkelsen et al., 2017; Segar et al., 2011). The emerging vision from this research was knowledge mobilization—bringing exercise education into mental health facilities and mental health education into exercise facilities (Stubbs & Rosenbaum, 2018).

This intervention study proposed that group exercise classes were appropriate educational spaces to disseminate mind-brain neuroscientific findings to promote multidimensional health outcomes (Basso & Suzuki, 2017; Beauchemin et al., 2019; Lee et al., 2019). The second proposal was that including appropriate neuroscience research in group exercise classes contributed to reframing how people would think about, speak about, understand, and value the relationship between movement, cognition, and emotion (Barrett, 2017; Fugate et al., 2019; Parvizi, 2009; Stevens-Smith, 2016). Thus, this literature review provides supporting theoretical and empirical evidence, backing how including mind-brain health in group exercise classes may support multidimensional health and wellness outcomes. The following section shows why multiple theories are necessary to address the complexities associated with altering traditional exercise instruction methods in an adult setting.

Theoretical Framework

An effortful literature search in scholarly search engines yielded no singular guiding framework with which to situate literature on instructor cueing and class designs specific to connecting physical movement with mental states. Consequently, combining widely accepted psychological and developmental theories created the strongest potential for developing a novel intervention framework. Thus, the nature of the complexities surrounding adult learning, human behavior, and health-related practices is combined with neurocognitive, psychological, and learning theories to guide this literature synthesis. The grounding theories include EEC (Di Paolo et al., 2017), the self-determination theory of intrinsic motivation (Ryan & Deci, 2000), andragogy (Knowles, 1980), social constructivism (Vygotsky, 1978), and transformational learning theory (TLT; Mezirow, 1997). The following sections present broad overviews of the theories and explain their utility to the intervention.

The Theory of Embodied Enactive Cognition

The foundational supporting theory of this intervention was a theory from the branch of cognitive sciences called EEC (Di Paolo et al., 2017). This theory posits that sensorimotor activities (senses and movement) and an organism's interactions within its social and physical environments impact the organism's cognition (mental processes; Di Paolo et al., 2017; Durden-Myers et al., 2020; Froese & Di Paolo, 2011; Leung et al., 2011; Varela et al., 1991). This theory replaces the metaphor of the brain as a computer by emphasizing embodiment and social interactions as sources of cognition (Jasanoff, 2018). In other words, human cognition arises from sensorimotor couplings between an organism and its environment (Di Paolo et al., 2017; Wilson & Foglia, 2017). The body and environment do not contribute to cognition; they are part of it (Barsalou, 2008).

The theory of EEC defends the educational validity of placing importance and value on human being's perceptual, sensory, and motoric experiences (Avilés et al., 2020; Fugate et al., 2019; Putrawangsa & Hasanah, 2020). *Enaction* refers to the ongoing process of an organism's dynamic coupling with the environment (Di Paolo et al., 2017; Varela et al., 1991; Wilson & Foglia, 2017). *Embodied* refers to an organism's cognitive dependence on the physical body and aspects of the body beyond the brain that play a role in the organisms cognitive processing (Di Paolo et al., 2017; Varela et al., 1991; Wilson & Foglia, 2017). Consequently, the theory of EEC provided a solid foundational argument for mind-brain health instruction that might make explicit the relationship between a person's bodily movement in an environment and how a person might think and feel.

Like Bronfenbrenner's (1994) ecological systems theory in Chapter 1, the theory of EEC recognizes the complex interactions between seemingly independent systems (Di Paolo et al., 2017). The EEC posits that knowledge emerges through bodily enacted engagement with complex environments, including culture (Varela et al., 1991; Wilson & Foglia, 2017). This stance contrasts with traditional education practices that treat the mind as disembodied and the brain as a computational top-down information processer, creating mental representations of the world before acting on it (Barsalou, 2008; Standal & Aggerholm, 2016). Instead, embodied cognition supports a bottom-up approach to learning, emphasizing that body functioning is a "constituent of the mind" (Leitan & Chaffey, 2014, p. 3), not secondary to it.

Educational systems and practices that prioritize the mind while excluding the body's role in those mental processes foster mind-body dualism (Burgmer & Forstmann, 2018). Similarly, exercise systems and practices that prioritize the body while excluding the explicit interdependence among body, brain, and mind also foster mind-body dualism. Additionally, the use of phrases, such as *physical health* and *mental health*, implicitly fosters mind-body dualism by suggesting the two are disconnected from one another. This example reveals how the meaning-making of simple words subliminally impacts culture at a macrosystem level, sending changes through other ecological systems (Bronfenbrenner, 1994; Lakoff & Johnson, 1999).

Recognition of cognition is situated within the interactions of the brain, the body, and the world (Lakoff & Johnson, 1999; Varela et al., 1991; Wilson & Foglia, 2017), influencing group exercise instructional methods in three meaningful ways. First, grounding exercise instruction in the theory of EEC favors creating environmental affordances that support practices to help exercise participants conceptualize exercise information via sensorimotor simulations (Gallagher, 2017). In ecological psychology, affordances are action possibilities in the environment that lie dormant until circumstances inspire their use (e.g., a knob on a door provides an affordance for opening it; Gibson, 1977; Suri et al., 2018).

Second, grounding exercise teaching practices in the theory of EEC reflects a consequential neurological reality. Despite the constant storms of neuronal crosstalk and activities happening throughout the brain, most is not consciously accessible to humans

(Baraniuk, 2016; Eagleman, 2011; Iso-Ahola, 2015). This neurological reality impacts exercise instruction and goal setting by highlighting (a) why conscious decision-making is an unreliable driver of exercise behaviors, (b) why conscious intention to exercise and following through with exercise action do not always align, and (c) why acknowledging subconscious drivers of behaviors matters in exercise instruction and adherence (Is-Ahola, 2015; Locke & Latham, 2019; Meng et al., 2019; Swann et al., 2020). Lastly, the theory of EEC served as the vital theoretical bridge connecting exercise instructors' kinesiology training (the study of bodily movement) with neuroscience (study of the mind-brain) and the group exercise class (the environment; Di Paolo et al., 2017; Kiverstein & Miller, 2015).

Self-Determination Theory: Intrinsic Motivation

The self-determination theory of intrinsic motivation (SDT-IM; Ryan & Deci, 2000) complemented the theory of EEC and neuroscience by showing that automatized subconscious neural processes influenced by brain-body-environment interactions shape conscious behavioral intentions (Meng et al., 2019; Schöndube et al., 2017). Humans evolutionarily developed both systems of automaticity (habits) and conscious intentional control to adapt to their environments. This adaptation allowed for conserving neural activation (Friston, 2010). Exercise intention versus exercise behavior illustrates the brain's subconscious ability to override conscious choices (Leotti et al., 2010). For example, a sedentary person may consciously know that behavior, such as exercise, is good for them and may even have a firm intention to participate. Despite having this conscious knowledge, which data and negative consequences may even support, it is still not enough to override deep beliefs into the inaccessible circuitry of the brain's subconsciousness (Larson et al., 2018; Leotti et al., 2010; Schöndube et al., 2017). In simple terms, knowledge alone is not a strong enough motivator to override people's evolutionarily predisposed sedentary habits (Lieberman, 2015; Pontzer, 2018).

The SDT-IM posits that basic needs drive people's well-being and psychological growth, and motivation is a product of fulfilling those needs (Ryan & Deci, 2000, 2020). This theory was critical to this intervention because motivation was sometimes erroneously conceived as the driver of exercise behaviors. Instead, according to the SDT-IM, motivation results from behaviors that meet needs (Larson et al., 2018; Ryan & Deci, 2020). Therefore, in the group exercise class, motivation was not something a participant should bring to the exercise class. Instead, it was something that the participant should experience from the class.

The SDT-IM shifts traditional perceptions of exercise motivation from the precursor of the behavior (motivation to exercise) to the result of the behavior (motivation from exercise). Consequently, intervention methods grounded in the SDT-IM require teaching strategies that co-construct intrinsically motivating movement experiences with participants in those moments (Ryan & Deci, 2020). Achieving intrinsic motivation during in-class movement associates with a higher probability that physical activity will become automatized or a habit (Larson et al., 2018; Leotti et al., 2010; Ryan & Deci, 2020; Schöndube et al., 2017).

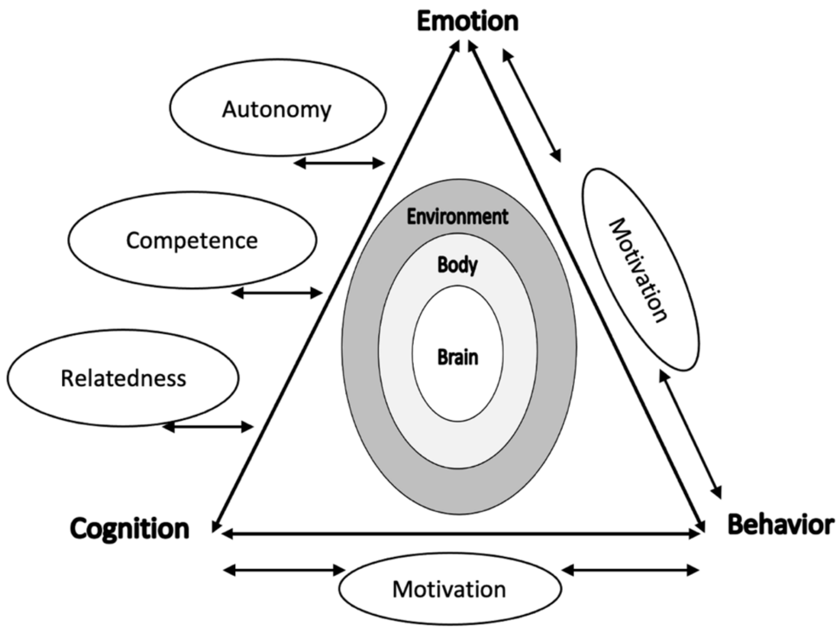
Ryan and Deci (2000) identified three psychological needs as crucial components of self-determined intrinsic motivation—competence, autonomy, and relatedness. The theory is that people's goals, behaviors, and relationships result from satisfying these three psychological needs. Competence refers to a human need to master challenging tasks. The feeling that one has about holding skills that beget success in an endeavor catalyze action to reach goals (Ryan & Deci, 2000). Autonomy is a basic human need to feel in control of goals and behaviors. A person achieves self-determination when they sense the ability to self-direct actions that affect personal change. Lastly, relatedness or a sense of connection is the need to experience attachments to other people. Regarding physical activity, Ryan and Deci (2000) attached an emotional valence or valuation to perceived competence.

The need to perceive task performance competence is ensconced in the task's salience, meaning, and value (Ryan & Deci, 2000). The SDT-IM posits that task execution is not synonymous with competence. Physical activity means that a kinesiology cue designed to implement an action correctly does not guarantee a participant's sense of competence. Therefore, SDT-IM grounded intervention methods need to co-construct feelings of competence, not just proper execution.

Figure 3.1 illustrates the relationship between the theory of EEC and the SDT-IM. The theory of EEC posits that cognition, emotion, and behavior are embodied and embedded within the brain, body, and environment (Di Paolo et al., 2017; Froese & Di Paolo, 2011; Durden-Myers et al., 2020; Leung et al., 2011; Varela et al., 1991). The SDT-IM posits that motivation and its antecedents—autonomy, competence, and relatedness—lead to intrinsic motivation that potentiates sustainable behavior change (Ryan & Deci, 2000, 2020). The figure illustrates that cognition, emotion, and behaviors are constructed from complex relationships between the interdependent systems of the brain, the body, and the environment (Froese & Di Paolo, 2011).

Figure 3.1

Embodied Enactive Cognition With the Self-Determination Theory



Note: Cognition, emotion, and behavior are embodied and embedded within the brain, body, and environment. Motivation and its antecedents—autonomy, competence, and relatedness—are subconsciously constructed from the relationships among these interdependent systems to influence behavior, cognition, and emotion.

Supporting Learning Theories

This intervention took the novel approach of viewing the group exercise class as an educational space versus a performance space. For this reason, it was critical to turn to learning theories. Along with the theory of EEC and the SDT-IM, the three following learning theories grounded the literature used to support and construct the instructional methods of this intervention. These complementary learning theories included andragogy (Knowles, 1980), social constructivism (Vygotsky, 1978), and TLT (Mezirow, 1997). The theories are defined here then later synthesized with intervention factors according to their relevant contributions to actionable teaching methods in group exercise class contexts.

Andragogy. Andragogy was coined in the 20^{th} century to describe the education of adults (Peterson & Ray, 2013). Because this intervention centers on adult learners in the group exercise context, the theory of andragogy is central to developing teaching methods that meet adult learner needs. Andragogy's five assumptions about adult learners strongly align with the tenets of the theory of EEC and the SDT-IM. These five assumptions are that (a) adults are self-directed and self-motivated, (b) adults' experiences are resources they bring to learning environments, (c) adult learning is related to developmental needs (i.e., stage of life), (d) adult learning is typically problem centered, and (e) adults desire immediate application of their learning (Knowles, 1962, 1980). For these reasons, andragogy was theoretically and methodologically valuable for guiding this intervention.

Social Constructivism. The SCT (Vygotsky, 1978) emphasizes the social nature of learning. Though SCT was proposed before the advent of brain imaging, the theory was prescient in understanding that social interactions affect cognitive functions. Like the theory of EEC, SCT posits that social contexts are entangled with learning. Furthermore, SCT's main concepts align with ECC in that (a) culture plays a role in cognition, (b) culture is rooted in language, and (c) development happens within an individual's role in the community (Vygotsky, 1978).

SCT proposes that learning happens most effectively through active engagement in a learner's ZPD (Vygotsky, 1978). The ZPD is the skill set or knowledge a learner cannot achieve independently but can achieve with the assistance of a *more knowledgeable other* (MKO). In other words, the ZPD is a skill level just beyond the learner's current skill set. *Scaffolding* is used to denote collaborative learning with MKOs in a learner's ZPD (Wood et al., 1976). Broadly conceived, the group exercise instructors in fitness classes serve as potential MKOs to scaffold and co-construct new knowledge, intrinsically motivating mind-brain-body experiences. SCT's valuation of language in constructing meaning supported this intervention's focus on language as a mechanism of knowledge co-construction, meaning-making, and behavioral change in group exercise settings. This interaction between the learner's biology and the social environment aligned with the theory of EEC (Di Paolo et al., 2017; Froese & Di Paolo, 2011; Durden-Myers et al., 2020; Leung et al., 2011).

Transformational Learning Theory. The TLT is an adult learning theory that builds on the theory of andragogy and introduces critical reflection (Mezirow, 1997). The TLT assumes that change happens through instrumental learning means (task-oriented problem solving) and communicative means (communication of needs, feelings, and desires; Mezirow, 1997). Transformative learning results from adults being autonomously able to change their *frames of reference* or their "structures of assumptions" (Mezirow, 1997, p. 5) previously used to make sense of their worlds. These frames of reference include habits of mind and points of view (Mezirow, 1997). In the context of this intervention, habits of mind consisted of the abstract ways of thinking about habituated exercise practices and beliefs. Points of view included participant beliefs about exercise that would manifest in their attitudes, value judgments, and personal interpretations (Mezirow, 1997) of what physical activity personally meant to them.

Like andragogy, TLT is self-directed and problem-centered (Knowles, 1980; Mezirow, 1997). The problem or *disorienting dilemma* is the catalyst for transformative adult learning experiences because it requires questioning previously held assumptions (Mezirow, 1997). *Critical self-reflection* requires adults to assess and critique deeply held beliefs and ask themselves why they have such thoughts (Mezirow, 1997). Critical self-reflection and discourse validating the reflective insights are the bridges to action that align with EEC and SDT-IM. In this intervention, changing perspectives on culturally embedded exercise beliefs could be broadly construed as a disorienting dilemma. Consequently, TLT was a valuable theory for constructing this intervention's framework because critical reflections on habits of mind and points of view served as actionable mechanisms for a change and mind-brain-body connection.

The following section is a literature synthesis of empirical studies supporting the needs assessment-generated factors and aligning with the multilayered theoretical framework. The synthesis is divided into the three main sections from needs-assessment findings—brain-body knowledge, mind-body unity, and intrinsic motivation to exercise. Each section contains findings from empirical literature that support interventional methods targeted at each factor.

Synthesis of the Literature

Sometimes, the "normal way of doing business is not responsive to changes in the surrounding community" (Mertens, D., 2018, p. 155). The rise of mind/brain health needs (Barbui & Albanese, 2019; Chen et al., 2018; WHO, 2020a) coupled with the reality of exercise attrition nudges the fitness industry to reflect on its "normal way of doing business" (Larson et al., 2018, p. 20) and drives this intervention. Currently, the language used in fitness classes and exercise cultures implicitly perpetuates exercise dualism—separating the body from the mind (Burgmer & Forstmann, 2018). Dualistic language contributes to extrinsic goal setting in exercise settings (Andreasson & Johansson, 2016; Markula & Chikinda, 2016). The needs-assessment findings lent empirical support for an intervention that explored a path forward for reframing instructor language that fostered a unified mind-brain-body perception. Because all movement is a mind-brain-body-environment experience (Di Paolo et al., 2017), all exercise classes are mind-body classes—not just the types of classes popularly marketed as such.

This literature synthesis focuses on studies where the role of language and communication in exercise, sport, or movement settings lend support to improving brain-body knowledge, mind-body integration, and intrinsic motivation in group exercise classes. Additionally, the literature includes researchers who explore programs, methods, and language cues that support cueing physical movements for intrinsic goals—goals that attach qualities, feelings, and lived experiences to the bodily action (Abraham et al., 2020; Ryan & Deci, 2020; Segar et al., 2017). The following subsection section synthesizes studies where programs successfully incorporated mental health and well-being knowledge in community, sport, and educational settings typically dedicated to athletic development to address the first needs assessment-generated intervention factor, brain-body knowledge.

Brain-Body Knowledge

The public dissemination of scientific knowledge is vital in a progressive society (Eagleman, 2020). It honors taxpayer dollars that fund research, inspires critical thinking, stems the flow of misinformation, informs public policy, clarifies science, and shares the "raw beauty of scientific pursuit" (Eagleman, 2013, p. 12148). When group exercise instructors weave scientific knowledge into classes, they become members of a science's public dissemination team. This action brings exercise neuroscience research directly into the YMCA that intersect with public health. Dissemination of scientific knowledge in an exercise setting aligns with the theory of EEC because it recognizes many ways of learning and knowing (Merriam & Kim, 2008). Group exercise classes afford opportunities to teach science to participants, use science to develop instructional methods, and co-construct knowledge and salience with participants for practical use beyond the class. Participants of these classes become social ambassadors of this information in their families and communities, fostering community dialogues about mental health.

One practical reason for group exercise instructors to participate in public dissemination of health knowledge is that it fills an adult education gap. Overhage and McCallie (2020) conducted a descriptive study, documenting 100 million ambulatory outpatient encounters with 150,000 subspecialist and primary care physicians in 17 specialties within 417 U.S. health systems. The researchers reported that physicians only spent an average of 16 minutes and 14 seconds with their patients (Overhage & McCallie, 2020). Of this time, 33% was spent reviewing the patient chart, 24% documenting, and 17% ordering tests. These statistics indicated that there was little, if any, extra time allocated for physicians to educate patients on wellness and health, promoting modifiable lifestyle factors.

Furthermore, physicians train in *pathogenesis*, the treatment of diseases, not *salutogenesis*, a health model focusing on health origins, assets, and wellness (Antonovsky, 1979; Mittelmark & Bauer, 2017; Pettitt & Joy, 2019). Trained fitness instructors are well-positioned to fill this complementary adult health education gap. According to a Mindbody research survey, 54.3 million adults in the United States (27%) reported attending one group exercise class a week (Mindbody Wellness Index Report, 2019). If one-quarter of the population avails themselves of group exercise classes, and fitness professionals serve as critical points of contact for adults' evidence-based health and fitness information, then turning scholarly attention to these spaces has public health implications.

Additionally, evidence-based scholarship and research in group exercise settings have social justice implications. Group exercise instruction that publicly disseminates health science aligns with the WHO's (2020b) *Health in All Policies* (HiAP) approach. The HiAP aims to improve population health and health equity by considering factors that collaboratively impact community health in all areas of policymaking.

A New Definition of Exercise. One intervention starting point is to reconsider how the current definition of exercise linguistically affects boundaries, beliefs, and policies surrounding the phenomenon of exercise (Piggin, 2019; Rosenbaum et al., 2020). Current definitions semantically bias exercise toward its physical benefits without connecting meaning with multiple dimensions of wellness (Piggin, 2019; Rosenbaum et al., 2020). Caspersen et al. (1985) published the most widely accepted definition of physical activity: "any bodily movement produced by skeletal muscles that results in energy expenditure" (p. 126). Current arguments against this definition critiqued it for its reductionist view, yet this mechanistic belief focused on skeletal muscle and energy expenditure shapes curriculum, textbooks, health policy, and government guidelines (Piggin, 2019). Though updated variations added "producing health benefits" (National Institutes of Health, 1995, p. 3), these exercise definitions still omitted social, affective, and cognitive processes in exercise (Piggin, 2019).

A new definition captures the holistic, inclusive, and complex aspects of physical activity by including that it is inherently cerebral, social, situated, and political (Piggin, 2019). In addition, a broader definition moves away from "overmedicalization" or justifying participation in exercise for disease risk by including emotional and social domains of wellness (Piggin, 2019, p. 73). The new proposed definition is the following: "Physical activity involves people moving, acting and performing within culturally specific spaces and contexts, and influenced by a unique array of interests, emotions, ideas, instructions, and relationships" (Piggin, 2019, p. 73). The language of the newer definition aligned with the theory of EEC, the SDT-IM, and the goals of this intervention. A contemporary definition dismantled the old narratives, shaping the meaning and purpose of physical movement, activity, and exercise that might serve as barriers to participation.

Mental Health Literacy in Community and Sport Settings. Due to its recent emergence, no empirical literature exists on the impact the new definition has on affecting policy and broadening the purposes for which people exercise. However, this section includes four sport and educational programs that have successfully included mental health literacy components (Hurley et al., 2020; Glazzard & Szreter, 2020; Miller et al., 2018; Stanton et al., 2019). Arguably, three of these studies (Hurley et al., 2020; Glazzard & Szreter, 2020; Stanton et al., 2019) embody the spirit of Piggins's (2019) definition by broadening the emphasis of sport settings to include emotions, ideas, social relationships, and mental health literacy. In a broad sense, these researchers actualized the new definition by explicitly integrating the cognitive and affective domains of wellbeing in places focused on the physical domain.

A mental literacy program, *Mind Your Head*, connected participation in sport and moderate physical activity to improved well-being. The program was delivered in six 1-hour lessons by sports coaches in Cambridge, England (Glazzard & Szreter, 2020). The mixed-methods study partnered a local football club with schools with 570 students aged 12 to 15 participating. Pre- and post-intervention mental health literacy tests were given using the Mental Health Literacy Scale (O'Connor & Casey, 2015). Independent *t*-tests showed a significant improvement in mental health literacy. In addition, focus group data from semi-structured student interviews and individual teacher interviews showed improvements in students' abilities to articulate how to seek help and understand that mental health existed on a spectrum. Students and teachers recognized physical activity could improve their mental health (Glazzard & Szreter, 2020). With its considerable sample size, this program showed the appropriateness of and success in partnering a traditionally physical-oriented sports club with mental health knowledge.

A program with adults yielded similar results from a considerable sample size. Hurley et al. (2020) conducted a qualitative study to evaluate 352 parents of adolescents. They participated in a month-long mental health literacy workshop called *Ahead of the Game* delivered through a community sports club. The duration of the 18 sessions averaged 1 hour each. Reflexive thematic analysis revealed that parents reported increased mental health awareness and viewed mental health education as important and valued. Furthermore, parents expressed that the workshop stimulated conversations with their children about mental health wellness and that sports facilities were appropriate for discussing mental health. Additionally, parents told program implementers that they wanted more sessions via online tailored materials (Hurley et al., 2020). Hurley et al. (2020) studied a community sports club, such as the YMCA context of this intervention. The Hurley et al. study was important to this intervention because it revealed that the program sparked parents' interests in opening dialogue with their children about mental health topics.

Furthermore, the parents found the material on mental health salient enough to request more sessions. This salience aligned with SDT-IM—that meaningful and relevant material would lead to internal motivations. The success of the Glazzard and Szreter (2020) and Hurley et al. (2020) studies indicated that an intervention including mind-brain-body wellness in the context of the YMCA group exercise classes might stimulate conversation beyond exercise classes. The successful addition of brain-body awareness in adult classes might have possibilities for future mind-brain wellness programs with youth.

Stanton et al. (2018) corroborated such results, showing the effectiveness and appropriateness of mental health information in the sport and exercise arena (Glazzard & Szreter, 2020; Hurley et al., 2020). Descriptive statistics from a 1,265-respondent Australian phone survey featuring vignettes indicated a high level of effectiveness in Australian national exercise and mental health literacy campaigns (Stanton et al., 2019). Two-thirds of the respondents (a) correctly identified depression in the vignette, (b) supported exercise as beneficial for the fictitious person in the vignette (showing signs of depression), and (c) reported an exercise physiologist as an appropriate person to consult regarding exercise (Stanton et al., 2019). The positive results from this considerable sample size supported that educational programs tying exercise with mental well-being might produce valuable outcomes. In summary, all three of these studies supported that exercise and sports contexts were appropriate spaces to educate about mental well-being.

The mental literacy of teachers was also associated with student literacy (Hurley et al., 2020; Glazzard & Szreter, 2020; Miller et al., 2018; Stanton et al., 2019). A 6-week adolescent depression awareness program was administered to 66 educators and 6,679 public, private, and parochial school students between the ages of 14 and 16 years old in Maryland, Delaware, Pennsylvania, Michigan, and Oklahoma (Miller et al., 2018). Pre- and posttests (the Adolescent Depression Knowledge Questionnaire and the Reported and Intended Behavior Scale) were electronically delivered to students and teachers before and at 6-week and 4-month intervals after training. The depression literacy program was developed by psychiatrists and psychiatric nurses at the Johns Hopkins School of Medicine to assess teacher and student depression literacy and stigma. The Adolescent Depression Knowledge Questionnaire assessed students' help-seeking knowledge and attitudes about depression. Results indicated that teacher depression literacy was significantly associated with student depression literacy (Miller et al., 2018). Although this scenario was in the traditional classroom, it still indicated that optimizing the mental health literacy of fitness instructors might positively impact the mental health literacy of their exercise participants.

These studies showed evidence of several benefits to including mental health literacy in community and sport settings. These benefits included an improvement in people's ability to articulate how to seek help, an understanding of mental health existing on a spectrum, and a recognition of using physical activity to improve mental health (Glazzard & Szreter, 2020). Other benefits included increased mental health awareness, increased valuing of mental health education as important, increased conversation between parent and their children about mental health wellness, and a sense that sports facilities were appropriate settings for discussing mental health (Hurley et al., 2020; Stanton et al., 2019). Lastly, increasing teacher mental health literacy increased student health literacy (Miller et al., 2018).

Science Literacy in Physical Education Settings. Science-based fitness knowledge introduced that constructivist PE also improves science literacy (Sun et al., 2012). Thirty elementary schools in a large U.S. school district were randomly selected to participate in a PE constructivist curriculum designed to introduce fitness and healthful living knowledge (Sun et al., 2012). A sample of fourth, fifth, and sixth-grade students was randomly assigned to control and treatment groups ($N = 5{,}717$). Standardized pre and posttests assessed students' knowledge on cardiorespiratory, muscle strength, body flexibility, and nutrition. Students in both groups received the same information on the health components of cardiorespiratory fitness, muscular capacity, body flexibility, and healthful nutrition. The control group learned material by a traditional lecture. The constructivist treatment group was encouraged to interact in learning experiences that were physical, cognitive, and social—all class experiences related to students' previous experiences and real-world applications. Thirty classes divided into three units were held twice a week for 30 minutes. The researchers used descriptive statistics and analyses of variance (ANOVA) to analyze the treatment effect. Classes were the units of analysis used to control for validity threat. Children in the treatment condition learned faster than children in the control group in all fitness categories (Sun et al., 2012). This study supported proof of concept that neuroscience added to adult constructivist, andragogical, and transformative group fitness settings could improve knowledge available for immediate wellness application.

Given the large sample sizes of these studies, as well as the validation of instruments and mixed methods used, there existed evidential support for including mind and brain health in group exercise classes and including mental health literacy in instructor professional development (Hurley et al., 2020; Glazzard & Szreter, 2020; Miller et al., 2018; Stanton et al., 2019). Furthermore, the use of Piggins's (2019) multidimensional definition of exercise established a linguistic starting point for how to scaffold this information (Bruner, 1960; Vygotsky, 1978).

Although these programs were effective and had large sample sizes, they remained programs and not embedded methods. The position of this researcher was that adapting spiral curriculum methods (Bruner, 1960) that embedded knowledge on mind and brain wellness in an ongoing manner in fitness classes aligned with learning strategies would make the information stick (Roediger & Pyc, 2012a, 2012b). Embedding knowledge might be more effective in changing the exercise narrative than using one-off types of workshops (Camburn & Han, 2017). Embedding knowledge also factored in the time and repetition necessary for critical reflection on habits of mind and points of view (Mezirow, 1998). Lastly, the addition of brain-body knowledge in group exercise classes aligned with the tenets of andragogy, particularly immediate application of knowledge (Knowles, 1980). The following subsection shows that behavioral neuroscience provides language and knowledge to bridge Western mind-body schism (Berg, 2010).

The Relevance and Utility of Neuroscience in Health Settings. Needs-assessment findings showed that the language of kinesiology and movement choreography dominated instructor cues for valid reasons. The argument raised in this intervention was that instructor cues that also reflected neuroscientific information could be the mechanisms used to connect participants' biology with their mental processes (Berg, 2010). Basic neuroscientific facts spiraled (Bruner, 1960) and embedded into group exercise instruction served as consistent reinforcement that bodily processes and functions would impact emotions and mental capacity (Basso et al., 2015; Berg, 2010; Lee et al., 2014; Naya et al., 2017). In other words, instructors combining kinesiology with neuroscience might foster participants' understanding about how exercise could influence their mind-brain-body. Furthermore, instructing exercise this way was theoretically supported by EEC and normalized that mind, brain, and body—features commonly thought of as distinct entities—were unified (Varela et al., 1991).

The utility of neuroscience in health and exercise settings is a growing field. Neuroscientist Wendy Suzuki (2021) ran a lab at New York University's Center for Neural Sciences teaching an undergraduate neuroscience course that included exercise sessions with her students *during* the class (Reynolds, 2015). Suzuki (2021) trained to become a certified fitness instructor and conducted fitness classes in her college courses to embed a living experience of participating in exercise while studying the effects of exercise on the brain. Her students participate in the exercise class and conduct research experiments on each other to study the effects of exercise on attention, focus, and mood (Suzuki, 2021). Suzuki (2021) published on exercise and memory while testing an app to allow people to track their responses to exercise and attention processing and mood. The app uses Stroop color word tests and mood questionnaires pre and postworkout (Basso et al., 2015; Lee et al., 2014; Naya et al., 2017). Suzuki's (2021) app study, which is still in progress, adds more evidence for exercise's effects on the brain and is aimed at making this brain-body connection more accessible to exercisers in the spirit of other popular fitness trackers. Creating a brain-body teaching framework for use in group exercise instruction is a way to extend Suzuki's and the work of other exercise neuroscientists into spaces where people can benefit from the knowledge.

Experiential and Contemplative Neuroscience. Brain training programs exist within and outside the fitness industry—some justified, some not (A. Diamond & Ling, 2016). A search for empirical studies testing a framework scaffolding neuroscience research into the continuing education model of group fitness classes produced no results. However, a few studies from interdisciplinary undergraduate college courses illustrate ways teachers incorporated neuroscience into their instruction (Foster et al., 2016; Olson, 2018; Reynolds, 2015; Sun et al., 2012; Wolfe & Moran, 2017). Some undergraduate college class teachers use neuroscience to inform their methods, and others use neuroscience to create mind-body experiences through physical activities (Foster et al., 2016; Olson, 2018; Wolfe & Moran, 2017). These studies are essential to this intervention because they share the same objectives—to teach (fundamental) neuroscience and use it to create student experiences of the concepts.

The first study used the precepts of neuroscience to teach a social constructivist introductory course in marketing (Foster et al., 2016). Like this intervention, the study was a pilot class. The study occurred in a large urban university (30,000+ students). The traditional class was taught in Fall 2012 in the one-way style of a 3-hour lecture on marketing theory and a lecture-practice session on marketing metrics in a large auditorium. In this group, the instructor used PowerPoint presentations, whiteboards, and worksheets in teaching methods. The pilot class taught in Fall 2013 used neuroscience principles of dual coding theory and working memory as a limited capacity processor. It changed the format to 2 hours of FTF class time. One hour outside of class consisted of listening to smaller-sized audiovisual files broken up into different marketing principles. This flexibility allowed students to consume the media at their convenience and rewatch media for notetaking and clarity. FTF class time started with overviews of topics and prompted students to trigger prior knowledge. Students were encouraged to work in small groups to apply previous material to new content.

Feedback on learning was frequent and included no-stakes tests that quizzed students' knowledge and posted correct answers immediately. Furthermore, feedback explained why answers were correct. Likert-survey responses about the pilot program were positive. Students reported a higher sense of engagement and enjoyed the ability to pause videos, rewatch them, and take more notes. This study supported that social constructivist methods leverage how the brain works.

Like Foster et al. (2016), Olson (2018) and Wolfe and Moran (2017) blended neuroscience and curriculum to reach a diverse mix of students by teaching applicable, health-relevant information while experiencing the information. These two studies were relevant because each supported this study's proof of concept intervention—how learning new knowledge while physically practicing it strengthened a mind-body connection (Olson, 2018; Wolfe & Moran, 2017). Both contexts were undergraduate interdisciplinary courses that tested experiential neuroscience and contemplative neuroscience with meditation and yoga.

Wolfe and Moran (2017) discussed the need for a novel blueprint to integrate neuroscience in a way that was accessible and applicable to student lives. Their stance aligned with this dissertation's objectives. Blending health-related interests and neuroscientific material fostered "brain literacy" (Wolfe & Moran, 2017, p. A77) and overcame science anxieties by connecting it to student interests outside of the undergraduate class. The authors related neuroscience with the usefulness of contemplation for students handling stress, life transitions, social and academic pressures, and mental health problems. The study was conducted in a "Yoga for Therapy" class at the University of St. Thomas in St. Paul, Minnesota. The course had been examining yoga as a contemplative practice for handling stress, depression, and anxiety since 2012.

The first author of the Wolfe and Moran (2017) study, like Suzuki (2021), was a university faculty member trained as a yoga instructor to teach the course. The class met for 1 hour and 45 minutes each week and examined yoga through the neural mechanisms and clinical evidence of yoga's benefits. Students' personal experiences were purposedly integrated into the class. The first 55 minutes were spent in discussion on a neuroscience topic. The rest of the class time was dedicated to the yoga practice. When possible, discussions were held after class. Class discussions were tied to the yoga practice. For example, if the course topic was centered on the neuroscientific principles of slow breathing on the parasympathetic nervous system, students were directed to pay attention to their slow breathing during the yoga practice. If the day's neuroscience topic was emotional embodiment, students were cued to pay attention to the markers of emotion in their bodies during practice (e.g., tension, heartbeat, breath depth).

Of the 80 students who participated in the study, approximately 50% came from nonscience majors. Posttest results were significantly higher on neuroscience knowledge tests than pretests, with an average increase from 33% to 77%. Half the students reported at least one item with which they had no prior knowledge on the pretest. On the posttest, no one reported this. In Likert surveys, students reported more positive feelings about neuroscience and rated the course as a highly positive experience. In inductively coded qualitative comments from journals, students said that they appreciated learning things they could use outside of class and how neuroplasticity made them feel hopeful about learning and changing habits. Students who indicated that they were previously nervous about taking science courses, suggesting that this class's experiential component brought them closer to enjoying science as something natural and helpful in their lives (Wolfe & Moran, 2017.)

Olson (2018) conducted a similar study on undergraduates at the University of Redlands, CA, finding similar results. Students who previously reported discomfort with science believed that understanding how neuroscience had immediate applications to their lives made science feel fun and exciting (Olson, 2018). Olson's (2018) study was conducted in a minisemester in May in a course called the Neuroscience of Meditation. The 3-credit course for nonscience majors spanned 14 class sessions, four per week, 4 hours each day. Content included practicing meditation forms from different cultural and religious practices, neuroscience lectures connected to these, and neuroscience labs. Pre and posttest ANOVA indicated an increase in neuroscience knowledge. Students' end-of-study surveys and comments showed the course had "stretched" (Olson, 2018, p. A63) them personally and scientifically. Students also perceived that learning neuroscience material made them feel like they were "learning to be a better person" (Olson, 2018, p. A63).

The innovative, experimental, and experiential nature of these studies provided support for this dissertation's intervention. Though not explicitly stated as their grounding theory, both studies were supported by the theory of EEC in the attention paid to the mind-brain-body-environment connection. SCT also supported their formats because students would learn from themselves (through their practices), from each other (through discussions and each other's experiences), and a more knowledgeable other (the instructor; Vygotsky, 1978). Group exercise classes were not instructed in the same manner as undergraduate college classes, and these studies were not precisely replicable in group exercise contexts. However, this researcher suggested that the Olson (2018) and Wolfe and Moran (2017) study results solidly supported the concept of integrating brain science into fitness settings.

This previous section argued why including relevant brain science information in group exercise classes is a valuable opportunity to disseminate science publicly and inspire awe, curiosity, and wonder about the brain's capabilities. This next section builds on this argument by synthesizing brain and behavior research studies that offer language and techniques to construct mind-body experiences for exercise participants.

Mind-Brain-Body Relationship

The brain's neuroplasticity, its ability to reorganize connections between brain cells, make teaching and learning new things possible throughout life (Cassilhas et al., 2016; Eichinger, 2018). Neuroplasticity, andragogy (Knowles, 1980), TLT (Mezirow, 1997), and Vygotsky's (1978) SCT all support this researcher's argument that group exercise classes were adult educational spaces that would allow reaching beyond current practices to actualize the WHO's (2020b) HiAP approach. From a public health perspective, the reason that mind-body connections were essential to this process was that empirical and replicated research showed that people who had stronger perceptions of mind-body integration tended to practice healthier lifestyles than mind-body dualists (Burgmer & Forstmann, 2018). This connection had implications for the health care system. From a personal health perspective, mind-body unity might influence a person's quality of life, including daily mental well-being (Mittelmark &

Bauer, 2017). The pictorial dualism tool in the Forstmann et al. (2012) study and the replicated Burgmer and Forstmann (2018) studies in Chapter 1 were helpful in this intervention to assess study participants' perceptions of mind-body unity.

