A STUDY OF STUDENTS' PERCEPTIONS OF THE EFFECTIVENESS OF AN INTERDISCIPLINARY METHOD FOR TEACHING INJURY-PREVENTIVE PIANO TECHNIQUE

by

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ABSTRACT

A STUDY OF STUDENTS' PERCEPTIONS OF THE EFFECTIVENESS OF AN INTERDISCIPLINARY METHOD FOR TEACHING INJURY-PREVENTIVE PIANO TECHNIQUE

Barbara Ann Lister-Sink

The rate of playing-related neuromusculoskeletal disorders (PRNDs) in advanced pianists remains consistently high worldwide, often limiting or ending study and playing careers. Injured pianists—desperate for solutions—seek out allegedly scientifically-informed approaches to developing injury-preventive technique but none of these approaches have been seriously investigated. This mixed-methods study investigated one interdisciplinary, non-traditional approach (the "Method") that had received considerable anecdotal support but had not been studied systematically to ascertain its efficacy in recovering from and preventing recurrence of PRNDs, as well as its effects on technique, musicality, and extra-musical factors. Participants included undergraduate and graduate students, independent piano teachers, college teachers, and professional pianists and organists who had studied the Method for at least two academic semesters between 1990 and 2015. An anonymous survey was administered to 103 pianists and organists aged 22 to 82, with 74 (N=74) pianists responding (71.8%), and 26 pianists and organists were interviewed in-depth. Survey and interview results established that participants perceived the Method as significantly helpful in facilitating recovery from PRNDs. Significance of

relationships among codes included correlations of .70 between the code “it works” and “playing without injury,” and .66 between “it works” and “playing again.” Interviewees also perceived the Method as helpful in preventing recurrence of PRNDs, as shown by the high correlation between the codes “will help prevent injuries” and “learned a lot from studying the Method” (.67). A one-sample *t*-test performed on the survey data also showed a positive perception ($p < .001$) of the Method in helping recovery from and prevention of recurrence of PRNDs. Additionally, both the survey and interview participants reported improvement of technique and musicality with many also reporting enhancement of their extra-musical lives. A one-sample *t*-test on the survey data showed these improvements to be significant at a 5% level or better. Research also yielded data on psychological, emotional, and professional challenges to learning the Method, as well as reactions to specific aspects of the Method. It is hoped that the data might serve as a baseline and become a useful model for the investigation of other approaches for teaching injury-preventive piano technique.

DEDICATION

To my daughter Chloe Fitzgerald Plumb, the joy and inspiration of my life;
and to the memory of my beloved friend, pianist Frank Glazer (1915-2015),
a shining example of how to live every moment to the fullest.

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To all my students over the last four decades—the enthusiastic ones, the skeptical ones, and everyone in-between—who inspired whatever good the Method embodies.

To the memory of my mother Annie Lee Fitzgerald Sink whose generous heart I have tried to emulate and whose sacrifices and love set me on this joyous path in music. And to the memory of my father Bright Sink, a great stride player, who continually said my only problem was that I never got my doctorate. Well, I finally got it, Daddy!

BL-S

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INTRODUCTION

Narrative

> …the most intricately and perfectly coordinated of all voluntary movements in the animal kingdom are those of the human hand and fingers, and perhaps in no other human activity do memory, complex integration, and muscular co-ordination surpass the achievements of the skilled pianist (Smith, 1961, p. 205).

This study is particularly important to me, considering my own history of playing-related injury and subsequent quest to explore potential strategies for teaching injury-preventive, efficient piano technique. In 1963, at the age of sixteen, I experienced a debilitating playing-related injury. Throughout my college years, I struggled with the injury continually, seeking but not finding clear answers regarding its nature and cause, as well as ways to use my body at the piano that would not precipitate a return to the injury. Any questions related to technique were answered with numerous confusing and contradictory suggestions from both teachers and healthcare professionals.

Introduction to an Alternative Technical Model and Pedagogy

Fortunately, I met a piano teacher in 1969 in Amsterdam after graduation from college. American-born pianist Lateiner-Grosz was a visionary pedagogue who offered an alternative and ultimately transformative approach to teaching injury-preventive technique. The technical model she used was familiar to me from my own exposure to pianists of the late 19th century "Russian School." Its hallmarks were efficient muscle

use; optimal skeletal alignment of the "playing apparatus" of arms, hands, and fingers, as well as the torso, neck, and head; economy of means; optimization of the use of gravity; non-accumulation of muscle contraction or tension; and, ultimately, virtuoso, "effortless" playing. Ongoing kinesthetic awareness and listening were also essential components. Later, in 1978, I would observe this same model in my teacher Agosti, a renowned Italian pianist and master teacher. While this type of playing was associated with virtuosity, it was also considered to exemplify the "Golden Age" of piano playing and tone production (Dubal, 2003). As a consequence of this more radical approach to practicing, I was able to perform virtuoso piano literature without fatigue, pain, accumulation of muscle contraction, or apparent stress on the neuromusculoskeletal system.

Introduction to a Holistic Approach to Diagnosis and Rehabilitation

However, in 1973, I developed another more medically confounding playing-related disorder that even Lateiner's approach did not alleviate. Luckily, I met de Lange-Boeke, a healthcare professional in Amsterdam who was noted for helping numerous musicians understand and rehabilitate from various playing-related disorders. Her approach utilized multifaceted components from several disciplines: acupuncture, neuromuscular massage, and physical therapy. She also addressed potential contributing psychosomatic origins of the disorder. Most importantly, she viewed playing the piano as a complex coordination of the entire body, directed by the brain, with the instrument. Thus was my holistic view of piano technique born. Piano technique was defined as not *what* we played but *how* we played with our mind and body.

The Influence of Cognitive Embodiment and Somatic Pedagogy

Concurrently, I began to hear numerous stories of injured pianists who had not been as fortunate as I. Consequently, after returning to the United States in 1975, I began a study of the history of piano technique. Examining numerous books and articles on piano technique throughout the past century, however, left me even more confused. In 1980, while teaching at the Eastman School of Music, I was introduced to the Alexander Technique and other somatic education disciplines such as the Feldenkrais Method by viola faculty member Tursi.

Influence of Sports Pedagogy, Neuroscience and Performing Arts Medicine

I grew up in a family of athletes who made me aware of the importance of the concept of fundamentals or basic form in each activity. This would be defined as a check list of biomechanically efficient coordination for the particular sport, and was considered essential by professional athletes and coaches. I wondered why this concept was not applied to piano technique. Then in 1980 my mother began showing signs of premature senility and died unexpectedly in 1983. As a consequence, I began research into the relatively new field of neuroscience to understand better the nature of my mother's illness. In 1994, I also discovered SyberVision, a neuromuscular training program for athletes that evolved from research studies by DeVore at Stanford University School of Medicine's Neuropsychology research laboratory. I thus became interested in the possible correlation between sports pedagogy and piano pedagogy, as well as the development of a "basic form" for playing the piano. I also joined the evolving field of performing arts medicine as a presenter and performer in the 1992 World Congress on Arts and Medicine, sponsored by MedArt International (Lister-Sink, 1992). During this

Congress, I attended presentations related to musicians and injuries by researchers in biomechanics, neuroscience, physical therapy, dance pedagogy, somatic education, and orthopedics.

After viewing piano technique and pedagogy from a number of non-music disciplines, I needed to explore whether embodied in these other disciplines there were overlapping common and fundamental principles of optimal body use, as well as common pedagogical strategies for teaching these principles. Concurrently, I believed that a more rational perspective from various related disciplines might be a partial solution to the problem of conflicting and contradictory approaches to technique and pedagogy throughout the history of the piano.

Meanwhile, my fundamental concept of piano technique, as well as how it should be taught, had also evolved: As a consequence of my second playing-related injury being caused by a spinal misalignment, my exposure to sports models and pedagogies, and my ongoing studies in the Alexander Technique, I now defined technique as the most efficient use of the *whole* body—directed by the brain—with the piano.

Development of an Interdisciplinary Method for Teaching Piano Technique

Over the last twenty years, I have attempted to integrate the aforementioned disciplines into the creation of a new pedagogical paradigm for teaching the technical model that I had witnessed and that had been taught to me by Lateiner-Grosz. Autodidactically, I did this by incorporating research findings in the fields of neuroscience, movement science, performing arts medicine, cognitive embodiment, non-Western pedagogies, sports pedagogy, neuropedagogy, and technology-assisted pedagogy. The result was a method that was radically different from the traditional ways

of teaching piano technique. It was built on the concept of training the most fundamental coordinations through immersion training in a carefully sequenced, step-by-step manner. In 1995, I produced a DVD *Freeing the Caged Bird – Developing Well-Coordinated, Injury-Preventive Piano Technique* (DVD introduction: https://youtu.be/I9ZsdAEycLs) that won the 2002 Music Teachers National Association-Frances Clark Keyboard Pedagogy Award. Over the years, however, the Method[1] evolved as I incorporated research findings with my own experience in teaching it to dozens of students. In 2009, the Method was incorporated into a curriculum and a certificate program at Salem College in Winston-Salem, North Carolina (Appendix A - Salem College Certificate Program in Injury-Preventive Keyboard Technique). However, while the Method had met with considerable anecdotal success in retraining both injured pianists and uninjured pianists, students of the Method frequently found such a radical, non-traditional approach challenging in a number of ways. Moreover, fear arose that one's artistry might be diminished if one taught technique from a more rational, interdisciplinary perspective. The question remained: Did students perceive this holistic, interdisciplinary Method a viable, reliable means of training efficient, injury-preventive technique?

It is this question that I hoped this study would answer.

Background

Playing the piano can be one of the most highly complex, multifaceted psychomotor activities known to humankind (Altenmueller & McPherson, 2008). Learning advanced musical repertory requires not only musical talent and aesthetic sensibilities: It also demands subtle and repetitive use of the musculoskeletal,

[1] Throughout the document, the Method is used to refer to the Lister-Sink Method developed by the author.

neuromuscular and sensorimotor systems (Pascual-Leone, 2001; Wilson, 1982). For example, Robert Schumann's Toccata, Op. 7 has over 6,000 notes and is frequently played in 5 to 7 minutes, equaling a rate of 14 to 20 notes per second to be executed by the pianist. Such an activity, in and of itself, could be considered extraordinarily demanding. However, the pianist must also understand and project the artistic, dramatic, and emotional content of the piece; make its structure comprehensible; execute the notes without inaccuracies and in exact split-second timing; and usually perform the piece by memory before an audience of silent listeners on an instrument that may or may not be ergonomically appropriate for the pianist's anatomical and physiological characteristics (Pascual-Leone, 2003). Moreover, while the history of piano technique and pedagogy may include pianists who are documented to have played with superbly coordinated technique, and pedagogues who have taught such techniques, it is also rife with contradictions, confusion, quasi-scientific theories and turf battles. Arguably, one might draw a correlation between such confusion, complexity, and contradictory information, and the high rate of playing-related injury that continues to persist today (Aoki, Furuya, Kinoshita & Nakahara, 2006; Ackland & Allsop, 2010).

Pianists as Athletes

Such dedication of energy, time, talent, and financial resources might be compared to that of serious young dancers, gymnasts, and figure skaters who also must combine artistic demands with complex neuromusculoskeletal activity. Indeed, noted neurologist and performing arts medicine pioneer Wilson stated that "there is very little to distinguish the serious musician from the serious athlete apart from this: the musician concentrates on perfecting control of the small muscles of the upper extremities (or the

vocal apparatus), tends to be stationary while performing, and monitors his own output largely with his auditory system" (Wilson, 1982, para. 13). Manchester, editor of *Medical Problems of Performing Artists*, noted that the distinction between artists and athletes is more blurred than might ostensibly be thought: the activities of musicians and dancers require athletic components, and those of certain athletes contain artistic elements (Manchester, 2011a). For the pianist, the continuous split-second timing of hundreds, even thousands, of key depressions in one piece, plus the unique interplay between relatively inactive but supportive large muscles of the torso and legs, and numerous small muscles of the arm, hand, and fingers during rapid, repetitive motions—all add another layer of demands onto an already challenging physical activity.