Neuroscience-inspired mind-body conversations and teaching methods in group exercise classes may open a path toward new intrinsic-centered (Ryan & Deci, 2000) exercise narratives about multidimensional wellness needs (Beauchemin et al., 2019). A brain-body teaching framework grounded in neuroscience, EEC, and SDT-IM affords opportunities in group exercise classes to move past the false dichotomy of health being "*either* mental *or* bodily" (Furtak, 2019, p. 101). Instructor language and teaching methods can reinforce the unity of somatic (bodily) processes with emotions, cognition, and knowing within the environment. Language in this framework reflects the unification of the mind-brain-body-environment while distinguishing between health span (the quality of life) and lifespan (the length of life; Bansal et al., 2015). Because living longer was not necessarily synonymous with living healthy or thriving (Bansal et al., 2015), this researcher suggested that a brain-body teaching framework might orient exercise language toward the quality of life. The mind-body connections co-constructed with participants during exercise classes (Franklin, 1996) might allow participants to internalize the sensations and executions of their movements. Instructors could assist with helping students to reframe them to meet their intrinsic personal needs (Ryan & Deci, 2000), automatize them through practice (Liu-Ambrose et al., 2005), and integrate them into a lifestyle for well-being (Barrett, 2017).

The needs assessment findings from Chapter 2 revealed that the methods and language used to instruct fitness classes, even ones labeled mind-body, were predominantly mechanical and do not explicitly integrate exercise movement's mind-brain-environment connection. In other words, current instructor language includes words that cue biomechanics (the actual movements), choreography (the directions and patterns of the actions), and culturally influenced extrinsic goals (weight loss and body shaping). Instructors who ground teaching practice in EEC can adjust teaching cues to connect participants' movements with neural activity, mental experiences, and affordances in the environments (Basso & Suzuki, 2017; Di Paolo et al., 2017; Franklin, 1996; Merleau-Ponty, 1945; Varela et al., 1991; Wilson & Foglia, 2017).

From an intervention developmental standpoint, this finding suggests that the teaching methods grounded in an EEC and SDT-IM framework must (a) reflect an appreciation of the crosstalk between the different regions of the brain, (b) recognize the contribution of cognitive *and* noncognitive processes in learning, and (c) include environmental affordances (Barrett, 2017; Fugate et al., 2019; Parvizi, 2009). Cognitive skills address memory, motor skills, visual and spatial processing, and executive functions (Doren & Grodsky, 2016). Noncognitive skills address motivation, effort, communication and interpersonal interaction, and self-efficacy or one's belief in an ability to do well in a particular endeavor (Bandura, 1997). An EEC, SDT-IM grounded group exercise class needs to reflect the value of cognitive and noncognitive skills explicitly (Bandura, 1997; Doren & Grodsky, 2016).

Neuroscience knowledge offers a path to transcend the current exercise narrative that messages bodily movement as a tool for shaping the body (Lee et al., 2019) by showing how movement is connected to mood, thinking, and behavior (Damasio, 1994; Pezzulo & Cisek, 2016). For example, crosstalk between cortical and subcortical regions of the brain reveals that subcortical brain areas may be the first to signal higher cortical structures (Parvizi, 2009). In other words, movement and thinking are connected. Because neuroscience data supports the embodiment of cognition (Pezzulo & Cisek, 2016), bringing this knowledge into the fitness realm affords opportunities may reframe the way the culture thinks about the benefits of movement, including exercise.

The literature synthesized in the following four subsections presents EEC and SDT-IM aligned teaching methods and cues that create mind-brain-body-environment connections and intrinsic experiences of physical activities. Each section further connects how neuroscience supports the rationale for (a) automatizing sensations that lead to feelings of competency, (b) using dynamic neurocognitive imagery and metaphors to embody movement, (c) cognitively reappraising bodily sensations, and (d) setting learning and intrinsic goals.

Automatizing the Feel of Postural Alignment and Balance. Interactions with the environment shape humans' experiences and physically reconfigure brain cell connections (Barrett, 2017). This neuroscientific evidence challenges information processing models of the brain by revealing that the human brain is neither analogous to computer hardware nor software (Pezzulo & Cisek, 2016). Instead, the brain is *liveware* constantly changing with environmental interactions (Eagleman, 2020). EEC-grounded group exercise teaching reinforces participants to understand that environmental interactions change the physicality of their brains, influencing their physical, mental, and behavioral processes. Teaching movement through neuroscience in the context of exercise adds a psychological element of hopefulness to the class environment (Olson, 2018). Furthermore, internalizing and automatizing functional movements may offer an intrinsic sense of agency over the quality of life and independence (Ryan & Deci, 2000).

Brain plasticity knowledge is relevant for participants when understanding, training, and automatizing postural alignment and balance (Kal et al., 2018). Postural alignment problems can trigger chronic pain or discomfort that affects the quality-of-life perception or perceived enjoyment of movement (Jacobs et al., 2009). Balance issues create fall risks that affect quality of life and movement independence (Patti et al., 2021). The brain does not simply react to events in the world. It predicts what may happen and compares these predictions of new sensory data from the world with sensory data inside the body (Barrett, 2017). The brain is also postdictive. Studies on perception using the flash-lag illusion, where a moving object aligned with its flash, is perceived as offset in the motion following the flash, show that the brain conjures a reaction ~80 milliseconds before a person's awareness of perceiving their reaction (Eagleman & Sejnowski, 2007). Furthermore, what happens in the ~80 milliseconds after the brain registers the reaction affects what a person will perceive. The flash-lag effect and other illusion study findings illustrate that brains constantly attempt to imagine a body in active engagement with the world (Shapiro & Stolz, 2019).

These perception findings are essential to education, showing that human perception is individual due to unique mind-brain-body-environment experiences. Conscious experience of control is somewhat illusory because the brain reacts before consciousness registers it (Eagleman & Sejnowski, 2007; Shapiro & Stolz, 2019). Though delving into the complexities of consciousness is beyond the scope of this dissertation, the primary implication of subconscious mental processing is essential. It shows that subconscious actions of the brain affect human decision-making, especially during stressful situations or unexpected perturbations (Barrett, 2017; Liu-Ambrose et al., 2005; Wirz et al., 2018). Stressful events can induce a shift from cognitive to reflexive or habitual systems (Wirz et al., 2018). Understanding subconscious processing suggests that practicing breathing strategies that stimulate the parasympathetic nervous system in group exercise class can automatize habits and reflexes for use in emotionally stressful or anxious situations (Adolphs, 2017; Hoemann et al., 2020; Olson, 2018; Wolfe & Moran, 2017).

The concept of automatizing healthy posture and balance through dynamic (movement-based) mind-body practice makes an EEC grounded exercise class a dress rehearsal for functional movement in life (Franklin, 1996). In a systematic review of literature on 25 controlled trials, a descriptive data analysis on motor dual-task performance concluded that automatized motor skills were less easily disturbed when athlete's cognitive recourses were compromised (Kal et al., 2018). This study aligned with neuroscience research, showing that automatized and procedural knowledge were consciously inaccessible and independent of working memory (Eagleman & Sejnowski, 2007; Masters, 1992). The value of automaticity found in the Kal et al. (2018) supported Liu-Ambrose et al. (2005). The researchers studied 98 low bone mass women (ages 75 to 85) to determine if exercise-induced fall risks were maintained a year after the cessation of 6 months of training interventions—agility training (dynamic balance), resistance training, and general stretching. Using the Physiological Profile Assessment tool, the Physical Activity Scale for the Elderly, and interviews, results indicated that these trainings appeared a catalyst for reductions in fall risks, even at the 12-month marker.

Kal et al. (2018) and Liu-Ambrose et al. (2005) illustrated the lifestyle functionality of automaticity. Functional skills can be taught and improved in an exercise class using mind-body techniques for use in all aspects of life beyond the exercise class (De Koning & Tabbers, 2011). In functional skills, such as postural alignment and balance, repetition of the experience reinforces the neural circuitry associated with the skills and automatizes it (Abraham et al., 2019). An example of automatization is the self-correction required to prevent a fall when stumbling upon an object. An automatized balance response assists in self-correction (Liu-Ambrose et al., 2005). Neuroscience reveals that subconscious mental processes, to which human beings have no immediate access, affect decision-making, learning, and perception faster than humans can consciously make them (Barrett, 2017). This automatic decision-making is illustrated in sport science research. Motor expertise regulates unconscious rather than conscious executive control when skilled athletes perform tasks (Meng et al., 2019). Athletes must make quick decisions under pressure, using automatized behaviors working below the conscious level (Meng et al., 2019). Subconscious processes are also illustrated in musicians, pilots, and surgeons who automatize skill sets through practice for later unconscious, speed-necessitated retrieval (Brown et al., 2014).

Postural alignment techniques can be employed to train balance (Abraham et al., 2019). Even positive verbal suggestions can help optimize a person's postural control, reinforcing the importance of language and cues in this intervention. Researchers studied 30 healthy undergraduate students at the University of Verona. The participants were matched for mean biological, strength, conditioning, and limb match variables and randomized into control and treatment groups to test a verbal placebo effect on balance (Villa-Sánchez et al., 2019). Methods included having each group balance on their dominant leg while flexing at the other leg's knee to attempt balance. Both groups were barefoot, fitted with small transcutaneous electrical nerve stimulation (TENS) devices that delivered a small vibration to their gastrocnemius (calf) muscle of the standing leg. Participants were asked to keep their visions focused on a fixation frame in front. The TENS device was set to 10Hz, which was enough to feel the vibration but had no muscular contraction effect. The placebo group was told that the TENS device had the effect of increasing the recruitment of muscle fibers and would consequently improve their balance control. The treatment group was told that the device had no bearing on postural control. Three trials measuring postural sway were averaged and statistically analyzed. Results showed a reduction in postural sways of the placebo group but not the treatment group, indicating that verbally induced positive expectations affected perception (Villa-Sánchez et al., 2019). These findings had translational relevance in fall-risk populations and healthy populations who might want to automatize posture and balance proactively for an overall sense of wellness and use in regular balance perturbations like stumbling (Villa-Sánchez et al., 2019).

Goal Setting. The literature showed that the types of goals set in exercise contexts might affect participation adherence and sustainability (Locke & Latham, 2019; Swann et al., 2020). Current exercise guidelines indicated that adults participated in 150 minutes per week of moderate-intensity aerobic physical activity or 75 minutes per week of vigorous-intensity (WHO, 2010). A meta-analysis of 76 randomized controlled trials, including longitudinal studies of young and older participants, examined PA interventions for reduced risk of cognitive impairment and dementia in later life (K. I. Erickson et al., 2019). The researchers found that moderate to intense bouts of aerobic activity positively affected cognitive outcomes (K. I. Erickson et al., 2019). However, these extrinsic goals might be perceived as a high bar to reach from a psychological goal-setting standpoint (Teychenne et al., 2020). If a person perceives that participating below that bar does not count toward well-being, they may opt out of participating in any physical activity (Arena et al., 2018; Swann et al., 2020). In other words, it may send an all or none message—that if the recommended goal cannot be reached, why bother participating at all (Swann et al., 2020; Teychenne et al., 2020).

Priming. Multiple forms of enjoyed bodily movement promote mental well-being (Ahmed, 2020). Consequently, researchers have suggested that the current physical activity guidelines should be updated to reflect using physical activity for mental well-being (Teychenne et al., 2020). In a study of 220 sedentary adults, Kang et al. (2018) found that priming participants with ideas and language that included self-affirmation and compassion practice increased neural receptivity to health messaging and behavior change. The motor priming of exercise or generating stimuli to change behavior could target the brain's motor cortex using repetitive movements to improve motor perceptual and cognitive systems (Stoykov et al., 2017).

Language is instrumental in the priming process. Small measures, such as instructors substituting the word *movement* for *exercise*, may remind that all movement counts toward physical activity goals (Segar et al., 2017), leading to two SDT-IM basic needs—competence and autonomy (Ryan & Deci, 2000). The literature in this section shows that small changes in instructor communication address the needs assessment finding concerning methods to bring mind-brain health into group exercise classes. The language used by instructors can prime or expose participants to a new critical reflection and co-construct the meaning-making of physical activity with their participants (Scheufele & Tewksbury, 2007). Instructor language can assist participants in reframing perceptions about what counts as physical activity (Arena et al., 2020).

Open and "Do Your Best" Goals Versus SMART Goals. Open goals include goals that are exploratory, open-ended, and non-specific—"letting it happen" instead of "making it happen" (Swann et al., 2020, p. 105). "Do-your-best" goals are also unspecific and include a "see how well you can do" (Swann et al., 2020, p. 2) frame of mind. Conversely, SMART is an acronym for *specific, measurable*, *achievable*, *realistic*, and *time-bound* (Swann et al., 2020, p. 1). The effects of open, "do your best," and SMART goals were compared in a walking session with healthy adults (N = 78; M_{age} = 55.88; Swann et al., 2020). When variables for distance, difficulty, and psychology were controlled, researchers found that open goals were more psychologically adaptive to pursue than SMART and do-your-best goals, meaning open goals aligned with the likelihood of exercise adherence (Swann et al., 2020).

Learning Goals Versus Performance Goals. Foster et al. (2016) used neuroscience to shift the marketing undergraduates' mindsets from being taught to actively learning. Neuroscience shows that in the exercise realm, learning goals (Swann et al., 2020) and goals of well-being (Segar et al., 2011) are intrinsically motivating (Ryan & Deci, 2000). As evidenced in the studies, the neuroscience of emotional regulation has implications on the language that fitness instructors use to cocreate goals with participants (Bechara et al., 1999). Even though SMART goals include the words *achievable* and *realistic* (versus challenging), goal setting that attempts too much specificity may hurt performance or willingness to continue participation during the early stages of learning new complex tasks (Swann et al., 2020; Locke & Latham, 2019). In this case, newcomers to exercise or inactive individuals learning to become active are better suited to learn goals instead of develop performance goals (Dimmock et al., 2020; Locke & Latham, 2019; Swann & Rosenbaum, 2018). Goals frequently messaged in the fitness industry are specific and challenging; thus, they may not always be suitable for all exercisers (Swann & Rosenbaum, 2018). Too much challenge and specificity (especially for newcomers) may elicit negative emotions, thoughts about personal shortcomings, thoughts about previous failures, or concerns over the potential for future failure (Bandura, 1998; Locke & Latham, 2019; Swann et al., 2020).

In these instances, psychological harm on self-concept, self-efficacy, and motivation negatively tips the emotional scale for inactive individuals attempting to become more active (Bandura, 1997; Locke & Latham, 2019; Swann et al., 2020). Learning goals (focusing on the processes of tasks rather than their outcomes) increase the odds of developing intrinsic motivation for some people (Ryan & Deci, 2000) to exercise (Swann et al., 2020). Human beings evolved to conserve energy (Lieberman, 2015). Because exercising as compensation for 21st century sedentariness is a relatively new behavior on the evolutionary continuum, goal setting for exercise participation—which goes against human biological nature—requires multidisciplinary teaching strategies (Lieberman, 2015). Effective teaching requires instructor consideration of participants' emotional needs (Hardiman, 2012). Teaching methods and language that support learning rather than performance goals align with SDT-IM and steer participants toward mentally internalizing physical activities (Franklin, 1996; Ryan & Deci, 2000). The following subsection discusses how imagery and metaphors prime mental experiences of physical activities.

Using Dynamic Neurocognitive Imagery and Metaphors. Cognitive psychologist Pinker (1995) stated, "Language is the main vehicle by which we know about other people's thoughts, and the two must be intimately related" (p. 135). This belief in the role of language supports social constructivist teaching methods (Vygotsky, 1978). In the previous section, priming (Scheufele & Tewksbury, 2007) and reframing goal setting (Swann et al., 2020) were identified as interventional methods that would promote healthier behavior by reducing dualistic beliefs (Forstmann et al., 2012) and increasing intrinsic motivation (Ryan & Deci, 2000). This subsection introduces how the use of imagery and metaphors creates mind-body unity that shifts the exercise narrative from deficit language (e.g., focusing on what is wrong and in need of fixing) to asset-based (e.g., on the capabilities of the human brain and body; Missingham, 2017).

The culture of fitness language has fostered slogans that equate bodily movement with work and pain, as evidenced by the euphemism for exercise, *work out,* and the famous saying, *no pain, no gain* (Boers, 1997). The cognitive semantics of cultural exercise metaphors reflect, consolidate, and reciprocally shape beliefs (Boers, 1997; Lakoff & Johnson, 2008). A first-of-its-kind study isolating the impact of motivational comments made by fitness instructors showed that motivational cues that messaged exercise's functional benefits improved participant's mood, body satisfaction, and body surveillance (self-objectification; Engeln et al., 2018). The study was conducted on a 16-minute strength and conditioning group fitness class of 203 undergraduate college-aged women. Participants were randomly assigned to two groups. The classes were instructed identically, except one group was taught using focused function cues (e.g., “Think of how strong you are getting!” Engeln et al., 2018, p. 508). The other was instructed using appearance-focused cues (e.g., “Blast that cellulite!”; “bikini bodies;” and “ditching love handles”; Engeln et al., 2018, p. 508). Participants were asked to list three words best describing how they felt after class. Two research assistants unaware of the assigned groups of participants counted the number of negative expressions (ashamed, unfit, discouraged, annoyed, and guilty) and positive words (accomplished, strong, excited, and motivated). The function-focused group listed statistically significantly more favorable terms, and the appearance-focused group recorded significantly more negative comments. When body functionality instead of appearance was cued, body satisfaction (p = .24) and positive affect (p = .16) statistically increased from pre to posttest.

Instructor use of cognitive strategies, such as imagery, capitalizes on the neural basis of participant attentional focus (Bigliassi, 2020). The brain activity involved in imagining a movement lights up similar brain regions as performing it. Consequently, imagination is a neurological reality and a valuable affordance in exercise (Reddan et al., 2018). An instructor fostering the imagination of enjoying and becoming energized by movement enhances emotional valences previously mentioned (Giles et al., 2018). Dynamic Neuro-Cognitive Imagery (DNI) is a trademarked method for imagery training in exercise settings and is effective for postural and movement retraining (Franklin, 1996). In this method, imagery draws attention to anatomical structures, locations, mechanical functions, and spatial relationships. Participants are cued to connect anatomical and functional movements with sensory cues, proprioception (the awareness of the spatial position of the body), self-talk, and self-touch (Franklin, 1996). Imagery cues are unrelated to the body but used to embody the movement. Some examples include, “sits bones widen, parting like curtains in a draft of wind” or the diaphragm during breathing compared to a “parachute floating in your rib cage” (Franklin, 199, pp. 72–73). Instructors verbalize imagery and metaphors and encourage participants to make up their own, emphasizing connecting internal images to something salient to that participant. In DNI, instructors enable participant self-talk, such as mantras, to serve as personal affirmations (Franklin, 1996). Self-talk may include a phrase, such as “my breathing is calm and relaxed,” or “I feel wonderful, and when that is not the case, I revert to feeling wonderful”—this last quote indicates a mental reframing of exercise-induced tension as the precursor to feeling calm when tension is released (Franklin, 1996, p. 73).

In a study of 20 subjects with idiopathic Parkinson’s disease, 10 were randomly assigned to DNI training (Abraham et al., 2019). The other 10 were assigned to an in-home learning and exercise program (16 hours over 2 weeks). The DNI training used multisensory, metaphorical, and anatomical imagery training techniques, focusing on anatomical and biomechanical embodiment and kinesthetic awareness for movement (Abraham et al., 2019; Franklin, 1996). Pre- and post-intervention assessments measured motor and nonmotor functions, imagery abilities, and disease severity. Though both groups reported enjoying their program and feeling more mentally active at the post-intervention assessment, DNI participants showed statistical improvement in all functional categories. In addition, the DNI participants self-reported improvements in balance, walking, mood, coordination, and being more physically active post-intervention (Abraham et al., 2019). This study on the efficacy of DNI with exercise showed the empirical benefits of using cognitive strategies to enhance emotional valences that might improve a person's perception of movement (Bigliassi, 2020; Giles et al., 2018).

DNI can also improve body schema or mental representations of the body for cognitive and motor functions by modifying sensorimotor experiences through somatosensory integration (Abraham et al., 2019). Mental representations of the body, prerequisites for efficient human functioning, are vital components for motor planning, execution, and control (Abraham et al., 2019; Maravita & Iriki, 2004; Pazzaglia & Zantedeschi, 2016). Movements through extended motor capabilities, such as tool use, change neural networks that update internal maps of body posture and shape (Maravita & Iriki, 2004). Knowledge of the body is mediated by direct sensorimotor information. Perceptual information filters sensory information and recalibrates it with previously stored innate information (Pazzaglia & Zantedeschi, 2016). Inaccurate body schema negatively impacts proprioception (body awareness) and kinesthesia (movement awareness; Santos et al., 2011). A randomized controlled trial was conducted on 20 participants with idiopathic Parkinson's disease (age = 65+) to test the effect of a 2-week DNI training versus in-home learning with traditionally instructed exercises on treatment and control groups (Abraham et al., 2019). At baseline and posttest, participants were asked to complete a "Draw Your Pelvis" test. Drawings assessed height, weight, and pelvic schema dimensions and found no statistical difference at baseline. Following the intervention, participants in the treatment group showed a statistically different change in pelvic schema (Abraham et al., 2019). This study suggested that DNI could have application in rehabilitative contexts and group exercise classes to increase mind-body integration and SDT-IM competence and relatedness (Ryan & Deci, 2000).

Self-talk and instructor imagery cues can be coupled with humor, which is also known to neurologically release tension states (Greene et al., 2017). A 12-week pilot study of a *LaughActive* pilot class that incorporated laughter and movement was conducted with older adults (N = 27, age ~ 60; Greene et al., 2017). Paired samples t-tests of pre- and post-intervention Self-Efficacy for Exercise Scale surveys showed significant improvements in exercise self-efficacy (Greene et al., 2017). Improvements were also seen in mental health and aerobic endurance. This study aligned with other empirical studies that revealed how physical activity programs eliciting positive emotions, even using laughter, might improve self-efficacy for exercise through enjoyment (Baldwin et al., 2016; Furzer et al., 2021; Greene et al., 2017; Zahrt & Crum, 2020). The following subsection shows how DNI use in group exercise classes offers participants actionable ways to reappraise or reframe how they experience movement cognitively (Franklin, 1996).

Teaching Cognitive Reappraisal. Cognitive reappraisal or reframing movement is a proactive strategy to change personal and cultural narratives surrounding the meaning of exercise and movement (Giles et al., 2018). It offers a chance to reframe the cultural history of exercise cognitively toward the fantastic capabilities of the human body and away from current narratives focusing on exercise as a mediator for something wrong with the body (Boers, 1997). Social constructivist mind-body teaching methods within a participant's ZPD (Vygotsky, 1978) balance the mechanical, physical action of exercise with an internal humanistic experience of movement (Franklin, 1996). DNI mind-body teaching cues in a group exercise class allow participants to reflect on emotional valences in their movement by identifying the biomarkers of emotion in their bodies during practices, such as tension, breathing, and comfort level (Olson, 2018; Wolfe & Moran, 2017). DNI requires instructors to interleave cues that invite participants to reflect on their movements critically while performing (Franklin, 1996; Mezirow, 1997). Stated another way, instructors co-create mind-body experiences with participants by using words that remind them to think about feeling what they feel during movement, while they are feeling it, and where they are feeling it. Participants are cued to reflect on what they think about the sensation they feel, why they might feel that way, and if they enjoy it. This personal assessment is an embodiment of the exercise (Franklin, 1996).

DNI creates affordances for immediate self-feedback cues so participants can autonomously make adjustments that meet personal needs (Di Paolo et al., 2017; Ryan & Deci, 2000). Furthermore, this critical reflection (Mezirow, 1997) and assessment of their experiences of the movement (Ryan & Deci, 2000) allow participants to make two crucial analyses that affect future participation in physical activity. First, these reflections (Mezirow, 1997) identify which movements bring pleasure and feel intrinsically motivating enough to incorporate them into lifestyle and which movements do not feel pleasurable or intrinsically motivating (Segar, 2015). Second, if movements are not pleasurable or enjoyable, the instructor assists the participant in modifying or cognitively reappraising (reframing) the movement or activity (Segar et al., 2017, 2018).

Cognitive reappraisal can be used as an emotional regulation affordance during movement execution to interpret stimuli personally (Suri et al., 2018). Affordances or "action possibilities latent in the environment" (Suri et al., p. 965) in group exercise classes place the SDT-IM grounded human need of choice or autonomy in the control of the participant. Instructor use of imagery, metaphor, and socially co-constructed instruction in a participant's ZPD (Vygotsky, 1978) offers a *reappraisal affordance* of movement, which means the participant can reinterpret the opportunities inherent in movement or exercise (Suri et al., 2018). The language used in instruction becomes an environmental affordance that helps participants autonomously regulate emotions using internal and external variables (Picó-Pérez et al., 2017; Suri et al., 2018).

EEC in group exercise instruction theoretically supports cognitive reappraisal in group exercise classes because it is an affordance that reinterprets situations with emotional valence (Giles et al., 2018; Suri et al., 2018). For nonexercisers, sedentary individuals, and people who have had negative experiences or dislike exercise, successful cognitive reappraisal may be the difference between leading active or inactive lifestyles (Giles et al., 2018). Cognitive reappraisal also reduces perceived exertion during endurance exercise (Giles et al., 2018), which increases a participant's chance of feeling successful and intrinsically motivated in the moment (Ryan & Deci, 2000). Habitual exercise is related to the cognitive reappraisal of emotional information and associated changes in the prefrontal cortex, an area of the brain related to planning and decision-making (Cox et al., 2016; Giles et al., 2018).

In an EEC, SDT-IM grounded class instructors who offer the opportunity for alternate meaning-making may help participants change their emotional interpretations of the body and its capabilities and possibilities (Giles et al., 2018; Megías-Robles et al., 2019). Functionally, the practice of cognitive reappraisal in group exercise settings may be applied to participants' life contexts to reroute anxieties and modify cognition, including their perceptions of motivation and self-confidence (Giles et al., 2018). Embedding DNI (Camburn & Han, 2017; Franklin, 1996) as a cognitive reappraisal affordance (Giles et al., 2018) offers participants critical reflection opportunities for transformational learning that changes habits of mind and points of view about what exercise and movement have meant in their lives and what it may mean going forward (Mezirow, 1997).

Intrinsic Motivation to Exercise

The final interventional factor under consideration is aligning teaching methods and cues to co-create intrinsically motivating exercise experiences with participants (Ryan & Deci, 2000). Behavioral neuroscience reinforces that cognition and perception are affected by context, motivation, and emotion (Eagleman & Downar, 2016; Pessoa, 2017). The needs assessment indicated that group exercise instructors were interested in strategies that helped them integrate multiple dimensions of wellness (Beauchemin et al., 2019) into class cueing and methods. Previous sections in this chapter illustrated techniques informed by research in imagery, metaphors, and cognitive reappraisal. This final section synthesizes literature explaining why SDT-IM supports the use of these EEC grounded methods (Di Paolo et al., 2017; Ryan & Deci, 2000).

Integrating cues that foster mind-brain-body-environment connections, such as DNI techniques and cognitive reappraisal (Franklin, 1996), leverages neuroscience to boost higher probabilities of participants experiencing intrinsic motivation while participating (Ryan & Deci, 2000). Class experiences need to co-construct interest, enjoyment, perceived competence, importance, choice, value, and relatedness in the participant's ZPD (Ryan & Deci, 2000; Vygotsky, 1978). The Intrinsic Motivation Inventory (IMI) is a validated measurement tool for assessing whether participants' intrinsic motivation needs were met (McAuley et al., 1989). Measurements from this tool serve as a proxy for whether cues and methods were successful at increasing participant intrinsic motivation. Thus, the IMI was used in this intervention.

Emotions as a Starting Point. The brain is affected by physical exercise (Lee et al., 2019; Basso & Suzuki, 2017; Schmitt et al., 2020), and interactions between the mind-brain-body-environment neurologically affect the brain's functions, including cognition and affective states (Eagleman & Downar, 2016; Namkung et al., 2017; Schmitt et al., 2020). Because physical exercise diminishes symptoms of anxiety and depression, the disciplines of neuroscience, neurology, and psychiatry recognize it as an additive nonpharmacological treatment (Namkung et al., 2017; Schmitt et al., 2020). In addition, there is scientific consensus that exercise plays a role in participants' subjective feelings (Namkung et al., 2017; Schmitt et al., 2020). This researcher argued that an EEC and SDT-IM grounded fitness teaching framework should also reflect that exercise regulated introducing feelings into participants' motivational and cognitive processes (Namkung et al., 2017). From a practical standpoint, this finding means that instructors need to consider a participant's *emotional brain target* (Hardiman, 2012) as the starting point for group exercise instruction instead of the traditional fitness assessments of weight, height, and body mass index (ACSM, 2021).

The Importance of Meaning-Making. Meaning constructed from past exercise and life experiences affects a person's current and subsequent motivation to exercise (Hale et al., 2007; Knowles, 1980; Mezirow, 1997). This meaning-making aligns with the theory of andragogy—that adult learning experiences must include the rich, lived experiences participants bring to classes (Knowles, 1980). Because meaning-making is a subconscious activity, the only way to change a participant's meaning of exercise is to deconstruct it and create new meanings through novel experiences and learning (Mezirow, 1997). Participants can use this deconstruction to find the unique roots of their motivations (Rahman et al., 2011). These experiences are embedded with emotional valences that shape participants' beliefs and choices about how things feel (Adolphs, 2017; Barrett, 2017; Hoemann et al., 2020). Emotional valences are supported by brain imaging that reveals the fallacy about conscious willpower (Schöndube et al., 2017; Wagner et al., 2013). Self-control in one area can deplete it in another (Schöndube et al., 2017;

Wagner et al., 2013), suggesting that intrinsic motivation is a more predictable exercise motivator than willpower (Ryan & Deci, 2000).

Letting Go of Willpower Cues. This unreliability of willpower was illustrated in a study testing self-control strength on a day level using ecological momentary assessment methodology (Schöndube et al., 2017). The researchers examined the relationship between self-control and the intention to exercise in 63 participants (19- to 32-year-olds). Self-control strength was measured as the fixed amount of regulatory capacity at any given moment. Strength and behavior were assessed every day for 20 days using the Intention to Exercise Questionnaire, the Trait Self-Control questionnaire, and an electronic diary. Descriptive statistics showed that self-control strength (willpower) was positively associated with physical exercise. However, the effect of *ego-depletion*, the concept that willpower draws upon a finite set of mental resources on any given day (Webb & Sheeran, 2003), was a barrier to exercise on days where self-control was low. This study and other studies on the neuroscience of goals and behavior change strengthened the argument for prioritizing intrinsic motivation cues over willpower cues because willpower was not a reliable motivator to move a person from intending to exercise to the behavior of exercise (Berkman, 2018; Wagner et al., 2013).

Enjoyment Goals are More Intrinsic Than Health Goals. Intrinsic motivation and participation outcomes depend on how physical activity is communicated (Dimmock et al., 2020; Williamson et al., 2020). Even though health goals are important and valuable, they remain considered controlling or extrinsic goals (Alberga et al., 2019; Ryan & Deci, 2020; Segar et al., 2011). Even well-intentioned extrinsic goals do not provide the right reason for motivation because they lack the immediate reward (Segar, 2015, p. 16). Furthermore, because health goals are abstract and future-oriented, they are not as sustainable as intrinsic goals offering immediate rewards (H. H. Chang & Tuan Pham, 2013).

A systematic review and longitudinal qualitative study of 77 older adult (70+ years old, 26 males, and 71 females) group exercise participants in a fall prevention program found that creating new emotional and social benefits promoted group exercise adherence and attendance (McPhate et al., 2016). Immediate perceptions of exercise participation were cited as the primary motivation to engage and return. These perceptions included fun, humor, interest, and engagement in concentration.

Younger populations also reported the importance of enjoyment in exercise participation. In a study of 53 undergraduate college students (22 males, 31 females) in a group, spin (biking) participation was strongly correlated with exercise enjoyment (Baldwin et al., 2016). However, in this study, fun was strongly correlated with participants' ability to choose their intensity levels and exercise modes (types). Both studies aligned with a meta-analysis of studies (n = 98) published between 1988 and 2015, examining leisure-time physical activity. The studies indicated that feelings of choice led to enjoyment, developing greater physical activity participation (White et al., 2017). In this meta-analysis, physical activity only positively contributed to a perception of mental well-being when the person freely chose the physical activity domain. For example, biking was perceived differently depending upon whether it was autonomous (e.g., a choice, such as biking on the weekend) or controlled (e.g., biking to work because there was no other way to get to work). These three studies revealed that the perception of the activity, not necessarily the activity itself, was the most vital driver of intrinsic motivation.

Liking Leads to Wanting. Instructor cues should reflect the behavioral neuroscience knowledge that liking something initiates hedonic or pleasurable experiences (Berridge et al., 2009). Liking an activity leads to desiring the pleasurable reward, which is immediate and makes a person want to approach the reward. In other words, liking triggers wanting after an association is made with a positive reward. In the context of exercise, this liking might be a feeling of more energy or a sense of positive emotion. This connection is made below the level of consciousness, using cues that encourage participants to move for pleasure in ways they genuinely like will trigger their desire for movement without having to rely on willpower (B. A. Lewis et al., 2017; Berridge et al., 2009). This researcher likened intrinsic motivation to exercise akin to a motivational autopilot. This intrinsic, immediate reward allows a person to feel autonomous rather than controlled (Ryan & Deci, 2000; Teixeira et al., 2012). The sense of autonomy and pleasure can be the difference between exercise being perceived as work or fun (Laran & Janiszewski, 2011). Fun means something different to everyone. Consequently, instructor messages and cues should co-construct meaning with participants likes and wants to foster intrinsic motivation.

Proposed Solution: A Brain-Body Fitness Framework

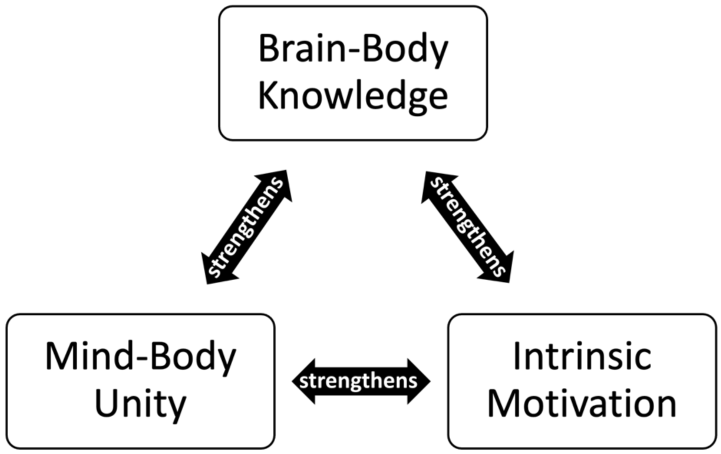
The interventional study was a pilot group exercise program instructed using a novel, researcher-created teaching framework. The purpose of the brain-body fitness framework was to serve as a practical teaching guide for group exercise instructors to scaffold and spiral (Bruner, 1960) mind-brain health appropriately into existing exercise class formats. A spiral curriculum approach to instruction was necessary because group exercise classes had high rates of variance in attendees. In this technique, learning was (a) iterative, (b) cyclical, (c) appropriately increased in depth with subsequent iterations, and (d) built upon prior knowledge (Bruner, 1960).

The andragogical brain-body fitness framework was modeled after Hardiman’s (2012) pedagogical brain-targeted teaching model for 21st century schools. Like Hardiman’s model, the brain-body fitness framework served as a bridge between educational and cognitive neuroscience research and practice in group exercise class settings. The domains of the andragogical brain-body fitness framework were like Hardiman's (2012) targets; the domains provided practical categories for instructors to situate the research with teaching practices that align with findings.

The domains of the brain-body fitness framework were based on the Chapter 2 needs assessment findings—brain-body knowledge, mind-body unity, and intrinsic motivation. The objectives in each domain of the framework were supported by a synthesis of the empirical findings presented in this chapter. Suggested teaching methods were supported by the literature as effective strategies for increasing brain-body knowledge, mind-body unity, and intrinsic motivation. The framework was empirically tested in two different group exercise class formats—barre and cardio. Figure 3.2 graphically depicts the brain-body teaching framework. Appendix H contains details on each domain's objectives and connection to theory.

Figure 3.2

The Brain-Body Fitness Framework



Note. The brain-body fitness framework is interdependent rather than hierarchical. Continuous interactions between domains strengthen each domain's objectives.

The brain-body fitness framework aligned with a spiral approach to curriculum instruction that embraces interdisciplinary integration of subject matter (Bruner, 1960). The spiral curriculum was relevant to an intervention attempting to integrate neuroscience, psychology, biology, and sociology within a group fitness framework. The spiral approach also theoretically aligned with SDT-IM, andragogy, and TLT because it posited that participant interest in subject matter and subject matter salience would influence learning outcomes (Berridge & Kringelbach, 2015; Harackiewicz et al., 2016; Knowles, 1980; Mezirow, 1997; Ryan & Deci, 2000).

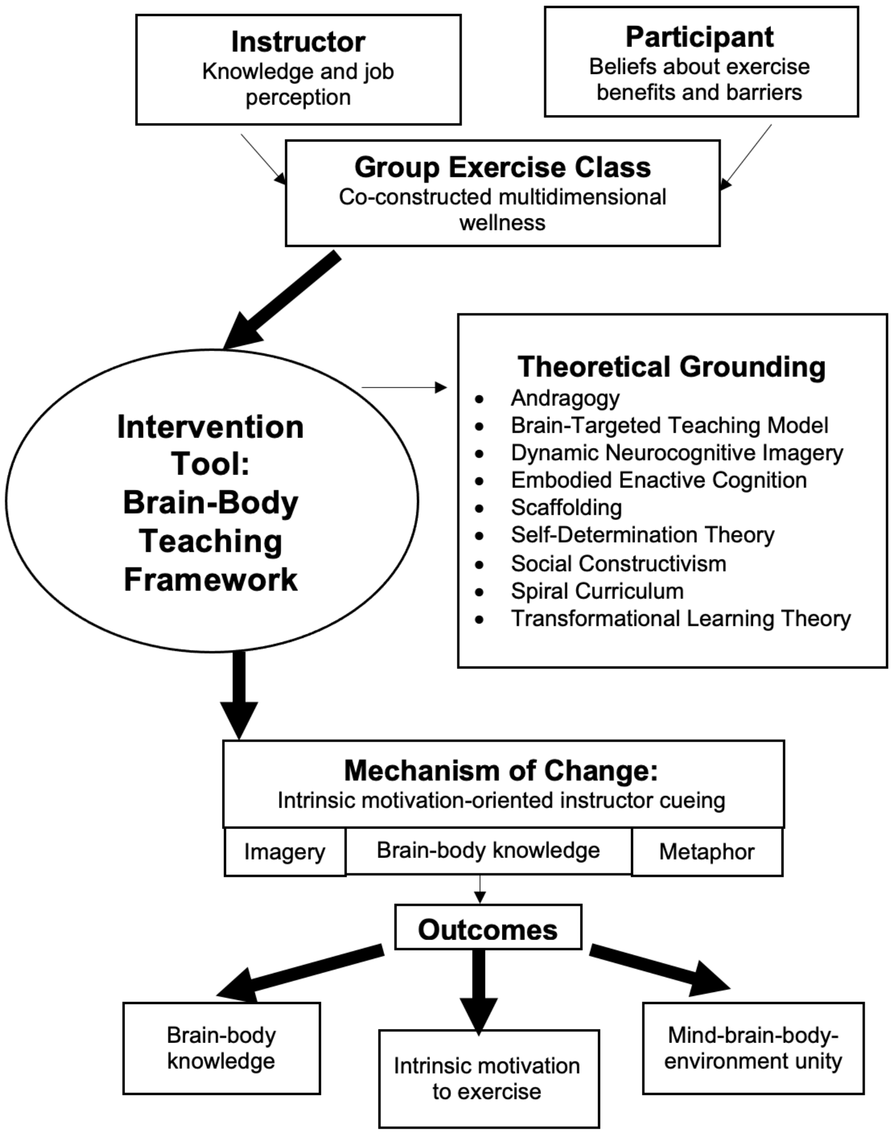
A spiral curriculum initially presents basic information, then circles back to reinforce previously learned material before adding new layers of depth and detail (Bruner, 1960). Details are repeated throughout instruction while emphasizing relationships between initial basic facts. This type of approach is beneficial for a group exercise environment. Groups of students progress linearly through a curriculum, and group exercise is open to newcomers and returning participants at any given time. Thus, a spiral approach to introducing new information into a group exercise class provides a way to compensate for the nature of nonmandatory attendance while still teaching new knowledge. Additionally, applying a spiral approach in group exercise classes creates an opportunity to informally use learning strategies by (a) spacing and interleaving material and (b) offering participants opportunities to practice retrieving, elaborating on, and explaining information in a casual and social way (Roediger & Pyc, 2012a, 2012b).