Amount of Practice Time Required

Additionally, studies from 2005 (Sloboda) and 2006 (Gruber) also demonstrated a direct association between expertise and amount of practice time, and showed that the expert musician invested about 10,000 hours over 10 years to achieve a high professional level. Indeed, the results from a 2004 study published in *The European Journal of Neuroscience* indicated "a direct link between tactile acuity and degree of piano practicing" (Altenmüller, Dinse, Ragert & Schmidt, 2004, p. 473), as well as maintenance of motor skills (Alpers, Altenmüller, Jabusch, Kopiez & Vauth, 2009). If a serious high school classical piano student averaged two hours of practice for 300 days per year during four years of high school, she would have accumulated 2,400 hours of practice time at the piano during her high school years. Additionally, if a pianist studying in a Bachelor of Music performance degree program over four years practiced an average of three hours per day for 300 days per year, she would have spent 3,600 hours in the

repetitive motion activity of practicing the piano, thus creating a deeply engrained set of neuromusculoskeletal habits at a relatively young age.

Motivation to Play Not Diminished by Risk of Injury

To further complicate the demands on pianists, these physical requirements are only one of many demands that include artistic, psychological, emotional, intellectual, financial, and even social challenges that a serious pianist must confront to achieve any degree of success. Moreover, such a pianist, like a dedicated athlete, usually exhibits an unusually high degree of motivation and determination to succeed, oftentimes in spite of intense peer, parental, and societal pressure. Such a combination of personal dedication with the aforementioned physical, artistic, emotional, intellectual, and psychological demands has been shown to place the pianist in a potentially vulnerable position for, among others, the risk of playing-related physical injury. Disturbingly, however, studies have shown that even the risk of injury and the presence of pain did not diminish musicians' motivation to continue making music (Guptill, Park & Sumsion, 2007). It might well be assumed that a serious pianist would be so deeply committed to her art that she would be willing to tolerate or even ignore discomfort and pain—both indicators of potential physical hazards—to the point of injury or even dysfunction.

Consistently High Prevalence of Playing-Related Injuries in Pianists

Research in playing-related injuries among musicians parallels the development of the field of performing arts medicine. In 1998, a systematic review by Zaza of published research on playing-related neuromusculoskeletal disorders (PRNDs) among musicians revealed incidence rates ranging from 34% to 62% in secondary school

musicians, and 39% to 87% in adult musicians (Zaza, 1998). More recent studies have suggested that pianists experience an even higher percentage of playing-related musculoskeletal disorders. In a 2006 systematic review of PRNDs specific to pianists, Bialocerkowski, Bragge & McMeeken (2006a) reported that documented playing-related injury varied between 26% and 93%. In a study out of Japan in 2006 focusing on female pianists, 77% reported having sustained some form of playing-related injury (Aoki, Furuya, Kinoshita & Nakahara, 2006). Moreover, in a pilot study in Australia in 2010, 71.9% of professional pianists reported experiencing PRNDs (Ackland & Allsop, 2010). Chong, president of the Performing Arts Medicine Association, stated in 2014 that pianists continued to have approximately a 50% risk of developing injury (Chong & Manchester, 2014)**.** Such injuries often resulted in physical, psychological, and financial hardship due to the consequent loss of college scholarships, time and energy invested in training, jobs, and, ultimately, the ability to make music (Aoki, Furuya, Kinoshita & Nakahara, 2006; Bialocerkowski, Bragge & McMeeken, 2006a).

Current Contradictory and Confusing Findings Regarding Risk Factors for Injury

Adding further confusion, studies since the 1980s have occasionally yielded contradictory results in their attempts to establish causal relationships between injuries and various postures, hand sizes, and diverse technical and pedagogical approaches. In a 2010 survey of pianists out of Australia, Ackland and Allsop found no correlation between pianists' hand spans and injury (Ackland & Allsop, 2010). Likewise, a Japanese study (Aoki, Furuya, Kinoshita & Nakahara, 2006) found that hand size was not a significant risk factor. However, in 2010, another study out of Japan posited a relationship between small hands and the increased risk for PRNDs (Sakai & Shimawaki,

2010). And more recently, Boyle documented the perceived benefits of reduced piano keyboards for smaller-handed pianists (Boyle, 2013).

Again, in the Australian study, Ackland and Allsop found a correlation between playing with the wrist in a neutral position and playing-related injury, thus contradicting the literature in ergonomic studies (Ackland & Allsop, 2010). However, in a study of carpal tunnel syndrome, Szabo and Madison (1995) had suggested a relationship between wrist flexion and hyperextension, and PRNDs. A more unexpected result came out of a study that posited finger mobility between the 3rd and 4th fingers as a risk factor (Aerts, Chesky, Paul & Yoshimura, 2006). Such a finding contradicted the widely held assumption that wrist and finger flexibility and mobility were important components in virtuoso technique (Gerig, 2007). Surprisingly, studies have also yielded contradictory results regarding the risk for PRNDs in female pianists compared with male pianists (Aerts, Chesky, Paul & Yoshimura, 2006; Bruno, L'Abbate & Lorusso, 2007; Chesky & Pak, 2001; Dockrell & Shields, 1999).

Perhaps most troubling of all for the field of injury-preventive piano technique were the results from a 2006 systematic review of risk factors for PRNDs in pianists. The study revealed that there was no consensus among authors regarding risk factors for PRNDs. Furthermore, there was no common or consistent definition for playing-related musculoskeletal disorders (Bialocerkowski, Bragge & McMeeken, 2006a).

The Need for an Interdisciplinary Approach to Technical Models and Methodologies

In the last thirty years, several studies have advocated a multidisciplinary approach to teaching injury-preventive piano technique (Allsop & Auckland, 2010;

Russell, 2006; Wristen, 2000). Indeed, a number of studies in the individual disciplines of neuroscience (Altenmüller, Dinse, Ragert & Schmidt, 2004; Pascual-Leone, 2001), neuropedagogy (Gruhn, 2004, 2007, 2008), movement science (Aerts, Chesky, Paul & Yoshimura, 2006; Aoki, Furuya, Kinoshita & Nakahara, 2006; Furuya & Kinoshita, 2008; Furuya, Kinoshita & Osu, 2009), and technology-assisted pedagogy (Coons, Marcarian & Riley, 2005; Riley, 2010), in addition to performing arts medicine (Manchester, 2012b), have attempted to address potential causes of playing-related injuries, as well as efficacious pedagogies.

In the field of sports and dance, accepted models and biomechanical principles for technique or basic form have been created over the past several decades (Foster, 2010; Hall, 2012; Koutedakis, Krasnow, Stecyk, Wilmerding & Wyon, 2011). As a consequence of studies in exercise science, kinesiology and neuroscience, more effective, efficient pedagogical strategies for maximizing athletic skill and preventing injury have been developed (Araújo, Button, Davids, Hristovski & Renshaw, 2006; Tinning, 2010).

Given the athletic nature of piano playing as a highly complex motor skill, components of these findings might be helpful for technical models and pedagogical strategies. Additionally, research in the field of cognitive embodiment and somatic education, including studies in the Alexander Technique (Batson, 1996; Dimon, 2003; Moore & Woodman, 2012) and the Feldenkrais Method (Benali et al., 2010; Buchanan & Ulrich, 2001), have yielded promising results for possible application to piano technique and pedagogy. Finally, studies in learning strategies from the fields of the martial arts, Zen Buddhism (Herrigel, 1953), Asian music pedagogy (Coff, 1998; Neuman, 2012;

Watts, 2001) and transformative learning (Cranton, 2006) have resulted in findings potentially applicable to piano technique and pedagogy.

Early 20th Century Piano Technique and Pedagogy

Hundreds of books and treatises have been written on piano technique throughout its 250-year evolution (Savage, 2002). However, written descriptions of technical models can be confusing and unclear to many readers (Gerig, 2007). Historically, words and terminology have been used with little consistency from author to author, and were subject to multiple—and even contradictory—interpretations. To further compound the problem, until recently, it was impossible to quantify or measure the actual degree of muscle effort used by pianists for various movements. Thus we could not know the precise nature of the various models described in written or even videographic sources.

Historically, several noted 20th century piano pedagogues took a rational, science-based approach to technique and pedagogy, if viewed through the lens of contemporary research (Kochevitsky, 1967; Matthey, 1947; Ortmann, 1929; Schmitz, 1935; Whiteside, 1961). But unfortunately, their findings have almost disappeared from the collective knowledge of piano teachers (Gerig, 2007). Furthermore, the writings, while purportedly grounded in science, are considered by many pianists to be inaccessibly dense with scientific terminology.

Several models and pedagogical approaches of the late 19th and early 20th centuries—the Russian school and the Leschetizky Method—could be considered examples of a more scientifically "enlightened" (Gerig, 2007, p. 507) technique and pedagogy. The biomechanical characteristics—as demonstrated in video-recorded performances of, among others, Paderewski, Brailowsky, Moiseiwitsch, Gabrilowitsch,

Rubinstein, Gilels, Richter, Horszowski and Cliburn—were economical movement, apparent muscle efficiency, optimal skeletal alignment, apparent non-accumulation of muscle contraction, and the incorporation of gravitational pull. Its artistic hallmarks were warm, resonant tone; singing melodic line; and effortless virtuosity (Gerig, 2007). Indeed, these pedagogical schools, among several others, are said to have exemplified the Golden Age of piano playing and tone production (Dubal, 2003).

Current Piano Technique and Pedagogy Purported to be Scientifically Informed

As of the writing of this study, there were a number of approaches to teaching injury-preventive piano technique that purported to be injury-preventive and scientifically informed. These included those by Fink, Fraser, Grindea, Karpoff, Lister-Sink, Taubman and Wirth. While these approaches were recognized nationally and internationally, little or no systematic investigation of them had been undertaken.

Statement of the Problem

Very little, if any, research thus far has focused on existing, anecdotally[1] successful teaching methods or approaches that claim to be scientifically informed in teaching healthful, efficient, injury-preventive piano technique. The few studies (Berkowitz, 1998; Grindea & Menuhin, 1995; Milanovic, 2005; Osada, 2009; Rezits, 1998) that do exist have not necessarily elucidated the research-based content of these approaches or addressed their efficacy. Indeed, when Manchester, editor of the *Performing Arts Medical Association Journal*, was asked in a forum at the 2006 MTNA Collaborative Conference in Toronto whether there were any known researched-based

[1] "Anecdotal" is used throughout this paper to refer to that which is observed rather than investigated.

methods for teaching injury-preventive piano technique, he responded that, to his knowledge, there were not (Manchester, 2006). Eight years later in 2014, Manchester wrote in his article "Playing Healthy, Staying Healthy: What Do I Need to Know About Neuromusculoskeletal Issues?" for the *American Music Teacher* that "We're just beginning to see the results of studies that have tested specific prevention strategies for instrumental musicians, and *none of them have targeted pianists* [emphasis added]" (Manchester, 2014c, p. 31).

Most critical to this circumstance is that, as of the writing of this document, no longitudinal studies exist regarding how students have responded to these approaches to injury-preventive piano technique training, either in the short run immediately after training, or in the long run years later. Due to continuing challenges to understanding and eliminating playing-related disorders, pianists—desperate for solutions—seek out approaches that claim to be scientifically-informed for training injury-preventive technique that, while anecdotally successful, remain largely uninvestigated.

Among the approaches that claim to be scientifically-based, one particular approach, among several, has received considerable attention and circumstantial support. In 2011, Osada, a pianist who suffered long-term PRNDs and who studied the Lister-Sink Method (the Method), in her dissertation on this Method wrote, "Although there is much demand for injury-prevention methods, very few are readily available today; the Taubman Technique and the Lister-Sink Method are two of the few internationally recognized ones" (Osada, 2009, p. 6). However, aside from Osada's investigation, this Method had not been studied systematically to more fully ascertain students' perceptions of its long-term impact on recovery from injury or in preventing recurrence of injury.

Purpose of the Study

The purpose of this study was to investigate students' perceptions of the effectiveness of studying one particular interdisciplinary Method for teaching injury-preventive piano technique. This study examined the short and long-term outcomes in adult pianists who had studied the Method for two academic semesters or the equivalent. Both pianists who had experienced playing-related neuromusculoskeletal disorders (PRNDs) prior to training, and those who had not, were included in the study. It was expected that this study would help increase understanding of how better to help pianists recover from PRNDs, and how to prevent further recurrence of PRNDs. Additionally, with respect to non-injured pianists, the study would hopefully shed light on ways to teach piano technique that would help prevent playing-related injury from the outset. At the very least, this data might serve as a baseline, and this study as a model for the investigation of other methods and approaches to teaching injury-preventive piano technique.

Research Questions

To better ascertain students' perceptions of the Method under investigation, the following Research Questions were addressed:

1. How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in recovering from those disorders?

2. How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in preventing recurrence of those disorders?

3. What effect, if any, do pianists perceive this interdisciplinary Method to have on various aspects of musicality (such as phrasing, rhythm, structural cohesion, emotional content, communication with audience, performance anxiety, fulfillment of artistic potential, etc.) and technique (such as tone control, tone quality, dynamic control, voicing, facility, muscular suppleness, speed, power, etc.)?