Conceptual Framework

The intervention treatment was based on the needs assessment findings. Figure 3.3 graphically depicts the intervention's conceptual framework from the needs assessment to proximal intervention outcomes. The graphic depiction shows the relationships between the brain-body fitness framework, its theoretical underpinnings, the mechanisms of change, and proximal intervention outcomes. Anticipated proximal outcomes include increased brain-body knowledge, the increased experience of mind-brain-body-environment unity and increased intrinsically motivating perceptions of exercise during class. Distal outcomes include the enculturation of exercise for multidimensional wellness and progress toward participant multidimensional health and wellness outcomes.

Figure 3.3

Conceptual Framework for Intervention



Note. The conceptual framework depicts the intervention strategy from the needs assessment to the intervention's theoretical grounding, mechanisms of change, and anticipated proximal outcomes.

Conclusion

The literature synthesized in this chapter illustrated various ways that group exercise instructors could adjust methods and language to promote exercise for multidimensional well-being (Beauchemin et al., 2019; Franklin, 1996). Based on the literature, an exercise environment combining biomechanically safe cueing, neuroscience knowledge, imagery, metaphors, and cognitive reappraisal would co-construct intrinsic and unifying mind-brain-body-environment experiences with participants. Chapter 3 lent empirical and theoretical support to the intervention hypothesis that group exercise instructors' language and teaching methods would play a role in community health and wellness education. The literature synthesis supported that instructor cues that included neuroscience, imagery, metaphors, and cognitive reappraisal would emerge as promising mechanisms of change for integrating multiple dimensions of wellness in group exercise classes. Testing the brain-body fitness framework filled a gap on researching practical ways to embed mind-brain health within group exercise settings. Chapter 4 provides details on the intervention implementation activities, procedures, program and outcome evaluation methodologies, and data collection instruments.

Chapter 4: Intervention Procedure and Program Evaluation Methodology

The needs assessment revealed all 45 group exercise study participants at this southwestern branch of the YMCA had firm beliefs in the benefits of exercise. Participants in this sampling reported perceiving few barriers to exercise. Data also showed agreement between the 31 group exercise instructors' and the 45 group exercise participants' perceptions that the primary domain of wellness addressed during class instruction was the physical domain. The focus groups with instructors clarified that traditional teaching methods used in these classes did not routinely connect exercise with mind-brain health and wellness benefits.

Instructors attributed this physical domain focus to preservice preparation and the influence of cultural perceptions about exercise goals. Instructors indicated that preservice fitness training focused on kinesiology, biomechanics, and preparation to lead participants safely through movements. Additionally, instructors perceived that culture implicitly and explicitly focused on using exercise for body benefits, including weight loss and body sculpting. Although instructors were amenable to incorporating mind-brain health and wellness in their classes, there was consensus that no direct support, encouragement, or well-organized practical resource existed to guide this endeavor.

Triangulation of needs assessment data indicated a need for fitness instructor guidance on how to facilitate connections between exercise and its mind-brain benefits during group exercise instruction. A literature search did not locate an empirically tested teaching framework for use in this intervention. Therefore, a novel framework named the brain-body fitness framework was researcher-constructed by integrating multiple behavioral, neurocognitive, and learning theories with exercise-related studies. The Chapter 3 literature review supported this framework as scaffolding mind-brain health into sport and fitness settings. The synthesis integrated findings from (a) outcomes of mental health literacy programs, (b) the role of language, imagery, and metaphors in mind-body teaching techniques, and (c) the effects of goal setting and intrinsic motivation on exercise behaviors.

The primary objective of a brain-body fitness framework is to provide exercise instructors practical, actionable, and evidence-based guidance for connecting exercise with its mind-brain benefits in group exercise settings. A second objective is to offer a new way for people to think about why human beings move. Connecting the value of physical exercise, physical activity, and overall bodily movement to multiple dimensions of wellness including emotions and cognition potentially offers people a more sustainable path toward increasing physical activity levels, decreasing sedentary behaviors, improving mood and cognition, and staving off cognitive decline. Lastly, it consistently embeds awareness of the reciprocal connections between movement, mood, and cognition (Di Paolo et al., 2017). Participant exercise offers instructors an opportunity to address and potentially impact the rising incidence of diseases of the mind-brain and mood disorders (Chen et al., 2018; Mosconi et al., 2018).

The brain-body fitness framework is grounded in theoretical and evidence-based research (Burgmer & Forstmann, 2018; Gallagher, 2017; Knowles, 1980; Ryan & Deci, 2000). However, the tenets of improvement science suggest that gathering empirical evidence on the efficacy of the novel framework before instructor professional development is a crucial first step toward meaningfully improving educational practice (Bryk et al., 2015). Therefore, the goal of this study was to fulfill this important initial step. Empirical evidence collection on the brain-body fitness framework consisted of (a) an online pre-participation launch meeting with 14 participants to explain the study and answer participant question, (b) six onsite YMCA group exercise classes instructed using methods in the brain-body fitness framework, (c) six online post-class journal entries completed by each of the 14 participants, (d) an online focus group after the final class, and (e) an online post-participation survey completed by each of the 14 participants.

The research questions guiding the study consisted of the following:

RQ1: To what extent was the intervention implemented as planned?

RQ2: What unique features differentiate instruction in this class from instruction in other group exercise classes?

RQ3: What were YMCA group exercise participants' experiences with the intervention?

RQ4: How did participation in the intervention change participants' knowledge of the benefits of exercise on the mind-brain?

RQ5: In what ways did participation in this intervention change participants' perceptions of their intrinsic motivation while exercising?

RQ6: How did the intervention change participants' mind-body relationship perceptions?

Research Design

The purpose of this study was to test a novel teaching framework designed to assist fitness instructors with scaffolding mind-brain health and wellness into group exercise settings. Social and affective processes were critical to understanding the brain-body fitness framework's efficacy and reception by group exercise participants. Consequently, data from the collection tools needed to reflect and honor each participant's unique voice and experiences (Schwartz & Paré-Blagoev, 2018). For this reason, a qualitative case study research design was deemed best-suited to collect this type of social-emotional data.

A case study is "an approach to qualitative research in which a practitioner-scholar focuses on a detailed study of one or more cases in a bounded system" (Lochmiller & Lester, 2017, p. 102). Bounded means "that the case is separated out for research in terms of time, place, or some physical boundaries" (Creswell, 2002, p. 485). Limits created around the studied phenomenon allow for deep exploration and understanding (Merriam, 1998). A case is a contemporary phenomenon set within its real-world context. In this study, the case and context were female YMCA group exercise participants' experiences in group exercise classes taught using the novel framework.

The second reason for selecting a case study design was that all six research questions were either descriptive or explanatory—asking to describe *what* or explain *how* and *why* about phenomena (Lochmiller & Lester, 2017). Descriptive and explanatory research questions aligned with qualitative case study design and guided the study's methodology. Methods used in a qualitative case study require tools that collect the type of data that will provide the researcher with an understanding of *what* is happening and *how* and *why* a phenomenon is happening (Lochmiller & Lester, 2017). Data collected from case study methods provide in-depth knowledge of the studied phenomena needed to answer the research questions (Miles et al., 2013).

Case study design researchers use multiple data sources, such as direct observations, interviews, archival records, documents, participant observations, and physical artifacts. A scholar-practitioner can collect data collected across time and space from these sources to triangulate the data or seek and establish evidence across multiple data sources (Creswell & Plano Clark, 2018). This current researcher triangulated (a) the researcher's direct observations of participants in exercise classes, (b) interviews with participants via focus group, and (c) participant observations/experiences collected from free-response journal prompts and a post-participation survey. All survey inquiries used in this study were constructed from empirical and theoretical literature synthesized in Chapters 1 and 3 to maintain the scholarly integrity of the qualitative data collection tools.

The final reason for choosing a case study design was that the three primary researcher interests in the empirical inquiry of a case—(a) understanding the individual case parts, (b) analyzing the relationships between those parts, and (c) comprehending how these parts function as a whole (Lochmiller & Lester, 2017)—aligned with the interests of this study. The systems thinking (Banathy & Jenlink, 2013) in case study design is compatible with Chapter 1's ecological systems theory (Bronfenbrenner, 1994), the grounding theory used to understand and analyze relationships while comprehending the "whole" of the contributing factors to this dissertation's problem of practice. The consistent use of systems thinking for problem identification and solution formation strengthens this dissertation study.

The following sections explain the development of the case study research design. The first and second sections include the progression from the theory of treatment to the logic model's inputs, outputs, and outcomes. The third and fourth sections include details of process and outcome evaluations. Lastly, the process and outcome matrices align research questions with indicators and constructs, data sources, data collection tools, and frequency of data collection.

Theory of Treatment

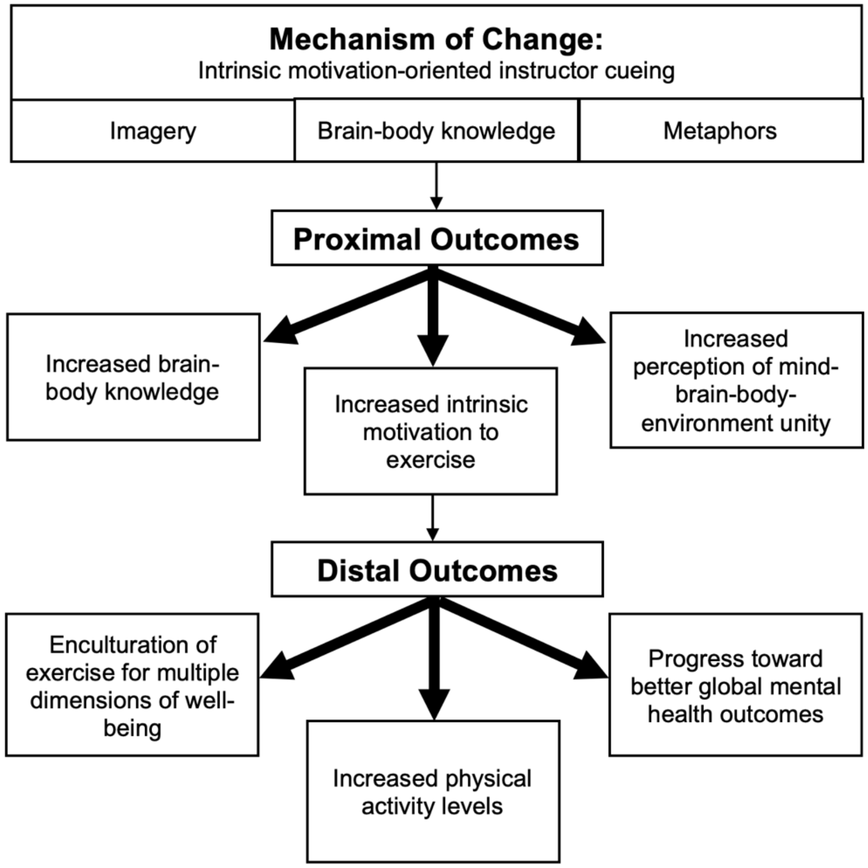
The theory of treatment was the foundation for using the brain-body fitness framework in this intervention study. It was expected that scaffolding knowledge and practice methods from the three framework domains during group exercise classes (the treatment process) would increase participants' brain-body knowledge, perceptions of mind-body unity, and intrinsic motivation to exercise. Achievement of these proximal outcomes eventually increases the enculturation of exercise for multidimensional well-being, perception of enhanced multidimensional well-being, and progress toward improved multidimensional health outcomes including mind-brain health (distal outcomes).

Leviton and Lipsey (2007) argued that the theory of treatment provided motive and rationale for intervention that, in this study, reframed a women's group exercise class as a social constructivist (Vygotsky, 1978) space in support of women's mind-brain health initiatives. Additionally, the theory of treatment supports the mechanisms for change that achieve the intervention's desired proximal and distal outcomes. The four-step model by Leviton and Lipsey (2007) defines the problem, defines the treatment, describes the mechanisms of change, and (defines desired outcomes.

In this study, the problem is defined as a need to instruct the benefits of exercise on the mind-brain in response to the rise in mind-brain health issues and women's increased risks (Chen et al., 2018; Mosconi et al., 2018; WHO, 2020a). Treatment is defined as the critical inputs that lead to change—six group exercise classes instructed using the researcher-created brain-body fitness framework. The mechanisms of change that transform participants through treatment were the language, teaching methods, class structure, and messaging (knowledge) embedded in the framework's three domains. Desired outcomes were from participant transformations through instructors' use of imagery, metaphors, and brain-body knowledge co-constructions that aligned with EEC (Di Paolo et al., 2017), the self-determination theory of intrinsic motivation (Ryan & Deci, 2000), andragogy (Knowles, 1980), TLT (Mezirow, 1997), social constructivism (Vygotsky, 1978), and applied neuroscience. Figure 4.1 depicts the intervention theory of treatment.

Figure 4.1

Theory of Treatment



Note. The theory of treatment posits that the brain-body fitness framework's evidence-based mechanism of change—intrinsic motivation-oriented instructor exercise cues that combine imagery and metaphors with the brain-body benefits of exercise—will lead to the projected proximal and distal outcomes.

The first proximal outcome of this study included participants' increased brain-body knowledge. This knowledge included the relationship between brain, body, and environment (Di Paolo et al., 2017); health as a multidimensional construct (Beauchemin et al., 2019); mind and brain health issues specific to women (Mosconi et al., 2018); and exercise benefits on the mind-brain (Lee et al., 2019). The second proximal outcome was participants' experiences of integration between their minds and their bodies. Evidence suggests that people with closer mind-body unity practice healthier lifestyle behaviors (Burgmer & Forstmann, 2018). The third and final proximal outcome was participants' increased sense of intrinsic motivation to exercise and participate in physical activity, which evidence suggested would lead to exercise adherence and sustainability (Di Domenico & Ryan, 2017; Segar et al., 2011, 2017).

Logic Model

A logic model demonstrates conceptual and practical elements of an intervention (McLaughlin & Jordan, 1999). Appendix I shows the details of implementing a brain-based fitness framework in the logic model. The model included program context, inputs, outputs (i.e., activities and participation), and program outcome (short-term, intermediate, and distal). Inputs included YMCA group exercise participants' and facilitator's time, executive director support and approval, and YMCA studio space and equipment (floor space, light hand weights, mats, stability balls, and Pilate's balls). The goal was to conduct six 1-hour in-person exercise sessions, computer access for participants to attend one preparticipation Zoom meeting, online access to post-class journal prompts, online access for a post-participation focus group, online access to the post-participation differentiation survey, and one post-participation gift for each participant—*Spark: The Revolutionary New Science of Exercise and the Brain* by Ratey (2013).

Intervention outputs included the participation of 14 adult group exercise participants (women) from the YMCA in three barre classes and three cardio combo classes. The researcher instructed the intervention classes—a mind, brain, and teaching specialist who was also a doctoral candidate and AFAA/NASM Certified Group Exercise Instructor, Personal Trainer, and Fitness Practitioner. Three exercise sessions were conducted using a Barre class format. Three were conducted using a cardio-combo class format to test framework applicability across modalities of cardio-respiratory fitness, strength, and flexibility training. Both formats were currently taught onsite at this YMCA at the time of the study. Classes included use of standard types of fitness equipment associated with the class formats. One online 30-minute nonexercise introductory session was held before study participation. Approved HIRB consent forms were signed and returned before participation. In addition, participation included completing six online, post-class journal prompts, one 1-hour focus group, and one online post-participation differentiation survey.

Process Evaluation

Process evaluation provides researchers with a set of tools to assess how interventions are conducted and received (Baranowski & Stables, 2000). The process evaluation also detects if a program reaches its target population and delivers services consistent with the intended program design. For example, documenting and evaluating intervention processes allows stakeholders to determine the fidelity of a program's implementation. This kind of assessment may highlight how and why a program achieved its outcomes (Rossi et al., 2019). The ability to pinpoint where in the process successes were achieved or where modifications may be needed informs future program iterations (Dusenbury et al., 2003). The following sections discuss process evaluation questions, indicators, data sources, data collection tools, frequency of the data collection, and how these processes align with the study's theory of treatment and logic model.

Process evaluation questions must precisely align with process evaluation components, such as quality of services delivered, program coverage, or fidelity of implementation to program design (Rossi et al., 2019). The process evaluation indicators measured in this study included fidelity of implementation through adherence, program differentiation, and participant responsiveness (Dusenbury et al., 2003). The three research questions guiding the process evaluation consisted of the following:

RQ1: To what extent was the intervention implemented as planned?

RQ2: What unique features differentiate instruction in this class from instruction in other group exercise classes?

RQ3: What were group exercise participants' experiences with the intervention?

Table 4.1 shows the details of the process evaluation.

Table 4.1

Process Evaluation Matrix

Process evaluation question	Process evaluation indicator	Data sources	Data collection tools	Frequency
To what extent was the intervention implemented as planned?	Fidelity of Implementation: Adherence (Dusenbury et al., 2003)	Participants, researcher	Framework checklist	Immediately following each class
What unique features differentiate instruction in this class from instruction in other group exercise classes?	Fidelity of Implementation: Program Differentiation (Dusenbury et al., 2003)	Participants and researcher	Differentiation survey and focus group	Post-intervention
What were YMCA group exercise participants' experiences with the intervention?	Participant Responsiveness (Dusenbury et al., 2003) Participant perceptions of (a) the quality of the facilitator and program content, (b) their perception of how the framework cues and imagery affected the way they thought about and executed movements, (c) their perception of class engagement with the frameworks content, cueing, and imagery, and (d) interest, satisfaction, challenges, and motivation with the framework.	Participants and researcher	Journal prompts and focus group	Prompts: Immediately following each class Focus group: post-intervention

Fidelity of Implementation: Adherence

Dusenbury et al. (2003) defined *adherence* as "the extent to which implementation of particular activities and methods is consistent with the way the program is written" (p. 241). RQ1 addressed adherence: "To what extent was the intervention implemented as planned?" Adherence to the program was operationalized and measured using a checklist containing the brain-body fitness framework components to identify which concepts were addressed during class. The framework checklist was uploaded to Qualtrics prior to the study. After class, the instructor-researcher completed an online Qualtrics checklist for each of the exercise sessions—checking boxes of framework content delivered in class. These data were triangulated and analyzed alongside survey and focus group responses to understand participants' experiences with the framework's components.

Program Differentiation

Program differentiation is defined as "identifying unique features of different components or programs so that these component or programs can be reliably differentiated from one another" (Dusenbury et al., 2003, p. 241). This process evaluation indicator was crucial to this intervention to analyze how or if participants perceived the brain-body intervention framework differently from other cues, messaging, and instruction they had experienced. Distinctions of teaching methods were necessary to understand which program features were associated with program outcomes. Program differentiation was operationalized through participants' verbalized perceptions of the teaching elements experienced in the class and the distinctions made between these elements and experiences in other group exercise classes. Data were collected from an online post-participation free-response survey. Fidelity for program differentiation was high if participants could detect elements in this program that felt uniquely combined or unique in content, delivery, messaging, instructor cueing, or some other perceived feature. Themes of program differentiation emerging from a priori and emergent codes were triangulated with focus group and journal data to analyze how program processes led to program outcomes.

Participant Responsiveness

Participant responsiveness is the process evaluation indicator defined as "ratings of the extent to which participants are engaged by and involved in the activities and content of the program" (Dusenbury et al., 2003, p. 241). Participant responsiveness was operationalized through participants' verbalized viewpoints of their participation experiences in post-class journal prompts and a post-participation focus group. Participants' experiences with the intervention were collected after each class and after the intervention study through online participant self-reflection journals, responses to open-ended survey questions, and a focus group. Robust self-reported ratings of engagement, class participation, and openness to novelty in exercise instruction were considered a high fidelity of participant responsiveness. Low fidelity would result from a self-reported a lack of engagement or a distaste for the novelty of this kind of exercise instruction. Lack of engagement or a discomfort with the novelty of the framework would then serve as a barrier to fully engaged participation.

Outcome Evaluation

Process evaluation research questions are used to assess program implementation and detect if a program reaches its target population and delivers services consistent with the program design (Baranowski & Stables, 2000). Outcome evaluation research questions are used to assess the change in the state or social condition the intervention expects to change (Rossi et al., 2019). The researcher defines intervention constructs, identifies potential threats to internal and external validity, and identifies ways to minimize these threats to evaluate the outcome of a study.

The purpose of this study was to test a researcher-constructed, theoretically grounded teaching framework that group exercise instructors could use to (a) reinforce the relationship between motor movements and the mind-brain during class time, (b) scaffold knowledge about why movement was essential for healthy mind-brain functioning, and (c) incorporate evidence-based verbal and imagery cues that would foster, facilitate, and co-construct intrinsically motivating embodied experiences. Proximal outcome results served as proof of concept (Kendig, 2016) of the feasibility of the framework to achieve its goals and provided the necessary data for adjusting the framework's structure. The outcome evaluation research questions guiding this study included the following:

RQ4: How did participation in the intervention change participants' knowledge of the benefits of exercise on the mind/ brain?

RQ5: In what ways did participation in this intervention change participants' perceptions of their intrinsic motivation while exercising?

RQ6: How did the intervention change participants' mind-body relationship perceptions?

The outcome evaluation matrix (Table 4.2) displays outcome evaluation research questions, relevant constructs, data sources, data collection tools, and frequency of data collection.

Table 4.2

Outcome Evaluation Matrix

Outcome evaluation question	Construct	Data sources	Data collection tools	Frequency
How did participation in the intervention change participants' knowledge of the benefits of exercise on the mind-brain?	Knowledge of (a) the relationship between brain, body, and environment (b) health as a multidimensional construct (c) mind and brain health issues specific to women (d) the benefits of exercise on mind and brain health issues	Participants	Self-reflection journal prompts and focus group	Prompts: immediately following each class Focus group: post-intervention
In what ways did participation in this intervention change participants' perceptions of their intrinsic motivation while exercising?	Intrinsic motivation	Participants	Focus group; post-participation survey	Post-participation
How did the intervention change participants' mind-body relationship perceptions?	Mind-body unity	Participants	Focus group; post-participation survey	Post-participation

Knowledge About Exercise Benefits on the Brain-Body

In this study, participant knowledge was operationalized as having a basic understanding about (a) the relationship between brain, body, and environment; (b) health as a multidimensional construct (i.e., physical, social, spiritual, emotional, cognitive, and lifestyle; Beauchemin et al., 2019); (c) mind and brain health issues specific to women; and (d) the benefits of exercise on mind and brain health. Knowledge was assessed in post-class online journal prompts following each exercise session and a post-participation focus group.

Intrinsic Motivation

Ryan and Deci (2000) referred to intrinsic motivation as internally driven behavior arising from internal satisfaction. This internal satisfaction-driven motivation contrasted from external motivation—engaging in behavior to either avoid punishment or earn external rewards. Intrinsic motivation was operationalized by participants' self-reported perceptions of the subscales of intrinsic motivation—enjoyment, competence, importance, tension, choice, usefulness, and relatedness—when exercising (McAuley et al., 1989). Participants' intrinsic motivation was assessed using researcher-generated free-response questions in the post-participation survey and focus group. Questions were derived from the subscales of McAuley et al.'s (1989) validated IMI.

Mind-Body Unity

Burgmer and Forstmann (2018) defined mind-body dualism as the belief that the mind and body were separable—that mind and body existed as two distinct entities. Conversely, mind-body unity entailed perceiving the mind and body as inextricably connected (Di Paolo et al., 2018; Gallagher, 2010). In this study, mind-body unity was operationalized in self-reports of participant's indication of how they perceived their bodies in relation to their minds when applying teaching cues from the brain-body fitness framework. Semi-structured questions in the focus group and the post-participation survey were used to collect this data.

Methods

This study's context was a branch of a YMCA that served approximately 200,000 diverse members in a large metropolitan city in the southwestern United States. The branch under study served a suburb of the city, along with its adjacent rural areas. This section describes the study participants, measures, data collection tools, data collection methods, and data analysis.

Participants

The researcher used a nonprobability convenience sampling (Pettus-Davis et al., 2011) of the YMCA branch's female group exercise participants. This study tested a novel fitness teaching framework (Dusenbury et al., 2003). Thus, the researcher differentiated its components, methods, and participant experiences with teaching methods used in other group exercise classes.

The inclusion criteria required that study participants had prior experience with other group exercise classes. Stated another way, none of the 14 participants in this study were first-time group exercisers. Most reported having years, even decades, of group exercise experiences. Additionally, inclusion required receiving a voluntary signature on the Johns Hopkins's HIRB participant informed-consent form (Appendix J), completing online surveys, participating in a focus group, and attending six brain-body themed exercise classes using the brain-body fitness framework. Once the researcher gained IRB approval, the study participants were recruited by email (Appendix K). Table 4.3 contains descriptive statistics of participant ages. Each age group was represented with at least one member, with heaviest representation in ages 51 to 70.

Table 4.3

Descriptive Statistics: Case Study Group Exercise Participants

Age group	Frequency	Percent	Valid percent	Cumulative percent
18-30	1	7.1	7.1	7.1
31-40	1	7.1	7.1	14.3
41-50	1	7.1	7.1	21.4
51-60	5	35.7	35.7	57.1
61-70	5	35.7	35.7	92.9
71-80	1	7.1	7.1	100.0
Total	14	100.0	100.0	

Measures

This section describes each of the four qualitative measures used to collect data. Each subsection contains a detailed description of how the tool measure the constructs and operational definitions explicitly described in the previous section: program adherence, program differentiation, participant experiences, participant knowledge, participant intrinsic motivation, and participant perception of mind-body unity. Each measure's purpose, the scholarly source from which it was adapted, subscales, and examples are included.

Adherence to the Brain-Body Fitness Framework Checklist. The *Adherence to the Brain-Body Fitness Framework Checklist* contained the primary teaching elements of the brain-body fitness framework. This tool was used to measure the fidelity of implementation (Dusenbury et al., 2003)—the instructor's adherence to the framework's teaching elements. All framework and checklist items were theoretically and empirically grounded in the Chapter 3 literature. The purpose of this measure was to assess if the instructor adhered to itemized brain-body fitness framework protocols during group exercise instruction. Before the study, the brain-body fitness framework checklist was uploaded to the online Qualtrics platform, where the instructor accessed it immediately after each class to check the boxes of the brain-body fitness framework items used in class that day.

Checklist items fell within four main domains: (a) basic exercise class structure, (b) brain-body knowledge, (b) mind-body unity, and (c) intrinsic motivation. The first domain included basic group exercise class structure protocols (e.g., warm up, body of class, and cool down; ACSM, 2021). The second checklist domain included items relevant to addressing brain-body knowledge. Examples include, "Instructor connected at least one fact about exercise's benefits to the brain, focus, mood, etc.," and "Instructor offered class knowledge extension via Twitter (literature, TED talks, books, etc.)." The third domain included items relative to mind-body unity. One example is the following: "Instructor used imagery, metaphors, and/or props/toys to help participants embody and automatize postural alignment." The final domain included items relative to intrinsic motivation. Examples include, “Instructor fostered a participant’s intrinsic feeling of usefulness and value of movements by explaining why certain moves were executed and how they helped the mind-brain-body in everyday life.” Appendix L contains the brain-body fitness checklist. Data from this tool empirically measured RQ1.

Program Differentiation Free-Response Survey. One goal of this study was to understand what, if any, unique features differentiated instruction in this class compared with instruction in other traditionally instructed group exercise classes. The *Program Differentiation Free-Response Survey,* found in Appendix M, measured RQ2—fidelity of implementation—program differentiation (Dusenbury et al., 2003). The goal of this tool was to gain an understanding of how, if at all, these differing class features affected participants’ knowledge (RQ4) and experiences and perceptions of exercise related to intrinsic motivation (RQ5) and mind-body unity (RQ6).

In this post-participation qualitative survey, participants were asked open-ended questions to explain how they perceived classes in this intervention as aligning or differing from previous group exercise experiences. Because this study was the first conducted on this novel fitness instruction framework, breadth and depth of participant experiences were crucial data. For this reason, free-response qualitative questions were deemed more suitable than quantitative Likert-style survey questions (Miles et al., 2013). One example from this survey relating program differentiation (RQ2) to knowledge (RQ3) is the following: “How does the knowledge content taught in these classes (e.g., exercise benefits on the mind-brain-body) differ from the knowledge content taught in your other group exercise class experiences?” Another example relating program differentiation (RQ2) to intrinsic motivation (RQ4) is the following: “Does your feeling of exercise competence in this class differ from other group exercise experiences? Please explain." One final example relating program differentiation (RQ2) to mind-body unity (RQ6) is the following: "Did these teaching methods help you to view physical and mental health in a more unified way than traditional group exercise instruction? Please explain."

Journal Prompts: Participant Experiences and Knowledge. Six free-response post-class online journal entries were used to assess participants' experiences with the intervention (RQ3) and knowledge gained from the intervention (RQ4). Though evidence-based information existed about the benefits of exercise on the mind-brain (Lee et al., 2019), it was unclear how or if this knowledge was disseminated in group exercise classes. Furthermore, the extent to which group exercise participants understood the benefits of exercise on the mind-brain was not well-understood. Lastly, the degree to which group exercise participants associated exercise with mental well-being was unknown. Triangulating the journal prompt responses with other collected intervention data contributed to understanding group exercise participants' experiences with an intervention that scaffolded knowledge about exercise and the mind-brain in group exercise classes.

The study's six class themes included (Class 1) effects of exercise on cognitive abilities, (Class 2) effects of exercise on emotional health, (Class 3) effects of exercise on neuroanatomy, (Class 4) effects of exercise on neurochemicals, (Class 5) Alzheimer's Disease and aerobic exercise, and (Class 6) connecting exercise to the brain. Journal prompts were uploaded to the Qualtrics online platform. Participants accessed each day's online journal prompts via a single-use QR code or a Qualtrics web link delivered via email. Each day's journal included only three prompts:

1. "What did you learn in class today?"
2. "Describe your experience in class today."

3. "Is there anything else you'd like to share?"

On Days 5 and 6, Prompt 2 read, "In what ways, if any, does participation in classes instructed using brain-body teaching methods change your intrinsic motivation to exercise," and "how did participation in these classes change your knowledge of the benefits of exercise on the mind-brain?" The goal was to see if responses differed in any way from Classes 1 to 4. Participants were free to share as much or as little as they wished (i.e., no limit was set on response length). Appendix N shows this journal survey tool.

Semi-Structured Focus Group: Intrinsic Motivation and Mind-Body Unity. The final data collection tool in this study was a post-participation semi-structured focus group discussion. Intrinsic motivation was a predictor of exercise participation and adherence (Ryan & Deci, 2000; Segar et al., 2011). Mind-body unity correlated with practicing healthy lifestyle behaviors (Burgmer & Forstmann, 2018). According to the theory of treatment, distal outcomes of participant brain-body knowledge, intrinsic motivation, and mind-body unity included (a) enculturation of exercise for multiple dimensions of well-being, (b) increased physical activity levels, and (c) progress toward better global mental health outcomes. Thus, the purpose of this study was to understand in what ways, if any, participation in a group exercise class instructed using a brain-body fitness framework affected participants' intrinsic motivation to exercise and perception of mind-body unity (RQ5 and RQ 6).

Social constructivist learning theory proposes that all learning is co-constructed (Vygotsky, 1978). According to this theory, new experiences and knowledge are integrated with a learner's previous experiences and knowledge. In the brain-body fitness framework, instructor language (verbal cueing) connects exercise and movement to benefits of the mind-brain—thinking, focus, memory, and feelings—while participants exercise. Imagery, metaphors, and applied neuroscience are the tools used to co-construct participant movement experiences—connecting new interoceptive (internal sensations), exteroceptive (external sensations), and proprioceptive (body's position in space) experiences with the familiar imagery. The study's empirically and theoretically grounded theory of treatment posited that these teaching methods led to perceptions of mind-body unity and participant experiences of the subscales of intrinsic motivation: (a) interest/enjoyment, (b) perceived competence, (c) effort/importance, (d) pressure/tension (reverse scaled), (e) perceived choice, (f) value/usefulness, and (g) relatedness (McAuley et al., 1989; Ryan & Deci, 2000).

Semi-structured focus-group questions and post-participation differentiation survey questions were adapted from the Post-Experimental IMI—a 44-item survey to assess participants' subjective experiences in experimental settings (McAuley et al., 1989). The quantitative IMI had high external validity and item face validity, with a 0.85 internal consistency alpha coefficient. It was factor analytically stable and coherent across various settings, tasks, and conditions (McAuley et al., 1989). IMI items had Likert-scale ratings from one to seven, indicating agreement with the item being 1 (*not at all true*) to 7 (*very true*). However, for the purposes of this case study, a Likert-style survey lacked the ability to provide the researcher with an understanding of *how or why* methods in the brain-body fitness framework corresponded (or did not) with the subscales. Thus, the IMI questions were converted into context specific qualitative open-ended prompts and questions to gain this perspective. One example of a focus group question was the following: "How does it feel to take an exercise class where the instructor explains the benefits of exercise on mood, memory, creativity, focus, and brain health?" Results from the focus group were triangulated with journal prompts and survey responses.

Table 4.4 lists the seven IMI subscales and corresponding item numbers in the IMI. Appendix O shows the quantitative IMI (McAuley et al., 1989) from which qualitative focus group prompts and differentiation survey questions were adapted. Appendix P shows the focus group prompts.

Table 4.4

Intrinsic Motivation Inventory Scale Items

Subscales	Items
Interest/Enjoyment	1-7
Perceived Competence	8-13
Effort/Importance	14-17
Pressure/Tension	18-22
Perceived Choice	23-29
Value/Usefulness	30-36
Relatedness	37-44

Note. The inventory items were used to generate qualitative post-participation focus group and program differentiation free-response survey questions.

Procedure

The procedures for conducting this pilot intervention included describing the components of the brain-body fitness framework intervention, data collection, and data analysis. Components of the brain-body fitness framework intervention included an online information session, six exercise classes instructed using the brain-body fitness framework, six post-class reflections via online journal prompts, one post-participation focus group, and one post-participation differentiation survey. The following subsections describe each component and provide brief overviews of data collection and analysis.

Brain-Body Fitness Framework Pilot Intervention Components. The purpose of this intervention was to collect empirical data to understand how, if at all, a group exercise class instructed using a brain-body fitness framework affects participants' class experiences, mind-brain knowledge, perceptions of mind-body unity, and perceptions of intrinsic motivation. Aligning with the tenets of improvement science and the plan-do-study-act cycles (C. Lewis, 2015), intervention assessments may empirically inform future decisions on intervention modifications, improvements, and potential scaling up. Table 4.5 provides a general overview of the brain-body fitness framework that was used in this intervention. Table 4.6 provides details regarding the activities, timeline, and duration of the intervention.

Table 4.5

Brain-Body Fitness Framework for Group Exercise Classes

Component	Description	Examples
Brain-Body Knowledge	Scaffold general knowledge on • the relationship between the brain, body, and environment • health as a multidimensional construct • mind-brain health issues specific to women • exercise benefits on the mind-brain.	Co-construct knowledge in participants' zone of proximal development (ZPD). Teach for immediate application. Match developmental, problem-centered tasks with participants' needs in current social roles. Incorporate participants' rich, lived experiences. Spiral content, increase depth appropriately, and building upon prior knowledge. Embed content that connects movement to brain-body in each class. Consider using women's mind-brain health issues, as a transformational "disorienting dilemma" creating an opportunity for participant critical reflection on habits of mind and points of view about exercise and physical activity. Reinforce health and wellness as a multidimensional construct (physical, social, spiritual, emotional, cognitive, and lifestyle).
Mind-Body Unity	Use language, cues, and methods that refer to the mind and body as one distinct entity.	Use imagery, sensory-motor, comparative, and metaphor cues to facilitate a unified mind-body experiences. Explicitly message embodied cognition in cues.
Intrinsic Motivation	Cues and practice methods environmentally support members' "spontaneous tendency to seek out novelty and challenges and to exercise and develop their skills and knowledge, even in the absence of operationally separable rewards" (DiDomenico & Ryan, 2017, p. 145)	Plant seeds of curiosity for further investigation. Open a social media page to share links to research/books/ podcasts, etc. to enrich class content. Facilitate social connections at appropriate times during class and optionally through social media outside of class. Use verbal cues that support affective/intrinsic experiences including competence, usefulness, relatedness, importance, choice, enjoyment. Use cognitive reappraisal for reframing tension with exercise. Prioritize the emotional climate of the class environment and participant learning goals (versus performance goals). Co-construct enjoyable "movement snacks" with participants to scaffold into lifestyle outside of the class.