4. What do pianists consider, if any, the extra-musical effects of studying this interdisciplinary Method (such as mental focus, sense of well-being, increased kinesthetic and auditory awareness, enhanced flexibility and suppleness of movement, etc.)?

5.What do pianists perceive as challenges and positive aspects of studying the Method?

Conceptual Framework

This study investigated students' perceptions of the effectiveness of a particular interdisciplinary Method that claimed to teach injury-preventive piano technique. Conceptually, it was first necessary to frame the Method in its historical roots—both conscious and unconscious. The conceptual framework endeavored to demonstrate through a review of the literature how principles from approximately five different disciplines converged to inform the Method. As is shown in Figure 1, these fields included historical methods of teaching piano technique, sports and dance pedagogy, neuropedagogy, somatic education, and technology-assisted pedagogy. However, any pedagogical method is created expressly to teach something: In this case, the Method was created to teach a particular technical and biomechanical model. Therefore, it was equally important to trace in the literature the origins of the technical model's core principles in the disciplines of historical piano technique, movement science, neuroscience, embodied cognition (Alexander Technique), and performing arts medicine.

It is difficult at times to separate the means of teaching from what is being taught. Likewise, the core interdisciplinary pedagogical methods of teaching the technical model

frequently emerged from the disciplines related to the model itself—historical technical models to historical pedagogical methods, movement science to sports and dance pedagogy, neuroscience to neuropedagogy, embodied cognition to somatic education, and performing arts medicine to technology-assisted pedagogy. Eventually, core principles from all of these disciplines were combined to create both the Method and the technical, biomechanical model it taught. Once the origins and interdisciplinary components of the Method and its biomechanical model were established, students' perceptions were investigated regarding the effectiveness of the Method in resolving playing-related injury, in preventing recurrence of playing-related injury, in musicality, in extra-musical areas, and regarding challenges and positive aspects of studying the Method.

A Study of Students' Perceptions of the Effectiveness of an Interdisciplinary Method for Teaching Injury-Preventive Piano Technique

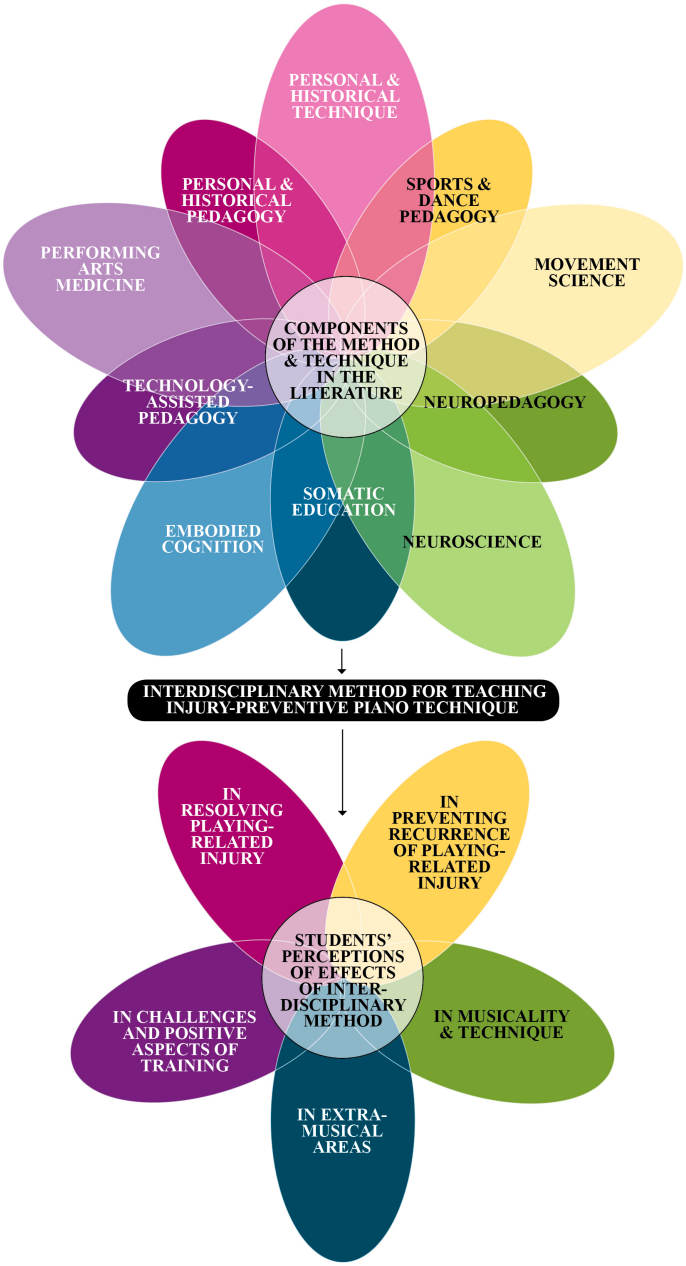

Figure 1. Conceptual Model

Overview of the Method

Before addressing the Research Questions, it was necessary to set the Method and its biomechanical model in the context of my own life as its developer, and to explicate the Method's salient principles and its technical model's primary characteristics.

I developed the interdisciplinary Method under investigation between 1989 and 1994 to create a new pedagogical paradigm for addressing several challenges:

1. The prevalence of debilitating playing-related neuromusculoskeletal disorders (PRNDs) among the pianists that I taught, as well as among the numerous teachers, performers, and students with whom I came in contact in workshops, conferences, and interviews.

2. The apparent lack of consensus in the piano profession regarding certain core principles of biomechanically efficient technique, as well as consistent means for teaching them to piano students.

3. The need for greater communication between researchers in the relatively new field of performing arts medicine, and pianists and piano teachers.

4. The contradictory information regarding injury-preventive piano technique articulated in both historical and contemporary forms.

5. The persistent anecdotal reports of pianists' frustration at the inability to develop their musicality to its full potential because of inefficient use of the body, fatigue, pain, and injury.

Purpose of the Method

The purpose in establishing a pedagogical method for teaching an injury-preventive piano technical model was six-fold:

1. To offer pianists—both injured and uninjured—a rational, accessible, step-by-step system for learning a specific technical model, based on biomechanical principles of efficient body use, from the simplest to the most complex coordinations

2. To advance the establishment of universally accepted principles of healthful piano technique by incorporating relevant principles of good coordination from the

fields of movement science, neuroscience, and cognitive embodiment into the technical model

3. To help students both understand and embody rational, science-based principles of efficient coordination of the whole body, directed by the brain, with the piano

4. To aid in the student's healing process, where necessary, while retraining

5. To help prevent further playing-related disorders or injuries

6. To help the student maximize his or her artistic potential by optimizing function of the neuromusculoskeletal system and removing physical impediments to playing (Lister-Sink, 2007a)

The Method was described and demonstrated in abbreviated form in the video *Freeing the Caged Bird – Developing Well-Coordinated, Injury-Preventive Piano Technique*, released in 1996 in VHS format and in 2005 and 2011 in DVD format, and winner of the 2002 Music Teachers National Association-Frances Clark Keyboard Pedagogy Award. In 2007, the Method (and the DVD) was officially copyrighted. It was also the topic of a doctoral dissertation (Osada, 2009).

Potential Knowledge Gained Through Study of the Method

The Method was designed to convey the following knowledge, in age and level appropriate styles (Lister-Sink, 2008; Osada, 2009):

1. How the body is constructed and how it works most efficiently (good coordination)

2. How the piano is constructed and how it works most efficiently

3. How the body and piano work most efficiently together (the technical model)

4. How to apply efficient, whole-body coordination to music, from the production of one sound to increasingly more complex kinetic patterns in complex repertory

5. How to help maximize the artistic experience through minimizing physical obstacles

Core Principles Embedded in the Method

The Method under investigation attempted to be based on certain salient principles that have their roots in both research and application in movement science, neuroscience, embodied cognition, sports pedagogy, neuropedagogy, somatic education, and transformative learning. Certain aspects of the Method were also found in historical piano technique and pedagogy. These principles are as follows (Lister-Sink, 1992, 1994, 1996, 2005, 2009):

1. Piano technique is a trainable but complex neuromusculoskeletal activity of the whole body, directed by the brain.

2. The technical model used in teaching, like other athletic models, should be based on rational, biomechanical principles of efficient whole-body use, and taught with consistent, accurate, and understandable terminology.

3. Piano technique is best acquired through neuromuscular programming in a step-by-step, carefully sequenced manner, from the simplest coordinations to the most complex, allowing sufficient time for the brain to process and master each step.

4. In the beginning stages of training, hands-on guided practice at least three times per week is necessary.

5. Enhanced auditory, tactile, and kinesthetic awareness through mindfulness training is essential to successful training.

6. The teacher must teach kinesthetic and somatic awareness of whole-body coordination through appropriate and professional tactile guidance (PTG).

7. Concurrent training in the Alexander Technique, or another somatic pedagogy, greatly enhances kinesthetic and somatic awareness, as well as the rate and quality of learning.

8. Modeling, mental practice, self-assessment through video and audio recording, and written self-reflection are all important tools for teaching.

9. Teachers of students with playing-related injuries must work in partnership with a team of qualified healthcare professionals, including traditional and complementary practitioners.

10. Piano technique—all coordinations, movements, and sensations—must be chosen to best serve the musical requirements.

11. The teacher must adapt appropriately and creatively to each student's individual learning style, training history, and state of health in a positive learning environment, potentially leading to psycho-physical transformation.

The Biomechanical Model

The technical, biomechanical Model that is taught through the Method represents my own attempt at formulating a way of playing the piano that embodies principles of biomechanically efficient coordination of the whole body, directed by the brain. In this way, the pianist is liberated from physical impediments to be more fully available for listening and for fulfilling musical concepts.

My own personal history of this technical Model originated in my observations of my father, a self-taught stride piano player, throughout our lifetime together. His arm and hand movements were "natural," economical, well-coordinated, and seemingly effortless. And his torso was upright and quiet. During my teens and twenties, I also observed a similar technical model firsthand in such classical pianists as Arrau, Ashkenazy, Cliburn, Fischer, and Rubinstein (see Narrative, Chapter I).

The Model embodies the following foundational biomechanical characteristics, explicated in part at the aforementioned panel presentation "Enlightened Piano Technique: A Definitive Model for the 21st Century" at the 2008 Music Teachers National Association Annual Conference in Denver, Colorado.

1. Torso is balanced dynamically on sitting bones.

2. Spine is lengthened in its four natural curves with minimal pressure on vertebrae.

3. Shoulders remain free of unnecessary tension.

4. Neck remains free of unnecessary tension.

5. Head is balanced on top of spine.

6. Arms are supported efficiently from the torso, allowing the medial deltoid to release the upper arm into gravity between phrases.

7. Forearm, hand, and finger bones are aligned optimally for structural support and efficient transmittal of energy into the key.

8. Unnecessary co-contractions of, for example, flexors-extensors or biceps-triceps are avoided to allow for ease of movement, optimal mobility at joints, and minimal muscle effort.

9. Joints used for transmitting energy into the key are timed for appropriate stabilization, and non-weight-bearing joints are not stabilized.

10. Kinesthetic awareness and proprioception are used continually to monitor alignment, muscle use, and breathing.

For a demonstration of a student of the Method under investigation using the biomechanical model as he plays, please go to: http://youtu.be/Cw6R_ZA8ozM

Cue Sheets 1 and 2 – Preparing to Play & the "Basic Stroke"

Inherent in the Method is the principle of neuromuscular *training* for beginners, or *retraining* for all other pianists. This requires a return to the most fundamental level—the production of one sound. This is the equivalent of basic form in sports—the simplest, most fundamental sensations and coordinations of the activity. In the Method under investigation, this fundamental level of coordination is called the Basic Stroke. It is an activity primarily of the forearm, supported by the torso, and incorporating the hands and fingers. Each component is mastered separately but eventually combined in one smooth coordination. Its purpose is the depression of one piano key and the consequent production of one sound (Lister-Sink, 2007a). In golf, such a foundational coordination would be called the basic "swing." However, while the golfer's swing and the pianist's

stroke of the key are both carefully timed, efficiently coordinated sequential movements, what differentiates the pianist's production of a sound and the golfer's hitting of the ball is key to injury-prevention: the pianist's act of sound production must be repeated at rapid and extremely precise intervals over multiple hours of practice per day. Without specific means of releasing the arm and hand muscles perpetually, tension is accumulated in the muscles, tendons swell, and nerves are impinged. The results of this accumulation of tension can run the gamut from muscle fatigue, inflamed tendons, overstabilized joints and compressed nerves, to pain, injury and dysfunction. Short-term results of repetitive motion syndrome in pianists can be loss of mobility, suppleness, ease, power, and control of the key.

However, since the Method asserts that playing the piano is an activity of the whole body, prior to executing the Basic Stroke, the pianist must prepare herself on the bench, just as the golfer prepares the stance. This requires learning to balance on the sitting bones, to allow the spine to lengthen gently, to allow the shoulders to remain released, to free the neck of unnecessary tension, to balance the head lightly on the spine, to allow the upper arms to hang into gravity supported by the torso muscles, to feel the feet supported by the floor, to observe the breath, and to continually monitor the body through the kinesthetic awareness. In the Method, this is called Cue Sheet 1. The pianist is then ready to produce sound with the harmonious coordination of the "playing apparatus" with the rest of the body. The Method's Basic Stroke provides a foundational means of programming into practicing and performing a continuous muscle-release mechanism of the arms. The Basic Stroke, which incorporates a freefall of the forearm, is only one of three ways of lowering the forearm at the piano (Ortmann, 1929) and is, it

should be noted, the least used in playing. However, it is biomechanically the simplest as it takes advantage of gravity. Mastering this fundamental coordination is critical to mastering more refined coordinations of the arm in later stages of training (Lister-Sink, 2007a; Appendix B – Movement Analysis of the Method's Basic Stroke).

Potential Results of Successful Training in the Method

Following are lists of alleged potential results of studying the Method:

Potential Injury-Preventive Results

The Method may help mitigate or alleviate the following:

- discomfort, fatigue, strain, injury, and eventual dysfunction
- discouragement, despondency, and depression resulting from inefficient, injury-inducing technique
- high dropout rate in music programs and the profession
- physical obstacles and impediments to artistry and musicality

Potential Musical and Artistic Results

- more acute and accurate listening
- a sense of well-being, control, and self-empowerment at the piano
- enhanced quality of sound
- more suppleness, facility, and power
- increased technical control of tone, dynamics, tempo, articulation, rhythm, voicing, and phrasing
- mental focus and concentration
- greater opportunity for fulfillment of artistic potential

Potential Extra-Musical Results

- increased kinesthetic awareness and enhanced proprioception in general
- understanding of overall optimal body use in everyday activities
- ability to more easily access an alert yet calm sense of "flow" when desired
- increased flexibility, muscle suppleness, and ease of movement
- increased sense of well-being in general

Types of Pianists Who May Derive Benefits from the Method

The following pianists may derive benefit from the Lister-Sink Method (Lister-Sink, 2007a; Lister-Sink, 2007b):

- teachers who wish to learn how to teach well-coordinated, injury-preventive technique

- performers who wish to enhance their own technique and maximize their musical potential
- beginning piano students of all ages
- advanced undergraduate and graduate pianists (and organists who also play the piano)
- intermediate or advanced students who believe they are not attaining their full potential technically
- pianists who would like to recover and retrain from playing-related neuromusculoskeletal disorders (PRNDs)

Length and Frequency of Training Required

The time spent in the Method is analogous to a pyramid: retraining in the step-wise, incremental foundational coordinations and sensations requires the most time for the brain to process each step and achieve automaticity of the coordinations. During the first six weeks, three guided practice sessions per week with the instructor or assistant instructor are desirable. Rate of progress depends in part on the pianist's history—how long he or she has been playing using a different neuromuscular program, as well as whether the pianist has a playing-related injury. Depending on the nature and length of the injury, as well as the length of study, additional training time might be required. Most pianists who have never been injured complete the foundational training in the Basic Stroke within three to six weeks.

After foundational training, the rate of step-wise progression through the various stages of repertory complexity is more rapid. It is essential that the pianist progress incrementally through carefully selected studies and repertory, thus allowing the brain and body to master and apply to musical repertory the increasingly complex coordinations. Anecdotally, most pianists achieve through step-wise progression their original level of repertory within six to twelve months (Lister-Sink, 2007a).

Similar to Riley's approach, the Method strives to promote optimal body alignment and efficient muscle use through carefully sequenced steps, from the simplest to the most complex kinetic patterns (Lister-Sink, 1995). Also as in Riley's approach, the Method relies on biofeedback for training overall body use and for creating a new neuromuscular program. But rather than using biofeedback technology, the pianist's own proprioception and kinesthesia (self-sensing) are cultivated and used throughout the training, concurrent with instruction in the Alexander Technique. The Method aligns itself with the field of cognitive embodiment wherein understanding and analysis (cognition) of the principles of well-coordinated technique are combined with the manifestation of these principles physically (embodiment). The Method also attempts to incorporate recent findings from the fields of neuropedagogy, movement science, and sports pedagogy into its methodology. However, although hundreds of hours of video documentation of training progress exist, the Method—as demonstrated in part in the DVD *Freeing the Caged Bird – Developing Well-Coordinated, Injury-Preventive Piano Technique*—has only testimonials and anecdotal evidence of success. Well-designed research studies were needed to investigate both the model of coordination used and the pedagogical means of attaining it (Lister-Sink, 1996).

Approach

This research is a study of piano students over the past 25 years who have studied the Method under investigation with its developer for at least two academic semesters, or the equivalent. A convergent mixed methods design was used with both qualitative and quantitative research tools. Data were collected in two ways: A survey was sent via email

to 103 students (approximately 150 had received extensive training in the Method but up-to-date contact information was found for only 103). Second, 23 hours of interviews were conducted of 26 students between the ages of 22 and 82.

Since the researcher was also the developer of the Method under investigation, it was important to reduce the potential for researcher bias and to protect participants from feeling coerced, or from any personal or professional harm. Therefore, protection was designed into the study (which received approval by the Institutional Review Board of Teachers College, Columbia University) as follows: Four Research Assistants were engaged and remunerated to conduct all protocols, including correspondence, signing of consent forms, administering of the survey, interviewing subjects, transcribing audio tapes, and encoding raw data. Additionally, the four Research Assistants were certified in CITI Human Subjects' Rights training. The survey was administered by a Research Assistant through Qualtrics online survey software. Another Research Assistant conducted the 26 interviews either in person or via Skype in a site not associated with studying the Method. Interviews were recorded using two audio recording devices to ensure that no interview data were lost. Data were uploaded to a password-protected site accessible only by Research Assistants and not by the researcher. Both survey and interview protocols included closed- and open-ended questions to gather in-depth information. Validation, objectivity and accuracy were achieved through multiple strategies: clarification of bias, orientation, and prejudices; and cross-checking of data.

Anticipated Outcomes

This study attempted to produce a comprehensive, multifaceted, and in-depth narrative of students' perceptions of the effectiveness of one particular interdisciplinary Method for teaching injury-preventive piano technique. It was designed to provide evidence if the Method were effective in both recovery from and prevention of recurrence of playing-related neuromusculoskeletal disorders (PRNDs), in both the short and the long term. It also sought to ascertain students' perceptions of technical, musical, and extra-musical effects, as well as challenges to and positive aspects of studying the Method. Moreover, the study provided information regarding the effectiveness of the approach's interdisciplinary components. It also revealed whether the Method was a viable alternative to more traditional piano technique training. Conversely, any negative outcomes or perceptions of studying the Method came to light. Fundamentally, such a baseline of information would be used to improve the Method itself. It was also hoped that the study would provide a model for the design of future studies of other approaches to teaching piano technique that claim to be scientifically informed and injury-preventive.

Assumptions

The assumptions of this study were as follows:

1. This Method has been reasonably effective in both helping pianists rehabilitate from playing-related injuries, and in preventing further playing-related injuries from occurring.
2. This Method has helped pianists develop greater technical control, flexibility, ease, and freedom.
3. The Method has helped pianists develop their musicality and artistry, and has lessened performance anxiety.

4. Piano students of this Method have benefited in extra-musical ways.

5. Research findings in multiple disciplines of movement science, neuroscience, and embodied cognition embedded in the Method help students gain more accurate knowledge of why various playing-related disorders occur and of how to prevent them.

6. Multidisciplinary components from sports pedagogy, neuropedagogy, somatic education, and transformative learning used in the Method ensure more consistently successful results and a more positive learning experience.

7. Studying this Method helps eliminate confusion regarding contradictory technical models, quasi-scientific information, and specious pedagogical strategies.

8. The results of this Method can be transformative in numerous ways, promoting self-empowerment, critical and independent thinking, and mental and emotional balance.

9. The successful teaching of injury-preventive piano technique requires a new interdisciplinary paradigm, including informed biomechanical knowledge, somatic education, critical thinking, creativity, sequential steps, more frequent guided practice lessons weekly in initial stages of training, expanding self-awareness, and ongoing reflection.

10. Learning this Method and following its non-traditional steps can be mentally and emotionally challenging and requires discipline, patience, and perseverance to stay the course and succeed.

Rationale and Significance

The rationale for this study was three-fold: First, playing-related injury rates among pianists remain consistently high. These alarming rates persist in spite of over 30 years of research, albeit at times with contradictory findings, in performing arts medicine; numerous attempts through journal articles, workshops, and conferences to disseminate information on injury-prevention; and even recently added accreditation requirements in neuromusculoskeletal health by the National Association of Schools of Music. Second, the history of piano technique and pedagogy is replete with biomechanical models and

teaching strategies, often confusing and contradictory, that are passed down from generation to generation, but that, nonetheless, might be implicated in the high injury rate. Third, while various well-known and anecdotally successful approaches—also somewhat contradictory—claim to be scientifically and pedagogically informed, they are yet to be systematically examined (Manchester, 2014b). As a consequence, pianists are left largely alone in their quest to find reliable injury-preventive teaching strategies.

The importance of this research was that it represented the first systematic examination of one of several anecdotally successful methods for teaching injury-preventive piano technique. The findings might offer pianists comprehensive information about the efficacy of at least one of these current methods in helping recover from injury and in preventing recurrence of injury, as well as in enhancing musical and technical aspects of piano-playing. The study was also designed to uncover the advantages and disadvantages of an interdisciplinary paradigm for teaching injury-preventive piano technique. Moreover, it was hoped that the study would offer the performing arts medicine field a base-line of information on one particular Method for teaching injury-preventive technique, and a model for investigating other methods currently available to pianists. Hopefully, pianists might be better assured in future of obtaining more reliable, research-based information on injury-preventive teaching strategies. Most importantly, the study was designed to contribute findings that might be helpful in reducing the prevalence of playing-related injury among pianists.

Chapter II

LITERATURE REVIEW

To investigate the effectiveness of one particular interdisciplinary method of teaching injury-preventive piano technique, and the biomechanical model it espouses, the Method was first contextualized through a survey of literature in relevant and related fields. Therefore, the purpose of this literature review was three-fold: The first section placed the Method and its technical model within the context of an historical overview of research in playing-related neuromusculoskeletal disorders (PRNDs) in pianists, including potential risk factors, and the degree of prevalence of PRNDs in pianists. The synthesis of this section included general research implications for establishing methods and biomechanical models for teaching injury-preventive piano technique.

The second section examined research related to historical piano methods and approaches that attempted to understand and teach well-coordinated piano technique. Additionally, the second section investigated research related to technical models and means that claimed to teach scientifically informed, injury-preventive piano technique. The section synthesis elucidated commonalities and divergences, as well as implications for revisions of the Method and its technical model under investigation.

In the third section, literature from relevant disciplines that addressed the teaching of complex motor skills, especially those in service of the performing arts and "artistic sports," was examined. Salient principles of the Method under investigation were examined in the context of the appropriate disciplines. Characteristics of the

biomechanical model were investigated in light of research in performing arts medicine, neuroscience, movement science, and embodied cognition. It was expected that weaknesses, as well as strengths regarding the "scientifically informed" assertion of the Method and its model would be revealed. Ultimately, it was hoped that, where needed, the salient principles embedded in the Method, as well as in its technical model, would be corrected, improved, revised, or even discarded.