Table 4.6

Activity Table for Study Using a Brain-Body Fitness Framework in a Group Exercise Class

Activity	Timeline	Duration	Description
Information Session	November 2021	30 minutes	Participant intro to study; Q & A; assist participants with opening Twitter
Class 1: Barre Post-class reflection brain-body fitness framework checklist	November 2021	70 minutes (55 class, 15 journaling)	Effects of exercise on cognitive abilities prompt; Health as multidimensional construct; mind-body unity using imagery/ metaphors; Adherence to brain-body fitness framework
Class 2: Cardio Post-class reflection brain-body fitness framework checklist	November 2021	70 minutes (55 class, 15 journaling)	Effects of exercise on emotional health prompt; Health as a multidimensional construct; mind-body unity using imagery /metaphors; Adherence to brain-body fitness framework
Class 3: Barre Post-class reflection brain-body fitness framework checklist	November 2021	70 minutes (55 class, 15 journaling)	Effects of exercise on neuroanatomy prompt; Health as a multidimensional construct; mind-body unity using imagery/ metaphors; Adherence to brain-body fitness framework
Class 4: Cardio Post-class reflection brain-body fitness framework checklist	December 2021	70 minutes (55 class, 15 journaling)	Effects of exercise on neurochemicals prompt; Health as a multidimensional construct; mind-body unity using imagery/ metaphors; Adherence to brain-body fitness framework
Class 5: Barre Post-class reflection brain-body fitness framework checklist	December 2021	70 minutes (55 class, 15 journaling)	Alzheimer's Disease and aerobic exercise prompt; Health as a multidimensional construct; mind-body unity using imagery/ metaphors; Adherence to brain-body fitness framework
Class 6: Cardio Post-class reflection brain-body fitness framework checklist	December 2021	70 minutes (55 class, 15 journaling)	Connecting exercise to the brain prompt; Health as a multidimensional construct; mind-body unity using imagery/ metaphors; Adherence to brain-body fitness framework
Online Post-participation Focus Group	December 2021	60 minutes	Participant experiences with intervention, components of framework, and teaching methods in brain-body fitness framework
Post-participation Program Differentiation Survey	December 2021 to January 2022	30+ minutes	Participant experiences and self-reports of program differentiation from other group exercise class experiences

Online Information Session. The first component of the study was an online launch meeting held via the Zoom platform in the last week of November 2021. The researcher-instructor held three separate launch meetings (morning, afternoon, and evening) on the Tuesday before study Class 1 to accommodate participants' schedules. This meeting was a nonexercise gathering designed as a question-and-answer forum for study participants. At each meeting, the researcher-instructor gave a short PowerPoint presentation to explain the purpose of the study, details of data collection, access to surveys, and information about the post-participation focus group. The presentation also included class organization and how to open or access the class Twitter account. After the presentation, the researcher-instructor answered questions and provided personal contact information, so participants could ask future questions at any time or communicate an absence. Lastly, previously emailed informed consent documents were discussed. Signed and dated physical copies of informed consent were returned to the researcher-instructor before Class 1. All 14 participants returned informed-consent documents and received physical copies for their personal files.

Group Exercise Classes Instructed Using the Brain-Body Fitness Framework. The second component of the study was a cluster of six 55-minute group exercise classes instructed using the brain-body fitness framework. The study materials were delivered through pre-existing YMCA classes; therefore, they were open to attendance by any YMCA members. Accordingly, the 14 study participants exercised alongside group exercise participants, not participating in the study in the studio where the classes were already being held. Data were only collected from study participants. The YMCA's executive director preapproved the researcher-instructor's use of the brain-body fitness framework in these ongoing classes, as well as the collection of data from the six specified classes and the 14 volunteer participants.

The researcher's qualifications to instruct fitness classes include national certification from the Athletics and Fitness Association of American (AFAA) in Primary Group Exercise and

Personal Training. Additionally, the researcher maintains certification with the American Safety & Health Institute in Basic Life Support for Healthcare Providers and Professional Rescuers, Basic First Aid, and Emergency Oxygen. Lastly, the researcher maintains personal trainer liability insurance through the K&K insurance group covered under the YMCA's umbrella liability insurance. Participants were covered under membership and liability agreements with the YMCA organization.

Three of the six study classes were barre format, and three were cardio format. The six classes ran over a 2-week period in late November and early December 2021, with three classes held per week. Each class was themed using content that connected exercise to benefits to the mind-brain. Class 1 mentioned the effects of exercise on cognitive abilities, Class 2 covered the effects of exercise on emotional health, Class 3 covered the effects of exercise on neuroanatomy, Class 4 discussed the effects of exercise on neurochemicals, Class 5 mentioned Alzheimer's disease and aerobic exercise, and Class 6 connected exercise to the brain. Additionally, all classes embedded explicit messaging of health as a multidimensional construct—physical, social, spiritual, emotional, cognitive, and lifestyle—and prolifically used imagery, metaphors, and visual props when instructing movement, alignment, and posture.

Brain-Body Fitness Framework Adherence Checklist. The third component of the intervention was an adherence checklist. The checklist included a list of instructional methods and guidance for best practices related to achieving the brain-body fitness framework's three domains of brain-body knowledge, intrinsic motivation, and mind-body unity. The online checklist, accessed by the instructor on Qualtrics immediately after class, served to assess how many of the framework's components were used in class each day.

Post-Class Journal Reflections. The fourth component of the intervention was a participant self-reflection digitally journaled after each class. Participants accessed online Qualtrics journal prompts after each of the six classes either via single use QR codes posted in the studio or email links (depending on preference of typing responses on a phone or computer). Each day's journal prompt had three free-response prompts; participants (a) responded on what they learned that day, (b) described their participation experiences that day, or (c) shared any other thoughts.

Post-Participation Focus Groups. The fifth component of the intervention was 1 hr-long online focus group convened after all six study classes were completed. Semi-structured questions guided informal conversation with and between participants. The purpose of this focus group was to glean an understanding of participant experiences with the intervention, components of the framework, and teaching methods used in the study classes. Three focus groups were held on the Zoom platform, audio recorded, and transcribed into Word documents using Otter.ai software to maximize discussion time for each participant and accommodate participant scheduling needs.

Post-Participation Program Differentiation Survey. The sixth and final component of the intervention study was a detailed post-participation survey. The goal of this survey was to assess in as much detail as possible participant experiences and self-reports of the differences between the teaching methods used in this study and those used in previous/other group exercise experiences. Data collected from this survey also included specific differentiation questions that corresponded with the IMI subscales (McAuley et al., 1987) and mind-body unity perceptions (Burgmer & Forstmann, 2018). Survey responses were triangulated with journal entries and focus group responses.

Data Collection

As per the study's case study design (Creswell, 2002; Lochmiller & Lester, 2017; Merriam, 1998; Miles et al., 2013), data collection occurred throughout the intervention. Quantitative and qualitative strands were analyzed then synthesized. Table 4.7 shows data collection measures, corresponding evaluations, types, and timeline. The remainder of the section describes the data collection procedures.

Table 4.7

Data Collection Methods and Timeline

Measure	Process/outcome	Quantitative/ Qualitative	Data collection type	Timeline
Program adherence	Process	Quantitative	Brain-Body Fitness Framework checklist	November to December 2021
Program differentiation	Process	Qualitative	Post-participation free-response survey and focus group	December 2021 to January 2022
Experience with intervention	Process	Qualitative	Journal prompts and focus group	November to December 2021
Knowledge of the benefits of exercise on the mind-brain	Outcome	Qualitative	Self-reflection journal prompts and focus group	November to December 2021
Intrinsic motivation	Outcome	Qualitative	Focus group; post-participation survey	December 2021 to January 2022
Mind-body relationship perceptions	Outcome	Qualitative	Focus group; post-participation survey	December 2021 to January 2022

Process Evaluation Data Collection. Process evaluation data were collected throughout the intervention to assess adherence to intervention protocols, program differentiation from other group exercise classes, and participant responsiveness (Dusenbury et al., 2003). The instructor accessed the *Adherence to the Brain-Body Fitness Framework Checklist* (Appendix L) via Qualtrics immediately following each class to assess adherence. The instructor-researcher identified all items covered in class that day and checked corresponding boxes. Results were stored on the researcher's password-protected computer and compared with participant experiences and journal entries to mitigate threats to validity.

Following the completion of the intervention, the *Program Differentiation Free-Response Survey* was administered via Qualtrics (Appendix M). Participants were emailed a link to complete the survey. The survey remained open until January 10, 2022, to accommodate participants' schedules with the impending holiday and the volunteer group's desire to have sufficient time to write thoughtful responses. Results from this survey were retrieved from Qualtrics, downloaded into Word documents for coding, and stored on the researcher's password-protected computer.

Participant experiences with the intervention were collected in two formats. The first format was self-reflection journal prompts (Appendix N) specific to each day's class. Participants retrieved the prompts immediately after each class via QR code or by email link, depending on participant preference to type on a mobile device or a larger computer screen. Responses from these free-response journal prompts were retrieved from Qualtrics, downloaded into Word documents for coding, and stored on the researcher's password-protected computer.

The second format used to assess participant experiences was a 60-minute focus group (Appendix P) that convened on Zoom at the end of the intervention. Because all 14 participants expressed a desire to participate, three groups were convened on three different days to accommodate participant schedules. This distribution over the 3 days also allowed for a smaller group to gather during each session—affording more time for each participant to engage in dialog with the researcher and the group. On the last day of classes, participants signed up for one 60-minute time slot and were emailed Zoom invitation links corresponding with this group. Group 1 had four participants, Group 2 had three participants, and Group 4 had six participants. The sessions were audio recorded and transcribed into Word documents using the Otter.ai transcription service. Documents from the free-response journal entries and focus groups were downloaded into the researcher's password-protected computer for coding.

Outcome Evaluation Data Collection. Outcome evaluation data were collected to understand how participation in the intervention changed participants' knowledge of the benefits of exercise on the mind-brain, their intrinsic motivations to exercise, and their perceptions of mind-body unity. Data assessing how intervention participation changed participant knowledge were assessed via self-reflection journal prompts (Appendix N) specific to each day's class. Participants retrieved the prompts immediately after each class via QR code or by email link, depending on participant preference to type responses on a mobile device or a larger computer screen. Responses from these journal prompts were retrieved from Qualtrics, downloaded into Word documents for coding, and stored on the researcher's password-protected computer.

Data assessing how intervention participation changed participants' intrinsic motivation to exercise and perceptions of mind-body unity were collected in two ways—the post-participation program differentiation survey (Appendix M) and the focus groups (Appendix P). As mentioned in the preceding section, participants were emailed a link to complete the final survey. The survey remained open until January 10, 2022, to accommodate participants' schedules with the impending holiday and the volunteer group's desire to have sufficient time to write thoughtful responses. Results from this survey were retrieved from Qualtrics, downloaded into Word documents for coding, and stored on the researcher's password-protected computer. Data on intrinsic motivation and mind-body unity were also collected during the same online, audio-recorded, and Otter.ai-transcribed focus groups mentioned in the previous section.

Validity Threats and Mitigation. Free-response qualitative survey responses were crucial to this study to give voice and context to participants' experiences. Understanding participant experiences with the methods, messaging, and content of the brain-body fitness framework intervention was paramount to understanding which elements of the framework were meaningful and which needed revision. Furthermore, qualitative data on participant experiences afforded the researcher the opportunity to understand where, how, or why participant experiences aligned (or did not) with the Chapter 3 literature used to construct and defend the teaching elements of the intervention framework.

Because the researcher is the instrument in qualitative data collection, qualitative data are subject to validity threats (Shadish et al., 2002). Researcher bias and the subjective nature of qualitative research may influence data interpretations (Guba, 1981). Thus, Table 4.8 shows the steps taken by the researcher to ensure the trustworthiness of the qualitative data in this study (Creswell & Plano Clark, 2018).

Table 4.8

Validity Threats and Mitigation

Trustworthiness threat	Step to mitigate	Description
Dependability	Audit trail	Keep detailed instructor log of intervention activities including anticipated and unanticipated events
Credibility	Peer debriefing	Weekly meetings with dissertation chairperson to discuss intervention details, data analysis, and other pertinent issues
Credibility	Member checking	Periodically check in with members and use focus group to assess if researcher interpretations are consistent with participants intended meanings.
Confirmability	Researcher reflexivity	Self-disclose researcher biases, beliefs, assumptions, and positionality about exercise and mental well-being that may shape study
Credibility/ dependability	Triangulation	Merge multiple and different sources of information (free-response surveys, participant feedback, journal prompts) for data analysis and conclusion corroboration
Transferability	Thick description	Describe study context and participant characteristics in detail

Data Analysis

The following sections describe the intervention's data analyses. Quantitative data analysis included descriptive statistics on data from the intervention adherence checklist. Qualitative data analysis included deductive and inductive thematic coding from the intervention journal prompts, surveys, and focus groups. Table 4.9 shows the data collection timeline and analysis for each of the interventions six research questions.

Table 4.9

Research Questions and Data Analysis

Research question	Data	Collection timeline	Analysis
RQ1: To what extent was the intervention implemented as planned?	Brain-Body Fitness Framework checklist	November to December 2021	Descriptive statistics
RQ2: What if any unique features differentiate instruction in this class compared with instruction in other group exercise classes?	Differentiation survey and focus group	December 2021 to January 2022	Inductive and deductive thematic coding
RQ3: What were YMCA group exercise participants' experiences with the intervention?	Journal prompts and focus group	November to December 2021	Inductive and deductive thematic coding
RQ4: How did participation in the intervention change participants' knowledge of the benefits of exercise on the mind-brain?	Self-reflection journal prompts and focus group	November to December 2021	Inductive and deductive thematic coding
RQ5: In what ways did participation in this intervention change participants' perceptions of their intrinsic motivation while exercising?	Focus group; post-participation survey	December 2021 to January 2022	Inductive and deductive thematic coding
RQ6: How did the intervention change participants' mind-body relationship perceptions?	Focus group; post-participation survey	December 2021 to January 2022	Inductive and deductive thematic coding

Quantitative Data Analysis. Quantitative survey data from the intervention adherence checklist were collected via Qualtrics then downloaded into SPSS for analysis. Descriptive statistics were used to calculate the percentage of items the instructor used from the brain-body fitness framework during each class. These results were triangulated with qualitative data from participants' self-reports of experiences to corroborate that the domains and methods in the framework were incorporated in the intervention. The results from this data analysis strengthened the trustworthiness and validity of the case study findings. Additionally, low adherence to intervention implementation of framework elements would make it difficult to correlate study outcomes with intervention methods.

Qualitative Data Analysis. Free-response survey data collected from downloaded Qualtrics documents and focus group transcriptions were analyzed using inductive and deductive thematic coding. Codes are "text-based labels that give meaning to segments of data" (Lochmiller & Lester, 2017, p. 290). Themes are "broad, analytically driven statements" (Lochmiller & Lester, 2017, p. 296) derived from the codes. Inductive analysis stems from moving from specific to broader analyses, whereas deductive analysis works from a series of assumptions to draw broader conclusions (Lochmiller & Lester, 2017).

As recommended by Miles et al. (2013), two cycles of coding were used. The first cycle of coding used a combination of a priori descriptive codes (predetermined from literature), in vivo codes (quotes from participant responses), and emergent codes (unanticipated codes emerging from participant responses). The second cycle of coding used patterns emerging from codes to develop themes. In this study, a priori codes were directly related to the three domains of the brain-body teaching framework—knowledge, mind-body unity (Burgmer & Forstmann, 2018), and intrinsic motivation (Ryan & Deci, 2000). Intrinsic motivation codes were further subdivided into the subscales of intrinsic motivation—competence, usefulness, tension (reverse), relatedness, importance, choice, and enjoyment (McAuley et al., 1989).

Strengths and Limitations of the Research Design

The strength of this case study design was that it allowed intensive, thorough, and deep study of the unit (see Miles et al., 2020). This case study gave new insight into phenomena that would otherwise be difficult to learn. Researcher observations and participants' words and experiences were usable data generated in real-time and real-world contexts of the group exercise class where exercise is performed. Additionally, the data generated created a path toward developing new knowledge. In this case study, knowledge generated toward creating a novel teaching framework might make an ecological contribution to improved multidimensional health and wellness outcomes and improved physical activity levels—both pressing global concerns at the writing of this dissertation (Chen et al., 2018; WHO, 2020b). Lastly, the researcher used new knowledge generated from this case study to adapt ideas and produce novel hypotheses for further testing by other researchers.

However, this case study also had a few limitations. The first limitation was the nonprobability convenience sampling (Pettus-Davis et al., 2011). The participants were chosen for the study sample because they were easily accessible. However, nonrandomization opened the study to internal and external validity threats (Shadish et al., 2002). Additionally, the sample might not represent all YMCA group exercise participants.

The second limitation was the study's small sample size. The study group was limited to 14 for logistical and practical reasons. According to Shadish et al. (2002), small sample sizes might not yield statistically significant results nor generate valid inferences about causality.

The third study limitation was a mono-method bias threat to construct validity. All measures in this study were self-reports. In this situation, the method might become part of the studied construct (Shadish et al., 2002).

The fourth study limitation was its context-dependent mediation (Shadish et al., 2002). The YMCA is a cause-driven organization whose members might have different mindsets than other gym or boutique group fitness settings. Consequently, study results might not generalize to other fitness-related contexts. Furthermore, results might not replicate in other contexts.

The fifth threat to validity was a potential Hawthorne effect (Rossi et al., 2019) created by participants' previous exposures to the researcher as an instructor at this YMCA. The Hawthorne effect might happen when participants alter their behaviors because they subconsciously want to cause favorable results for the researcher's study. Lastly, because the researcher was the data collection instrument in qualitative research, researcher bias was always a possible threat to study validity (see Guba, 1981).

Conclusion

This case-study researcher examined the experiences of 14 female YMCA group exercise participants instructed using a novel brain-body fitness framework. The study consisted of a preparticipation launch meeting to introduce the study, participation in six group exercise classes, six free-response online journal prompts completed after each class, participation in post-intervention focus groups, and completion of an online post-participation free-response differentiation survey. The launch meeting and focus groups were conducted virtually on Zoom. The exercise classes were conducted on site at the YMCA. All data were collected online in Qualtrics surveys and in verbal transcriptions from the Zoom focus groups.

The group exercise classes were conducted using specific protocols in the brain-body fitness framework (Appendix L). The framework was incorporated into six pre-existing YMCA group exercise classes—three barre formats and three cardio formats. Assessments included one quantitative measure (instructor's adherence to brain-body fitness framework protocols) and three qualitative measures (journal prompts, focus groups, and a survey). Chapter 5 presents the process of implementation, findings, conclusions, and discussion, including implications for practice and future research.

Chapter 5: Findings and Discussion

This case study examined the experiences of women participating in YMCA group exercise classes scaffolding mind-brain health and wellness knowledge into instruction. In addition to kinesiology and choreography cues required in group exercise instruction (ACSM, 2021), case study instructor cues and language explicitly connected the benefits of exercise to multiple dimensions of well-being while consistently reinforcing that the mind, brain, body, and environment were intertwined (embodied enactive cognition; Di Paolo et al., 2017). Learner-centered teaching methods within the given class formats intentionally targeted intrinsic motivation antecedents for exercise sustainability and employed imagery/metaphor cues and props to foster mind-body unity. The purpose of the study was to examine how group exercise instruction using the researcher-created B-BFF affected exercise participants' brain-body knowledge, perceptions of mind-body unity, and perceptions of intrinsic motivation; these three indicators emerged from the literature as supportive of improving mental health literacy, lifestyle health practices, and sustainable participation in physical activity (Burgmer & Forstmann, 2018; Hurley et al., 2020; Segar et al., 2011).

The study's theory of treatment posited that increasing brain-body knowledge, mind-body unity, and intrinsic motivation during exercise sessions (the study's proximal outcomes) provided a path towards distal outcomes of enculturation of exercise for multiple dimensions of well-being, increased physical activity levels, and progress toward better global mental health outcomes. For this reason, all teaching methods in the B-BFF targeted three domain objectives—increasing participants' brain-body knowledge, fostering intrinsically motivating exercise experiences, and strengthening perceptions of mind-body unity. The study results are presented in this chapter in the following order: the process of implementation, process and outcome findings, study conclusions, and a discussion of the implications for practice and future research.

Process of Implementation

The needs assessment findings indicated that group exercise instructors wanted a framework to scaffold mind-brain health and wellness into their group exercise classes. To fill this gap, the researcher constructed the B-BFF from empirical and theoretical literature, then field-tested it in established group exercise classes at a suburban branch of a southwestern metropolitan YMCA. This case study explored the experiences of 14 women who received mind-brain health and wellness instruction while exercising in group exercise classes instructed using the B-BFF. Instructor language, methods, and cues in the B-BFF were theoretically grounded in embodied enactive cognition (Di Paolo et al., 2017), the self-determination theory of intrinsic motivation (Ryan & Deci, 2000), andragogy (Knowles, 1980), social constructivism (Vygotsky, 1979), and transformational learning (Mezirow, 1997). Additionally, all teaching methods aligned with the framework's three research-inspired domains—brain-body knowledge, mind-body unity, and intrinsic motivation subscales. The following research questions guided the study:

RQ1: To what extent was the intervention implemented as planned?

RQ2: What unique features differentiate instruction in this class from instruction in other group exercise classes?

RQ3: What were YMCA group exercise participants' experiences with the intervention?

RQ4: How did participation in the intervention change participants' knowledge of the benefits of exercise on the mind-brain?

RQ5: In what ways did participation in this intervention change participants' perceptions of their intrinsic motivation while exercising?

RQ6: How did the intervention change participants' mind-body relationship perceptions?

The case study began the last week of November 2021 and ended mid-January 2022. As per institutional review board protocols, 14 female volunteer participants, ages 18 to 74, signed voluntary consent forms prior to participating in six researcher-instructed group exercise classes. The format for three of the study class was barre, and the three other classes used a cardio combo format. Barre classes at the YMCA are defined as hybrid workout classes that combine ballet-inspired moves with dance, yoga, Pilates, and functional fitness training. Cardio combo classes are defined as aerobic classes that raise the heart rate and keep it sustained by combining a variety of large muscle group movements. All 14 participants met the inclusion criteria of having had prior experience with group exercise classes and completed the study's virtual pre-participation information session, six onsite exercise classes, six post-class electronic journal entries, and post-participation electronic differentiation survey. All survey questions were answered electronically on Qualtrics.

All 14 members expressed a strong interest in participating in the culminating focus group. The winter holidays in North America were approaching, and participants indicated upcoming busy schedules. To accommodate these circumstances, separate sessions were offered over the course of three days, with morning and afternoon time options. Participants chose their most convenient time slot, and the resulting group distribution was as follows: group 1 (n = 4), group 2 (n = 2), and group 3 (n = 7). Focus groups were conducted virtually on Zoom, audio-recorded, and transcribed using Otter.ai. One participant had a family emergency before the slated session, leaving the final focus group participation count at 13. However, instructor field notes indicated that the missing focus group participant shared thoughts on the focus group questions (e.g., use of the Twitter knowledge extension) in the final differentiation survey. The following sections specify the exercise and B-BFF protocols used in the study.

Basic Group Exercise Protocols

All six group exercise classes were 55-minute formats instructed using the B-BFF. Per ACSM (2021) guidelines, each class began with a warm-up, segued to the body of instruction using industry-standard barre and cardio movements, and concluded with a cool down. Standard group exercise tools were employed, including mats, stability balls, Pilates balls, 2- and 3-pound hand weights, resistance bands, and steps.

Brain-Body Fitness Framework Protocols

The aim of the B-BFF is to convey a philosophy about exercise meaning-making that recognizes, values, and broadens the relationship between the movement of the body, well-being, and affective (feeling) and cognitive (thinking) processes. This philosophy is practically conveyed via instructor cues, activities, and messaging. In the fitness industry, a cue is a group of words an instructor verbalizes to prompt a participant to execute a movement. Activities in an exercise class include physical movements that align with the class format objective (e.g., strength training, cardiorespiratory training, flexibility, or balance) Instructor messaging includes any words an instructor says within the class time frame in addition to movement cues (e.g., delivering a content fact, socializing, telling a joke, making an analogy, or explaining a concept).

The instructional difference between these intervention classes and other barre and cardio formats taught at this YMCA was the use of the B-BFF to guide and shape cues, activities, and messaging. This research-informed andragogical framework consists of actionable prompts to align movement cues, activities, and verbal messaging with multiple dimensions of well-being while creating intrinsically motivating and socially inclusive environments for participants. In other words, the study classes still retained the exercise formats of barre (fusion classes of ballet/Pilates/yoga) and cardio classes (classes that elevate heart rate and keep it sustained). However, unlike other barre and cardio classes, the study classes intentionally used the B-BFF prompts to connect fitness instruction to each of the neuro-, affective, and cognitive science inspired domains in a practical and targeted way. Table 5.1 lists the B-BFF's guiding prompts that bridge research with practical exercise instruction application.

Table 5.1

The Brain-Body Fitness Framework

Domain	Instructional Prompts for Exercise Instructors
Brain-Body Knowledge	• Talk about how the mind-brain-body-environment are interconnected. • Connect at least one fact about exercise's benefits to the brain, focus, mood, etc. • Offer a class knowledge extension via Twitter or other social media (to share literature, TED talks, books, etc.). • Offer "movement snacks" (ideas for movement in real-life settings) to assist participants with increasing movement throughout the day for their mind-brain wellness. • Explicitly and frequently talk about wellness as a multidimensional construct (physical, social, spiritual, emotional, cognitive, and lifestyle).
Mind-Body Unity	• Use imagery, metaphors, and props/toys to help participants embody and automatize postural alignment. • Frequently connect movement to mood and offer ways for participants to self-assess post-movement feelings. • Cue participants on awareness of their interoception, exteroception, and proprioception to foster mind-body unity and illustrate how the body-brain-mind-environment interact as one. • Encourage participants to critically reflect on connections between what they were feeling and doing so they could adjust their movements to fit into their unique zone of proximal development (ZPD) and sense of enjoyment. The ZPD is the level where a participant can work with assistance from an instructor. Use metaphor of a Goldilocks Zone, (referring to the children's fairy tale), to help participants find their sensation of a movement sweet spot perceived as "not too easy" or "not too hard," but "just right."
Intrinsic Motivation	• Cue the purpose of movements for participants' meaning-making. • Use Piggin's (2019) broadened definition of physical activity (chapter 3, p. 93). • Refrain from using aesthetic extrinsic motivator cues (e.g., bikini bodies, weight loss, hard bodies, tight buns, etc.). • Include the importance of joy, feelings, emotions, mind-brain-body unity, lifestyle, functional fitness, health, strength, vitality, and quality of life exercise benefits like reducing stress and anxiety in cues and messaging. • Talk about the quality of life and mind-brain benefits of exercise. • Broaden the scope of the group exercise class by messaging it as a space for social connection, support, learning, community building, and mental well-being. • Foster intrinsically motivating exercise experiences by targeting teaching strategies to the seven antecedent subscales: o Competence: Offer movement modifications and vivid imagery/metaphor cues to help participants self-align and embody movement cues within their ZPD and personal needs. o Usefulness and value of movements: Explain why certain movements are executed and how they help the mind-brain-body in everyday life. o Tension release: Offer ways for participants to cognitively reappraise, reframe, and release tension in the body. o Relatedness between class members: Offer spaces within class time to effortfully build community and common bonds. o Importance of the activities: Appropriately explain the science behind moves and the benefits to immediate and future well-being. o Choice: Offer many movement modifications, intensity progression options, opportunities to be creative and unique with movement, and the agency to "refresh" (take a moment to pause and come back in at any time). Rebrand modifications as progressions rather than as beginner, intermediate, or advanced movement. Demonstrate all as equally valuable. Message that all movement counts. Invite participants to customize and internalize the group movements as "personal training" within a social group setting. o Enjoyment: Inspire laughter, a sense of levity towards movement, awe at the wonders of the beauty of the mind-brain-body capabilities, optimism about the immediate benefits of exercise, learning goals, and well-being goals.

Findings

This section includes the case study's empirical findings. The findings are divided into process and outcome evaluations, further subdivided by the study's six research questions. Process evaluation was used to assess how the study was conducted (see Dusenbury et al., 2003), whereas outcome evaluation was used to assess the effects of the intervention treatment on study participants (see Rossi et al., 2019). Because the study's goal was to capture participant experiences deeply and richly, the following sections generously use vivo codes to create vignettes (F. Erickson, 1986) that "stimulate within readers a vivid and engaging experience with the participants and their actions, reactions, and interactions" (Saldaña, 2022, p. 20).

Process Evaluation

The three processes measured included program adherence, program differentiation, and participant responsiveness. Adherence was measured quantitatively by the researcher-instructor using a B-BFF checklist after each class. Results were synthesized with qualitative data for internal auditing. Program differentiation and participant responsiveness were qualitatively measured in free-response survey questions electronically accessed on Qualtrics. The following three subsections report study findings on these three process evaluations.

Fidelity of Implementation: Adherence. Fidelity of implementation measures if a study is carried out in the designed way (Dusenbury et al., 2003). These measures are important because ascertaining a study's adherence to its protocols permits a researcher and reader to evaluate what about the intervention contributed to the outcomes observed. It helps to understand *what* is being evaluated—not a proposed intervention but the *actual* intervention. Furthermore, adherence measurements inform future case study replications and cross-case analyses that may enhance generalizability or transferability in other contexts (Miles et al., 2020). In this case study, RQ1 asked the following: To what extent was the intervention implemented as planned?

Results from the B-BFF Adherence Checklist showed that all items were included in each class. Knowing which instructor methods were included in the study was paramount to understanding the framework's relationship with study outcomes. Immediately following each class, the researcher-instructor accessed the checklist in Qualtrics to electronically check boxes aligning with the teaching methods used in class that day. A synthesis of participant survey and focus group responses corroborated researcher-instructor reports. The following paragraph provides an example of this data triangulation.

One item from the B-BFF Adherence Checklist (Appendix L) included, "Instructor used imagery, metaphors, and props/toys to help participants embody and automatize postural alignment." In survey and focus group responses, participants elaborated on these methods. During the focus group, one expanded on an experience with the instructor-researcher using a rubber toy frog as a prop to explain gluteal muscle support in lifting legs:

> Can I bring up the frog? When you have a squishy frog, and you sit there and you squeeze him in his little eyes bug out, and it just makes me so tickled. Funny, and it's fun. And it's one of those things where you go from, "okay, I'm kicking… whatever"… to like, "this intentional involvement is okay, what exactly am I doing? How am I balancing myself?" It just makes it feel both keyed in. And while you're sitting there laughing at this observed little frog motif, you're also understanding how it relates to all of these other muscle groups and things like that in a way that you weren't thinking about before. All in a way that like, anybody in the class, if you said, "Remember the frog?" They'd all be like, "oh, yeah, yeah, I know exactly what you're talking about!" And it's silly, but fun.

Over 100 pages of free response question and focus group transcript data were collected in this case study, providing data saturation—a redundancy where no new data were discovered and data collection could then end (Miles et al., 2020). Data provided ample evidence that every item in the B-BFF Adherence Checklist was addressed.

Fidelity of Implementation: Program Differentiation. Data collected from the Program Differentiation Free-Response Survey (Appendix M) were triangulated with journal entries and focus groups provided answers for RQ2: What unique features differentiate instruction in this class from instruction in other group exercise classes? Selection criteria for study participation required that everyone had previous group exercise class experiences to make comparisons (e.g., no participant was new to group exercise, and most had years, even decades, of experience). They were instructed to use any other group exercise classes (or aggregate of class experiences) at any facility, in any location (i.e., including outside of the YMCA) as comparison classes. For this dissertation, the study classes were called B-BFF classes, and the comparison classes were called "regular."

Seven categories emerged from the data as notable differences between B-BFF classes and regular classes: (a) brain-body content, (b) educational versus solely performative instructional methods, (c) "real-life" applicability of instructional methods, (d) asset-based and body aesthetic-free instructor language, (e) continual imagery-filled instructor cues, (f) asset-framed modifications rebranded as movement progressions, and (g) the starting point of instruction focused on emotions rather the body. This subsection reports the findings on these perceived differences and their implications for exercise practice.

Brain-Body Content. The most consequential content difference unanimously reported was the instructional inclusion of exercise's benefits on their mood, cognition, and brain health.

They confirmed that mind-brain-body connections in the intervention were “consistent,” “explicit,” and brain-body benefits of exercise were embedded “through the entire class.” The relevance placed on the health of their minds during exercise class was “very different” from any previous class experiences. One highly experienced individual noted the following:

> Although I have been taking various classes for over 25 years (yikes) the mind-brain has never been talked about in conjunction with exercise … in other classes only the physical is talked about … do this for abs, do this for biceps, etc.

Though some industry classes were labeled as mind-body, the implicit understanding was that the class was either mat-based (performed shoeless) or a slower-paced, such as Pilates or yoga. It was noted that even in mind-body labeled classes, “there is nothing in particular that helps us connect body to mind.” She continued with the following:

> Even ‘mind-body’ labeled classes like Body Flow are labeled by their segments. So, one knows you are in the balance segment or the hip opener segment or the twist segment, but at no time is it taught, as in this (B-BFF) class, that learning balance will benefit one in the real world should you begin to fall. Or that the twist segment is good for spinal flexion and why. Knowing the benefits of moves, I believe, would encourage people to remain in a class versus walkout when they are uncomfortable and/or return for improvement in areas where they struggle.

Before joining in the study, none had considered that a cardio class “counted” as a mind-body class because cardio movements were “fast.” Upon learning more about embodied enactive cognition, the inextricable interconnection between mind, brain, body, and environment and how and why aerobic activity helped the mind-brain, they remarked on this knowledge as being highly motivational given that “your mood and thoughts are easier to access than your blood pressure or cholesterol level." One remarked, "The content was VERY motivating and resulted in me recommitting to cardio classes." Another reported, "Learning that with aerobic exercise I can improve the neuroplasticity of the brain … I am now committed to aerobic exercise for life. An additional motivator is that my father had Alzheimer's."

A notable difference reported between this class and others was that learning how exercise positively affected the brain (e.g., built new neural connections, generates new blood supply in the brain, grew new neurons in the cerebellum and hippocampus, and regulated mood-affecting neurotransmitters) gave them a concrete and immediate sense of connection between their physical movement and their mental wellbeing. One stated the following:

> Very few instructors bring the concepts of mind and brain into exercise classes (other than pushing endurance, which is a mental state). I have renewed excitement, motivation, and energy to ensure that I am both exercising and engaging in as much movement as possible daily, not only for my physical and emotional health, but also for the long-term health of my brain. As I age and watch others age around me, I am also watching so many suffer from various stages of dementia. I do not want dementia. I want to be as mentally sharp on the day I die as I was at age 30.

In this sense, discussing basic neuroscience while exercising made the formerly elusive and abstract concept of mind-body unity concrete.

This finding has important public health implications on two levels. The first is that stronger mind-body unity perceptions correlate with healthier lifestyle practices (Burgmer & Forstmann, 2018). The second is that literature on the neuroscience of reward shows that immediately felt rewards foster sustainable exercise behavior change (Segar et al., 2011). The key takeaway is that the study data suggest that inclusion of basic neuroscience in group exercise classes may have transitive health properties.

If neuroscience offers a way for people to concretely feel a stronger mind-body connection, and stronger mind body connections correlate with healthier lifestyle practices, then the inclusion of exercise neuroscience to physical fitness education may serve as a mechanism for healthier lifestyle practices. The reason for this finding may be that people can more easily access the immediate quality of life benefits of exercise on mood and thoughts than traditional biomarkers of fitness like blood pressure, body mass index, and cholesterol (Segar et al., 2011). In summary, these findings suggest that as a topic the inclusion of mind-brain health in group exercise classes may (a) improve exercise sustainability, (b) increase physical activity levels, (c) lead to improved mental health well-being, and (d) the association of physical activity with mental health.

***Educational Versus Solely Performative Methods*.** A noted difference between instructional methods in these study classes and other group exercise classes was that people sensed they were being educated as opposed to being led through movement sequences. Other classes were described as performative spaces, where one learned how to execute the class format protocols (e.g., an overhead press, a dance sequence). These study classes were perceived as educational: "The educational aspect to what we are doing and the why behind it, is the biggest difference for me. Most other classes are just about copying the movement of the instructor." The women described instruction in the B-BFF classes as "offering not only the 'HOW,' to exercise, but equally important, the 'WHY'" as a unique experience.

This educational perception has motivational implications. One asserted, "You explain the reason behind your instructions. Knowing the benefit and reason makes me want to do it."

Hearing explanations behind why movements are beneficial to their overall wellbeing and the reasons behind the executions of movements made them “want to do them,” aligning with literature on intrinsic motivation and behavioral neuroscience. Liking and wanting are intrinsically motivating, lead to feelings of pleasure and autonomy, and foster behavior sustainability (Conner et al., 2016; Ryan & Deci, 2000; Teixeira et al., 2012).

There was group consensus that the “small pieces of science” embedded throughout the class explaining “why they were doing what they were doing” was inordinately different from other classes. It increased two subscales of intrinsic motivation—usefulness and importance (Ryan & Deci, 2020). This finding has important lifestyle health implications (Beauchemin et al., 2018). The group perceived that learning the immediate benefits, utility, and value of exercise to enhanced mind-brain-body well-being and was intrinsically motivating in class *and* outside of class. The data illuminated that knowledge gained in class combined with the explicit connection to its functional practicality fostered their abilities to connect mindfully with what they were doing in classes with their “real world” outside of class.

“Real Life” Applicability of Instructional Methods. All study participants reported they used information and techniques learned in these study classes in other classes, the weight room, and “outside life” (physical activity outside of class). These data suggest that the methods in the B-BFF are foundationally supportive in other physical activity applications and provide a new way of thinking about movement outside of class. The implication is that using the B-BFF may encourage more physical activity beyond just exercise. Participants noted that consistently hearing about the interconnectivity of mind, brain, body, and environment in classes caused them to “think more intentionally” of themselves as “systems of interacting parts.” Their thinking about the value of bodily movement broadened, consequently allowing them to view their health in a more multidimensional way than they normally would. One participant expressed the following:

> I use many of these props and mental images in my daily life now, to improve my posture and position in everything that I do … I cannot think of a single cue or imagery from any other class which I have embodied into my daily life.

Humorously, study participants noted that they could now hear the researcher-instructor's voice (in their head) in other classes or when gardening, climbing a step ladder, skiing, or steadying their balances during near-falls.

Asset-Based and Body Aesthetic-Free Instructor Language. A noteworthy difference mentioned by all in some fashion was the positive, asset-based, aesthetic-free instructor language used. This topic was emotionally charged, with some becoming teary-eyed, speaking of negative body-image struggles, choking up, and needing to pause to collect themselves during the focus groups. Participants reported that instructional language and the overall tone of instruction in the B-BFF was different from other group exercise classes because content did not assume body deficiency—something they labeled as the "usual" perspective of exercise classes, "assuming something was wrong" with their body "that needs fixing."

The group reported that the unspoken messaging of exercise marketing was that joining a gym or attending exercise class meant one was there "to get fixed." Data showed that they did not feel that starting deficit in B-BFF instruction; instead, they felt uplifted. One participant interpreted the framework language as "helping us feel beautiful in our own way—in the dance setting of the barre classes and in adjusting movement to what was right for us in each class." Another chimed in that the "mantras are so different. It feels like a safe haven of health and strength for my body and frame of mind." Lastly, when describing the difference between the asset-based starting point of B-BFF guided instruction with industry standards, different members of the group noted that cues were positive, encouraging, lacked sarcasm and belittling, and focused on the "totality of mental emotional, and physical health."

The youngest (age 18) and oldest (age 74) described negative physical education experiences that they perceived as leaving emotional scars on their body perceptions, self-worth, and movement self-efficacy. Others chimed in with similar stories of being tired of instructor cues about "getting better bodies," referring to aesthetics and not wellness. Looking better in pants, shorts, swimsuits, and sleeveless shirts was often cued in regular classes as a reason to keep committed to exercise. One lamented the following:

> If I had one instructor say that we were working towards "summer readiness" I've had a dozen. And that's before you get up to the "how many squats do you need to burn off the Christmas cookies" random weird ways of thinking about lifestyle that gets tossed around in casual fitness conversation. Not that it's not one component of wellness, but with so many other things affecting weight, I feel like knowing the neural and emotional benefits of exercise is far MORE important than doing everything to look good in a bikini.