Section I: Playing-Related Musculoskeletal Disorders in Pianists

It could be said that playing-related injury among pianists is a worldwide plague. Abundant clinical and anecdotal evidence indicates a consistently high percentage of playing-related musculoskeletal disorders in pianists globally. In 1998, a systematic review by Zaza of published research on playing-related musculoskeletal disorders (PRNDs) among musicians in general revealed incidence rates ranging from 34% to 62% in secondary school musicians, and 39% to 87% in adult musicians. The researcher stated that musicians' health problems were under-researched, as opposed to those of workers in other occupations requiring repetitive motion. Perhaps as a consequence of an historic lag in research, problems were cited in design, methodology, low response rates, unsystematic measurement protocols, absence of statistical analyses, and a lack of rigor in general (Zaza, 1998). Seven years later in a 2006 systematic review of PRNDs specific to pianists, Bialocerkowski, Bragge & McMeeken (2006a) reported similar findings: Prevalence of documented playing-related injury was reported to vary even more widely between 26% and 93%. Congruent with Zaza's conclusions, Bialocerkowski et al. (2006a) also posited that a review of the literature over the past 20 years revealed

numerous contradictory findings, inconsistent definitions—including that of "playing-related neuromusculoskeletal disorder," flawed designs, compromised methodologies, insufficient reporting, and little testing for statistical significance (Bialocerkowski et al., 2006a). Researchers concluded that little progress had been made in reducing the prevalence of playing-related injury among pianists of all ages. Indeed, statistically few consistent risk factors have been established thus far, although clinical and anecdotal evidence is copious. Much more consistent, rigorous research must take place or playing-related neuromusculoskeletal disorders (PRNDs) will continue to undermine the lives and careers of pianists.

An Overview of Performing Arts Medicine

To gain an overview of the history of research in PRNDs, it is important to note that the field of performing arts medicine is only several decades old. As recently as 2005, there were only three peer-reviewed journals: *Medical Problems of Performing Artists, The International Journal of Education in the Arts,* and the *International Journal of Arts Medicine.* However, members and leadership of the Performing Arts Medicine Association (PAMA) have worked worldwide for over 25 years since its founding in 1989 to promote research and prevent injury. As its website states, "PAMA is an organization comprised of dedicated medical professionals, artists, educators, and administrators with the common goal of improving the health care of the performing artist." It offers members an extensive bibliography of over 14,000 articles that "consists of citations…from the medical, musical, and popular literature, with emphasis on clinical problems and relevant basic science in performing arts medicine." The bibliography also

includes articles related to complementary therapies such as the Alexander Technique and the Feldenkrais Method (http://www.artsmed.org).

Performing arts medicine clinics have been established throughout the United States, and professional music organizations and agencies such as Music Association for Music Education (NAfME), Music Teachers National Association (MTNA), and the National Association of Schools of Music (NASM) have begun to pursue wellness and injury-prevention initiatives more intentionally. Indeed, the *NASM Handbook 2011-12*, under Standards for Accreditation – Purposes and Operations, Section II, F, I, i, states, "It is the obligation of the institution that all students in music programs be fully apprised of health and safety issues, hazards, and procedures inherent in practice, performance, teaching and listening… This includes but is not limited to information regarding hearing, vocal, and musculoskeletal health and injury prevention…" (*NASM Handbook, 2011-12*, p. 67). Additionally, various wellness committees have been formed in the MTNA and National Conference on Keyboard Pedagogy (NCKP) and the World Piano Pedagogy Conference. However, research in PRNDs has been much more extensive among general populations of musicians, rather than among piano populations.

Risk Factors for Playing-Related Injuries

Historically, a disproportionately large number of studies have come out of Japan. One of the first studies on PRNDs in piano populations was designed by Sakai in 1992. Sakai did a clinical study of his own 40 patients who were Japanese professional and student pianists presenting with forearm and hand pain caused by playing-related overuse. The research design incorporated a review of medical records, as well as a questionnaire. Pianists were asked whether they had been practicing particular "keyboard

techniques" at the onset of their disorder (Sakai, 1992). Keyboard techniques were defined as chords, octaves, fortissimo passages, arpeggios, and "wide extended passage" [*sic*]. (Such a definition in itself is narrower than other definitions of technique as *how* one coordinates the body while playing, as opposed to *what* one is playing. As Manchester (2013b) pointed out, a Merriam-Webster definition of technique is not only the basic physical coordinations—what one plays, but the ability to use these coordinations—how one plays). One conclusion Sakai drew was that 77% of the pianists had pain during chords, octaves, and loud passages because of the abduction of the thumb and fifth finger. He also concluded that smaller handed pianists were disadvantaged in comparison with their larger handed colleagues in Europe and America. However, variables such as length of practice, level of repertory, heaviness of piano action, etc., were not considered (Sakai, 1992).

Clinical studies such as Sakai's were supplemented in the late 1990's by research utilizing surveys. In a more complex and ambitious study out of Ireland in 1999 (Dockrell & Shields), researchers set out to determine prevalence of injuries in pianists, anatomical locations of injuries, risk factors, and the most frequently reported symptoms. A 26-item questionnaire was sent out to 182 pianists who were either majors in school or who had attained a Grade 6 level or above in the Royal Irish Academy of Music. Out of the 159 (87%) that responded (79.9% female and 20.1% male), 26% of females and 25% of males reported pain, stiffness, weakness, or cramping, and 83% had over two symptoms. Multiple factors were reported to contribute to injuries including practice habits (46.3%), posture (39%), and overuse (39%). The researchers concluded, however, that there was no substantial difference between men and women, but the survey only

included 20% male pianists. However, they did agree that injuries were “extensive,” but that programs for prevention could not be established until risk factors were verified (Dockrell & Shields, 1999).

Blackie, Stone, and Tiernan (1999) investigated injury-preventive education among 25 piano students attending a liberal arts university in Washington State. Remarkably, 93% reported 27 playing-related musculoskeletal disorders (PRNDs), but only 7% had sought medical care. A survey addressed questions about pianists’ knowledge of the following injury-preventive components: using good body mechanics, avoiding practice when tired, strengthening, conditioning, gradual increase of practice load, stretching, graduating repertory, reducing stress, being aware of physical limitations, taking breaks, warming up, and decreasing practice when tired. Specific questions regarding actual systematic methodologies for teaching technique were not referenced. The majority of piano students (62%) reported that they were taught body mechanics, posture, lessening practice when tired, and strengthening and conditioning. In spite of the high rate of injury, pianists perceived themselves as having sufficient endurance, strength, and ability to play well. Researchers concluded that a course in injury-preventive technique should be added to the curriculum. Even more desirable would be for pianists to be educated in their early years of study to the principles of healthful playing in all of its aspects (Blackie et al., 1999).

Research in playing-related injuries among pianists, historically, gained substantial momentum through Internet surveys after 2000. While the hand-delivered Irish survey of 1999 had yielded a return of 159 respondents out of 182, Chesky and Pak (2001) targeted 455 keyboardists with the University of North Texas Musician Health

Survey. A total of 437 subjects responded, out of which 54.2% were females, as opposed to 79.9% in the Irish survey of 1999. Moreover, only 40% were classical pianists, as opposed to 100% of Irish pianists. The five other subsets of this heterogeneous population were church musicians, educators, jazz players, composers, and "casual" pianists (Chesky and Pak, 2001). The purpose of this survey was to assess the extent of upper extremity musculoskeletal problems, and to investigate the correlation among musician types, gender, age and daily practice habits.

Notable outcomes of the survey included no statistically significant relationship between age and disorders, except in the over-60 population; no statistical significance regarding playing time variables; data that the right wrist was the most frequently reported site of pain; a conclusion that jazz players had the highest rate of upper-extremity musculoskeletal problems; and that female keyboard players had a statistically significant occurrence of injuries in the category of "severe problems." Researchers maintained that this study design eliminated the potentially misleading weaknesses in previous surveys and studies: It was an Internet, self-reported survey; the demographics were not limited to occupation or geography; and various types of keyboard players were surveyed. They faulted previous studies for low response rates, erroneous reporting of occurrences, and unsystematic data collection, among others. However, researchers did admit that the nature of the injury was not questioned, and that younger musicians would more likely respond to an Internet survey (Pak et al., 2001).

Improvements in research design, use of the Internet as a survey tool, an increase in peer-reviewed journals, and growing involvement of professional organizations in wellness topics led to heightened awareness of the widespread problem of PRNDs and to

synergistic relationships among researchers. Researchers revisited their own findings and improved on their own designs. Such was the case with Sakai whose often-cited 1992 clinical study had implicated "special keyboard techniques" such as octaves, arpeggios, chords and fortissimo playing in creating a variety of PRNDs. In his study of 2002, Sakai did not change the aim of his research. He continued to investigate whether there was a relationship between injuries and specific hand motions at the piano. In a clinical study, he collected medical data on 200 Japanese professional or pre-professional pianists (35 men, 165 women with an average age of 26.3) with hand pain due to overuse at the piano. In this 2002 study, Sakai was more specific in reporting the data. Of the 200 Japanese pianists, 56 were diagnosed with tenosynovitis (inflammation of the lining of the sheath surrounding the tendons), 49 with enthesopathy (disorders of bone attachments such as ligaments, tendons, and muscles), 38 with muscle pain, 28 with neurological disturbances, 24 with joint pain, and five with neck or scapular pain. Seventy subjects reported using his so-named "specific keyboard techniques," including chords and octaves, when pain occurred. Sakai found that playing chords and octaves caused 21 cases of tenosynovitis or tendinitis, 19 cases of enthesopathy, eight cases of muscle pain, and four cases of PIP (proximal interphalangeal joint, between the knuckle and the last joint nearest the finger tip) pain. These injuries were primarily attributed to the necessity for hyperabducting (spreading the hand wide) the thumb and little finger when playing octaves or loud chords. These more specific data and findings compelled Sakai to conclude that 1) before any reconstructive hand surgery, hand function of the pianist should be considered, and 2) research in pianists' injuries should focus on the cause; otherwise, the injury would recur (Sakai, 2002).

2005 Systematic Literature Review of PRNDs

These four studies out of Japan, Ireland and the United States spanned a decade. While they yielded a large amount of data regarding types of PRNDs, Bialocerkowski et al. (2006a) posited that there was as yet little solid research regarding risk factors for playing-related injuries. In this landmark study, 38 databases were searched. Eligible studies included only those investigating the prevalence of PRNDs in pianists, and the studies had to utilize "appropriate methodologies." Most of the research from the three noted peer-reviewed performing arts medicine journals had to be done manually due to lack of indexing. Of the 482 qualified citations identified, 52 were ranked in a "hierarchy of evidence" (using the University of Sheffield Hierarchy of Evidence, as well as the Critical Review Form—Quantitative Studies). Interestingly, only 12 were deemed eligible to be evaluated using a "quality assessment tool" (Bialocerkowski et al., 2006a).

The startling results of this landmark systematic review were revealing in multiple ways; they also might offer explanations as to why little progress had been made in understanding and reducing pianists' PRNDs over several decades of research. Bialocerkowski et al. (2006a) concluded that prevalence rates of injury varied widely from 26% to 93%; that no authors offered a clear "operational" definition of PRNDs; and that there was no consensus among researchers regarding risk factors.

Furthermore, the researchers found numerous methodological limitations. Those included inadequate reporting of reliability/validity outcome measures, and no statistical significance testing. Four authors showed statistically significant risk factors but lacked a clear definition of PRND. Three out of four studies did not give a response rate, and the one response rate reported was considered by the researchers to be low (61%).

Furthermore, Bialocerkowski et al. (2006a) reported no consistency regarding risk factors for injuries, and a 1996 study by Benjjani et al. that did list potential risk factors (changes in schedule, posture, technique, body habits, and joint laxity) was inconsistent with other risk factors found in the 2006 review. In addition, those listed were anecdotally or clinically evidenced in narrative, not systematic, form. Poor descriptions of samples were also cited as a weakness in reporting. Only two papers in the literature review reported using research designs that were appropriate for establishing causation. Authors of the 2006 review submitted that generalizability, internal validity, and comparison with other evidence must all be incorporated to evaluate existing evidence and establish causal relationships regarding risk factors (Bialocerkowski et al., 2006a).

Findings since 2005

The findings of the 2006 landmark review of the literature on PRNDs were consistent with this literature review author's much less comprehensive investigation of research through 2006. Perhaps because of the rigorous scrutiny of research design and methodologies by Bialocerkowski et al. (2006a), improvements may have been made in this field of inquiry. To ascertain any positive changes, a quantitative/qualitative study out of Japan in 2006 by Aoki, Furuya, Kinoshita, and Nakahara was examined. Again, as in the 1992 and 2002 studies by Sakai, this research was conducted in Japan to investigate both the prevalence and causes of PRNDs in Japanese female classical pianists of a variety of ages. A questionnaire with 40 questions was sent out to 260 subjects in two high schools and five colleges, to piano teachers in those institutions, and to 25 active professional female pianists. A total of 203 pianists responded, or 78%. Ages ranged from 15 to 60.