These findings align with Chapter 1's literature on the potential toxic, far-reaching effects of negative physical education experiences and how physical fitness instruction may be complicit in contributing to body negativity and low physical activity participation (Rodrigues et al., 2020). The data support that the neuroscience lens of B-BFF instructional created an authentically positive and safe emotional environment that fosters a healthy body image while offering another positive reason to move the body that either feels more meaningful to a participant or aligns with their values/needs. The implication is that an instructional shift to the mind-brain benefits of exercise creates the intrinsic motivation subscale of importance of exercise. The data suggest that methods in the B-BFF are a mechanism for this change. Furthermore, the data support that participant emotions as the foundational starting point (Hardiman, 2012) for fitness instruction creates an environment conducive to repairing the psychological damage from previous experiences that may serve as participation barriers.

Constant, Imagery-Filled Instructor Cues. The data on imagery cues were the most prolific in this study's data corpus, indicating the impact of this teaching method. Participants reported that imagery, metaphor, and visual cues (props) were not used in regular classes and described the difference this type of cueing made in perceptions of their exercise competence. The most salient point made of imagery cues was that imagery made movement feel more natural. One woman eagerly explained why she felt imagery and metaphorical cues were instructionally helpful: "I've never encountered this before. The cues are three-dimensional. I instantly understand them."

Several indicated, "Some classes don't use any cues at all. They just move and you follow. Not a secure feeling," and "Cues in other classes are just counting and following the leader." Furthermore, they indicated not having experienced a class where an instructor used so many cues. One participant said, "You don't just cue at the beginning, you keep using cues to fine tune throughout the entire class!" This consistency of cueing mattered to them, as many agreed that right about when they had begun to feel themselves "slouch" or misalign, a general overall cue of "shoulders up back and down" or "head floating over the cradle of the hips" was given that would bring them back into mindfulness. This participant articulated the following:

> Your class's use of imagery, metaphors, and props causes you to think through exactly what you are supposed to do in the movement. You connect the correct action and the way your body should feel. This mind-body connection imagery prompt keeps you from

zoning out and copying movements without engaging the muscles that should be employed.

The group appreciated how imagery cues allowed them to self-correct, “fine-tune,” and “tweak” movements. This ability to self-correct was important because they noted feeling embarrassed in other classes when singled out for correction, even when they knew the instructor wanted to help. Participants described how the generous use of imagery cues alleviated that need because cues were so descriptive, they could be generally presented to the whole class, and each participant could embody that self-correction.

Imagery, metaphor, and visual (prop) cues not only allowed them to self-correct, but these types of cues were also perceived as so useful, they engendered “aha!” feelings of embodiment useful in many applications. One participant described that for years, she could not understand what instructors meant when they asked her to stabilize her “core.” It felt elusive. But when she was cued in the B-BFF study classes to imagine a grapefruit sitting in the cradle of her hips, and she could see a plastic grapefruit sitting in the studio skeleton’s hip cradle, when the instructor asked her to imagine what she might feel when she “squeezed” this grapefruit, the participant described herself as having a “lightbulb moment” of embodiment, akin to the moment of finding balance on a bicycle: “You feel it, know it, and use it.”

Imagery, metaphors, and props were reported as making a “huge difference” when making postural adjustments, releasing tension, contracting muscles, and mentally mapping out where to place weight or levers. This success in movement execution fostered a sense of internal reward, feelings of accomplishment, confidence boosts, and competence, which is one of the subscales of intrinsic motivation. One said, “Being able to see a visual that represents the specific points of position our body is supposed to be is hugely different from what I have experienced in the past." Imagery cues allowed them to embody the instructor cues and experience exercise in a completely new way.

This case study used a variety of props to assist with embodiment of cues. For example, a plastic lemon was used as a prop for shoulder stabilization. Exercisers were told to imagine holding the lemon in their armpit while they extended their elbows. A plastic grapefruit sitting in the hip bones of a spine and hip bone skeleton in the studio served as a visual for finding one's core stabilization. A slinky toy was used to demonstrate spinal mobility. A rubber toy frog that had eyes that popped forward when the belly was squeezed was used to demonstrate squeezing or contracting in one place for power and stability to move another body part (e.g., contracting left gluteal muscles while lifting the right leg). One described the difference that the use of imagery, metaphors, and props made for her:

> Most instructors call moves with very little attention to how the moves should be executed, and then fill in "dead space" with chit chat about current events or what's going on in their lives. I appreciate the constant flow and plethora of visual images that you use to keep our minds connected to the bodily movements we are doing.

Another expounded the following:

> Visual cues help me do the exercise correctly. They also help me get the most out of it I can. Her verbal prompts to visualize our body stretching to the wall to ring a doorbell or twisting as if we were wringing out something help me push and stretch further than I would in semi-static stretches and moves. The verbal visualization prompts engage another sense by giving a mental image to "see." Imagining a grapefruit in my core helps me to think of squeezing it which engages more muscles than just telling me to engage my core does. Plus, it adds a playful element to work—sometimes I think of it as the

"spoonful of sugar that helps the (exercise) medicine go down." She makes exercising fun as we visualize ourselves on stage in a Nutcracker role or other dance part.

Modifications Rebranded as Progressions and Options. There was consensus that another major way B-BFF classes diverged from regular classes was how exercise modifications were rebranded and instructed as "progressions." Alternative semantics and methodology in the B-BFF changed how they felt about making movement choices. When modifications were cued as "progressions" rather than the industry-standard "levels" of "beginner, intermediate, and advanced" or "easier/harder;" feelings described were "empowered," "in control," and "intelligent" as opposed to "lesser than" or "not good enough to keep up." Consequently, making modifications in the B-BFF class felt like an asset instead of a deficit, a "gift" they gave to themselves, not a "failure." One participant noted that in the B-BFF class, "I am not discouraged by modifications I need to take"—implying the difference the asset-framed choices made in her exercise experience.

For safety reasons, all fitness instructors were trained to offer modifications (ACSM, 2021). These movements were offered in classes as modifications to the moves cued by the instructor. However, the group noted vulnerability associated with taking exercise modifications in a group exercise setting. Aside from feeling that they were "sticking out" because they were doing something different, they noted that making modification choices came with emotions and "negative self-talk" about their bodies and physical abilities. In regular classes words like "beginner," "intermediate," "advanced," "harder," and "easier" implied a hierarchy of ability that they subconsciously attached to their self-worth. All described how traditional fitness level labels held emotional power. Implicit in their meaning was that there existed a normative standard, and any deviation from it made them "lesser than" if they chose the "lesser" option.

All agreed the metaphorical cues in the B-BFF (that were sometimes humorous) helped personalize their choices about intensity progressions and modifications without feeling the stigma of performance levels. Conversely, they perceived B-BFF methods as honoring their personal needs and previous injuries described as making them feel personally "respected." Reframing modifications as self-care and respecting their bodies felt different from regular classes where exercise sometimes felt implicitly punitive—"how hard you could push yourself" or experience pain as a badge of honor.

Interoceptive cues (about sensations felt in the body; e.g., breath depth and rate) in the B-BFF were perceived as mindfulness training, even in cardio classes, as it helped them locate their workout "Goldilocks Zone," a metaphor used in class to self-locate the intensity where they perceived the work was not too difficult, not too easy, but just right. One woman noted the irony that despite being given agency to "pull back" in order "to refresh, but not stop" (a mentality opposite of standard "killer" gym mindsets), the Goldilocks Zone mindset did not shortchange workout efficiency. Conversely, she found that paying attention to interoception and the mindfulness of her "Goldilocks Zone" resulted in perceiving her workout as more efficient than before. She could "push harder" than she might have otherwise thought she could while "pulling back" at other times unabashedly. In aggregate, she believed that she worked more on target without feeling physically or psychologically debilitated than before. These data suggested that the Goldilocks Zone metaphor and the agency of taking progressions engendered a collective positive psychology because the power dynamic had shifted. In regular classes, the instructor was perceived as in charge of everyone's bodies. In the B-BFF classes, all perceived that *they* were in control, and the instructor was a facilitator helping them find a personal best that aligned with *their* values, lives, and needs.

Two consequences were reported as resulting from regular fitness class modification labels. The first was physical injury. To not risk appearing that they could not "keep up," at times, in other classes, they did not take the "beginner" or "easier" label; thus, they pushed themselves too hard, too fast—to their personal detriment and injury. The second consequence was emotional injury—they felt shame or awkward for having to take the "easier" option. This second consequence made them not want to return and created a negative feeling toward their physical bodies.

In the B-FF class, progression options of varying intensities were noted as class infrastructure, meaning many different options were continually spiraled and sprinkled throughout the class as selections from which to choose—just as one would choose food items in a buffet spread. "Being different" was encouraged, lauded, and rebranded as creative and fun. No hierarchical labels were assigned to progressions—they were merely options in the "movement buffet."

Instead of ability labels, B-BFF instruction cued and encouraged using interoception—paying attention to how their bodies felt with the movement at that moment—to make their decisions. Participants noted how different it felt to be asked to "listen to their body" in this B-BFF class instead of just patently being told, "C'mon! You can do this!"—which they labeled as instructor "toxic positivity." One participant reported that when an instructor shouted, "You can do this," she sometimes wanted to scream and say, "Um, no, I just CAN'T!" This point elicited uproarious laughter and a show of solidarity by the approving nods emanating from all heads in the focus group zoom boxes. Another chimed in saying the following:

> I wish more instructors would understand why some people cannot and should not do specific exercise movements. You tell us if this is not a move that works for us, do something else and you give us a few safe choices.

One more participant added, that in this B-BFF class, “there were options to move, but in a way that didn’t have to hurt.”

In the B-BFF classes, members were aware of being trained to notice and respect internal sensations matching movements. If breathing had become too deep and rapid, the instructor showed techniques on how to “rein in” the movement until they felt they were back in their Goldilocks Zone. If a knee was hurting in a plié (a bend at the hip and knee in barre class), several degrees of joint flexion options or leg distance widths were offered to help find their Goldilocks Zone. Progressions were offered for interoception of intensity and as encouragement to enjoy the feeling of movement in their bodies.

Participants reported that the imagery, metaphor, and props were helpful in guiding them into their Goldilocks Zone. One example entailed pushing and pulling back one’s foot on a car accelerator pedal to manage averaging the speed limit. The myriad permutations of pushing and pulling back that existed between the extremes of pedal to the metal or coming to a complete stop felt relatable and translatable to their bodies. Metaphors offered an embodied shared meaning that made the movement accessible. One woman described the following:

> Again, such cues are not used in other classes I attend or have attended in the past. Not only do they help in alignment during the class but continue to serve as prompts with my posture outside of class. Also, the cue about lemon in the armpit has also helped me in healing from a minor shoulder injury. In the class I find they [visual cues] achieve your

> purpose and that visualizing the "lemon" really gives me interoception regarding using my back muscles.

Another participant described why the visual imagery helped her: “I know how big a lemon is and when you cue me to hold a lemon in my armpit, I visualize the lemon and know how much force to use.” This next participant expanded deeply on her perceptions of making choices and progressions in the B-BFF and how it had affected her meaning-making:

> It took a while (several classes) for me to go from visualizing what muscles in my core you meant the first time you mentioned "a grapefruit in the cradle of your hips" to being able to activate and use them properly when cued. I liked the imagery though, because I instantly understood the circular three-dimensional shape of what you were trying to explain. Consistent use of vivid helpful cues helped me gain confidence and ability over time in the movements asked of the class. The continuous use of positive talk about all of the levels and choice around picking and choosing what is right for us in class each day creates a sense of imaginative play that encourages fun and movement within ways that are biomechanically safe, like acknowledging that it's a cold day and encouraging us to take as long as we need to safely warm up or doing whatever challenge is right for us today even if that's a single moving plank and then child’s pose.

Lastly, the women expressed appreciation of how the researcher-instructor cycled through demonstrating all the progression options on a constant basis. They reported this behavior as contrasting with other group exercise experiences, where the instructor always performed movements at the highest level of intensity. Seeing an instructor flow through all modifications made them feel less self-conscious about any choices made.

One final note about modifications and progressions was that many lamented how prescripted franchised classes required instructors to adhere to choreography, making it difficult or impossible to meet individual modification needs in a group exercise situation. In these classes, it was incumbent on each person to "know" how, when, why, and where to make modifications and how those new to the class or group exercise did not intuitively know. This issue could result in physical or psychological injury. Rather than being user-centered, strict adherence to franchised choreography made an exercise class feel instructor-centered and one-size-fits-all. This finding aligned with the literature about the potential drawbacks of prescripted classes (Andreasson & Johansson, 2016). Participants in the current study noted that they now used B-BFF postural alignment imagery and progressions to feel safer and more effective in prescripted franchised classes than they felt before.

This study finding suggests that rebranding deficit-based exercise modifications as asset-based movement progressions fosters positive body-self-concept and perception of movement competence, choice, and enjoyment—three antecedents of intrinsic motivation (Ryan & Deci, 2020). A strong implication for practice is that co-constructing strategies with class members for finding their right choices in movements fosters intrinsic motivation, a predictor of physical exercise participation and sustainability (Conner et al., 2016; Segar et al., 2011).

Mental Wellness Domains as the Exercise Class Foundation. The B-BFF classes differed from regular classes; the mental domains of wellness—emotional, cognitive, and social—were explicitly discussed throughout exercise instruction and were the grounding points of instruction. The physical domain of wellness was reported as the basis of regular exercise class instruction. Consequently, all reported being accustomed to only thinking about their bodies during an exercise class. They expressed that they had "not thought particularly" much about the interplay between their minds and bodies; they were unaccustomed to hearing about exercise being important to mind-brain health in regular classes. Before the intervention, most reported putting mental health and physical health into two distinct categories. This finding aligns with Burgmer and Forstmann's (2108) research that people tend to be implicit mind-body dualists, partly because language and culture delineates them as such in medicine and disciplinary studies.

In a survey response, one participant appeared incredulous at emotions being the foundation of an exercise class: "You ask me how I'm feeling!" All noted this comment as something they were not asked in other classes, but they deeply appreciated it. The inclusion of neuroscience, imagery, and metaphors in class instruction was identified as the differentiating instructional features that helped them to feel and understand how mind, brain, body, and environment interactions had shaped multiple dimensions of their well-being.

Study members also reported that the social component of B-BFF classes was different from regular classes. They noted that when the instructor cued up music or members picked up props, the instructor actively encouraged them to introduce themselves to one another by "saying hi to a friend" they had not seen in a while or "saying hi to a new friend" they "had never met."

The time was carved out for this interaction as an important part of social well-being. One noted all B-BFF-instructed classes had at least two to three social interactions per class:

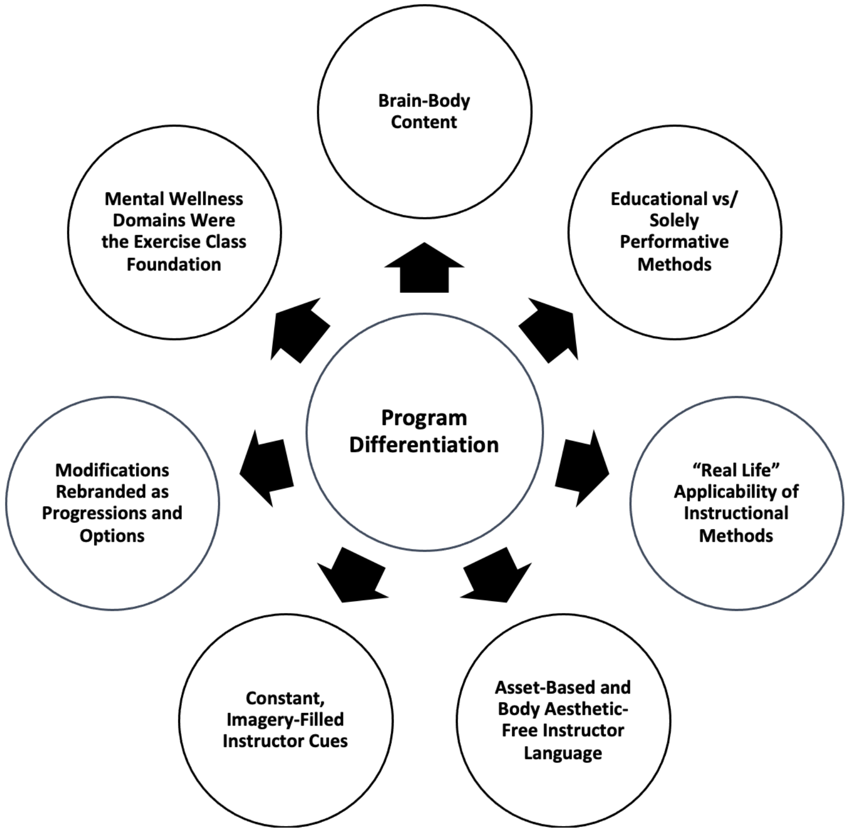
> You acknowledged the social component of the class and encouraged it. During a brief break to change the music you would encourage us to introduce ourselves to someone new or say hi to an old friend—pointing out the psychological and physical value of the social connection part of class. This is the first time I've had this piece emphasized in any

exercise class I had taken. I've been a member of the YMCA for 32 years and taken many types of different classes.

Those used to taking the franchised style exercise classes agreed that the B-BFF classes made them feel "less mechanical" than the "scripted classes." They expressed a sense of immediate gratification and reward in benefit perception. Because the class was instructed with a primary focus on how movement made them feel as opposed to how they looked, they became acutely cognizant of "just how much better" they felt in mood and thoughts during and after exercise. This positive experience with exercise for mental (emotional, cognitive, and social) well-being supports the thesis of this dissertation study. Figure 5.1 depicts perceptions of program differentiation.

Figure 5.1

Participants' Perceptions of Program Differentiation



Note. Elements of the program perceived as different from instruction in regular group exercise class experiences.

Participant Responsiveness: Group Exercise Participants' Experiences. Experiences with the intervention case study were captured through post-class journals, post-participation surveys, and focus group transcripts. Responsiveness is the process evaluation indicator defined as "ratings of the extent to which participants are engaged by and involved in the activities and content of the program" (Dusenbury et al., 2003, p. 241). Through detailed analysis of individual experiences, five categories emerged as key shared engagement experiences: (a) All were highly engaged with the study, (b) the social media extension was useful, (c) hearing that "all movement counts" was "game changing," (d) the B-BFF neuroscience lens increased curiosity and creativity, and (e) the group unanimously expressed enjoyment with study participation. These categories support the dissertation argument and answer RQ3: What were YMCA group exercise participants' experiences with the intervention?

All Participants Were Highly Engaged. All 14 members of the study completed every activity of this study, minus one participant who backed out of the focus group at the last minute due to a family emergency. Given this study was conducted during the winter holiday season in North America, commitment was remarkable. Furthermore, despite the surveys being lengthy and completely free response, all members answered each question at a level of detail that surprised the researcher. An original concern with having all free-response questions was not collecting enough data for saturation. However, survey responses and focus group transcripts totaled over 100 pages in Microsoft Word documents, making the data source a wealth of participant experiences in their own voices.

The Social Media Extension was Useful. Most reported visiting the Brain-Body-World Twitter account that had been set up as a knowledge extension for this this study.
Richards et al. (2020) suggested that Twitter could be used for professional development, and this study revealed it could be used effectively to provide supplemental resources to topics discussed in fitness classes. Social media use was generational, with younger members reporting social media as infrastructure in their lives and older members agreeing they were open to using it for these purposes.

The group enjoyed watching the videos and reading tweets; however, they preferred when videos and articles were brief. They also said that they were more likely to visit the site when the instructor mentioned it or reminded them about it during class and gave a topic prompt. Everyone reported enjoying the ease of a QR code posted on the studio door, and many used their phones to access the site on their way out. An important suggestion was to post supplemental brain-body information across several platforms, so people could “use the one they are already on the most;” otherwise, “it’s just one more thing to do.” A few also suggested creating a blog or B-BFF email list.

Hearing That “All Movement Counts” was Game Changing. All described in some fashion how continually hearing that all movement counts (WHO, 2020c) toward their health and well-being during the B-BFF classes changed their perceptions of movement in the exercise class and their daily lives. The group admitted that they tended to have “all or none” mindsets—either they could make a workout class that day; if they missed, then they just wrote that day off as one they did not “get a workout in.” Before the study and hearing this phrase embedded in class, they admitted to “discounting movement outside of classes” as “counting” toward their health and well-being.

One disturbing finding was learning of the strong correlation made between “exercise that counts” and pain. The youngest participant (age 18) mentioned how much she liked learning: “There were options to move, but in a way that didn’t have to hurt.” The tragic implication was that by the age of 18, this young woman had already enculturated that hurting was just part of exercise. This finding’s congruence with research on people’s mistaken beliefs about what kind of physical activity was beneficial for health and well-being (Arena et al., 2018) suggested that “all movement counts” messaging of the B-BFF in group exercise classes was useful. The message was timely in increasing population physical activity levels while helping people relearn a healthier mindset about the movement of their bodies. The implication is that human nature is to avoid pain. Therefore, to increase population physical activity levels, a foundational necessity is to break the negative association between body movement and pain, redirecting it toward pleasure and joy.

In summary, participants reported that consistently being reinforced that all movement counts was “validating,” “affirming,” “positive,” and “empowering.” One participant noted that the “all movement counts” slogan “combats feeling of intimidation when you can’t quite keep up” in class. Another participant began to cry when she said how wonderful it felt being told that she was successful “just by showing up” and that no matter how she moved, “it mattered, and it counted:” It’s a really big deal. It allows me to have a really positive experience in class.” Furthermore, they noted that they now turned movement into a game they played with themselves and their families—parking farther from store entrances, engaging in more gardening and consciously “counting it,” taking more walks, and being highly cognizant of all the collective movement they now purposefully built into their day. All noted how much better they felt after moving around. Just taking time to “notice” how much better they felt strengthened the relationship between movement and mood.

The B-BFF Neuroscience Lens Engendered Curiosity and Creativity. Two interesting and unexpected themes emerged from the data—curiosity and creativity. There were two aspects of the B-BFF classes identified as piquing curiosity and catalyzing feelings of creativity. The first was the neuroscience knowledge incorporated in the classes. The second was imagery used by the instructor to cue body movements, posture, and sensations.

Learning about the brain and how exercise positively affected it sparked curiosity to learn more. Participants noted that curiosity became a motivating factor to attend the classes because hearing about these benefits while performing the work became reinforcing in the moment and in their thoughts after class. Learning that aerobic activity promoted the expression of brain-derived neurotrophic factor (BDNF), a protein associated cognitive improvement and the alleviation of depression and anxiety, made them want to learn more. One declared the following:

> It's really very eye opening to learn that the brain is so, I mean, you know the brain conducts so much activity in your whole well-being. But that exercise is something that contributes to that brain function. Well, we've always known that mood is elevated by exercising, but I didn't know that my brain cognitive functions would also be enhanced by that … I'm more psyched than ever to work out more and make it part of my learning structure.

Another added, "I appreciate the emphasis that you've brought here in these recent classes on the BDNF (brain-derived neurotrophic factor) and the learning and the neuroplasticity and neurogenesis going on in the brain. That, for me has been remarkable." Lastly, one member interjected the following:

> The more I learn about this kind of stuff, the more I want to learn about this kind of stuff, because I've only found it more motivating to learn more about how all this works … I love that you teach in spiral. So, we're going to hear it again and again, with new little details and ideas brought in.

Because seminal literature on curiosity posits that curiosity first requires knowledge, then identifying the gap in one's understanding (Lowenstein, 1994), this case study's findings support including the knowledge domain in the B-BFF. The neuroscience knowledge attached to mood and cognition sparked their curiosity which led to learning (Murayama, et al., 2019). Murayama et al. (2019) suggested when rewarding experience was associated with knowledge acquisition, the rewarding experience "strengthens the value of further information" (p. 875). From an educational standpoint, this finding implies three takeaways. The first is that positive knowledge experiences in fitness classes elicit curiosity and have lifestyle health implications as the exercisers desire to learn more. The second is a social media extension curating relevant brain-body content offers immediate reinforcement for further exploration. Finally, from a learning perspective, salience—things stand out in instruction and that people prioritize as important in the external world—is more likely to be transferred to long-term memory (Roediger & Pyc, 2012a, 2012b; Santangelo, 2015).

Members also noted feeling a spark of creativity generated from content and methods. The youngest participant, a recent high school graduate, remarked that because the B-BFF instructor "started class talking about the brain, and the effects of exercise on it, I was imagining good things happening in my brain while I exercised." The use of imagery and metaphors made movement "novel and interesting," and they began to make up their own imagery, such as imagining themselves as an "ice skater" to embody a smooth movement with balance. Another said she found herself "dancing around the house" and pretended that her counters were ballet barres. Creating their own imagery connected them to things they individually and uniquely found joyful. All participants noted that they now used imagery on their own in other classes.

The contextual implication of curiosity and creativity is that the B-BFF provides a path for individual meaning-making of what exercisers find salient and joyful while still in a group setting—"like personal training in group exercise." The group noted that they enjoyed the B-BFF's prioritizing of creativity over conformity. Conformity was noted as a negative consequence of prescripted franchised fitness classes, as supported by the literature (Andreasson & Johannsson, 2016; Felstead et al., 2007).

Unanimous Expression of Enjoyment. All participants testified to enjoying the experience of participating in this study. Members were generous with their emotional expressions of appreciation and gratitude and vulnerable when sharing unpleasant experiences from their past. What was notable in the copious amount of extraordinarily detailed data was that these women wanted their stories, opinions, and ideas on these matters shared. Expressing themselves seemed cathartic. Participation in this research allowed these 14 women to safely open a Pandora's box of issues in the fitness world—body dysmorphia, shame, pressure, feeling out of place, low self-worth, and so on—topics that could fill another dissertation.

Experiences with the novel teaching framework (B-BFF) were all positive. The methods created exercise experiences described as "empowering," "validating," "setting me up to do my best," "reinforcing that my personal best is good enough," and "emotionally boosting." Other comments included the following: "This kind of instruction makes me want to rise to the occasion," "the cues and modifications make me feel like you respect me," "I can do more because of the fun," "It's social," "It's playful," "I loved these classes," "I loved the social feeling," "there's positivity in the environment," and "I feel successful with the props." Lastly, the focus groups, though divided into three separate groups, all included laughter when they admitted unanimously "hearing" the researcher-instructor's "voice" in other classes and their daily lives. As one participant humorously put it, "I have her on my shoulder talking in my ear."

In summary, the three process evaluation measurements provided invaluable data on study processes. The adherence measurement found that all study protocols were implemented as designed in Chapter 4. The differentiation survey identified that all could discern clear distinctions between regular exercise classes and classes instructed using the B-BFF. Lastly, triangulation of survey and focus group data indicated that all expressed positive experiences with study participation and the B-BFF classes. Figure 5.2 illustrates a summary of experiences with the B-BFF intervention, and the following section reports the study's outcome evaluation findings.

Figure 5.2

Responsiveness: Group Exercise Participants' Experiences

Note. Participants noted elements of the program that sparked high engagement.

Outcome Evaluation

Outcome evaluation is an assessment of the change in the state or social condition the intervention expected to change (Rossi et al., 2019). This study ecologically addressed the rise in mental health unwellness and how exercise serves as a mitigating and protective practice for mental dimensions of well-being. In context, this study addressed the problem that exercise is primarily enculturated in media and instructed in the fitness industry for its physical and aesthetic benefits, potentially depriving people of understanding that exercise is a free and accessible tool for emotional and cognitive well-being. Additionally, some research suggests that cultural and instructional practices in media and the fitness industry, respectively, contribute to high levels of exercise dropout due marketing to unrealistic, unattainable, or unsustainable outcomes (Donaghue & Allen, 2016). Lastly, the intersection between human bodies evolutionarily selected to move, yet conserve energy (Lieberman, 2015; Pontzer, 2018) and a sedentary designed 21st century (Eanes, 2018; Huang et al., 2020; Kilpatrick et al., 2013; O'Donoghue et al., 2016) has multidimensional health implications including mental health outcomes (Alty et al., 2020; Basso & Suzuki, 2017; Budde et al., 2016; Guszkowska, 2004; Konopka, 2015; Lee et al., 2019; Rabin et al., 2019; Stimpson et al., 2018).

Consequently, the challenge of this study was to create a model that recognized and addressed the complexity of solving this problem. The study's distal outcomes of (a) enculturating exercise for multiple dimensions of well-being, (b) increasing physical activity levels, and (c) making progress toward better global mental health outcomes required a multidisciplinary systems approach that acknowledged the interplay between all the biological, sociological, and psychological moving parts. The three proximal outcomes organically emerging from the literature as key features required to theoretically meet distal outcomes were (a) people understanding more about how and why movement is connected to brain functioning (brain-body knowledge), (b) people perceiving the subscales of intrinsic motivation (competence, usefulness, reversed tension, relatedness, importance, choice, and enjoyment) when they moved their bodies or exercised, , and (c) people perceiving unity between the functioning of their mind-brain and the functioning of their body. According to the study's theory of treatment, the achievement and interplay between these three domains is required to meet distal outcomes. Three domains—brain-body knowledge, intrinsic motivation, and mind-body unity—shaped the model of the B-BFF and the study's outcome research questions:

RQ4: How did participation in the intervention change participants' knowledge of the benefits of exercise on the mind/ brain?

RQ5: In what ways did participation in this intervention change participants' perceptions of their intrinsic motivation while exercising?

RQ6: How did the intervention change participants' mind-body relationship perceptions?

Learning theories shaped the instructional methods created for each domain to achieve intended outcomes. The case study empirically tested the B-BFF in the context of an exercise class that was representative of industry standards to understand if the framework could meet these three outcomes. The thick qualitative descriptions in post-class journals, post-participation surveys, and post-participation focus groups provided ample data to evaluate perceptions of brain-body knowledge, intrinsic motivation, and mind-body unity outcomes resulting from intervention participation. The following sections provide the case study findings which indicate the B-BFF used in this case study achieved its intended proximal outcomes.

Brain-Body Knowledge. Data assessing experiences with the neuroscience information presented in study classes was collected through post-class journal entries, the post-participation differentiation survey, and the post-participation focus groups. Findings from these measures answered RQ4: How did participation in the intervention change participants'' knowledge of the benefits of exercise on the mind-brain? The information presented in each class about the brain and its relationship to exercise came from a variety of evidence-based sources (Basso & Suzuki, 2017; Crowley, 2017; DiGangi, 2018; Eagleman, 2020; Mosconi, 2018; Ratey, 2013). Basic neuroscience information included the effects of exercise on cognitive abilities, emotional health, neuroanatomy (brain structures), neurochemicals (chemicals substances affecting the nervous system), and Alzheimer's disease.

The change in knowledge of the brain benefits of exercise from participating in exercise classes instructed using the B-BFF fell into five main categories. Members disclosed that the neuroscience knowledge presented in class (a) increased their brain-body knowledge, (b) boosted their desire to increase their physical activity/exercise, (c) concretely connected mental health and bodily movements, (d) increased their perceptions of exercise's immediate usefulness for mood, and (e) increased their perceptions of exercise as an "intelligent" pursuit.

Increased Brain-Body Knowledge. The group exercisers reported hearing things they "never heard before"—not just in an exercise class, but some information was new to them. In the journal prompts asking about what they learned after each class, they could recall the brain facts included that day. This new information included basic neuroscience knowledge associated with each of the six class topics (see Appendix Q). Some recalled information included "exercise impacts executive function," "social connections affect our brains," and information about stress hormones and exercise. One participant asserted the following of the B-BFF instructor:

> [They] talked about stress and how exercise is a healthy release of stress. She talked about stress as a chemical response and as something that is good unless we have too much of it. This felt like something I could identify with based on my lived experience with depression and anxiety at different times in my life and in the lives of some of my children.

One remembered that "exercise helps with buildup of stress chemicals and reduces catecholamines. This helps with emotional health!" Another recalled, "In today's world our 'fight or flight' stress hormones rarely get expended as intended (i.e., run for safety). Exercise is a wonderful way to expend that built up, chronic stress." About neuroanatomy, one participant remembered the following:

> The brain continuously changes throughout our life based on how we use it. I learned that cardio exercise is very important for the hippocampus which is very important to our memories and plays a huge role in Alzheimer's and dementia.

About neurochemicals produced during exercise, one participant journaled the following:

> I was introduced to brain-derived neurotrophic factor or BDNF. I had never heard of this before. Its production is stimulated by aerobic exercise, and it creates the cognitive and emotional benefits of exercise. Any kind of aerobic exercise produces it, but the more intensely you exercise, the more it is produced.

Another participant journaled a stream of consciousness about what she learned about Alzheimer's disease in class that day:

> Learned several facts about Alzheimer's disease (AD)—AD deaths up 89% (since 2000)—AD has excess accumulations of 2 proteins: Beta amyloid and Tau. Tau create tangles and Beta Amyloid is a sticky protein that prevents communication between brain cells. Estrogen plays a large role in brain health … 2/3 of all AD patients are women. Aerobic exercise increases BDNF and reduces risk of developing AD by 45%!!!!—reduces progression of AD.

Boosted Desire to Increase Physical Activity/Exercise. The data suggested that when basic details about exercise's benefits to mood, cognition, and brain health were sprinkled throughout class, the information felt personal. Furthermore, it increased their perceptions of exercise's usefulness and importance to emotional and cognitive well-being in their extended families. This important finding showed that usefulness and importance were two indicators of intrinsic motivation, and intrinsic motivation was the strongest sustainable motivator of physical exercise (DiDomenico & Ryan, 2017; Segar et al., 2011). One statement summed sentiments of the middle- to older-aged participants:

> Well, it just really makes me want to keep doing it as I "turn calendar pages" (as you call it). I used to be like … in your 20s, you go do a little run, or you know, lift weights for five seconds, and you know, you see a little muscle pop up and you, you can see the change in your body rather quickly in your 20s. And now that I'm 60, it doesn't, you know, the sense, you don't get the same, you know, visually, …. you can't see externally what I used to be able to see …. if that makes any sense. But I'm so glad it'll make me keep doing it, realizing that it also helps my brain continue to not decline.

Another participant noted that the neuroscience lens offered a more gratifying reward than some of the aesthetic extrinsic rewards used as motivational content in regular exercise classes and fitness culture:

> I found the neuroscience lens really motivated me to make sure that I came back to class on a regular basis. It's fun to learn something new and it's fun to have extra motivation to complete the exercises to the best of my ability. Rather than focusing on things such as getting skinny for swimsuit season or burning calories, so I could eat Halloween candy like other classes do.

The youngest participant in the group (age 18) expressed worry about the mental health of her peers. She wished that this information had been included in her high school and more people talked about mental health because so many of her friends were hurting. In the focus group, she described how she felt the holistic view of the B-BFF would be beneficial to younger demographics:

> I think focusing on that benefit [mental health], would help draw more young adults to work out classes to think of it not as "you are making yourself super fit, and helping your muscles and your bone," but to make sure your *selves* are mentally fit. And, you know, it'll make your mental health feel better—better memory and better focus. Things like that, I think, are really beneficial for my age range. And, yeah, those younger and older than me.

Concrete Connection Made Between Mental Health and Bodily Movement. Participants disclosed they did not readily associate mental health with exercise before the study. However, after participation, this feeling was no longer the case. One member described that "learning the neuroscience" allowed for a biological comprehension of the "systems" interaction between mind, brain, body, and environment. The scientific nature of understanding, such as about "neurotrophins in the blood stream triggering anxiety," made them "feel more justified for their reactions and less 'crazy.'" One person stated the following:

> Up to now I really only thought of exercise as keeping physically fit. Now, I know the reason it makes me feel good …. my brain chemistry gets a lift. It makes me want to learn more about why I enjoy exercise and my husband does not.

Another participant eloquently captured the group's overall sentiment of neuroscience's contribution to their new viewpoint: "I see that not all the benefits of exercise are visible, and that perhaps the ones most beneficial are invisible, but measurable."

Increased Perceptions of Exercise's Immediate Usefulness. Participants clarified how using neuroscience facts to connect movement to mood. They were consistently asked, "How are you feeling?" This question made them cognizant of how movement made them feel better. This language reinforced exercise's usefulness for enhancing their moods immediately if they were feeling stress or mood problems. This immediacy perception of reward aligned with the neuroscience of sustainable behaviors (DiDomenico & Ryan, 2017; Segar et al., 2011). Some researchers suggested that exercising for health goals too far in the future (e.g., heart health) might be too abstract to feel and too expendable when placed into the queue of daily competing goals requiring immediate attention (Lee et al., 2016; Segar et al., 2011). If people can immediately access and perceive the benefits of their exercise class, a walk outside, or bodily movement breaks during computer work, this action increases the probability of adhering to physical activity (Hall et al., 2018).

The data revealed the neuroscience information—when explicitly connected to prompts that cued exercisers to "notice and compare their moods" before and after class—engendered a feeling of "immediate reward." Participants said, "It makes the workout feel more effective and rewarding" and "useful in my life," because the neuroscience knowledge made exercise "feel like it addresses [my] quality of life." One interjected that neuroscience knowledge made her feel like she was "learning more about [her]self." Lastly, all agreed the neuroscience information in class related to exercise and daily life, "felt really useful beyond the class," and spoke of personal issues with bouts of mental unwellness or family members with cognitive decline and Alzheimer's disease.

Increased Perceptions of Exercise as a Cognitive Pursuit. The most unexpected yet interesting and impactful theme emerging from the data was a post-participation shift toward perceiving exercise as "more intellectual" or cognitive pursuit than previously perceived. One person noted that she used to feel like exercise was selfish and the only reason to exercise was to "look good in pants. Now it doesn't feel selfish anymore to take this time for myself." Another also used the word "selfish," saying that "all through life I was made to feel selfish [when exercising]—like I should be doing something more productive." Her mother would look up from reading the newspaper as she went out for a run and would sarcastically say, "Well, I wish *I* had time to go for a run." Others chimed in about how previous beliefs included that there were "physical people" and then there were "intellectual people." One stated, "It was very black and white." The implicit message was that physical activity was not a "smart" activity. Consequently, they should spend their time in more cognitively productive pursuits.

Participants reported that the neuroscience knowledge connecting the mind, brain, body, and environment created a new sense of importance of the body's role in cognition and mood. One woman laughed saying she now felt that "you aren't just a little brain being driven around by a body and you aren't just a body that happens to have a brain. You're both at the same time!" Interesting dialogues in the focus group and survey responses indicated that in their life's journeys, most had encountered strong sentiments amongst people who viewed exercise as either an unintelligent pursuit or not as important as "matters of the mind." Considering their newly learned neuroscientific information, the exercisers now saw this binary as a false dichotomy: "Learning about the effect of exercise on the mind-brain helped connect the dots and give real scientific backing to things." One stated the following:

> I come from a family of mostly doctors who view yoga and that kind of thing is kind of "woowoo" a little bit, "hippie dippie" a little bit, "fringe" a little bit. So, it was really nice to see the science back up what had previously been, for me at least, an abstract experience.

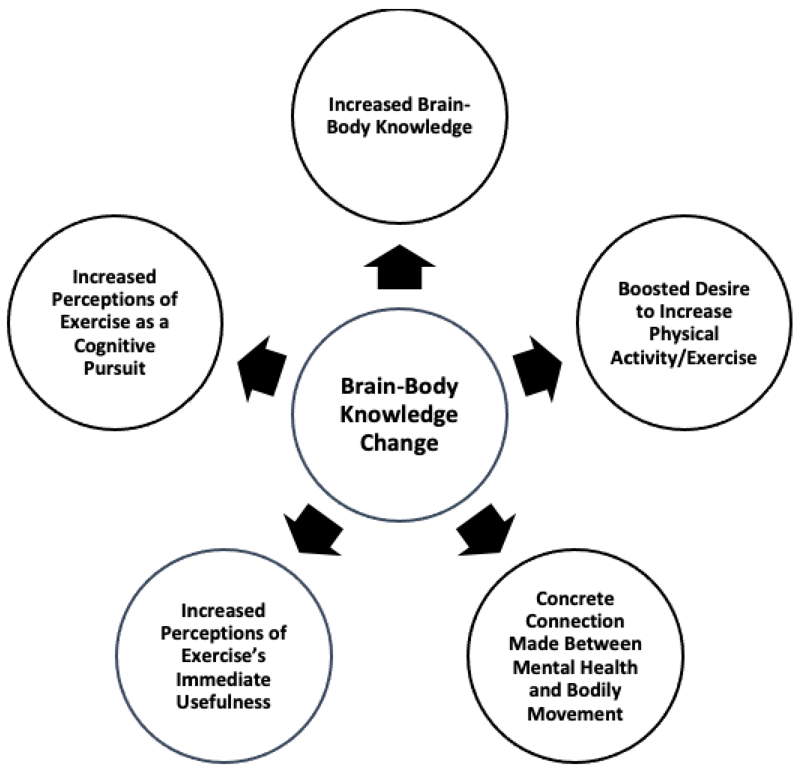
One participant said that she had grown up being told that exercise was for people not smart enough to find something better to do, so "learning this stuff makes me feel like I'm not wasting time. It shows me the value of what I'm doing. It's reinforcing." Another added that "this class structure feels engaging and mentally stimulating. I feel fed and engaged throughout."

Prior beliefs (or beliefs foisted upon them) of the primacy of mind over body sentiment aligns with beliefs in Cartesian dualism (Forstmann et al., 2012; Hamilton & Hamilton, 2015), a contributing factor to this study's problem of practice. Dualism entails perceiving that the thinking mind and the body exist as two separate entities, with the mind conceived as holding primacy of the two. The educational and workplace implications of these findings are that educators, parents, and work supervisors who espouse the notion that the body has no bearing on the mind will likely not create a physical, social, or cultural infrastructure that allows for adequate bodily movement. Furthermore, people like those described in the quotes—who de-intellectualize body movement and view people as disembodied "brains on a stick" (Hrach, 2021, p. 20)—are complicit in impeding multiple dimensions of well-being including physical, emotional, social, cognitive, and lifestyle (Beauchemin et al., 2019). This issue impacts individual health, healthcare systems, and economics (Chen et al, 2018).

The findings in this study detail that participation in the classes instructed using the B-BFF changed group exercisers' knowledge about the brain-body benefit of exercise in five specific ways. Participation (a) increased their brain-body knowledge, (b) boosted their desires to increase their physical activities/exercises, (c) concretely connected their mental health with bodily movement, (d) increased their perceptions of exercise's immediate usefulness for mood, and (e) increased their perceptions of exercise as an "intelligent" pursuit. The overarching implication of this study outcome is that connecting brain-body knowledge and exercise *during* the exercise instruction increased intrinsic motivation to exercise and a concrete sense of mind-body unity. Figure 5.3 depicts how participation in the intervention changes knowledge of the benefits of exercise on the mind-brain.

Figure 5.3

Participants' Perceptions of Knowledge Change



Note. Participants noted how participation in the B-BFF changed their knowledge of the benefits of exercise on the mind-brain.

Intrinsic Motivation. Intrinsic motivation is a predictor of exercise participation and sustainability (Segar et al., 2011). Consequently, the necessity of understanding intrinsic motivation in the context of group exercise participation using the B-BFF generated RQ5: In what ways did participation in this intervention change participants' perceptions of their intrinsic motivation while exercising? This section reports the study findings on intrinsic motivation by subscale—competence, usefulness, reappraised tension, relatedness, importance, choice, and enjoyment (McCauley et al., 1987).

Triangulated data from post-class journals, post-participation differentiation surveys, and post-participation focus groups reveal that everyone reported increased perceptions of the seven antecedent subscales of intrinsic motivation during study class participation. Furthermore, the data detail which methods in the B-BFF related to these perceptions. These findings are meaningful because intrinsic motivation results *from* participation in an activity (Ryan & Deci, 2020). Intrinsic motivation results from the interaction between human needs and incentives. Regarding group exercise, this finding suggests that a participant feels intrinsically motivated when the available incentives in class lead to the satisfaction of their needs. The following study data expose how the interaction between exercisers' needs and the incentives generated by content and methods framed by the B-BFF result in perceptions of competence, exercise usefulness, reappraised tension, relatedness to one another, importance of exercise, exercise choice, and exercise enjoyment.

Increased Perception of Competence. Participants described two specific aspects of the B-BFF teaching methods that led to them perceiving a higher level of competence than they ordinarily felt in traditionally instructed classes. The first was imagery, prop, and metaphor use; the second was the unique and constant use of movement progressions and options. Making the connection between their movements and the imagery cues helped them "self-correct," feel that they could "do movement correctly and in a more effective way," and "know exactly what the instructor was referring to." Visual cues helped them to "place body parts better," "remember the image and how it felt for the next time" they executed it, and engendered "confidence." One participant asserted, "It makes me feel like I always know what I'm doing." Another said, "I'm not left wondering if what I'm doing is correct." One participant described the visual cues as feeling like "protection." Visual cues felt "entertaining" and "fun" which contributes to the most predictive subscale of intrinsic motivation—enjoyment.

The unique and constant cueing of movement progressions and options was the second most cited method leading to a feeling of competence. This B-BFF method was also cited as a highly differentiated feature from regular group exercise classes and is potentially the most important finding of this study. All used the word, "control," to describe how the B-BFF methods made them feel. They reasoned this feeling with the following statements: "I feel confident, because there is never pressure," and "options let me feel independent and like a contributing member of the class who will make smart choices about challenging myself but respecting myself within the context of the class." One participant perceived the progression options as the following: "I feel in control of my own body. *I'm* in charge. *I* call the shots." Descriptions on the freedom to modify options that left them feeling in control and were one of the most important findings of this study. Appendix R presents several more quotes for readers to see the findings.

Increased Perception of Exercise's Usefulness. Findings suggested that the three B-BFF elements contributing to participants' increased perceptions of exercise's usefulness were (a) the neuroscience content, (b) the inclusion of exercise's benefits to multiple dimensions of well-being, and (c) the explicit messaging of exercise benefits while exercising. Members reported that because the B-BFF content and methods focused on more dimensions of well-being than in regular exercise class experiences, their perceptions of exercise's usefulness increased. Participants noted was how a consistent messaging of exercise's benefits on emotional, cognitive, social, and lifestyle well-being not only made exercise feel more useful in their lives but was also immediately perceived as a rewarding experience.

One noted the following of the constant class reminders of exercise benefits: “It feels like an immediate reward. It makes me want to come back even when things are a little bit difficult. I carry those messages into my decision to exercise.” This perception of immediate usefulness finding is important because immediately perceived intrinsic rewards correlate with exercise adherence and sustainability (Segar et al., 2011). As such, this finding suggests that content, methods, and messaging in the B-BFF support exercise adherence and sustainability. These findings also suggest that although group exercisers are implicitly aware of general exercise benefits, it appears that *explicitly* hearing about specific multidimensional exercise benefits *while* exercising increases their perceptions of exercise’s immediate usefulness.

Participants mentioned that they appreciated being given “many reasons to exercise beyond ‘swimsuit season is coming.’” One illustrated this sentiment by saying that hearing constant reminders during exercise sessions about all the ways exercise enhances her life made her feel less discouraged when she “doesn’t see outward results” because she could also “focus inward on mind-brain-body health.” Lifestyle usefulness landed on the exercisers as feeling more “empowering” and “motivating” when exercise “isn’t all about losing weight but about feeling better right now.” Lastly, everyone agreed that exercise’s usefulness was not discussed in regular exercise classes, that the B-BFF “sprinkles” of “usefulness reminders throughout class makes remembering benefits “stick,” and that explicit class reminders “feels like a means to an ongoing future of general integrated well-being.” One participant said, “I take this to my family.” Another said, “Hearing the information helps to see the value and the relationship [of exercise] to my mind and my life.” Appendix S includes more quotes that support ways the content, methods, and messaging in the B-BFF have led to increased perception of exercise's immediate usefulness.

Increased Skill in Cognitively Reappraising Tension. Participants agreed that methods and imagery in the B-BFF taught them to think about creative ways to reframe the tension felt in their bodies during bouts of exercise. Reframed tension positively affected their exercise experience. Participants reported, "It allows me to redirect my energy to where it's needed." and "Learning and hearing these visualizations allows me to carry them into other classes and life activities." Thus, they noted that being coached on how to cognitive reappraise tension helped them with "relaxing," "focusing," "movement competence," "posture," and a sense of "getting more" from their workouts.

The members indicated that they had "not previously been taught to notice sensations" in their bodies and that being explicit with this technique "fostered intentionality and agency." The novelty of learning how to "juxtapose" or hold tension in one area of the body while relaxing another felt like "a metaphor for life." They contrasted how cues from regular classes, such as "relax the jaw," now seemed less embodiable as the imagery cues in the B-BFF. One participant described this contrasted feeling: "It's easy to tune out [the instructor who says] 'relax the jaw' than [the instructor who says] 'release the tension like butter melting on warm toast.' Besides, the thought of tension melting aways sounds so enjoyable, and it is."

The important implication of this finding according to affective neuroscience is the changes in the feelings of pleasure-displeasure may be the main path that homeostatic perturbations (disturbances in the equilibrium state of the body) enter a person's consciousness (Hartman et al., 2019). Described another way, when exercising, the way a person perceives the changes happening in the body shapes the emotion attached to the change, even the sense of physical fatigue. Consequently, the ability to cognitively reappraise or reframe tension in the body during bouts of exercise affects future participation. Exercisers all reported an increase in enjoyment when able to reframe tension. Appendix T contains more quotes supporting this finding.

Increased Perception of Relatedness to Other Class Members. Study volunteers reported an increased relatedness to other class members. The primary B-BFF method attributed to this increase was the intentionality of the instructor to consistently include in-class opportunities to talk with other class members and the instructor. Reliably, at the beginning of each class, the instructor invited everyone to scan the room and introduce themselves to someone they had never seen, met, or talked to before or someone with whom they had not chatted in a while. This quick informal invitation to chat was repeated during a music or equipment change. At the end of class, all were informally invited to meet and greet in the hall or building foyer if they had time. There was group consensus that feeling connections to the instructor and other members were powerful motivators to return.

This small gesture made a large impact, with exercisers indicating they now felt “linked.” Even when they saw one another out in the community, such as in the grocery store, they reported how they now struck up conversations. Participants stated the following:

- “These are now friends.”
- This social connection “makes me want to come, rain or shine.”
- It has a “huge positive impact on my day.”
- It is “my favorite part of returning.”

These phrases illustrate the importance placed on a sense of belonging and connection. A need for social connection and belonging was something they had craved after COVID-19 lockdowns. When groups of learners gather to explore and grow together, the success of the group experience is contingent on the quality of the relationships built among group members (Roos & Borkoski, 2021). Considering these findings, the social cohesion methods in the B-BFF appear to foster increased perception of relatedness to other class members. Appendix U contains more supporting quotes.

Increased Perception of Exercise Importance. Incorporating neuroscience and the mind-brain benefits into the group exercise classes increased participants' perceptions of exercise's importance. Even the most experienced members indicated that this new knowledge "validated and further encouraged" them to "continue nudging themselves to attend." They enjoyed "being taught" information while they exercised. Participants believed that the information on "neuroplasticity, neurogenesis, and BDNF" added to their perception of exercise's importance feeling like exercise was "far more important" to them. Their brains were perceived as a body organ that impacted their quality of life in an irreplaceable way citing that unlike the heart, kidneys, lungs, and other organs that had medical options for mechanical interventions or even transplants, the brain seemed to be in a more precarious league of its own.

Brain health was perceived as impacting well-being in a critical and immediately perceptible way. Cognitive decline was viewed as a major blow to lifestyle wellness, independence, and family relationships. The idea of exercise's protective role in cognitive decline, stress, anxiety, and depression felt immediately accessible and important to all age groups in the study, but (unsurprisingly) *extremely* important to older exercisers. Appendix V has more quotes illustrating how the B-BFF content increased perception of exercise importance.

Increased Perception of Movement Choice. Consistent usage of the phrase "all movement counts" and progression and movement options were the key B-BFF contributors to increased perceptions of movement choice. Having movement choices was cited as a crucial factor to their exercise adherence, sustainability, and enjoyment—which aligned with intrinsic motivation research (DiDomenico & Ryan, 2018; Ryan & Deci, 2020; Segar et al., 2011) and supported B-BFF teaching methods. One participant noted, "I am more willing to come to a class where I can participate at the level, I need that particular day without feeling I have done less."

Progression and movement options combined with being reminded that "all movement counts" were key B-BFF components causing members to jettison prior "all or none" thinking. Such thinking had often affected their decision to attend class and how they perceived movement/physical activities done outside of class. Findings indicated that this new way of thinking about exercise—connecting feeling and thinking to make movement choices—felt radical considering what they previously believed. They felt "ownership" of their movements and "less self-conscious" about making choices in this new "judgement-free" mental space.

In comparing how their increased perception of movement choice experience differed with choice experiences in other group exercise class experiences, participants used emotionally charged words: "shame," "guilt," "insecurity," "lesser," and "embarrassment." Findings showed that being able to make movement choices that did not carry unspoken stigmas of being "unable to keep up" or "lower" felt "empowering" and "respectful" of people's diversities and individual needs and wants. An interesting finding in these data that might seem counter-intuitive, even unsettling to a fitness culture accustomed to using cues (e.g., "push harder, stronger, longer") to motivate people, was that offering intensity choices did not cause exercisers to "slack off" or shortchange themselves in any way. Conversely, they reported that when given the agency to choose intensity levels throughout the class, the ability to "pull back" in certain places made them feel like they could "push" stronger in others. The key was that paying attention to their interoceptive feedback kept them in a perceived Goldilocks Zone that led to feelings of enjoyment and competence in physical, emotional, cognitive, and social domains. Appendix W includes quotes that support the numerous ways movement choices in the B-BFF classes have affected perceptions in multiple domains of well-being.

Increased Perception of Enjoyment of Movement. All participants reported an increase in their perceptions of enjoying movement. This crucial finding supported B-BFF teaching content and methods. Prioritizing enjoyment of exercise and encouraging pleasant physical activity improves the likelihood of future physical activity through automatic motivational processes (de Oliveira Calado et al., 2022). One participant's comment summed up the group's perceptions:

> This way of teaching recognizes us as whole individuals rather than just physical bodies that need to be trained. Who wouldn't want to return to an activity or class where they feel inspired, educated, valued? This is the kind of class that becomes part of my routine because I enjoy it—it is not just exercise.

Because enjoyment experience is the foremost predictor of intrinsic motivation, the data supports the study's second proximal outcome—increased intrinsic motivation to exercise.

A variety of class aspects that sparked exercise enjoyment included changing up movements; the accepting manner of instruction; the constant explanations about "why" they were doing moves; the creative and sometimes silly imagery; the invitation to "play;" slogans like "giggle when you wiggle," "all movement counts," and "you were successful the minute you walked through that door;" being taught to take notice of "how good they feel" during and after the workout; being offered a new dimension of learning about exercise and its connection to mood and cognition, feeling "safe," feeling "accepted," feeling "creative;" experiencing “novelty;” experiencing new challenges; being given permission to laugh and “not take everything so seriously even if it’s serious work;” the participant versus instructor focus; the “radically different” environment; and the ability to just “be themselves” with a group of friends or “friends they just haven’t met yet.” Appendix X contains in-depth quotes lending support to this study’s findings on enjoyment.

In summary, participants reported feeling increased levels of all seven subscales of intrinsic motivation—competence, usefulness, reversed and reappraised tension, relatedness, importance, choice, and enjoyment. Data identified the attributes of the B-BFF’s neuroscience content, methods, and cues that had contributed to increased perceptions of each subscale. Increased intrinsic motivation outcomes reinforce that the three B-BFF domains—knowledge, intrinsic motivation, and mind-body unity—work in tandem to produce this outcome. The following outcome section includes findings about mind-body relationship perceptions.

Mind-Body Relationship Perceptions. Forstmann et al. (2012) posited that dualistic beliefs correlate with less engagement with healthy behaviors. As such, it was essential to understand if B-BFF content and instructional methods fostered mind-body unity perception. The study’s theory of treatment hypothesized that B-BFF content would proximally increase exercisers’ perceptions of mind-body unity, which would distally lead to multiple dimensions of well-being by way of increased health-supportive behaviors, including increased physical activity. Therefore, the sixth and final research question guiding this study was the following: How did the intervention change participants’ mind-body relationship perceptions?

Triangulated results from journals, post-participation surveys, and focus groups showed that intervention participation increased perception of group exercisers’ mind-body unity. Three distinct categories emerged from the data as the contributing factors for this perceived increase.

The first contributing factor was that the B-BFF neuroscience content, imagery use, and instructional methods made the abstract mind-body concept feel more concrete than before. The second factor was that the B-BFF neuroscience content, imagery use, and instructional methods heightened participants' attunement to bodily sensations and feelings. The final contributing factor was that the B-BFF neuroscience content, imagery use, and instructional methods expanded ways for them to think about body movement and exercise. The next subsections provide details and supporting data for each of these categories.

B-BFF Content and Methods Made the Abstract More Concrete. Participants reported that making the formerly abstract concept of mind-body more concrete enabled them to perceive a closer relationship between their physical actions and their mental states. Closing a perceived gap between the physical and mental, or, the body and mind, is a primary objective of instructional methods in the B-BFF's second domain—mind-body unity. They unanimously identified two primary catalysts in B-BFF instruction that facilitated making the abstract mind-body concept more concrete—the inclusion of neuroscience content and the prolific use of imagery cues in movement instruction.

Neuroscience knowledge sprinkled throughout allowed them to not only mentally make general roadmaps between aspects of their biology and their psychology, but also, between their brains and their environments. One person disclosed that "hearing about it [the neuroscience facts] while doing it [exercising], feeling it, and thinking about it" made the mind-body connection tangible. Another reported she now thought of exercise as a "bio-hack" for her mood. Hearing and thinking about the neuroprotective proteins created in the brain during exercise, then how this neuroprotection affects mental states and quality of life, made the mind-body term feel concrete and not as "woo woo" or "hippie dippie" as previously thought. One participant offered, “I understand myself better now—bodies are designed to move.” Another offered that the neuroscience inclusion “helps me to be more aware of the interconnectivity between my thoughts, emotions, and bodily movements.”

The second catalyst to making the abstract concept of mind-body more concrete overwhelmingly mentioned in every data collection tool was the use of imagery cues throughout movement instruction. The group communicated that the use of props and imagery “taught,” then “reinforced” where they could “notice the feelings” in their bodies (e.g., internally squeezing a grapefruit sitting in the cradle of the hips or extending a contracted leg with the feeling that one is trying to ring a doorbell with a big toe, but the doorbell is just an eighth of an inch out of reach).

B-BFF Content and Methods Heightened Attunement to Bodily Sensations/Feelings. The second contributing factor to emerge from the data offering potential explanation for the reported increase in mind-body unity perception was a heightened attunement to bodily sensations and feelings. The data illuminate that the consistent inclusion of neuroscience facts and imagery cues in the B-BFF taught group exercisers how to use body sensation awareness to cognitively reappraise and self-regulate during exercise. This explicit instruction in the class also provided tools for them to use in other exercise classes, stressful situations, and in situations where balance, core stabilization, or shoulder stabilization helped them avoid injury or enhance quality of life.

The study classes felt like a place to learn and practice for their “real world” lives. The analogy of a “dress rehearsal” for the “show” was mentioned to compare B-BFF exercise instruction with real world needs. Participants described how they were now creating their own metaphors and imagery with their bodily sensations and using breathing techniques learned in class when they felt their heart rates accelerating or breathing becoming shallow during stressful life events. One member described how using imagery gave her an "internal consciousness" of her posture. Another explained how imagery helped her "internalize" her movements—being "intentional" about thinking about what she was "feeling" in her body and "where she was feeling it." Being attuned to their *bodily* feelings lead to *cognitively* processing their *emotional* feelings in the moment.

These heightened attunement findings have important practice implications. The first implication is that people with greater interoceptive awareness experience physical tasks as less fatiguing (Greenhouse-Tucknott et al., 2022). Correspondingly, this finding suggests that teaching methods in the B-BFF mind-body domain may lead to the distal outcome of increased physical activity levels. The second practice implication is that some research suggests that peoples' sensitivity to interoceptive signals (e.g., feedback from the body including heartbeat, breathing, muscle tension) correlate with their capacities to regulate emotions and subsequently, their susceptibility to anxiety and depression (Furman et al., 2013). People with depression often display poor interoceptive awareness; conversely, people with anxiety are attentive to interoceptive signals but may not read (make meaning of them) them accurately (Slotta et al., 2021). The implication for this study is that content, methods, and messaging in the B-BFF that help group exercisers understand their interoceptive signals support better mental health outcomes—a distal outcome of the study's theory of treatment.

B-BFF Content and Methods Expanded Ways to Think About Exercise. The third contributing factor emerging from the data that may explain why participants' increased perception of mind-body unity was that the B-BFF content, methods, and messaging offered them a new and broadened way to think about exercise. Participants noted that content and methods in the study consistently served all dimensions of well-being. Data illustrated how the lens of neuroscience served as a novel teaching prism capable of refracting well-being into meaningfully teachable physical, social, spiritual, emotional, cognitive, and lifestyle dimensions in a group exercise class. One participant documented the following:

> Seeing the connections between physical and mental health from a biochemical/neurological standpoint helped integrate how I view my life. Exercise isn't something separate or chore based, like walking a dog. Come to think of it, that's how I used to look at group exercise—a chore … I didn't really think of it as involving my mind at all.

Another added, "Now I think about returning to class for my mental health and to counteract stress. Learning the science made it feel more connected." Another pondered, "I never really thought of the reciprocal relationship between brain and body. This is new."

Data also showed that the lens of intrinsic motivation served as a novel teaching prism capable of refracting basic human needs into meaningfully teachable antecedent subscales—competence, usefulness, reappraised tension, relatedness, importance, choice, and enjoyment. Teaching exercise with these intrinsic goals in mind facilitated unified mind-body perceptions and novel ways to think about exercise. One participant's response was representative of the data:

> It kind of feels a bit like you're celebrating what you're currently doing, which gives that little boost to wanting to repeat it as well. Because when we're hearing about all these good things we're doing, and we're there doing them, it's like, "Oh, well, yay! I'm doing that!" It's immediate reinforcement.

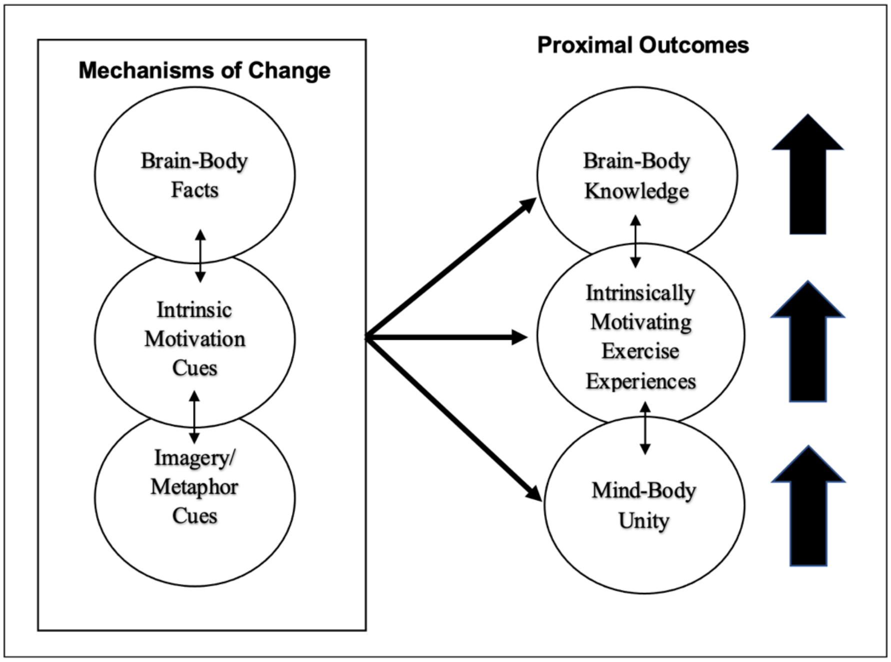
In summary, this finding about engendering new ways to think about exercise, physical activity, and body movement theoretically suggest that content and instructional methods in the B-BFF can lead to the enculturation of exercise for multiple dimensions of well-being—one of the study's distal outcomes.

Conclusions

Several conclusions can be drawn from this study. This study's theory of treatment hypothesized that in the context of group exercise, intrinsic motivation-oriented imagery and metaphor cues and brain-body information delivered in class would serve as interventional mechanisms of change. Grounded in embodied enactive cognition, the self-determination theory of intrinsic motivation, neuroscience, and multiple learning theories, these mechanisms would subsequently produce three proximal outcomes—increased brain-body knowledge, increased intrinsically motivating exercise experiences, and an increased perception of mind-body unity. The study results adduced evidence in support of this theory as these mechanisms—central to the core of the B-BFF—led to all three proximal outcomes. The study results illustrated that the content and methods in the three domains of the framework—brain-body knowledge, intrinsic motivation, and mind-body unit—worked in tandem like gears, with the mechanisms in each domain strengthening and reinforcing changes in the others. Figure 5.1 conceptually illustrates the relationship between mechanisms and outcomes.

Figure 5.4

Conceptual Framework for Theory of Treatment Results



Note. The conceptual framework depicts how the interacting mechanisms produce outcomes that are also interacting. These relationships highlight how the interactions between the three domains of the B-BFF strengthen one another.

Differentiating methods and content in B-BFF-instructed classes (compared with regular group exercise experiences) increased brain-body knowledge, all seven subscales of intrinsic motivation, and perceptions of mind-body unity. The group exercise class—reframed as an educational and performative space as opposed to a performative space—led to group exercisers' curiosity, creativity, high engagement, new sense of "real-life" applicability of things learned in exercise class, and boosted desires to increase physical activity outside of class. Asset-based, aesthetic-free instructor language, and mental wellness as the foundation for the class—as opposed to the usual physical starting point for exercise instruction—led participants to new exercise perspectives in practice. This new perspective was called "validating," "empowering," and "freeing," with more immediately perceived exercise motivations and rewards including lifestyle, emotional, social, spiritual, and cognitive. Lastly, embedding consistent opportunities for group exercise members to meet and greet one another as infrastructure in each class led to increased perceptions of relatedness, operationally defined as a meaningful connection with others in a safe and secure space for exploration and self-expression (DiDomenico & Ryan, 2017).

Refraining from leveling movements as beginner, intermediate, and advanced, instead rebranding modifications as options and progressions to cycle through (using their interoception), strengthened participants' perceptions of competence, choice, and control over their bodies. Sensing control over their bodies was one of the most crucial findings of the study. A sense of control with the appreciation of judgement-free choice was also the most emotionally charged finding, with women becoming visibly emotional and either tearful or on the brink of tears when talking about previous negative experiences with control and choice.

Using the phrase "all movement counts" consistently and continually throughout class and offering "movement snacks" for later in the day counteracted "all-or-none" thinking about physical exercise and activity. This catchphrase created a new sense of appreciation for what people *could* do as opposed to focusing on what they could not. The new aggregate way of thinking about bodily movement also made exercise seem less daunting, more attainable, and more sustainable than before. "Counting all movement" was valuable because it allowed exercisers to "give themselves permission" to find joy in their movements (as opposed to thinking of it as "all business"), seeking out movement they enjoyed.

By making small, basic, but consistent connections between the brain and behavior, the neuroscience content in the B-BFF served as a prism for participants to refract well-being into its physical, social, spiritual, emotional, cognitive, and lifestyle dimensions. Brain-body knowledge increased; more importantly, the knowledge cocreated in practice served as the bridge between mental and physical health and mental health and bodily movement. Basic neuroscience information served as a practical catalyst toward a concrete understanding of the phrase, "mind-body unity." Members disclosed how infusion of neuroscience knowledge helped them view exercise as more multidimensionally useful than previously thought. Understanding the "why" behind exercise and movement *while* executing those movements solidified their mind-body connections. Lastly, participants reported that including brain-body content in the class caused them to perceive exercise as a cognitive and physical pursuit. Thinking about exercise benefitting their cognition, mood, and quality of life expunged old stereotypes about exercise being a less cerebral, add-on pursuit of lesser cognitive value. Participants attributed this change of thinking to better understanding the inextricable entanglement of mind, brain, body, and environment.

Embedding imagery cues, metaphors, and props in tandem with neuroscience information facilitated experiencing the subscales of intrinsic motivation while exercising. Combining these methods heightened exercisers' abilities to notice sensations in their bodies. The researcher included prompts: What are you feeling? Where are you feeling it? What might it mean? What movement adjustment might you make? These promoted connecting bodily feelings with emotions and cognitively reappraising physical or emotional tension. Connecting cognitive activity with physical movement engendered feelings of competence, choice, and control while exercising.

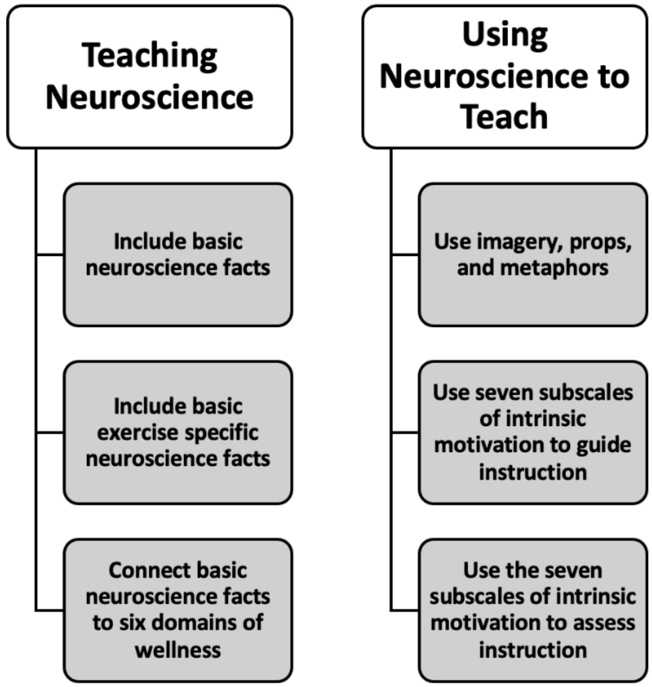
In summary, two key mechanisms of change emerged from the data as essential to reaching the study's proximal outcomes—*teaching* basic neuroscience in group exercise classes and *using* neuroscience to inform instructional practices. In the former, the inclusion of basic neuroscience information turned out as essential for connecting participants' minds, brains, bodies, and environments with brain changes. The data showed that disseminating and co-constructing knowledge *while* participants were exercising (e.g., hearing, doing, experiencing, and feeling) were vital to study outcomes. Neuroscience served as a tangible path to broaden thinking about health in multiple dimensions. Metaphorically speaking, neuroscience was the prism allowing health to be refracted into physical, social, spiritual, emotional, cognitive, and lifestyle domains. Each domain could offer group exercise instructors new opportunities to adapt methods that would reach beyond the usual physical domain of exercise instruction.

In the latter mechanism, using neuroscience to guide instructor methods within the three framework domains affords group exercise instructors tangible way to broaden their instructional methods to utilize the science of learning and rewards. Although knowledge can give reason to value exercise, knowledge is insufficient to change behaviors alone (Arlinghaus & Johnston, 2018). Teaching in ways that align with how the brain works increases the probability of changing behaviors through improving exercise participants' brain-body knowledge, creating intrinsically motivating exercise experiences for each participant, and unifying mind body perceptions.

Methods in the B-BFF align with advances in neuroscience that assert that humans experience emotions first from their experiences in the world and then from make meaning of those experiences (Damasio, 1994; Hardiman, 2012). This feel first, think second order has implications on instruction, as human emotions must be considered as a valuable starting part of cognition (Pezzulo & Cisek, 2016). As such, the B-BFF targets emotions as the foundational target of instruction. Figure 5.5 illustrates these two key mechanisms of change, and the final sections of this dissertation contain a discussion on the research and practice implications of this case study.

Figure 5.5

Two Key Mechanisms of Change in Brain-Body Fitness Framework Intervention



Note. Teaching basic neuroscience in group fitness classes affords the opportunity to concretely connect the mind, brain, body, and environment to the physical, social, spiritual, emotional, cognitive, and lifestyle domains of wellness. Using neuroscience to inform teaching methods in group exercise classes affords the opportunity to utilize the science of learning and rewards to improve participant knowledge, mind-body unity, and intrinsically motivating experiences with physical activity.

Discussion

The primary aim of this study was to address the overarching problem of the rising incidence of diseases of the mind-brain (Hidaka, 2012; Steinberg & Daniel, 2020; WHO, 2020b). Exercise provides protective brain benefits and can mitigate depression, stress, and anxiety (Alty et al., 2020; Basso & Suzuki, 2017; Béland et al., 2019; Blumenthal et al., 2007; Budde et al., 2016; Frodl et al., 2019; Hayes et al., 2015; Lee et al., 2019; Li et al., 2019; Mikkelsen et al., 2017; Trivedi et al., 2011). However, one must exercise to receive exercise mind-brain benefits. Problematically, perhaps relationally, as diseases of the mind and brain have increased, the population's physical activity in developed nations have declined (Conger et al., 2021). To make matters worse, standard exercise instruction, marketing, and messaging may unintentionally be contributing to exercise dropout, unsustainability, and a distaste for exercise by ignoring research in evolutionary biology, psychology, and affective neuroscience.

This needs assessment concluded that group exercise instructors were open to scaffolding mind-brain health and wellness into classes but lacked a teaching framework to guide this endeavor. To fill this gap, the B-BFF was researcher-constructed using interdisciplinary literature from neuroscience, kinesiology, the learning sciences, and psychology. The B-BFF was then tested in group exercise classes at a branch of a large southwestern metropolitan YMCA.

The unique aspect of this teaching framework was its dual use of neuroscience as a mechanism of change. The first use of neuroscience was educational—disseminating basic neuroscience facts and co-constructing them with exercisers' previous knowledge and experiences. The B-BFF scaffolded neuroscience information into group exercise classes to increase participant knowledge of (a) the relationship between the mind, brain, body, and environment; (b) health as a multidimensional construct; and (c) exercise benefits on the mind-brain. Findings supported that the B-BFF met these objectives in this group of exercise participants.

The second creative use of neuroscience in the B-BFF was methodological—using neuroscience to shape instructional methods, teaching cues, and class messaging. The neuroscience of imagery (Abraham et al., 2019; Franklin, 1996; Nanay, 2020) embodied enactive cognition (Di Paolo et al., 2017; Gallagher 2017) and intrinsic motivation (Di Domenico & Ryan, 2017; Ryan & Deci, 2000) to guide regular kinesiological ACSM best practices in a manner that aligned with current understanding about how the brain worked and learned. As such, the B-BFF contributes to neuroeducation initiatives that expand, pilot, and prototype inventions that link research and educational practice.

Findings detailed that in this group of volunteers, the combined use of visual and mental imagery to teach exercise movements led to stronger perceptions of mind-body unity. Moreover, adding neuroscience information into classes offered a new way of thinking about the biological substrates of mental activities, the relationship between movement/exercise and the mind-brain, and the ways the brain would change in response to interactions in its environments. This information helped group exercisers bridge the gap between their minds, brains, bodies, and environments, indicating that a B-BFF-framed class would engender embodied enactive cognition in its members (Di Paolo et al., 2017). The reason for this experience may be that people can more easily access the immediate quality of life benefits of exercise on mood and thoughts than biomarkers of fitness like blood pressure, body mass index, and cholesterol (Segar et al., 2011). This experience has health implications because mind-body unity correlates with engagement in healthier lifestyle behaviors (Forstmann et al., 2012). Consequently, the inclusion of exercise neuroscience in physical fitness education may serve as a mechanism for healthier lifestyle practices.

Additionally, all teaching methods in the B-BFF targeted the seven subscales of intrinsic motivation. Methods successfully increased levels of satisfaction in each of the antecedents. The context-based research in the group exercise class allowed for a deep examination of these social and affective constructs where experienced—strengthening the understanding of how these theoretical constructs in the B-BFF actualized in a real-world setting.

Meeting proximal goals in the intrinsic motivation domain of the B-BFF was crucial because intrinsic motivation mapped onto neural substrates in the brain was tied to the dopamine reward center and conferred adaptive consequences in humans that would help them cope with novel experiences, challenges, and gaps in their knowledge (Di Domenico & Ryan, 2017). The evolutionary benefit is that intrinsic motivation helps humans develop diverse competencies and skills that help them cope with future uncertainties. Intrinsic motivation is a driver of energizing exploration, but its expression is not automatic—it must be cultivated with ambient support to meet the basic needs of the subscales.

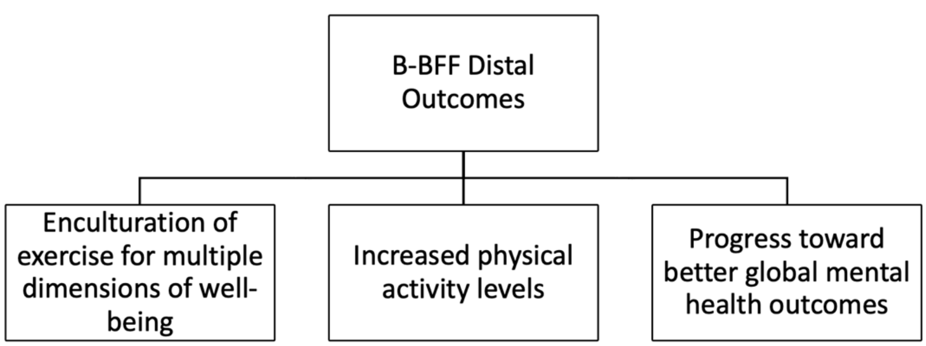
In this study, the methods of the B-BFF successfully cultivated this support. Consequently, this B-BFF strength contributed one methodological solution to the complex problem of the low physical activity crisis, including adherence and sustainability. Standard exercise instruction, marketing, and messaging may be unintentionally contributing to exercise dropout, unsustainability, and a distaste for exercise. Thus, the findings in the B-BFF study demonstrate that intrinsic motivation guided instruction, marketing, and messaging can serve as an intentional contribution to exercise retention, sustainability, and enjoyment of exercise.