Unlike Japanese researcher Sakai in the 1992 and 2002 studies, Aoki et al. (2006) sought to focus on female pianists only. Researchers found that 77% had sustained some form of injury, with the finger/hand unit yielding the highest rate. After that, injuries were reported in the forearm, shoulder and neck/trunk. The most commonly reported pain in fingers (89%) was in the thumb and little finger. Of the injured pianists, 64% sought medical treatment and 30% received acupuncture treatments. Rest and changing technique [*sic*] were reported as solutions to injury (Aoki et al., 2006).

Aoki et al. (2006) compared this high rate of injury to a much older Western study (Revak, 1989) in which 42% of female pianists reported PRNDs, as well as to the 2001 study from North Texas State University in which females had a 16% higher rate of injury. The Japanese researchers attributed the 10% higher injury rate in Japanese female pianists to an increase in the number of technically demanding pieces being played, and to increased participation in international competitions. Surprisingly, Chi-square tests found no statistical significance regarding size of hand span, unlike previous studies by Sakai in Japan.

Causes for PRNDs suggested were aging, excessive muscle tension, and more than four hours of daily practice. Researchers concluded that there were contradictions with other noted studies (Brandfonbrener, 1990; Manchester & Park, 1996) regarding the correlation between injury and length of practice. They also suggested that further studies needed to address personality traits or "mental variables" and how they might affect proximal body parts (neck, shoulders, torso). Confusing terminology and definitions further weakened the study, e.g., "senior pianists" were not defined by a specific age as they are in the United States, and piano "majors" were associated with high school as

well as with college in the study. Erroneous assumptions about the correlation between PRNDs and aging were also troubling. No mention was made of measurements of hand span to determine a possible correlation between pain and size of hand. Additionally and most noticeably, no mention was made of excessive or accumulated tension, or of quality of musculoskeletal coordination and overall use of the body being factored into the study.

In yet another 2006 study, Aerts, Chesky, Paul, and Yoshimura at the University of North Texas investigated the relationship between pain and hand measurements. Of the 35 piano performance majors recruited for the questionnaire, eight were males and 27 were females. Of those 27, 50% were Asian. The study was twofold: a questionnaire was given addressing demographics, musical background, and practice habits. A second section asked four questions regarding playing-related pain, and a third section posed questions regarding general problems with non-playing-related states such as depression, fatigue, anxiety, etc. After the questionnaire, hand measurements were taken and upper extremity tests were given for range of motion, isometric strength, and speed of rotation. SPSS statistical software was used to analyze the results (Aerts et al., 2006). Findings were again inconsistent with previous studies and somewhat confusing. Of the respondents, 26% reported musculoskeletal pain in four areas, and 83% reported no hyperlaxity (compared to much earlier studies in which 65% of musicians were reported to have hyperlaxity). While researchers admitted that knowledge of risk factors was essential to understanding the cause of playing-related pain, they posited a risk factor never before occurring in the literature: finger joint mobility between the right 3rd and 4th fingers. They also noted that, as in certain but not all previous studies, age and size were also important risk factors, as well as overall health. Reported weaknesses of a small

sample size and homogeneous level of playing ability further underscored reservations expressed in 2006 by Bialocerkowski et al. (Bialocerkowski et al., 2006b) regarding flawed or inconsistently designed studies. Indeed, the concern for "developmental, pedagogical, and clinical implications for piano players with limited right 3-4 spans" (Aerts et al., 2006) was vexing. Such anomalous findings, albeit in peer reviewed journals, further complicated and confused an already troubled field of research.

At the 2014 MTNA Annual Conference, past PAMA presidents Dawson and Manchester and current president Chong gave presentations on musicians' health, risk factors, and suggestions for rehabilitation that seemed to indicate a stronger collective agreement. In spite of the aforementioned contradictory study results, all three of these leaders in performing arts medicine seemed to agree on risk factors and ways of avoiding injury. Dawson emphasized the importance of communication between musicians and health professionals, outlining diagnostic methods—including observation of playing, medical and non-medical interventions, risk factors, and an especial emphasis on the need for proper skeletal alignment (Dawson, 2014). Manchester outlined the new NASM guidelines for musicians' health and stated that over 50% of orchestral musicians experience PRNDs at any given time, and that each year 10% of college performance majors developed PRNDs. The most common PRNDs listed were muscle-tendon repetitive motion disorders, tendonitis, de Quervain's syndrome, thoracic outlet syndrome, and peripheral neuropathies. Women pianists were at a higher risk for developing PRNDs, although Manchester suggested that making smaller keyboards available might lower the risk (Manchester, 2014a).

Research on Interventions for PRNDs

There were several recent studies of intervention programs for music instrumentalists. Between 2010 and 2014, three studies of controlled trials for injury-prevention among instrumentals were published. In the 2010 study in Germany, 247 first-year music students were assigned non-randomly to either a control group or an intervention group. The latter group participated in a two-semester, 32-hour curriculum taught by two physicians in performing arts medicine, as well as a Feldenkrais instructor. The intervention group improved in psychological scores, but not in physical symptoms (Spahn, Voltmer & Zander, 2010). In 2013, Lopez and Martinez published results from warm-up exercise interventions for 180 instrumentalists who took a course in injury-prevention, including stretching, warm-ups, posture, etc. After one year the experimental group showed a 78% decrease in PRNDs (Lopez & Martinez, 2013). And most recently in 2014, Ackermann, Chan and Driscoll published the results of a 10-week exercise program for orchestral musicians in Australia who had experienced PRNDs. While improvements were shown after 10 weeks regarding PRNDs and perceived exertion during practice session, after six months a lower rating in perceived exertion was shown, but not in improvements in PRNDs (Ackermann, Driscoll and Chan, 2014).

Synthesis of Section I

The literature revealed that, in spite of growth in the field of performing arts medicine and in research of PRNDs and risk factors, playing-related injuries among pianists of all ages have not been significantly reduced. Risk factors for injury varied widely from study to study, and had also not been statistically established. Furthermore, clear, consistent definitions for PRNDs had not been established among researchers.

Over the last thirty years, the field of performing arts medicine generated a number of studies of playing-related injuries from a multitude of disciplines, including movement science (biomechanics, kinematics, and kinetics) and neuroscience. However, while studies attempted to establish causal relationships between risk factors and playing-related injuries, little has been done to define or establish a biomechanically informed model for injury-prevention for pianists, or methods for teaching such a model. Therefore, pianist subjects are chosen for study based on musical achievement rather than on the biomechanical principles they demonstrate. However, in the field of sports medicine, models that attempt to reduce injury and enhance performance have been studied over the past several decades, perhaps largely due to the highly competitive nature and popularity of sports, and the need for athletes to avoid life-threatening injury.

Leadership in the field of performing arts medicine has made encouraging strides in building consensus on playing-related risks, and in educating musicians and healthcare professionals to these risks. Additionally, potentially efficacious interventions for rehabilitation and injury-prevention in general are being increasingly investigated.

Section II: Historical and Contemporary Technical Methods and Models

Discussion of Terminology: Method vs. Technique vs. Approach

Determining the appropriate terminology for the particular pedagogical paradigm was critical to the study, both in accurately describing it and in researching the literature for similar paradigms. Throughout the history of piano technique, the terms “technique,” “approach” and “method” have been used interchangeably to describe a particular pedagogical paradigm or the model it espouses. The term “method” has also acquired a negative connotation in the piano teaching world, frequently referring to rigid, dogmatic

and even injurious means of forcing the piano student to learn technique. Even the 19th century Polish piano pedagogy Leschetizky (1830-1915) whose method was well-known, eschewed the idea of any method and was quoted as saying, "I *have* no method and I *will have* no method…Write over your music-room the motto: NO METHOD!" (Newcomb, E., 1967, p. 107). His fear was distortion, misinterpretation, and exaggeration of his technical ideas, but most especially, application of technique to unmusical playing. Nonetheless, his numerous students included Paderewski, Friedman, Essipov and Schnabel (Gerig, 2007). Kochevitsky wrote that "Evidently, method was once understood as frozen dogma…the expression 'absence of method' was used in describing the attributes of a good piano teacher" (Kochevitsky, 1969, p. 36). Even the pianist Horowitz stated that he did not believe in methods: "I think each pianist must ultimately carve his own way, technically and stylistically" (Mach, 1991, p.117). Clearly, the term "method" must be used in the piano teaching world with awareness of its negative connotations.

A closer scrutiny of the terms "method," "approach," and "technique" in other fields revealed their unique characteristics; it also revealed the historical and present-day confusion in the field of piano technique regarding terminology. For well over a century, the field of teaching foreign languages has been especially interested in finding a method generalizable to diverse populations. Brown (2007) restated the hierarchical definition posited in 1963 by Anthony: An approach was defined as a set of assumptions; a method was a systematic approach to teaching a topic. Techniques were the specific means whereby the approach's assumptions were taught through the method (Brown, 2007).

In the field of human movement, Tinning asserted that many researchers used method and pedagogy interchangeably. Instructors might choose from a wide array of

methods and pedagogies, but one method tended to dominate: the DEP model, a sequence of demonstration, explanation, and practice (Tinning, 2010). Furthermore, he quoted Mosston's means of classifying a wide spectrum of teaching styles, from the Command Style of maximum control by the teacher, to the Indirect Method, so-called by Bilborough and Jones (1966) and characterized by almost maximum control by the student (Tinning, 2010). The Command Style was also called the Traditional Method (Hoffman, 1971) and the Direct Method (Bilborough & Jones, 1966). The Direct Method was considered by most physical education teachers to be the only way to teach certain complex motor skills that required extreme precision, both to attain high skills and to avoid injury (Tinning, 2010).

The Oxford English Dictionary defines "method" simply as "A particular form of procedure for accomplishing or approaching something, especially a systematic or established one" (Oxford Dictionaries online, 2015), while "approach" is "a way of dealing with someone or something; a way of doing or thinking about something such as a problem or a task" (Oxford Dictionaries online, 2015). In spite of the discrepancies and confusion, both common and discipline-specific usage seemed to include in their definition of method a sequenced, stepwise and systematized means of learning a skill. Throughout this section, "technique" was consistently used to refer to a pianist's particular biomechanical, physiological formula, as it were, for playing the piano, rather than to what the pianist actually plays (scales, arpeggios, exercises, studies, etc.).

An Overview of Relevant Historical Piano Methods and Approaches 1880-1920

No study of injury-preventive piano technique methodology should ignore the momentous body of historical artifacts of the past 200 years. Numerous books and treatises have been written by pedagogues and pianists of all degrees of expertise (Lister-Sink, 1994). However, since these artifacts were created largely before the invention of video recording to enable motion analysis, or surface electromyography (sEMG) for measuring muscle use, the topic was necessarily limited to written and verbal descriptions throughout history. Since researchers could not measure the technical formulas used or know exactly how a method was applied, these historical methods and technical models were open to misinterpretation and even distortion. A quick search on the Internet would yield numerous websites and web chat rooms that discuss piano technique, often revealing widely disparate perspectives on the same approach, method, or model. The absence of credibility and quality control remains a serious challenge to the pianist in search of accurate information, understanding, or help.

In 1974, Gerig published a groundbreaking, encyclopedic examination of the entire history of keyboard technique titled *Famous Pianists & Their Technique* (Gerig, 1974). In it, he not only attempted to research the dozens of keyboard and piano technical schools and methods, he also strove to established in Chapter 11 ("The Perspectives of an Enlightened Piano Technique") certain core principles of scientifically informed and musically enhancing technical principles. His exhaustive research revealed, for the first time, minute details of the great pianists' approaches, systems, and methods, and the particular biomechanical "formulas" they used. However, Gerig's sources for the chapters on non-living pianists and pedagogues were written materials only—always

open to multiple interpretations and misunderstanding, including differing translations of primary sources. And as athletes might acknowledge, written descriptions of complex physical coordination could not convey the actual sensations of that coordination.

In this literature review of historical piano technique—methods and models—Gerig's research was heavily relied upon, as well as primary sources written by the pianists themselves. The research focused on those pianists, teachers, methods, and models that most represented the core principles embodied in the Method under investigation, and its technical model. Throughout this chapter, core characteristics of these techniques were extrapolated from the literature, and their resonance—or lack thereof—with the core principles of the Method summarized. Apart from Gerig's monumental work, there has been little research over the years in historical piano technique. Savage wrote an informative treatise "The History, Evolution and Application of Biomechanics and Physiology in Piano Playing" that afforded insight into the circuitous path toward physiological understanding. He pointed out that the piano has not had any major design modifications since 1880. Savage also appropriately asserted that the concepts of the functioning of the body (physiology) and biomechanics (the application of mechanical principles to the body) were by no means new to piano technique. Savage further stated that the entire body is involved in piano playing, and that the fact that, "the whole body plays a vital role in keyboard playing and is subject to the same laws of physics as other moving bodies (such as levers) are, mirrored the evolution of the piano…" (Savage, 2002, p. 6). For this reason, the primary focus of Section II was on piano technique, methods and models since 1880.