This study also sought to address the problem of exercise predominantly being marketed and messaged in group exercise classes for its physical benefits to the exclusion of the other important dimensions of health and well-being—social, spiritual, emotional, cognitive, and lifestyle (Beauchemin et al, 2019). On cultural and individual levels, the unintended consequence of this unidimensional fitness practice is that it perpetuates mind-body dualism—treating cognitive and affective states as disembodied or separate from the physical body (Burgmer & Forstmann, 2018). Regarding exercise practice, mind-body dualism results in exercise not being culturally associated with mental health in the same way it is with physical health. This mental-physical disconnect affects health behaviors, multidimensional health outcomes (e.g., cognitive), educational practices, public policymaking, and the healthcare system (Burgmer & Forstmann, 2018; Di Paolo et al., 2017; Mandolesi et al., 2018).

In-vivo codes and emergent themes in the data supported that this dissertation study's proximal outcomes—increased brain-body knowledge, increased intrinsic motivation to exercise, and increased perception of mind-body unity—were achieved. These outcomes supported that exercise instructor methods, messaging, and cueing in the B-BFF positively impacted group exercise participant experiences. Increased brain-body interaction knowledge increased mental health literacy and forged stronger mind-body unity (Glazzard & Szreter, 2020). Mind-body unity supported healthier lifestyle behaviors (Burgmer & Forstmann, 2018). Intrinsic motivation highly correlated with sustainable physical activity levels (Segar et al. 2011). Taken together, successful outcomes in these three domains serve as proxy for distal outcomes, including enculturation of exercise for multiple dimensions of well-being, increased physical activity levels, and progress toward better global mental health outcomes (see Figure 5.6).

Figure 5.6

Distal Outcomes of the Brain-Body Fitness Framework



Note. The distal outcomes of this study's theory of treatment aligned with the problems addressed in this study—the rising incidence of diseases of the mind-brain, low population physical activity levels, and the lack of multiple dimensions of well-being being addressed in group exercise classes. Theoretically, because the intervention achieved its proximal outcomes, there was empirical support for the future achievement of distal outcomes.

Implications for Practice

This research on the novel B-BFF was the first of its kind to examine the experiences of women in group exercise classes instructed using neuroscience to shape content, instructional methods, and cues. The findings in this study have important public health implications for exercise practice and instruction. Stronger mind-body unity perceptions correlate with healthier lifestyle practices (Burgmer & Forstmann, 2018). Additionally, literature on the neuroscience of reward shows that immediately felt intrinsic rewards foster sustainable exercise behavior change (Segar et al., 2011). The key takeaway is that inclusion of basic neuroscience in group exercise classes may have transitive health and wellness properties by way of changing the way people think about and experience their exercise and body movement.

The neuroeducation lens of the B-BFF impacts exercise practice by creatively reframing a group exercise class as an educational space in addition to being a performance space. Spiraling the B-BFF strategies into group exercise classes facilitates the kind of practical, experiential learning essential to adult education (Saltiel, 1995). Crucially, the B-BFF philosophy reimagines the meaning of bodily movement in a sedentary world—affording an alternative way of thinking about exercise and physical activity for multiple dimensions of well-being. Adopting this alternative way of thinking organically changes exercise practice and instruction via broadening movement's value beyond typical extrinsic and physical domain goals to include intrinsic and multidimensional wellness goals that are emotional, cognitive, and social. Theoretically, a collective change in individual thinking and practice leads to socially expanding and enculturating exercise for multiple dimensions of well-being including mental health and wellness.

In practice, the stakeholders directly impacted by the results of this study are group exercise participants, group exercise instructors, and organizations that train and certify group exercise instructors. Group exercise participants participating in B-BFF-instructed classes have a new framework for thinking about the benefits of bodily movement in a sedentary world beyond the exercise class. This broadened mindset views physical exercise and bodily movement as an accessible mental health and quality of life tool for navigation in a stressful world. Because physical exercise and activity grounded in the B-BFF philosophy prioritizes co-constructing intrinsically motivating experiences during group exercise, self-reflection opportunities and progression choices targeting the antecedent subscales of intrinsic motivation improve the chances of a participant finding sustainable movement opportunities that resonate with personal needs, interests, and lifestyle. In summary, this study's findings suggest that a group exercise participant taking a class with content, cues, and messaging framed in the B-BFF philosophy may increase their odds of self-locating intrinsically motivating, sustainable, and personally meaningful movement possibilities in and outside of exercise classes. It is hoped that locating these possibilities may lead to an increase in overall physical activity levels and a decrease in sedentary behavior during the day.

The second stakeholder group—group exercise instructors—can use the B-BFF to broaden their practice by increasing participants' understandings of how and why we move our bodies and by expanding participants' movement possibilities and opportunities in and outside of class. Using the complementary B-BFF assists instructors in connecting kinesiology methods learned in fitness certification programs with their participants' social, emotional, and cognitive domains of well-being. Critically, group exercise instructors framing their teaching practice in the B-BFF offer hope, inclusion, and a feeling of achievable success to exercisers harboring unpleasant past experiences derived from unsustainable extrinsic or unrealistic aesthetic fitness, sport, or cultural body image messaging.

Study data indicated that fragile body image, low exercise self-efficacy, and negative physical education/body movement experiences serve as barriers to participation in physical activity. To borrow a popular idiom, instructors embedding B-BFF strategies into practice have a unique opportunity to preach to those who have felt physically, socially, and emotionally ostracized from the sport and exercise choir. The B-BFF expands Caspersen and colleagues' (1985) clinical definition of exercise (skeletal muscle movement producing energy expenditure) with Piggin's (2019) definition, which situates a person's movement within an influencing sociocultural context (see Chapter 3, p. 107). Consequently, instructors adopting the philosophy of the B-BFF reinforce to their participants the complexity of exercise behaviors in an ecological system and the inextricable entanglement of mind, brain, body, and environment. Embracing and explicitly teaching this element of exercise's complexity may empower clients to make informed decisions as they navigate the myriad of over-simplified claims in exercise sales marketing.

The third stakeholder group this study impacts includes national organizations who certify exercise instructors and personal trainers. The study findings show that the B-BFF is compatible with industry standard physiology and kinesiology methods—scaffolding actionable strategies for including multiple domains of well-being into existing exercise formats. This study used barre (frequently labeled as a strength and flexibility format) and cardio (an aerobic format) classes. The YMCA and similar national certifying entities could potentially effect change at scale by developing a curriculum or course that trains instructors on how to incorporate the B-BFF in existing classes and personal training sessions. This course could be part of certification training and/or continuing education courses. Since the B-BFF also addresses exercise sustainability, curriculum needs to help instructors develop the skill of teaching exercise movements and choreography (included in industry standard certification) with a keen sensitivity to the person doing the movement (philosophy of the B-BFF). Training instructors to understand and prioritize the foundational importance of emotion and affect on exercise participation and sustainability may longitudinally provide a path for increasing population physical activity levels via targeting, promoting, and measuring intrinsic motivation and mind-body unity instead of extrinsic goals.

Lastly, findings from this study have practical implications for future use in publications that disseminate knowledge and information to a broad array of readers. One possibility is publishing the study results, implications, and commentaries in scholarly academic journals that reach other scholar practitioners and academics who can further the research and impact. Another practical use of this study is sharing B-BFF strategies, reporting results, and expanding on implications in contemporary book, handbook, podcast, or mixed-media form. Rather than a solely academic audience, this publication could target a broader audience of parents, community leaders, health care workers, classroom teachers, and people interested in practical health and wellness. The B-BFF framework and its results might also be informative to physical education teachers in training and in the field. A presentation and practicum tailored to educators might be fruitful for expanding physical education practices. Finally, and perhaps most importantly, these study results could be used to create an age-appropriate children's book that takes a proactive approach to teaching the mind-brain-body-environment connection and why movement matters to our feeling and thinking.

Future Research

In the final analysis, this case study concluded that the B-BFF successfully scaffolded mind-brain health into group exercise classes. In this population and context, B-BFF-instructed classes qualitatively increased participants' (a) brain-body knowledge, (b) perceptions of intrinsic motivation during exercise experiences, and (c) perceptions of their mind-body unity. As such, results from the study open a myriad of possibilities for future research from replicating the qualitative study in different contexts to quantitatively measuring pre- and post-participation constructs of brain-body knowledge, intrinsic motivation, and mind-body unity after taking B-BFF-framed exercise classes.

More practice-based/focused research is needed to improve, refine, codify, and design effective and adaptable B-BFF-inspired curricula. To accomplish these tasks, an appreciative inquiry model (Cooperrider & Srivastva, 1987) is recommended to co-produce new content in collaboration with context stakeholders (exercise participants, instructors, and certifying boards) and interdisciplinary experts (neuroscientists, psychologists, physiologists, and others). Rooted in social constructivist tradition, appreciative inquiry uses collective inquiry to generate new ideas, theories, and knowledge (Randall et al., 2022). Co-created ideas are generated from stakeholders' first-hand experiences and stem from "a relationship where professionals and citizens share power to plan and deliver support together—recognizing that both have vital contributions to make to improve quality of life for people and communities" (P. D. S. Ross et al., 2013, p. 7). These new ideas about the B-BFF and how best to implement it in practice can be further tested using implementation science Plan-Do-Study-Act inquiry cycles (Bryk, 2015) where "each cycle builds on what was learned in previous cycles until a team has discerned how to effect improvements reliably under different conditions" (p. 122).

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Appendix A: Operational Definitions for Domains of Wellness

Physical: "Measures the degree to which one maintains cardiovascular fitness, flexibility, and strength. Measures the behaviors that help one to prevent or detect early illnesses." (Hettler, 1980, p. 78.)

Social: "Measures the degree to which one contributes to the common welfare of one's community. This emphasizes the interdependence with others and with nature" (Hettler, 1980, p. 78).

Spiritual: "Measures one's ongoing involvement in seeking meaning and purpose in human existence. It includes a deep appreciation for the depth and expanse of life and natural forces that exist in the universe" (Hettler, 1980, p. 78).

Emotional: "Measures the degree to which one has an awareness and acceptance of one's feelings. This includes the degree to which one feels positive and enthusiastic about oneself and life. It measures the capacity to appropriately control one's feeling and related behavior, including the realistic assessment of one's limitations" (Hettler, 1980, p. 78).

Intellectual: "Measures the degree to which one engages his or her mind in creative, stimulating mental activities. An intellectually well person uses the resources available to expand his or her knowledge in improved skills, along with expanding potential for sharing with others" (Hettler, 1980, p. 78).

Lifestyle change: "Establishing healthy behaviors to improve multiple domains of wellness that result in wellness promotion, and ultimately decreased chronic illness and death" (Beauchemin, et al., 2019, p. 149).

Appendix B: Semi-Structured Focus Group Questions

1. How did you first get involved in the fitness industry (De Lyon & Cushion, 2013, p. 1418)?
2. How long have you been an instructor? Comparing from now to when you first started, has your experience of working in the fitness industry changed (De Lyon & Cushion, 2013, p. 1418)?
3. What are some of the practice expectations for group exercise fitness instructors at the YMCA. What is your primary job function (De Lyon et al., 2017, p. 319)?
4. How do you view your role as a fitness instructor (Rosado et al., 2013, p. 26)?
5. What are your thoughts about fitness' recognition and credibility as a profession (De Lyon et al., 2017, p. 321)?
6. Do you perceive that fitness instructors have an impact on their participants' health (De Lyon et al., 2017, p. 318)?
7. The definition for 'ethical responsibilities' in a health framework is 'doing the right thing for the patient.' What are the ethical responsibilities of fitness instructors (Rosado et al., 2013, p. 26)?
8. Do you have any concerns about your training or education (De Lyon et al., 2017, p. 320)?
9. What are some of the subjects/topics of continuing education courses/ workshops that your certifying organization offers (My question as per my POP)?
10. What are your reasons for choosing specific continuing education course topics? Are there any barriers to taking the courses you want to take (My question as per my POP)?

11. Which do you feel has had more direct bearing on your role as a fitness instructor: updates in choreography, updates in scientific knowledge, or both (De Lyon & Cushion, 2013, p. 1418)?
12. Where do you acquire fitness-related knowledge? What kinds of knowledge have you found to be the most important to your teaching? (De Lyon & Cushion, 2013, p. 1418)?
13. Do you perceive that your certifying organization prioritizes mental health in the same way it prioritizes physical health? If so, how is this reflected? (My question as per my POP)
14. Does your certifying organization provide CEUs on the brain and mental health? If so, have you taken any of these courses/workshops? (My question as per my POP)
15. Wellness domains have been divided into social, physical, emotional, cognitive, spiritual, and lifestyle change. Which do you feel most comfortable teaching or incorporating in group exercise classes and why (Beauchemin et al., 2019, p. 153)?
16. What do you perceive as your most important contribution as a fitness instructor (De Lyon & Cushion, 2013, p. 1418)?

Appendix C: Needs Assessment Informed Consent Form for Group Exercise Instructors

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Title of Study: Addressing Mind and Brain Health in Group Exercise Classes

Primary Investigator: Lisa Weber Serice, Doctoral Student, JHU, SOE

Date: May 30, 2020

THIS PROTOCOL HAS BEEN REVIEWED AND APPROVED BY THE EXECUTIVE DIRECTOR OF THE WOODLANDS YMCA.

PURPOSE OF RESEARCH STUDY:
This study is being carried out as part of dissertation research about addressing mind and brain health in group exercise classes. The purpose of the study is to better understand what ways, if any, mind and brain health are addressed in group exercise settings and to identify the contributing factors that may obstruct their inclusion.

PROCEDURES:
Participants will be asked to complete an electronic survey that will take approximately one minute to complete. Participants may also volunteer to participate in a focus group, which will last approximately 60 minutes. Interested parties should contact Lisa Serice at lserice1@jhu.edu. The total time commitment for instructors who participate in both the survey and a focus group will be about 1 hour and 1 minute. Survey data will be collected electronically by Qualtrics, a survey program used at Johns Hopkins University. Data will be anonymous and will not be identifiable to individual instructors. The focus group convened to discuss perceptions of job roles as fitness instructors will be facilitated by Lisa Serice and will take place on the Zoom platform at a date mutually agreed upon by volunteers. The focus group will be audio recorded, and the recordings will only be available to Lisa Serice. Recordings will be maintained on password protected devices that are only accessible to Lisa Serice. No names will be used when the data is analyzed, and instructors will not be individually identified in written reports of the focus groups. Study participants include fitness instructors currently employed by the YMCA of Greater Houston, The Woodlands branch.

RISKS/DISCOMFORTS:
The risks associated with participation in this study are no greater than those encountered in daily life.

BENEFITS:
Because mind and brain health issues are considered a global health crisis, participation in this study contributes to a greater understanding of how mental health is addressed in group exercise contexts. This knowledge helps to develop an informed intervention that will address factors learned in this study.

CONFIDENTIALITY:
All survey data will be collected through anonymous surveys, and responses will not be traced to the individual participants. Only Lisa Serice will have access to the anonymous survey responses, and they will be deleted after seven years. The focus group will convene on Zoom, but participant responses will not be written or published with their names. Audio recordings of the focus groups will be kept confidential, and only Lisa Serice will have access to the records, which will be deleted seven years after collection.

QUESTIONS OR CONCERNS:
You may ask questions about this research study now or at any time during the study by contacting Lisa Serice (student researcher) at [redacted] or Dr. Iris Saltiel (Lisa Serice's academic advisor) at [redacted] If you have questions about your rights as a research participant or feel that you have not been treated fairly, please call the Homewood Institutional Review Board at Johns Hopkins University at (410)516-6580.

VOLUNTARY PARTICIPATION AND RIGHT TO WITHDRAW:
Your participation in this study is entirely voluntary. If you decide not to participate, there are no penalties and your status at the YMCA will not be impacted. If you choose to participate in the study, you may withdraw from the study at any time. A decision not to participate or to withdraw from the study will not result in any negative consequences for you. If you want to withdraw from the survey, please close the browser window. If you want to withdraw from the focus group, please do not attend or feel free to leave once the group has begun.

STATEMENT OF CONSENT:
I have read this form and am voluntarily agreeing to participate in this study. I have been allowed to ask the questions I have, and my questions have been answered to my satisfaction. I have read this consent form and agree to volunteer as a research subject in this study with the understanding that I may withdraw at any time. I may print a copy of this consent form for my records.

SURVEY ACCESS:
To access the survey, please click on the Qualtrics link below. Clicking on the "Agree" button on survey question number one indicates that:

- You have read and understand the above information
- You voluntarily agree to participate
- You are 18 years of age or older

Appendix D: Needs Assessment Informed Consent Form for Group Exercise Participants

Title of Study: Addressing Mind and Brain Health in Group Exercise Classes

Primary Investigator: Lisa Weber Serice, Doctoral Student, JHU, SOE

Date: May 30, 2020

PURPOSE OF RESEARCH STUDY:
This study is being carried out as part of dissertation research about addressing mind and brain health in group exercise classes. The purpose of the study is to better understand what ways, if any, mind and brain health are being addressed in group exercise settings and to identify the contributing factors that may obstruct their inclusion.

PROCEDURES:
Participants will be asked to complete an electronic survey that will take approximately 5 minutes to complete. Survey data will be collected electronically by Qualtrics, a survey program used at Johns Hopkins University. Data will be anonymous and will not be identifiable to individual participants. Data will be maintained on password protected devices that are only accessible to Lisa Serice. No names will be used when the data is analyzed, and participants will not be individually identified in written reports. Study participants include group exercise fitness participants who are currently members of the YMCA of Greater Houston, The Woodlands Branch.

RISKS/DISCOMFORTS:
The risks associated with participation in this study are no greater than those encountered in daily life.

BENEFITS:
Because mind and brain health issues are considered a global health crisis, participation in this study contributes to a greater understanding of how mental health is addressed in group exercise contexts. This knowledge helps to develop an informed intervention that will address factors learned in this study.

CONFIDENTIALITY:
All survey data will be collected through anonymous surveys, and responses will not be traced to the individual participants. Only Lisa Serice will have access to the anonymous survey responses, and they will be deleted after seven years.

QUESTIONS OR CONCERNS:
You may ask questions about this research study now or at any time during the study by contacting Lisa Serice (student researcher) at [redacted] or Dr. Iris Saltiel (Lisa Serice's academic advisor) at [redacted]. If you have questions about your rights as a research participant or feel that you have not been treated fairly, please call the Homewood Institutional Review Board at Johns Hopkins University at (410)516-6580.

VOLUNTARY PARTICIPATION AND RIGHT TO WITHDRAW:
Your participation in this study is entirely voluntary. If you decide not to participate, there are no penalties and your status at the YMCA will not be impacted. If you choose to participate in the study, you may withdraw from the study at any time. A decision not to participate or to withdraw from the study will not result in any negative consequences for you. If you want to withdraw from the survey, please close the browser window.

STATEMENT OF CONSENT:
I have read this form and am voluntarily agreeing to participate in this study. I have been allowed to ask the questions I have and my questions have been answered to my satisfaction. I have read this consent form and agree to volunteer as a research subject in this study with the understanding that I may withdraw at any time. I may print a copy of this consent form for my records.

SURVEY ACCESS:
To access the survey, please click on the Qualtrics link below. Clicking on the "Agree" button on survey question number one indicates that:

- You have read and understand the above information
- You voluntarily agree to participate
- You are 18 years of age or older

Appendix E: Needs Assessment Group Exercise Instructor Survey

Sources of Instructor Knowledge

How frequently do you use the following resources when looking for new exercises, programs, or ideas? (a) Never, (b) Rarely, (c) Sometimes, (d) Often

1. Academic textbooks (exercise/sports science-related)
2. Workshops or specialized courses
3. Scientific journals (exercise/sports science-related)
4. Ideas from other instructors
5. Generally, develop my own ideas
6. Online/internet search for fitness training-related websites
7. Popular fitness magazines

Frequency of Addressing Multiple Domains of Wellness

How frequently do you discuss the following during the instruction of your group exercise classes? (a) Never, (b) Almost Never, (c) Sometimes, (d) Often, (e) Very Often

1. Physical wellness
2. Social wellness
3. Spiritual wellness
4. Emotional wellness
5. Cognitive wellness
6. Lifestyle change

Appendix F: Group Exercise Participant Survey

Frequency of Addressing Multiple Domains of Wellness

How frequently does your instructor discuss the following during the instruction of your group exercise classes? (a) Never, (b) Almost Never, (c) Sometimes, (d) Often, (e) Very Often

7. Physical wellness
8. Social wellness
9. Spiritual wellness
10. Emotional wellness
11. Cognitive wellness
12. Lifestyle change

Exercise Beliefs: Benefits/ Barriers (EBB)

The following are statements that relate to ideas about exercise. Please indicate the degree to which you agree or disagree with the statements by clicking on the corresponding choice. (a) Strongly Disagree, (b) Disagree, (c) Agree, (d) Strongly Agree

1. I enjoy exercise.
2. Exercise decreases feelings of stress and tension for me.
3. Exercise improves my mental health.
4. Exercising takes too much of my time.
5. Exercise reduces my chance of heart attacks.
6. Exercise tires me.
7. Exercise increases my muscle strength.
8. Exercise gives me a sense of personal accomplishment.
9. Places for me to exercise are too far away.
10. Exercising makes me feel relaxed.
11. Exercising lets me have contact with friends and people I enjoy.
12. I am embarrassed when I exercise.
13. Exercise can help me control high blood pressure.
14. It costs too much to exercise.
15. Exercise increases my level of physical fitness.
16. Exercise facilities do not have convenient schedules for me.
17. My muscle tone is improved with exercise.
18. Exercising improves functioning of my cardiovascular system.
19. I am fatigued by exercise.
20. I have improved feelings of well-being from exercise.
21. My spouse (or significant other) does not encourage exercise.
22. Exercise increases my stamina.
23. Exercise improves my flexibility.
24. Exercise takes too much time from family relationships.
25. My disposition is improved with exercise.

26. Exercise helps me sleep better at night.
27. I will live longer if I exercise.
28. I think people in exercise clothes look funny.
29. Exercise helps me decrease fatigue.
30. Exercise is a good way for me to meet new people.
31. My physical endurance is improved by exercise.
32. Exercise improves my self-concept.
33. My family members do not encourage me to exercise.
34. Exercise increases my mental alertness.
35. Exercise allows me to carry out normal activities without becoming tired.
36. Exercise improves the quality of my work.
37. Exercise takes too much time from my family responsibilities.
38. Exercise is good entertainment for me.
39. Exercising increases my acceptance by others.
40. Exercise is hard work for me.
41. Exercise improves overall body functioning for me.
42. There are too few places for me to exercise.
43. Exercise improves the way my body looks.

Gender

1. Male
2. Female

Age

1. 20-29
2. 30-39
3. 40-49
4. 50-59
5. 60+

Are you currently a participating member of YMCA group exercise classes?

1. Yes
2. No

Appendix G: Frequency of Group Exercise Participant Beliefs about Benefits and Barriers to Exercise

Table G

Frequency of Group Exercise Participant Beliefs About Benefits and Barriers to Exercise

	Strongly disagree	Disagree	Agree	Strongly agree
I enjoy exercise.	0.00	0.00	32.00	6.45
Exercise decreases feeling of stress and tension for me.	2.00	0.00	22.00	76.00
Exercise improves my mental health.				
Exercise takes too much of my time.	0.00	0.00	20.83	79.17
Exercise reduces my change of heart attacks.	44.00	48.00	6.00	2.00
Exercise tires me.	0.00	0.00	58.00	42.00
Exercise increases my muscle strength.	20.83	56.25	20.83	2.08
Exercise gives me a sense of personal accomplishment.	2.04	0.00	36.73	61.22
Places for me to exercise are too far away.	0.00	0.00	22.45	77.55
Exercise makes me feel relaxed.				
Exercise provides social contact with friends and people	65.31	32.65	0.00	2.04
I enjoy.	0.00	10.20	48.98	40.82
I am embarrassed when I exercise.	2.04	2.04	20.41	75.51
Exercise can help me control high blood pressure.				
It costs too much to exercise.	42.86	48.98	8.16	0.00
Exercise increases my level of physical fitness.	0.00	0.00	62.50	37.50
Exercise facilities do not have convenient schedules for me.	39.58	58.33	0.00	2.08
My muscle tone is improved with exercise.	0.00	0.00	16.67	83.33
Exercise improves the functioning of my cardiovascular system.	25.00	66.67	4.17	4.17
I am fatigued by exercise.	0.00	0.00	28.57	71.43
I have improved feelings of well-being from exercise.	0.00	0.00	24.49	75.51
My spouse (or significant other does not encourage exercise.	22.92	58.33	18.75	0.00
Exercise increases my stamina	0.00	0.00	21.28	78.72
Exercise improves my flexibility.				
Exercise takes too much time from family relationships.	42.55	44.68	8.51	4.26
My disposition is improved with exercise.				
Exercise helps me sleep batter at night.	0.00	0.00	37.50	62.50
I will live longer if I exercise.	0.00	2.08	35.42	62.50
I think people in exercise clothes look funny.	47.92	52.08	0.00	0.00
Exercise helps me decrease fatigue.				
Exercise is a good way for me to meet new people.	0.00	0.00	38.30	61.70
My physical endurance is improved by exercise.	0.00	2.13	42.55	55.32
Exercise improves my self-concept.	0.00	4.26	53.19	42.55
My family members do not encourage me to exercise.	63.83	31.91	4.26	0.00
Exercise increases my mental alertness.	0.00	6.67	64.44	28.89
Exercise allows me to carry out normal activities without becoming tired.	2.08	4.17	64.58	29.17
Exercise improves the quality of my work.	0.00	0.00	37.50	62.50
Exercise takes too much time from my family responsibilities.	0.00	2.13	48.94	48.94
Exercise is good entertainment for me.	45.83	41.67	8.33	4.17

	Strongly disagree	Disagree	Agree	Strongly agree
Exercise increases my acceptance by others.				
Exercise is hard work form me.	0.00	0.00	52.17	47.83
Exercise improves overall body function for me.	0.00	2.08	60.42	37.50
There are too few places for me to exercise.				
Exercise improves the way my body looks.	2.13	6.38	59.57	31.91
	43.75	52.08	4.17	0.00
	0.00	10.42	64.58	25.00
	12.77	29.79	44.68	12.77
	14.58	41.67	39.58	4.17
	0.00	2.04	44.90	53.06
	52.08	45.83	2.08	0.00
	0.00	6.12	61.22	32.65

Appendix H: The Brain-Body Fitness Framework

Actualizing Theory in Practice

Embodied Enactive Cognition

- Embed language that consistently and frequently unifies that the mind, brain, body, and environment are interdependent.
- Intersperse exercise neuroscience and cognitive psychology facts where appropriate.

Self-Determination Theory of Intrinsic Motivation

- Consistently align class practices, cues, and language to foster participant's experience of autonomy, competence, and relatedness. Co-construct experiences that engender the subcomponents of intrinsic motivation (a convenient acronym is CUTRICE):
    - **Competence**: set up for success
    - **Usefulness**: reminders of practical translations of exercise benefits to lifestyle
    - **Tension** (reappraised): reframe slight discomforts
    - **Relatedness**: feeling of social connectivity between participants and instructor
    - I**mportance**: appropriately explain why certain moves are executed
    - **Choice**: consistently provide options, modifications, alternatives, and ability to stop or "refresh" at any time
    - **Enjoyment**: (biggest predictor of adherence) collaborate with participants on finding what can personally be perceived as enjoyable. Be creative.

Andragogy

- Align teaching practices with the five tenets of andragogy
    - Adults are self-directed and self-motivated.
    - Adults' experiences are resources they bring to learning environments.
    - Adult learning is related to their developmental needs (stage of life).
    - Adult learning is typically problem-centered.
    - Adults desire immediate application of their learning.

Social Constructivism

- Emphasize the social nature of the group exercise learning environment. Connect participants with one another.
- Recognize the role of participants' culture in learning.
- Actively engage participants in their zone of proximal development—the skill set or knowledge a learner cannot achieve independently but could achieve with the assistance of a *more knowledgeable other* (MKO). Staying in this zone for learning and intrinsic motivation purposes. Think of a "Goldilocks Zone"—not too easy, not too difficult, just right.
- Recognize language as a powerful tool for meaning-making.
- Socially and individually co-construct meaningful class experiences with participants by building upon their prior knowledge and experiences.

Transformational Learning Theory

- Provide participants opportunities for critical self-reflection about deeply held beliefs about exercise, cultural beliefs about bodies, reasons for movement, and previous exercise experiences.
- Create a space for dialog to reflection where participants can reflect on habits of mind and points of view resulting from their beliefs about mind-brain-body unity, exercise practices, and other salient issues relating to exercise and movement.

Supporting Teaching Methods

Scaffolding

- Scaffold new experiences, moves, and knowledge by providing tips and tricks, progressions, and modifications.
- Use imagery and metaphors to make mind-body connections, create salience, and add novelty.

Spiral Curriculum

- Be iterative with new knowledge about the mind-brain-body. Start with basic facts and appropriately introduce more details as learning progresses. Since group exercise classes have high rates of variance in attendees, make learning cyclical, increase depth with subsequent iterations, and build on prior knowledge.

Class Extensions

- Offer "movement snacks" (opportunities to increase movement during the day) at the end of each class.
- Utilize Twitter to tweet or retweet relevant research articles, extend and support learning, and offer social connection between class participants (Tang & Hew, 2017).

Evidence-Based Goals of Domains of The Brain-Body Fitness Framework

Brain-Body Knowledge

- Offer new definition of exercise
- Increase mental health literacy
- Increase science literacy
- Highlight relevance and utility of neuroscience

Mind-Body Unity

- Help participants automatize the feel of postural alignment and balance
- Use priming, "do your best," and learning goals
- Use dynamic neurocognitive imagery and metaphors in instruction
- Teach cognitive reappraisal of exercise tension

Intrinsic Motivation

- Use emotions as a starting point for instructions

- Place a premium on meaning-making in classes
- Let go of willpower cues
- Prioritize enjoyment goals
- Stay cognizant that liking leads to wanting

Appendix I: Logic Model

<table>
<tr><th>Context</th><th colspan="3">Processes</th><th>Outcomes</th></tr>
<tr>
<td rowspan="3">Needs assessment findings suggest that YMCA group exercise instructors feel prepared to lead the biomechanics and choreography of exercise classes but lack a practical teaching framework to:
(1) reinforce the relationship between motor movements and the mind-brain during class time,
(2) scaffold knowledge about why movement is essential for healthy mind-brain functioning, and
(3) use evidence-based verbal and imagery cues that foster, facilitate, and co-construct intrinsically motivating embodied experiences.

This intervention tests a Brain-Body Fitness Framework (B-BFF) grounded in:
• Andragogy
• Applied neuroscience
• Brain-targeted teaching model
• Embodied enactive cognition
• Self-determination theory of intrinsic motivation
• Social constructivism
• Spiral curriculum
• Transformational learning theory</td>
<td>Inputs</td>
<td colspan="2">Outputs</td>
<td rowspan="2"><u>Short-Term</u>
• Increased knowledge of (1) the relationship between mind, brain, body, and environment (2) health as a multidimensional construct, (3) mind-brain health issues specific to women, (4) exercise benefits on the mind-brain.
• Increased perception of mind-body unity
• Increased intrinsic exercise motivation
Subscales include:
○ Interest/Enjoyment
○ Perceived Competence
○ Effort/Importance
○ Pressure/Tension (Reverse score)
○ Perceived Choice
○ Value/Usefulness
○ Relatedness

<u>Intermediate</u>
• Enculturation of exercise for multidimensional well-being
• Perception of enhanced multidimensional well-being

<u>Distal</u>
• Progress toward better multidimensional health outcomes including mind-brain health</td>
</tr>
<tr>
<td>• Participants' and facilitator's time
• Executive director support and approval
• Studio space and equipment to conduct 6, 1-hour exercise sessions
• Access to personal computers for pre-participation Zoom meeting (30 min), post-class journal prompts, post-participation focus group and final survey
• 1- Brain-Body Fitness Framework (researcher constructed and led)
• Book "Spark" by John Ratey, MD for each participant as gift
• Instructor-made pre/posttests, journal prompts, and surveys based on the Intrinsic Motivation Inventory (McAuley et al., 1989), neuroscience literature, and the theory of embodied cognition (Gallagher, 2017).</td>
<td><u>Activities</u>
• Online launch: non-exercise introductory session (30 min)
• 6 exercise sessions at the YMCA (3 per week) using the B-BFF with group exercise participants. (3 barre classes, 3 cardio classes, 1 hour each)
• Post-class online journaling (<15-min)
• 1 post-intervention focus group
• Post-intervention online differentiation survey (<45 min)
• Instructor field notes including adherence to framework after each class</td>
<td><u>Participation</u>
• 14 group exercise participants (adult women) from the YMCA
• Mind, brain, and teaching specialist (the researcher, who is an AFAA Certified Group Exercise Instructor, Personal Trainer, and Fitness Practitioner) to incorporate the B-BFF into two group-ex class formats: Barre and Cardio Combo</td>
</tr>
<tr>
<td colspan="2">Assumptions
• Participants have an intrinsic desire to feel well.
• Because of this desire, participants will be sufficiently motivated to voluntarily participate.
• Participants are Y members and attend many classes, so participation is not an unusual inconvenience.</td>
<td colspan="2">External Factors
• Situations arise in lives and daily routines that my impact the ability to attend every class (e.g., illness, outside injury, illness of a family member, unanticipated work requirement)
• Pandemic/studio restrictions could arise.</td>
</tr>
</table>

Appendix J: Informed Consent

JOHNS HOPKINS UNIVERSITY
HOMEWOOD INSTITUTIONAL REVIEW BOARD (HIRB)

RESEARCH PARTICIPANT INFORMED CONSENT FORM

Study Title: Pilot Testing a Brain-Body Fitness Framework in a Women's Group Exercise Class

Application No.:

Principal Investigator: Iris Saltiel, Ed.D.

Senior Education Adviser
Iris Saltiel
[redacted]

You are being asked to join a research study. Participation in this study is voluntary. Even if you decide to join now, you can change your mind later.

1. Research Summary (Key Information):

The information in this section is intended to be an introduction to the study only. Complete details of the study are listed in the sections below. If you are considering participation in the study, the entire document should be discussed with you before you make your final decision. You can ask questions about the study now and at any time in the future.

The proposed study is conducted as part of dissertation work in the Doctor of Education program in the School of Education at Johns Hopkins University. The goal of this intervention is to study the effects of using a brain-based fitness framework while instructing a women's group exercise class. A mixed-methods approach will be used to examine the effects of the framework on participants mind and brain health knowledge and self-reported perception of their exercise practices and experiences.

Total time commitment will be approximately 8 hours spaced over the course of 4 weeks (Week 1: launch meeting and surveys, Weeks 2 and 3, 3 classes/ week, Week 4: wrap-up meeting and surveys). The study will take place in the fall of 2021. Survey data will be collected electronically using Qualtrics. Data will be stored on a password protected computer. All exercise classes in the study will be conducted over the Zoom platform. Verbal feedback from participants will be collected throughout the study in instructor field notes kept in password protected device.

Participants will complete/attend:

- one non-exercise orientation prior to the study (30 minutes),
- one initial pretest electronic survey (20 minutes),
- six group exercise classes via Zoom (3 barre, 3 cardio combo),
- one brief, post-class reflection via Qualtrics after each class (15 minutes)
- one, non-exercise post-intervention follow-up with instructor via Zoom (30 minutes)
- one posttest electronic survey (30 minutes)

The risks associated with participation in this study are no greater than those encountered in daily life beyond the normal risk associated with attendance at any group exercise class at the YMCA. Potential participation benefits include a contribution to scholarship that explores a better understanding of how including a brain-body fitness framework in existing group exercise classes impacts mind and brain health knowledge, intrinsic motivation to exercise, and increased perception of multidimensional well-being.

2. Why is this research being done?

This research is being done to pilot test a brain-body fitness framework as means of incorporating mind and brain health and wellness within the context of women's group exercise classes. The study will facilitate understanding the impact and effects of implementing a brain-body framework on participants' mind and brain health knowledge and self-reported perceptions of mind-body unity, and intrinsic motivation. Adult women who are members of the YMCA may join. We anticipate that 12 people will take part in this study.

3. What will happen if you join this study?

If you agree to be in this study, we will ask you to do the following things:

- Attend one non-exercise orientation prior to the study (30 minutes)
- Complete one initial pretest electronic survey (20 minutes)
- Attend six group exercise classes via Zoom (3 barre, 3 cardio combo),
- Complete one brief, post-class reflection via Qualtrics after each class (15 minutes)
- Attend one, non-exercise post-intervention follow-up with instructor via Zoom (30 minutes)
- Complete a posttest electronic survey (30 minutes)

Photographs/Video recordings:

As part of this research, we are requesting your permission to create and use audio recordings from Zoom to transcribe data from group conversations. Recordings will not be used for advertising or non-study related purposes.

You should know that:

- You may request that the audio recording to be stopped at any time.
- If you agree to allow the audio recording and then change your mind, you may ask us to destroy that recording.
- If the imaging/recording has had all identifiers removed, we may not be able to do this.
- We will only use these audio recordings for the purposes of this research. The audio recording will be transcribed by Zoom. All data is kept confidential.

How long will you be in the study?

You will be in this study for 4 weeks. The first week is for an introductory meeting and time to complete the pre-participation surveys. The second and third weeks are for exercise class participation in the six classes. The fourth week is for a wrap-up meeting and time to complete the post-participation surveys.

4. What are the risks or discomforts of the study?

The risks associated with participation in this study are no greater than those encountered in daily life beyond the normal risk associated with attendance at any group exercise class at the YMCA. You may get tired or bored when we are asking you questions, or when you are completing questionnaires. You do not have to answer any question you do not want to answer.

5. Are there benefits to being in the study?

You can reasonably expect to gain the educational benefits of small group instruction as well as any physical and mental benefits associated with participation in physical exercise. This study may also benefit society if the results lead to a better understanding of how including a brain-body fitness framework in existing group exercise classes could impact mind and brain health knowledge, mind-brain unity, intrinsic motivation to exercise, and increased perception of multidimensional well-being.

6. What are your options if you do not want to be in the study?

Your participation in this study is entirely voluntary. You choose whether to participate. If you decide not to participate, there are no penalties, and you will not lose any benefits to which you would otherwise be entitled.

7. Will it cost you anything to be in this study?

No

8. Will you be paid if you join this study?

No. However, as a thank-you gift for contributing your time to participate in the study, the YMCA is donating a copy of the book "*Spark: The Revolutionary New Science of Exercise and the Brai*n" by John J. Ratey, MD to each of the study's participants.

9. Can you leave the study early?

You can agree to be in the study now and change your mind later, without any penalty. If you want to withdraw from the study, please contact Lisa Serice at lserice1@jhu.edu or 936-443-9592.

10. Why might we take you out of the study early?

You may be taken out of the study if staying in the study would be harmful, you fail to follow instructions, or the study is cancelled. If you are taken out of the study early, Johns Hopkins may use or give out your information that it has already collected if the information is needed for this study or any follow-up activities.

11. How will the confidentiality of your biospecimens and/or data be protected?

Any study records that identify you will be kept confidential to the extent possible by law. The records from your participation may be reviewed by people responsible for making sure that research is done properly, including members of the Johns Hopkins University Homewood Institutional Review Board and officials from government agencies such as the National Institutes of Health and the Office for Human Research Protections. (All of these people are required to keep your identity confidential.) Otherwise, records that identify you will be available only to people working on the study, unless you give permission for other people to see the records. The study records will be created, stored, and maintained to protect confidential information by using code numbers rather than participants' names on data sheets, keeping records in a locked file cabinet, and keeping electronic records on a password-protected computer owned by Lisa Serice. Records will be stored for three years following the conclusion of the study.