In more recent research, in an attempt to define a biomechanical model of injury-preventive technique, as well as to establish rate of, and risk factors for, injury, Ackland and Allsop (2010) addressed three historic approaches to teaching technique. Importantly, and unlike many other researchers, they used the term technique to mean *how* one uses one's body to play the piano, as opposed to *what* type of exercises one plays.

The researchers chose to examine "traditional" technique, the Breithaupt (1873-1945) "weight-playing technique," and the Levinskaya Technique, in relation to wrist alignment. While the traditional technique called for the wrists to be in a neutral to flexed (raised) alignment, the Breithaupt technique required an extended (lowered) wrist, and the Levinskaya approach incorporated all alignments (Ackland & Allsop, 2010). Contrary to the findings in favor of the flexible wrist (Furuya et al., 2011; Lee, 2010), Ackland and Allsop concluded that the neutral wrist would require less muscle activation unless the hand were raised off the keyboard; in such case, muscles would have to stabilize the wrist joint, thereby impeding mobility (Ackland & Allsop, 2010). They also posited that an extended wrist would require less muscle activity. However, such a statement would depend on whether the pianists were pushing the wrist down while depressing the key, or merely relaxing the entire forearm in the extended position. The former would be potentially injurious, while the latter would not be. Elevated shoulders were also implicated in inducing injury. Notably, researchers also cited misuse of muscles, in addition to overuse, as being a risk factor for injury (Ackland & Allsop, 2010).

Breithaupt and his school of weight playing were of particular interest in this investigation of the origins of the Method being studied because the Method under investigation has been erroneously associated with the Breithaupt relaxation, weight-

playing technique. Both “weight” and “relaxation” could be deemed two of the most controversial terms in the lexicon of piano technique. Like so many pianists at the turn of the last century—including Matthay in England, Leschetizky’s teaching assistants in Vienna, and Jaell in France—Breithaupt was fascinated by anatomy and physiology, and the search for technical ease and freedom (Breithaupt, 1909).

Throughout piano history, the way the body was used to play the instrument was intrinsically linked with the requirements of the particular keyboards. Depending on the demands of a specific mechanical lever system, the biomechanical lever system would be adapted. For example, harpsichordists and early forte-piano players, by virtue of the lightness of their instruments, used very little of the whole arm or torso in playing, and used a ratio of more finger and hand levers to arm levers. Herein, however, lay the historical gremlin: Were finger levers used in isolation from the arms, possibly resulting in stiffness and potential injury to tendons and muscles in the wrist and forearms? Or were the finger levers to be coordinated efficiently and in sequence with the entire arm? Historical documents indicated that even early keyboardists who employed more finger lever usage—such as Couperin, Bach, Mozart, Czerny, and Hummel—were known for their supple muscular elasticity and technical freedom (Gerig, 2007). Nonetheless, widespread isolated finger lever use continues through the present day.

Although this review focused largely on piano technique after 1880, the important contributions of Chopin (1810-1849) and Liszt (1811-1886) to this field should not be omitted. Chopin and Liszt were famed for their extreme suppleness (both were said to have hypermobile joints), as well as expanded piano techniques such as use of thumbs on black keys, and flexible fingerings. Indeed, without this elasticity and flexibility, the

etudes of both Chopin and Liszt would be virtually impossible to perform. As one of Chopin's students wrote, he frequently intoned in the lesson, "Facilement, facilement!" He insisted that they "Have the body supple right to the tips of the toes" (Eigeldinger, 1988, p. 29). Chopin abhorred stiffness of any kind. One might also surmise that the piano music of both Liszt and Chopin—with its expanded use of the registers, singing line, increased colors, and flowing arpeggiated figures over the entire keyboard—was not only a product of their creative genius, but a product of each's own anatomical anomalies, as well as of the evolving piano. However, while both pianists focused a great deal of their own time and energy on cultivating technique, in their teaching they emphasized music-making, not developing the student's technique. A great deal of writing exists on how both Chopin and Liszt played, taught, and composed—including their demanding etudes and Liszt's exercises. But no method or system emerged from either pianist. Chopin had begun writing a method book in the last year of his life. But according to the pianist Cortot who obtained the manuscript fragment in 1936, it was limited in length and quality. Chopin did, however, write that, "The hand should remain supple and the wrist and forearm round themselves into a curve making for ease of movement" (Cortot, 1952, p. 43-44).

As the piano over the 19th century became larger and heavier to the touch, pianists gradually engaged more of the arms and torso for power—hence, the growing interest in physiology and engagement of the whole body in playing. However and most ironically, during the mid-19th century, conservatories such as the Lebert-Stark school in Stuttgart reacted to freedom of movement and efficient coordination of the whole arm by insisting on a high-fingered, stiff-arm approach. As Gerig states:

> It is difficult to understand how so many of the instructors of the period could be so blinded to the physical and musical evils of their system and so little influenced by the freedom and abandon of a Liszt or Rubinstein performance or the more subtle arm pressure touch exhibited in Clara Schumann's playing (Gerig, 2007, p. 230).

Anecdotal evidence suggests that this system, as potentially injurious as it is, continues to surface in a number of piano studios and conservatories today. Breithaupt reacted strongly to the reactionary high-fingered, stiff Stuttgart School by promoting hyper-relaxation of the whole arm, minimal involvement of the fingers, and free-falling arm weight. This way of playing became widely popular with numerous followers. However, even those who acknowledged the advantages of releasing unnecessary muscular tension added cautionary notes. Carreno (1853-1917), a Venezuelan pianist who performed as a child for Lincoln in the White House, warned of the problem of excessive relaxation: "Relaxation does not mean to flop all over the piano; it means, rather, to loosen just where it is needed and nowhere else…" (Brower, 1915, p. 161).

In view of what Gerig termed enlightened—whole-arm, well-coordinated—piano technique, Breithaupt's excessive emphasis on relaxation seemed ill-conceived, especially as it reportedly could lead to sloppiness, looseness, inaccuracies, and heaviness. However, even the pianist Godowsky—known as one of the greatest virtuosi and musicians of his day—taught similar principles, claiming that his discovery of "relaxed weight" was a revelation. Unfortunately, Godowsky was hesitant to create a method for transmitting these principles to students, fearing its ossification. He encapsulated the very challenges pianists continue to face today in these words from an article "The Best Method Is Eclectic" of 1933: "Unfortunately, every opinion announced by any innovator immediately leads to all sorts of fallacious statements, contradictions

and misunderstandings, by those who jump at conclusions without comprehending the fundamental principles" (Godowsky, 1933, p. 784).

In the end, however, Breithaupt reluctantly acknowledged that Deppe (1828-1890) "…had the first theoretical notion of how a great genius plays. He came upon the idea of letting the arm fall from the shoulder through correct observation of Rubinstein's playing" (Breithaupt, 1911, p. 12). Deppe is acknowledged by some in the field of historical piano technique as the father of modern piano technique—the efficient coordination of the whole arm structure, beginning in the torso, with the piano. He was known for having a teaching method that analyzed the mechanical aspects and trained, among others, beautiful tone production; simple movements of lifting and falling of the hand and forearm; relaxed, quiet fingers; suppleness, elasticity, and ease of movement; smooth coordination of all the units of the arm structure; use of gravity; synergistic muscle use; support and regulation of the forearm and hand by the upper arm and back muscles; sensitivity in the finger tips; direct, purposeful, simple movements; and, most importantly, the connection between "beauty of movement and beauty of tone" (Caland, 1903). Deppe believed strongly that technique, however free, must always be in service of the music.

The Early Russian School

The research on the Russian Levinskaya (Ackland & Allsop, 2010) was also of particular interest to me because of my own pianistic provenance. Her teachings resonated with those of my own Russian-trained teachers, including Lateiner-Grosz, and further clarified my own connection with the Russian school of piano technique. Levinskaya coincidentally was the teacher of Rubens, one of my college piano teachers

who was also considered to be her most famous student. She in turn was a student of the noted Safonov (1852-1918), one of the premiere teachers of the famous Russian school. Safonov had taught at the St. Petersburg Conservatory from 1881 to 1885, as well as the Moscow Conservatory from 1885 to 1905, and was close friends with Anton Rubinstein, who was considered to be the first great European pianist to perform in America, and an influential music educator. Safonov was director of the St. Petersburg Conservatory from 1887 to 1891 and was also the teacher of Scriabin and Josef and Rosina Lhevinne, among many other notable virtuoso pianists (Gerig, 2007).

During that period between 1880 and 1917, the Russian school of pianists and teachers included luminaries such as Siloti, Gabrilowitsch, Rachmaninoff, Blumenfeld, Essipov, Horowitz, Scriabin, and the Lhevinnes who immigrated to the United States after World War I. Their students at the Juilliard School included Chasins, Marcus, Gorodnitzski, Raieff, Browning, and Cliburn. The characteristics of their pianism and technique—as well as that of Leschetizky—most reflected my own training and the principles embedded in the Method under investigation. They included the following: 1) A clear musical concept of a phrase, followed by mental practice before executing the phrase, and ending with evaluation of the phrase; 2) attention to rich, "golden," singing tone production; 3) attention to continuous listening; 4) firm finger tips and a solid, natural hand arch; 5) an elastic, flexible wrist; 6) upper arms hanging into gravity; 7) quiet, upright torso and head; 8) using gravity to advantage with the arms; 9) moving with economy, suppleness, and ease; 10) no accumulation of muscle tension in the arms; 11) coordination of all parts of the arm structure; 12) technique always in service to musical values.

Of especial relevance to this study were the words of Lhevinne on how the great Russian pianists acquired their prodigious technique. He wrote:

> They build not upon sands, but upon rock…in the conservatory examinations, the student is examined first upon technic. If he fails to pass the technical examination he is not even asked to perform his pieces. Lack of proficiency in technic is taken as an indication of a lack of the right preparation and study…. Particular attention is given to the mechanical side of technic, the exercises, scales and arpeggios.…The full course at the leading Russian conservatories is one of about eight or nine years (Cooke, 1917, p. 176).

The emphasis was clearly on building a solid foundation of technical freedom with regular, daily technical drill—something quite familiar to athletes and dancers nowadays, but not to pianists (although the piano pedagogue and composer Czerny in the early 19th century recommended that the student receive a one-hour lesson per every weekday in order to gain foundation principles of piano playing; Gerig, 2007, p. 109). Even more pertinent to the Method under investigated was the importance placed on taking the necessary time to build this foundation. Lhevinne states:

> During the first five years, the pupil is supposed to be building the base upon which must rest the more advanced work of the artist. [Only] the last three or four years…are given over to the study of master works (Cooke, 1917, p. 176).

Arguably, such an approach to teaching technique would simply not be possible in today's world outside of a more disciplined, some might even say rigid, culture. However, as will be shown later, certain characteristics of this approach may find resonance in research in other disciplines—namely, neuroscience and neuropedagogy, as well as sports pedagogy.

Isabelle Vengerova. One particular teacher should be mentioned who, like the Lhevinnes, influenced the course of piano playing and technique in America, for better or for worse, though her "extraordinary and highly developed system of technique and tone

production which she apparently evolved on her own" (Schick, 1982, p. vii). Like many other Russian pianists, Vengerova (1877-1956), a student of Leschetizky and Essipov, developed her pedagogical talent at the St. Petersburg Conservatory before immigrating to America in 1923 to join the Curtis Institute in Philadelphia, Pennsylvania. Her students included Barber, Bernstein, Kallir, Kalish, Foster, di Bonaventura, Foss, Graffman, and Lateiner, the brother-in-law of Lateiner-Grosz. The Vengerova method, as summarized by her student Lateiner, included emphasis on characteristics similar to her other Russian colleagues, such as 1) singing tone, 2) firm fingertips and hand arch for strength and precision, 3) flexible wrist, and 4) a beautiful legato touch. She also required that all students study technique intensively before beginning lessons with her (Gerig, 2007).