What should you do if you have questions about the study?
Call the principal investigator Iris Saltiel at [redacted]. If you wish, you may contact the principal investigator by letter. The address is on page one of this consent form. If you cannot reach the principal investigator or wish to talk to someone else, call the IRB office at 410-516-5680. You can ask questions about this research study now or at any time during the study, by talking to the researcher(s) working with you or by calling Lisa Serice at [redacted].

If you have questions about your rights as a research participant or feel that you have not been treated fairly, please call the Homewood Institutional Review Board at Johns Hopkins University at (410) 516-6580.

What does your signature on this consent form mean?
Your signature on this form means that you understand the information given to you in this form, you accept the provisions in the form, and you agree to join the study. You will not give up any legal rights by signing this consent form.

WE WILL GIVE YOU A COPY OF THIS SIGNED AND DATED CONSENT FORM

Signature of Participant	(Print Name)	Date/Time
Signature of Person Obtaining Consent	(Print Name)	Date/Time

NOTE: A COPY OF THE SIGNED, DATED CONSENT FORM MUST BE KEPT BY THE PRINCIPAL INVESTIGATOR; A COPY MUST BE GIVEN TO THE PARTICIPANT.

Appendix K: Brain-Body Fitness Framework Pilot Test Participant Recruitment Email

Initial recruitment email:

Dear group exercise participants,

As many of you know, I am pursuing a doctorate at Johns Hopkins University. My dissertation explores ways to incorporate mind and brain health and wellness within the context of women's group exercise classes to support women's mind and brain health initiatives.

As part of my dissertation research, I will conduct a research study this fall that pilot tests a Brain-Body Fitness Framework that scaffolds mind-brain-body knowledge in group exercise classes. The title of this study is, *Pilot Testing a Brain-Body Fitness Framework in a Women's Group Exercise Class*. I hope you will consider participating in this research study.

Participation requires:

- completing one initial pretest electronic survey (15 minutes),
- attending one non-exercise orientation prior to the study (30 minutes)
- attending six exercise classes via Zoom (3 barre, 3 cardio combo),
- completing brief, post-class reflections via Qualtrics after each class
- completing a posttest electronic survey (15 minutes)
- attending one post-participation follow-up via Zoom (30 minutes)

Your participation in the study will help me to understand the effects of implementing a brain-body fitness framework on mind-brain health knowledge and the perceptions of your exercise practice and experience.

If you are interested in participating, please reply to this email.

Thank you,
Lisa

Follow-up recruitment email sent one-week following the initial email:

Dear group exercise participants,

Just as a reminder, I am conducting a research study this fall to explore the impact of using a brain-body fitness framework to support women's mind and brain health initiatives in group exercise classes. The title of this study is, *Pilot Testing a Brain-Body Fitness Framework in a Women's Group Exercise Class.*

Participation requires:

- completing one initial pretest electronic survey (15 minutes),
- attending one non-exercise orientation prior to the study (30 minutes)
- attending six exercise classes via Zoom (3 barre, 3 cardio combo),
- completing brief, post-class reflections via Qualtrics after each class

- completing a posttest electronic survey (15 minutes)
- attending one post-participation follow-up via Zoom (30 minutes)

Your participation in the study will help me to understand the effects of implementing a brain-body fitness framework on mind and brain health knowledge and the perceptions of your exercise practice and experience.

If you are interested in participating, please reply to this email.

Thank you,

Appendix L: Measurement Tool for Research Question 1: Fidelity of Implementation

(Adherence)

To what extent was the intervention implemented as planned?

Following each class, this checklist was used by the intervention instructor and a peer-auditor to identify if the instructor adhered to protocols recommended in the Brain-Body Fitness Framework (B-BFF) Intervention.

Basic group exercise class structure as per ACSM, AFAA/NASM protocols.

- Warm-up
- Body of instruction
- Cool-down

B-BFF Knowledge Domain

- Instructor addressed how the mind-brain-body-environment are interconnected
- Instructor connected at least one fact about exercise's benefits to the brain, focus, mood, etc.
- Instructor offered class knowledge extension via Twitter (literature, TED talks, books, etc.)
- Instructor offered "movement snacks" to assist participants with increasing movement throughout the day for mind-brain wellness
- Instructor explicitly messaged wellness as a multidimensional construct (physical, social, spiritual, emotional, cognitive, and lifestyle)

B-BFF Mind-Body Unity Domain

- Instructor used imagery, metaphors, and props/toys to help participants embody and automatize postural alignment
- Instructor frequently connected movement to mood and offered ways for participants to self- assess post-movement feelings
- Instructor cued participants on awareness of interoception, exteroception, and proprioception to foster mind-body unity and illustrate how the body-brain-mind-environment are interacting as one
- Instructor cued the purpose of movements for participants' individual meaning-making
- Instructor cues encouraged participants to critically reflect on connections between what they were feeling and doing so they could adjust their movements to fit into their unique zone of proximal development and sense of enjoyment

B-BFF Intrinsic Motivation

- Instructor used Piggins' (2019) broadened definition of exercise
- Instructor refrained from using traditional industry aesthetic extrinsic motivator cues (e.g., bikini bodies, weight loss, hard bodies, tight buns, etc…)

- Instructor used cues for joy, feelings, emotions, mind-brain-body unity, lifestyle, functional fitness, health, strength, vitality, and quality of life exercise benefits like reducing stress and anxiety.
- Instructor used cues to connect mind-brain benefits of exercise and quality of life.
- Instructor broadened the scope of the group exercise class as a space for social connection, support, learning, community building, and mental well-being.
- Instructor fostered a participant's intrinsic motivation for exercise. Specifically:
    - Instructor fostered a participant's intrinsic feeling of **competence** by offering movement modifications and vivid imagery/metaphor cues to help participants self-align and embody movement cues within their zone of proximal development and personal needs.
    - Instructor fostered a participant's intrinsic feeling **of usefulness and value** of movements by explaining why certain moves were executed and how they helped the mind-brain-body in everyday life.
    - Instructor fostered a participant's intrinsic feeling of **tension release** by teaching participants how to cognitively reappraise, reframe, and release tension in the body
    - Instructor fostered a participant's intrinsic feeling of **relatedness** between class members by offering spaces within class time to effortfully build community and common bonds
    - Instructor fostered a participant's intrinsic feeling of **importance** of the activities by appropriately explaining the science behind them and the proactive benefits to immediate *and* future well-being.
    - Instructor fostered a participant's intrinsic feeling of **choice** by offering many movement modifications, intensity progression options, opportunities to be creative and unique with movement, and the agency to "refresh" (take a moment to pause and come back in at any time). The instructor also fostered choice by inviting participants to customize and internalize the group movements as a "personal training" within a social, group setting.
    - Instructor fostered a participant's intrinsic feeling of **enjoyment** by inspiring laughter, a sense of levity towards movement, awe at the wonders at the beauty of the mind-brain-body capabilities, optimism about the immediate benefits of movement, learning goals, and well-being goals.

Appendix M: Measurement Tool for Research Question 2: Fidelity of Implementation

(Program Differentiation)

What, if any, unique features differentiate instruction in this class compared with instruction in other group exercise classes?

(Free response participant survey administered at the end of the intervention)

Directions

The objective of this study is to pilot test a Brain-Body Fitness Framework that targets three integrated, evidence-based domains affecting exercise adherence and multiple dimensions of wellness. The three targeted domains shaping teaching methods and cues are (a) brain-body knowledge, (b) mind-body unity, and (c) intrinsic motivation.

One goal of this study is to understand what, if any, unique features differentiated instruction in these six classes compared with instruction in other traditionally instructed group exercise classes you have experienced.

Another goal of equal importance is to understand how, if at all, these differentiated features affected your (a) exercise experiences, (b) how you think about exercise, (c) your perceptions of mind-body unity, (d) your intrinsic motivation to exercise, and (e) your knowledge of exercise's benefits on mind-brain health.

The following short answer questions ask for specifics on how the classes in this study **DIFFER** from other traditionally instructed group exercise classes. In other words, you are asked to compare methods and experiences in this class with other traditional group exercise methods and experiences. You may draw upon an aggregate of *all* your previous experiences. These experiences may include other group exercise classes taken at this YMCA or any other facility.

Since this is the first research study ever conducted on this novel fitness instruction framework, your feedback is crucial, extremely valuable, and greatly appreciated. Your responses can be brief or lengthy (no word limit) depending upon what you would like to share. The more specific detail you provide, the better I can understand the strengths and weaknesses of the framework as I analyze where to make future changes.

General

- What are some things I said, or did that **<u>differ</u>** from things said and done by instructors in your experiences with *other* group exercise classes?

Knowledge

- How (if at all) did ***<u>the knowledge content</u>*** taught in these classes (e.g., exercise benefits on the mind-brain-body) differ from the knowledge content taught in your other group exercise class experiences?
- How (if at all) did this mind-brain health knowledge content, with its neuroscience lens, affect your workout experience?

Mind-Body Unity

How (if at all) did the explicit ***<u>mind-brain-body connections</u>*** made in these classes (e.g., using imagery, metaphors, imagery props, interoception—feelings in the body, exteroception—senses from outside of the body, and proprioception—position of the body in space) **<u>differ</u>** from teaching methods used in other group exercise classes?

a. How (if at all) did these teaching methods affect your workout experience?
b. Did these teaching methods help you to view physical and mental health in a more unified way than traditional group exercise instruction? Explain.

Intrinsic Motivation

A sense of competence in your ability to find a progression that worked for you

I used exercise progressions, imagery props, and vivid imagery/metaphor cues such as imagining a "grapefruit sitting in the cradle of your hips" to help you locate your core, and "holding a lemon in each armpit" to help you embody what stabilizing your shoulders felt like. My goal was to foster your exercise **<u>competence</u>**, by helping you self-align and embody my movement cues within your unique ability levels, needs, and wants.

- How do these types of cues differ from those used in other classes?
- How, if at all, do these cues affect your feeling of exercise competence when executing exercise movements?
- Does your feeling of exercise competence in this class differ from other group exercise experiences? Please explain.

A sense that the moves were immediately useful to your life

I frequently explained *why* certain exercise moves are executed in the manner they are executed, *how* exercise immediately helps the mind-brain-body, and subsequently *how* this affects your everyday quality of life (e.g., mood boosting, anxiety busting, stress-relieving, neuroprotection, etc.) My objective was to engender a feeling of exercise's immediate access and **<u>usefulness</u>** for maintaining mind-brain-body health, including emotions and a sense of mental wellbeing.

- How (if at all) does your perception of exercise's usefulness in this class **<u>differ</u>** from other group exercise experiences? Explain?
- How (if at all) does talking about the mood boosting, anxiety busting, stress-relieving, neuroprotection benefits of exercise affect your feeling of exercise's usefulness? Why or why not?

A sense of cognitively reappraising (intentionally reframing) tension while exercising

I employed mindfulness techniques to help you contrast your internal sensations of tension and release and brought awareness to how you could experience tension in one part of your body while simultaneously relaxing another area. We practiced this, for example, by squeezing our pelvic floor while simultaneously imagining our heads as floating feathers. Additionally, I cued imagery such as "butter melting on warm toast" to help you imagine a sense of melting and releasing all tension. My objective in using these imagery cues, metaphors, props, and breathing techniques was to assist you in personally cognitively reappraising, or reframing, **tension** you might be feeling while you were exercising in class. In other words, together, we were reframing your tension the moment you were internally sensing it.

- How does instruction on tension (squeezing/contracting/sensing stress) and releasing (releasing/relaxing/letting go/melting) in this class **differ** from methods taught in other classes?
- How, if at all, does learning about how to manage tension in the body affect your experience with exercise?
- Do your experiences with managing tension and release in this class **differ** from your experiences with tension and release in other group exercise classes? Please explain.

A sense of feeling related/socially connected to other class members

I offered spaces within class time to effortfully build community and common bonds between us. The objective was to foster feelings of **relatedness** between you and other class members and between you and me.

- How (if at all) does this conscious effort, where the exercise instructor socially connects members, **differ** from your experiences in other group exercise classes?
- How (if at all) does connecting with your exercise instructor and other class members affect your exercise experience?
- Does your experience with social relatedness in this class **differ** from your experiences with social relatedness in other group exercise classes? Please explain.

A sense that the movements you were doing were important

Where appropriate, I connected the science behind the movements we were doing with the immediate *and* future benefits to multiple dimensions of well-being. The objective was to foster your unique intrinsic feeling of the **importance** of the activities in *your* personal life experience—in the class and beyond the class.

- How (if at all) does incorporating the neuroscience and mind-brain benefits of exercise affect your perception of the importance of exercise to your health and well-being?
- How (if at all) does this perception **differ** from your experience of the importance of exercise in other group exercise classes?
- Does learning more about the effect of exercise on the mind-brain change your view of exercise and physical activity in any way? Please explain.

A sense that you had choices on your movements and intensity levels throughout the class

I offered many movement modifications, intensity progression options, opportunities to be creative with your movement, and the agency to "refresh" yourself, or take a moment to pause and come back in at any time. I invited you to customize and internalize the group movements as if they were your "personal training," but within a social, group setting. Lastly, I frequently reminded you that "all movement counts" and that when you are moving—whether it is in exercise or general movement, your mind, body, brain, and environment are in conversation with one another. Success was defined by showing up and moving in any way that made you feel good. The objective of these cues was to foster your intrinsic feeling of **<u>choice</u>** of movement and to continually reinforce that there were many ways you might choose to incorporate both vigorous and light physical exercise and activity to meet your personal needs, likes, and wants.

- How do these *teaching methods* offering choice **<u>differ</u>** from other group exercise class experiences?
- How does having a choice affect your exercise experience?
- How does knowing your personal choice of movement "still counts" affect your exercise experience?
- Does your experience with choice in this class **<u>differ</u>** from other group exercise classes?

A sense that you were enjoying yourself while you exercised

I used humor, imagery, metaphors, language, and cues to inspire your sense of levity and joy towards movement, inspire your sense of awe and wonder about your mind-brain-body capabilities, and inspire your sense of optimism about the immediate mood and long-term brain-boosting benefits of exercise and physical movement. These cues were intentionally used to foster your curiosity to learn more about mind-brain-body health and wellbeing and to increase your sense of multidimensional well-being (physical, cognitive, emotional, and social). My objective was to assist you with finding your own personal **<u>enjoyment</u>** with bodily movement and exercise.

- How does this enjoyment philosophy **<u>differ</u>** from your other group exercise class experiences?
- How does seeking the enjoyment of movement affect your exercise experience and your views towards movement and physical activity?
- How does your experience of enjoyment in this class **<u>differ</u>** from your experience of enjoyment in other group exercise classes?

Appendix N: Measurement Tool for Research Question 3: Participant Experiences With the Intervention and Research Question 4: Knowledge From the Intervention

What were YMCA group exercise participants' experiences with the intervention?

How did participation in the intervention change participants' knowledge of the benefits of exercise on the mind-brain?

Journal Prompts

After each class, a link to an online journal prompt will be posted in the Zoom chat box. Each journal prompt will inquire about three items: (a) what you learned in class that day, (b) your experience in class that day, and (c) anything else you might like to share.

Class 1: Effects of Exercise on Cognitive Abilities

Today we talked about the effects of exercise on emotional health.

1. What did you learn in class today?
2. Describe your experience in class today.
3. Is there anything else you'd like to share?

Class 2: Effects of Exercise on Emotional Health

Today we talked about the effects of exercise on emotional health.

1. What did you learn in class today?
2. Describe your experience in class today.
3. Is there anything else you'd like to share?

Class 3: Effects of Exercise on Neuroanatomy

Today we talked about the effects of exercise on structures in the brain. Journal a few thoughts about what you learned in today's class and how it made you feel.

1. What did you learn in class today?
2. Describe your experience in class today.
3. Is there anything else you'd like to share?

Class 4: Effects of Exercise on Neurochemicals

Today we talked about the effects of exercise on the chemicals involved in the functioning of your nervous system.

1. What did you learn in class today?
2. Describe your experience in class today.
3. Is there anything else you'd like to share?

Class 5: Alzheimer's Disease and Aerobic Exercise

Today we talked about Alzheimer's Disease and Aerobic Exercise.

1. What did you learn in class today?
2. In what ways, if any, does participation in classes instructed using brain-body teaching methods change your intrinsic motivation to exercise?
3. Is there anything else you'd like to share?

Class 6: Connecting Exercise to the Brain

Today was our final class. We continued to connect exercise and the movement of the body to the physical and emergent properties of the brain (e.g., the structures of the brain and thinking and feeling.)

1. How has your knowledge of the mind-body connection changed?
2. How did participation in these classes change your knowledge of the benefits of exercise on the mind-brain?
3. Is there anything else you'd like to share?

Appendix O: Post-Experimental Intrinsic Motivation Inventory

Wording adapted from McAuley et al. (1987) to reflect group exercise context.

Not at all true			**Somewhat True**			**Very True**
1	2	3	4	5	6	7

Interest/Enjoyment

1. I very much enjoyed participating in group exercise classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain.
2. Participation in group exercise classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain was fun to do.
3. I thought these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain were boring.
4. Participation in classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain did not hold my attention at all.
5. I would describe participation in classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain as very interesting.
6. I thought participation in these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain was quite enjoyable.
7. While I was participating in classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain, I was thinking about how much I enjoyed them.

Perceived Competence

1. I think I am pretty good at executing the moves in these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain.
2. Compared to other students, I think I did pretty well in classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain
3. After working at the moves for a while in these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain, I felt pretty competent.
4. I am satisfied with my performance at executing the moves in these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain.
5. I felt pretty skilled when executing the moves in these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain.

6. I felt I couldn't do the activities in these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain very well.

Effort /Importance

1. I put a lot of effort into participating in these group exercise classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain.
2. I didn't try very hard to do well at these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain.
3. I tried very hard during these exercise classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain.
4. It was important for me to do well in these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain
5. I didn't put much energy into these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain.

Pressure/Tension

1. I did not feel nervous at all while participating in these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain.
2. I felt very tense while doing these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain. (R)
3. I was very relaxed in doing these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain.
4. I was anxious while doing these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain. (R)
5. I felt pressured while doing these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain. (R)

Perceived Choice

1. In these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain, I believe I had some choice about doing the activities.
2. I felt like it was not my own choice to do the activities in these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain.

3. I didn’t really have choices about doing the activities in these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain.
4. I felt like I had to do the activities in these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain.
5. I participated in the activities in the classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain, because I had no choice.
6. I did the activities in these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain because I wanted to.
7. I did the activities in these classes where the instructor frequently used imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain because I had to.

Value/Usefulness

1. The exercise instructor’s frequently use of imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain makes exercise feel like it could be of some value to me.
2. I think that an instructor’s frequent use of imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain is useful for helping me improving multiple dimensions of my health and my sense of well-being.
3. An instructor’s frequent use of imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain is important to do because it can remind me that exercise is important for multiple dimensions of my health and well-being including my memory and mood.
4. I would be willing to take classes again where the instructor frequently uses imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain because it has some value to me.
5. I think taking group exercise classes where the instructor frequently uses imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain could be beneficial to me.
6. I think exercise classes where the instructor frequently uses imagery, metaphors, and applied neuroscience to connect the benefits of exercise to the mind-brain is an important activity.

Relatedness

1. I felt really distant to this instructor and other group exercise participants in these classes.
2. I really doubt that this instructor and the other group exercise participants in these classes and I would ever be friends.
3. I felt like I could really trust this instructor and the other group exercise participants in these classes.
4. I’d like a chance to interact with the instructor and other group exercise participants in these classes more often.

5. I’d really prefer not to interact with the instructor and other group exercise participants in these classes in the future.
6. I don’t feel like I could really trust this instructor and other group exercise participants in these classes.
7. It is likely that this instructor and the other group exercise participants in these classes and I could become friends if we interacted a lot.
8. I feel close to this instructor and the other group exercise participants in these classes.

Scoring information for the IMI

To score this instrument, you must first reverse score the items for which an (R) is shown after them. To do that, subtract the item response from 8, and use the resulting number as the item score. Then, calculate subscale scores by averaging across all of the items on that subscale. The subscale scores are then used in the analyses of relevant questions.

Appendix P: Focus Group Prompts Assessing Participants' Intrinsic Motivation (Research Question 5) and Mind-Body Unity (Research Question 6)

1. Did you use the Twitter extension? If so, can you tell me a little bit about your experience with it? If not, can you explain why?

2. Describe how hearing that "all movement counts" makes you feel about physical activity and exercise?

3. How does learning about the benefits of exercise on the mind-brain affect the way you think about physical activity and exercise?

4. Describe how you felt when you were participating in these classes.
   - Specifically, can you cite any specific examples from the class (e.g., movements, my cues, knowledge, experiences, social connections, humor, etc.) and describe how they made you feel in those moments?

5. Describe how (if at all) this intervention affects your physical activity level outside of the class.

6. In what ways (if any) did participation in this intervention change your perception of your mind-brain-body relationship?

7. How does it feel to take an exercise class where the instructor explains the benefits of exercise on mood, memory, creativity, focus, and brain health?

Appendix Q: B-BFF Study Activity Table

Table Q

Activity Table for Study Using a Brain-Body Fitness Framework in a Group Exercise Class

Activity	Timeline	Duration	Description
Online Information Session	November 2021	30 minutes	Participant intro to study; Q & A; assist participants with opening Twitter
Class 1: Barre Post-class reflection brain-body fitness framework checklist	November 2021	70 minutes (55 class, 15 journaling)	Effects of exercise on cognitive abilities prompt; Health as multidimensional construct; mind-body unity using imagery/ metaphors; Adherence to brain-body fitness framework
Class 2: Cardio Post-class reflection brain-body fitness framework checklist	November 2021	70 minutes (55 class, 15 journaling)	Effects of exercise on emotional health prompt; Health as a multidimensional construct; mind-body unity using imagery /metaphors; Adherence to brain-body fitness framework
Class 3: Barre Post-class reflection brain-body fitness framework checklist	November 2021	70 minutes (55 class, 15 journaling)	Effects of exercise on neuroanatomy prompt; Health as a multidimensional construct; mind-body unity using imagery/ metaphors; Adherence to brain-body fitness framework
Class 4: Cardio Post-class reflection brain-body fitness framework checklist	December 2021	70 minutes (55 class, 15 journaling)	Effects of exercise on neurochemicals prompt; Health as a multidimensional construct; mind-body unity using imagery/ metaphors; Adherence to brain-body fitness framework
Class 5: Barre Post-class reflection brain-body fitness framework checklist	December 2021	70 minutes (55 class, 15 journaling)	Alzheimer's Disease and aerobic exercise prompt; Health as a multidimensional construct; mind-body unity using imagery/ metaphors; Adherence to brain-body fitness framework
Class 6 Cardio Post-class reflection brain-body fitness framework checklist	December 2021	70 minutes (55 class, 15 journaling)	Connecting exercise to the brain prompt; Health as a multidimensional construct; mind-body unity using imagery/ metaphors; Adherence to brain-body fitness framework
Online Post-Participation Focus Group	December 2021	60 minutes	Participant experiences with intervention, components of framework, and teaching methods in brain-body fitness framework
Post-participation Program Differentiation Survey	December 2021 to January 2022	30+ minutes	Participant experiences and self-reports of program differentiation from other group exercise class experiences

Appendix R: Competence

Table R

Participant Quotes on B-BFF Movement and Progression Option Leading to Increased Competence Perception

Quote
• In other group classes, I felt VERY competent when I was "on" and could do EVERY single rep with full effort. If something felt twinge-y or cold, I'd often push through anyway from the general cheerleader level enthusiasm from instructors to get us through the entire routine pushing ourselves at "110%". (I've been in many classes that have used that exact phrase and it has always irked me from a mathematical point of view, but you get what I mean.) If I was sick or had a rough day or week the week before, that didn't matter. I'd still do the classes full out, with heavy/normal weights if applicable. My husband joined me for one of my classes at that time and literally had to leave two thirds of the way through the class to throw up from trying to keep up with me. I FELT competent. But I was basically being cheered right into severe burnout and heading towards overuse injuries. If I couldn't do things full out in other classes or had to baby myself at all I felt incompetent. This is almost the polar opposite of how I feel in these classes.
• I feel more competent because I feel more in charge of my choices in following the instructor. I feel accepted at what level I am that day. I am the only one who decides if I am doing my best. My best does not always match others. sometimes it is higher than others sometimes lower. It is accepted and celebrated that I am there and not on the couch. Even my first simple efforts are celebrated, and I can reach farther because I feel successful from the start.
• In other classes I got used to the feeling of 'If I don't get it now, I never will and there's no hope'. Certain instructors would give visual examples of exercises, and if you didn't get what you should be doing from that, they just moved on. I feel like Lisa always tries to describe an exercise 5 different ways before she moves on, ensuring that everyone has an idea of what they should be feeling.
• In this class, I can complete all the exercises correctly for my body in this class. If I have trouble with a move, I do not feel incompetent; I just need to modify the movement. The modification maybe for now, or there may be a reason the change will be permanent. For example, I will never do sit-ups because of 3 compressed disks in my back; I will never do sit-ups. I do not feel my inability to set up is seen as a failure in this class. You point out that there may be a reason why a move is not suitable for you…There are also classes where the instructor tells you the one correct way to make a move. You are then encouraged to continue the movement after you have reached the point that you cannot complete the move with good form. I do not feel competent in these classes.
• The visualizations do help me to be sure my form is correct and that I am doing the exercise correctly. Since I am giving my time, I want to be sure that I am working hard, working correctly and I am able to protect myself with encouragement to do what is best for myself. I will say that one of the key differences [in B-BFF classes] is that as a participant I am provided with scaffolding exercises that allow me to continue to participate in class at the level that is best for me and yet pushes me to be better. It allows for individual differences without feeling embarrassed that I am not doing the same thing as the class. You make it acceptable to participate at your level. My opinion, but I think some new exercisers drop out of classes after one or two tries because they see everyone doing everything at a higher level and so easily and they feel like they can't, so they don't come back. However, many times they don't realize that some of the participants have been doing the class for years and that they fumbled in the beginning too. Your scaffolding cues and encouraging words of 'you aren't on the sofa' may make newcomers feel like trying again and increasing their confidence.

Appendix S: Usefulness

Table S

Participant Quotes on B-BFF Content, Methods, and Messaging Leading to Increased Perception of Exercise's Immediate Usefulness

Quote
• Talking about these wonderful benefits of exercise helps me understand better how I can exercise in ways that increase the positive effects in my life. Talking about them while in a class led in ways that help me to achieve them only increases this experience of telling my mind and heart that exercise in incredibly useful for me in so many ways.
• I guess going to other classes you know there will be a benefit, but the feeling of well-being after hearing all of the ways these movement benefit me is so much more rewarding, giving me a sense of a much more accomplished workout.
• I greatly appreciate the extra tidbits of information to help us realize that these activities have immediate and useful positive impacts on all areas of our physical-mental-emotional lives. For me, the benefits to my brain and emotional health are far more motivational than achieving speed or repetitions. Generally speaking, other instructors do not cue performance demands based on benefits, but rather on quantifiable metrics such as speed, RPM's and repetitions. Perhaps because I have never been a great athlete, these types of metrics simply do not motivate me. Whether I am in your class or others, I now set my intentions a bit differently. Rather than just following the instructions in a cardio class (i.e. to increase RPM's on a spin bike), I now think about how many BDNF's I can produce and how much cortisol I can burn off. Those thoughts are more motivational to me than simply the command to increase my RPM's.
• I think learning brings awareness and awareness impacts daily life choices. I also think that we need to hear messages several times before we remember them and understand their relevance in our lives, which is why incorporation of these cues and information interspersed in instruction brings the message to every class and the participant hears it where they are that day, but then hears it again another day. When they are in a decision-making time, they can recall the message and it will influence the decision.
• In this class there is no room for doubt about the many ways exercise is useful and beneficial to us in our daily lives. Talking about this in class while we exercise helps me understand how I can use it to better my life. It changes my experience of exercise.

Appendix T: Reappraising Tension

Table T

Participant Quotes on B-BFF Content, Methods, and Messaging Leading to Increased Skill in Cognitively Reappraising Tension

Quote
• This skill feels beneficial. Like a self-cleaning oven. • I feel more like I am grounded in and in control of the process rather than forcing anything to happen. I realized I didn't hear that kind of talk in other classes. • Mindfulness about anxiety=ability to reduce its hold on me. • This helps me notice and observe muscular processes. Other classes focus on "push and burn" and forcing something to happen rather than observing and monitoring. • I finally identified how to feel certain moves in my core.

Appendix U: Relatedness

Table U

Participant Quotes on B-BFF Content, Methods, and Messaging Leading to Increased Perception of Relatedness to Other Class Members

Quote
• Feeling connected is the primary reason I continue to come to this class in particular. The cardio machines and weight room are by far easier to work into one's schedule. (Always open and available as soon as I arrive.) But the class members and instructor feel like an extended group of friends. Feeling that sense of belonging is a large part of why I regularly attend this particular class.
• I feel more relaxed and fulfilled when the class is over. For example, I like it when I find other people that have the same interests I have or to learn what other people do outside the Y.
• It feels like I'm wanted in the class.
• I am more interested in coming to class when I know the teacher knows who I am, and I know her and some of the other participants. I am more accepting of my attempts in class when I know the others around me. I feel like a community member who is valued because we know names and ask about things we know others have discussed - like children, grandchildren, trips, etc.
• Unless I was attending a group exercise class with a friend, I never knew anyone nor spent time getting to know anyone else in my previous workout classes.
• Your class is the only class I have taken where the instructor tries to build community and common bonds within the class. I have gotten to know the people standing around me in classes. I always enjoy hearing about what is going on in their lives. I know many more of my classmates in your class than any other class I have taken because of your community building.
• This is exceptional. So often I walk into a class and feel like a stranger, and it appears that others feel the same. It's as if everyone is in their "spot" and can't cross that boundary. There are no smiles in the room and no pre class chatter - it's a cold environment and discouraging.
• Wow! Hugely different. The social aspect is part of the enjoyment. Most classes I have attended never encourage any social interaction with others in the class…

Appendix V: Importance

Table V

Participant Quotes on B-BFF Content, Methods, and Messaging Leading to Increased Perception of Exercise's Important

Quote
• It actually made me think that exercising is not just something I do to be physically fit, but it also helps with my mental health.
• This is very different. No one talks about the brain.
• I feel like exercise is far MORE important that when we started with this developing instructional framework. It's fascinating how reframing movement took it from something that felt indulgent or "just for me" or even selfish (mom guilt is real, y'all) to something that felt justified. I guess I mean that reframing it as benefiting ongoing neural health seems less shallow than just exercise so I look nice in an outfit for an upcoming vacation. Somehow that seems a lot more important and sustainable as motivation.
• For me, incorporating neuroscience and mind-brain benefits into the purpose of exercise is highly motivational to continue on the path of including exercise in my regime towards health and well-being. As I age, my focus on "physical looks" becomes less important as my focus on brain health and quality of life becomes increasingly more important. Being less focused on physical looks could easily result in being less focused on exercise. However, bringing neuroscience knowledge and mind-brain benefits into exercise adds many, many fundamental reasons to keep exercising. Exercise is one of the core pillars of health, and the neuroscience factors have increased the reasons for exercising exponentially.
• My perception of the importance of exercise is mainly based on how I feel during and following the class. I feel alive and in touch with my inner self. My problems and negative thoughts disappear. My muscles feel as if they were meant to do what they were doing. Knowledge of the neuroscience and brain benefits enforces my general feelings about exercise. Hopefully some of those not inclined to be physically active will be inspired by these mind-brain benefits even if they don't care about burning calories or strengthening muscles.
• Learning about neuroplasticity, neurogenesis, and BDNF adds to the importance I place on exercise. It feels immediate. Like it's happening now.
• My perception stays with me no matter what class I'm taking.
• Like I said before, there is not much education being offered in other classes. Just a follow the instructor and count.
• Other classes do not focus on the overall, multi-faceted benefits of exercise. Most classes simply deliver the activity, and that's it. More attuned instructors will focus on the physical benefits of an improved resting heart rate, increased flexibility, and increased strength and some focus on reduced stress. Taking exercise to the level of improving mental functions and learning is new and unique.

Appendix W: Choice

Table W

Participant Quotes on B-BFF Increased Perception of Movement Choice Supporting Multiple Domains of Well-Being

Quote
• It makes me LESS likely to push too hard and MORE likely to continue through the end of class. It gives me a lot more confidence in class and more understanding for the process.
• By having choices that are all proclaimed "good," shame is left out of the experience. I can work at whatever level feels best to me that day. I can even alternate between levels or adjust. Just because I chose a particular level does not mean I have to stay there if I am feeling like I could do more, or I am feeling unbalanced and want to scale back. Class feels like an accepting environment that allows for change and growth.
• The approach does make me comfortable in class to know that I am not being judged by the instructor nor my classmates. I do not feel my self-esteem being battered by class. Class is a safe haven for exercising with others who are also trying to maintain their health. I feel like we are all in the same boat and encourage one another by our mere presence.
• I think these methods are inspiring and motivate me to push. I'm "young" enough now that I love when we show me ranges so that I can push toward the top range. I don't instinctively know what a top-level might be sometimes until you explain it to me. I think a squat is hard until you offer a jumping-jack squat and then I'm able to go harder. On the opposite end, I love knowing how I can dial-down my energy a little bit while still getting a great workout. If I don't want to jump, you give me options. It's my workout, I feel confident in what I know and how I can move my body through space.
• This section of questioning is probably one of the biggest differences in instruction from other classes. By providing the scaffolding you allow participants to be in class and work based on their knowledge of what their body can do on that given day without feeling embarrassed or "less than" the others, giving that permission, acceptance is encouraging, and I think makes people want to come back. Now, I take this "permission" into other classes so I can participate in the way my body needs that day. I particularly like your concept of a personal training within a social setting.
• In most classes, there is only one level of movement which seems acceptable. A class that you can customize to what is right for you is more enjoyable. You are more likely to come back to a class that is enjoyable. It helps you move more during the day when you think about the statement all movement counts. Counting all movements encourages you not always to do tasks the most efficient way. Sometimes, a more playful way is more fun and is good for your body and mind.
• These teaching methods made me feel relaxed and confident during the class. I feel that I can change my intensity or progression at any time without any judgment from myself or others.
• I feel that choice is implied, or at least understood, although I have not heard it mentioned in any other class. If I was noticeably impaired, I would stand in the back of the class so that I would not confuse anyone behind me. Most of the classes I've taken at the Y are "see and do" with minimal verbal instruction, with possibly a word of encouragement now and then. For example, in Les Mills Body Combat, once the music starts, there are no demos of what the different punches or kicks are. Even though she's sometimes saying the name of the punch, you probably can't hear it over the music. I'm sure it's not easy for beginners.
• I have found that a few other classes offer levels, but the implication is usually due to lack of ability and the need to progress to the instructor's level. The concept of personalizing within a group setting is refreshing and encourages you to attend in spite of a change in my physical condition on a given day. It encourages attendance and then hearing that all movement counts is almost a reward.
• An area where I have changed due to your teaching is that I no longer feel "driven" to do the exercise that everyone else is doing when perhaps my joints contraindicate the movement. I now feel more comfortable with substituting movements that are better for my joints or my situation on a given day. Your teaching style has helped me to mature in this area.
• Lisa made me feel like the way I chose to exercise each time I came to her class was good. I could work at the level that felt right for me. There was no need for negative comparison between myself and the other participants in my mind because I knew I was making conscious wise decisions based on how I felt and how my body was responding. I was in control of my own experience. It is a very empowering feeling to know this and feel accepted right where I am. It also gives me the power to know that I can adapt and grow and change in ways that feel best to me in my exercise. Because Lisa repeats these reminders frequently, they also echo in my head as I approach other challenges and tasks outside of my exercise classes. I am more accepting of my efforts and where I am at because of the way she teaches.

Appendix X: Enjoyment

Table X

Participant Quotes on B-BFF Content, Methods, and Messaging Leading to Increased Perception of Enjoyment of Movement

Quote
• The accepting manner of your instruction, the encouragement to do what you can do, explaining the ways the participant can increase their level of exertion are all very motivating to me to come to class. It is the effect of feeling rewarded coupled with good instruction, good cueing, and a very positive spirit. Today's activities with breathing were very interesting, and your visual cueing was very helpful—like the exhale example—like a breath to clean your glasses. Each class choreography is different and that is also intrinsically motivating.
• It is just fun, and it is different every time. The instruction is novel, so not knowing what to expect makes it fun. Although I am not a dancer and certainly am not graceful, I enjoy watching how I can incorporate hand movements, arm movements into the dance/exercise experience. At first, I was uncomfortable, but now I just listen and do the best I can, and I have your permission just to laugh at the outcome.
• I LOVED every part of this class.
• Wow - how to describe it? So much fun and energy and positivity!! Not just a focus on the exercise moves, but a focus on participants as valuable individuals who are able to make choices and decisions with the amazing instructions Lisa gives. Her cues help my focus my energy correctly and choose the level I can wisely and effectively work at rather than trying to keep up with an example that I am not able to meet yet. I walk out feeling physically and emotionally and mentally challenged and supported. I feel alive in the healthiest ways.
• I never left these classes feeling defeated, overdone, or on the brink of injury. These classes were less mentally hard to get through (despite being plenty challenging physically). I think the enjoyment and camaraderie through the process made it much easier to love what we were doing
• Your class is a place where exercise and learning, acceptance, and belonging happen; this is not felt as strongly in other classes.
• I feel that this class participants are friendly and seem happy to be there, therefore it is contagious and I feel the same.
• I love the "giggle as you wiggle" slogan. It has helped me to realize that our efforts are what count, and not necessarily the ultimate excellence of the movement itself. That slogan and other light-hearted comments have helped me to not take myself so seriously. It's okay to not be perfect (hard words for a perfectionist)! This open acceptance by you has helped me to find more joy in the activity. The lesson translates into life as well. We should try things, regardless of how well we perform. If we don't perform as well as desired, just laugh and try again. View activities in as exercise. The more we do something, the better we get at it. However, the ebb and flow of life impacts our outcome just like the ebb and flow of life impacts how our bodies behave every day doing the same movement in the studio. Most instructors don't say much about not performing a move well. They are not at all critical either. They simply don't say anything. They show what you should be doing and move on.
• So much fun and energy and positivity!! Not just a focus on the exercise moves, but a focus on participants as valuable individuals who are able to make choices and decisions.
• I have never had another instructor use so many cues that spark joy. Classes are more fun when you feel relaxed and optimistic about your success.
• We are encouraged to laugh. If I mess up, I hear you saying that my brain loves novelty, and a mess-up is a great thing. This is priceless.
• I love having fun infused, the sense of humor, and the way movement is encouraged to be fun rather than just an activity to get through or a job that needs to be completed.
• You definitely helped me find my own personal enjoyment with bodily movement and exercise. I find myself seeking out fun exercise movement or dancing around my house when I'm by myself.