Of even greater importance to this tracing of roots of the Method being investigated was Vengerova's focus on fundamental tone production—somewhat similar to the Russian school and the Method being studied—by beginning with a 5-finger exercise with an accent on each note as a result of a lifting and rapid lowering of the forearm. The student would then progress to a 2-note, 3-note, 4-note, etc. pattern for each cycle of raising and lowering the forearm. However, Vengerova also directed the student to feel the arm weight going into each key by imagining "that a ton was suddenly placed on [the] wrist forcing it down, with the pressure going into the fingertip and then into the key" (Schick, 1982, p. 23). While she also emphasized the immediate relaxation, the student was to achieve this tone with a lowered wrist. Such directives might be implicated in the reported hand injuries of some of her students. She also apparently departed from the older Russian school model in one critical area: Rather than allowing the upper arms to hang freely into gravity from the shoulder girdle, she required that the

arms be held slightly away from the torso. It might be shown that these particular biomechanical directives signaled a critical shift in a prominent historical piano pedagogy away from efficiency and toward potential playing-related injury.

Finally, Leffler (1998) stated that although Vengerova—as well as her teacher Leschetizky and his teacher Czerny—had detailed step-by-step methods, all eschewed the idea of a method, believing that individualism in training was most important. Leffler wrote that "Each student's success in training was tailored to their musical capabilities and their physical features….Individualism would make it impossible to develop a single definitive method" (Leffler, 1998. p. 96).

Ironically, the aforementioned statement revealed a lapse in critical thinking and logic. The repudiation of methods by famous piano pedagogues known for their methods is a topic worthy of investigation unto itself. The rationale given by Leffler in his study of three pedagogues (Czerny, Leschetitzky and Vengerova) that a method would, by definition, damage a piano student's individuality, flew in the face of each of these teachers actually applying most stringently his or her technical method. The question might be asked: Could a successful method not include a tailoring of the steps to each student's particular needs?

Piano Technique and Methodology 1920 to 1980

No review of the literature on writings on piano technique should fail to mention the contributions of Matthay (1858-1945), considered by many to be the most noted 20th century British piano teacher. His students included the legendary Hess. Like Breithaupt and Deppe, he struggled to reconcile—musically and technically—the concepts of individual finger articulation with relaxation and arm weight. In his *The Visible and*

Invisible in Pianoforte Technique of 1932, he insisted on the importance of sensing the actual degree and timing of muscle contraction (the "invisible") that then determine movements or position (the "visible"). This signaled a paradigm shift in the piano technique world—an emphasis in teaching on sensing the state of the muscles through the kinesthetic and tactile senses (Matthay, 1932). Only in recent years has the technology of surface electromyography (sEMG) been used to assist piano teachers in this important aspect of injury-preventive piano technique (Riley, 2007).

Otto Ortmann. While anatomy and physiology were embraced by early 20th century piano theorists and pedagogues, Ortmann, director of Peabody Conservatory, took the investigation of piano technique into a new realm. Gustafson believed that Ortmann's work represented an historical turning point in both research and piano pedagogy: Ortmann's meticulous scientific experiments in piano technique, touch, and tone at Peabody Conservatory during the first third of the 20th century represented one of the first interdisciplinary investigations (Gustafson, 2007). Ortmann's research and writings, including *The Physiological Mechanics of Piano Technique* (Ortmann, 1929), incorporated the fields of physics, acoustics, biomechanics, anatomy, physiology, and psychology and placed him at the forefront of the field (Gerig, 2007; Gustafson, 2007; Savage, 2002). Ortmann sought to address through exacting scientific analysis the numerous historical contradictions and misconceptions that beleaguered the piano world. "He wanted to apply irrefutable scientific truths as the basis for understanding and then, after examination and testing, to set forth the exact ways in which the piano-playing mechanism worked" (Savage, 2002, p. 9). Through this scientific scrutiny, Ortmann affirmed certain pedagogical beliefs and concepts. However, more importantly, he was

able to disprove, through scientific investigation, many popular beliefs, including the misconception that a pianist could be "relaxed" while playing (Savage, 2002).

Ortmann's writings were greeted with disapproval, skepticism, and criticism by pianists who believed that subjecting one's piano playing to rational, scientific analysis might diminish one's artistry—a fear still prevalent today. Nonetheless, as Gustafson asserted, though Ortmann's scientific research might be considered outdated, it has yet to be disproven by other research (Gustafson, 2007). As Gerig stated, "Another major accomplishment of Ortmann's work is its synthesis of the valid tenets from the conflicting historical schools of technical thought" (Gerig, 1977, p. 442).

Mid-20th Century Piano Theorists

After Ortmann's exhaustive research and writings (most of which are out of print today), the way was paved for other pianists-as-scientists to build on the foundation laid by Ortmann. Schultz extended the research to a thorough study of muscular coordinations of the fingers, and a codification of movement types. The research and writings of Gat (1913-1967) reflected the trend toward an interdisciplinary approach to piano technique and teaching, including the fields of biomechanics, physics, and technology. While Ortmann lamented in 1967 the lack of adequate technology in his self-constructed laboratory of the 1920s (Gerig, 2007), Gat in the 1960s was able to use a camera with rapid shutter speed to actually capture pianists' arms and hands in motion. Echoing Ortmann's beliefs, he stated from the outset in his *The Technique of Piano Playing*:

> The main fault of most books on piano playing is that they depend too much on the individual experiences of the authors gained in the course of teaching. These works are consequently often full of contradictions. The only solution is to search for the general laws (Gat, 1965, p. 9).

These "general laws" he believed to be found only in sound science—anatomy, physiology, biomechanics, and physics—combined with the experiences of teaching and performing (Gat, 1965). He believed in the increasingly popular notion that piano playing was an activity of the whole body, just as in sports. Pichier in *The Pianist's Touch* believed whole-heartedly in the intrinsic connection between the mechanics of tone production and musicality. His goal was to convince pianists that they should strive for the most efficient, freest coordination that would enable them to play with the greatest expression (Pichier, 1972).

Whiteside (1881-1956) studied biomechanics and anatomy and observed dancers, athletes, jazz players, and other instrumentalists in an effort to establish ways of teaching well-coordinated piano technique. Her primary discover as a teacher, in relative isolation from research, was that feeling the rhythm throughout the entire body while playing was essential to an efficient technique and a musical performance. For Whiteside, playing the piano was an activity of the entire body involving the harmonious coordination of all of its parts (Whiteside, 1961).

One of the most forward-thinking figures in the history of piano technique was Kochevitsky (1903-1993) who studied at the Moscow and Leningrad conservatories. Closest in philosophy to the topic of this study, he revealed the influence of Russian neurophysiologists and Pavlovian reflexology in his book *The Art of Piano Playing: A Scientific Approach* (1967). Like Ortmann, he sought a more objective foundation, rather than the teach-as-you-were taught approach, and lamented the widespread use in the 19th century of mechanical devices for facilitating the learning process. (Ironically, similar devices are being marketed today at very high prices.) Kochevitsky belonged to the so-

called “psycho-technical” school of piano playing, the precursor of neuropedagogy. He asserted that the motor activity in piano playing originated in the brain. By extension, the learning of a complex motor skill such as piano playing should follow a brain-based learning sequence: 1) seeing the visual stimulus on the page, 2) imagining the sound, 3) anticipating the motor act, 4) executing the motor act producing the sound, and 5) perceiving and evaluating the sound. Interestingly, Kochevitsky was echoing the original Russian school learning sequence, but in modern neuroscientific language and a more expanded version. Moving beyond the anatomic-physiological schools of technique in the early 1900s, he adhered to the belief that piano playing was a function of the central nervous system. Kochevitsky emphasized the ideas of Steinhausen’s *The Physiological Misconceptions and Reorganization of Piano Technique* of 1905. His most arresting idea, relative to the times, was that, “Technique is the interdependence of our playing apparatus with our will and our artistic intentions” (Kochevitsky, 1967, p. 13). As in the Method under study, he advocated a focus on the mastery of playing one note, “The pupil should concentrate on tone production, starting from single, separate tones, with attention on tone quality, proprioceptive (self-perceiving) sensations and form of movement, all three closely united” (Kochevitsky, 1967, p. 31). It should be noted, coincidentally, that Kochevitsky also believed, like the author, that “…every piano teacher should have his method, for absence of method in pedagogy means chaos. But the *use of some definite method…by no means excludes an individual approach to each student* [emphasis added]” (Kochevitsky, 1967, p. 36).

Pianists, writers and theorists searching for a new approach to playing included Busoni, Bardas, Prokofiev, Kogan, and Petri. My own connection to the Psycho-

Technical School was through my teacher Lateiner-Grosz who repeated almost verbatim Kochevitsky's belief that successful practicing was a combination of a clear mental concept of what is desired musically and focus, awareness and energy to achieve that concept (Kochevitsky, 1967).

Yet another connection to the philosophy of the Model under investigation was Busoni's declaration that, "Technique in the truer sense has its seat in the brain, and it is composed of geometry—an estimation of distances—and wise coordination" (Kochevitsky, 1967, p. 16). Busoni was the teacher of Agosti, one of the author's most influential teachers. Kochevitsky's statements regarding practice were astonishingly prescient of discoveries much later in neuroscience: First he asserted that any "bone-muscle apparatus" could develop an efficient technique because it was directed by the brain—the concept of mental imaging to be discussed later. Second, listening to and observing great pianists play helped overcome technical hurdles because it gave a vivid and clear image—the concept of using the brain's mirror neurons. Kochevitsky emphasized, as well, the importance of proprioception (self-sensing) for constructing, mastering, and monitoring new coordinations.

Bonpensiere also believed that mental imaging—or "ideokinesis" was a key concept in learning to play the piano. Although the language in his *New Pathways to Piano Technique, a Study of the Relations between Man and the Body with Special Reference to Piano Playing* (1953) is difficult to understand at times, his ideas about the power of ideation presaged those of Kochevitsky and neurophysiologists, "I imagine the act [of piano playing] as if already performed—and lo! it is done. My hand did it, but I did not make any effort" (Bonpensiere, 1953, p. 37).

Clearly, throughout the history of the piano, writers and writings on piano technique and the methodology for teaching a technical model were plentiful. However, after the 1960s, fewer and fewer writings emerged. Of especial significance in the 1980s was a book by Sandor, a virtuoso student of Bartok. His *On Piano Playing – Motion, Sound, and Expression* (1982) offered a rational, but more accessible and simplified approach than Ortmann's. He discussed in three parts the piano and the body mechanism, fundamental technical patterns, and the application of technique to music. Like his early 20th century predecessors, Sandor emphasized the smooth coordination of all parts of the body mechanism and the importance of muscle efficiency, allowing continual release of the muscles and prevention of accumulated muscle tension. However, echoing beliefs of a growing number of his colleagues, he eschewed exercises for developing technique. Like Ortmann, Kochevitsky, and earlier Russian pedagogues, Sandor feared the growing trend toward the pianist manifesting visually the emotional contents of the music, "Today more than ever, audiences mistake the excessively tense muscular activities of the performer for an intense musical experience, and all too often we see the public impressed and awed by convulsive distortions and spastic gyrations" (Black, 2006, p. 1).

Present Day Methods and Models

It is understandable, for the aforementioned reasons, that there is a paucity of research on historic piano technique and methodology. However, in the last decades of the 20th century and first decade of the 21st century, a number of piano technique books and approaches emerged that have not been investigated for their effectiveness. Fink was one of the first writers to include a video recording to illustrate the exercises in his *Mastering Piano Technique: a Guide for Students, Teachers and Performers* (1992). He

believed that "musical continuity demands physical continuity" and stated that there was "no single correct way to play. Good technical training encourages a variety of approaches for, by encouraging flexibility, efficiency, and surety…performers become freer to follow their imaginations" (Fink, 1992, p. 11). Although his book is replete with various exercises for his 10 "primary movements,' as well as for chords, octaves, legato, staccato, etc., this sentiment once again reflected the movement away from any type of step-by-step methodology. One might wonder whether this trend toward ambivalence regarding the establishment of certain irrefutable laws of good coordination (a "correct way to play") might not be a partial reason for the persistence of PRNDs.

Grindea (1914-2009), a student of Matthay, was an international pioneer and leader in injury-preventive technique. She founded in 1978 the European Piano Teachers' Association (EPTA) and in 1980 the International Society for the Study of Tension in Performance (ISSTIP). An indefatigable champion for healthful piano playing, her approach to teaching technique was relatively simple. Her fundamental belief was that,

> …any School of Piano Playing can be used successfully if the muscular co-ordination is allowed to function unhindered. Whether a pianist uses *high finger articulation* or plays from the *key surface* (the approach I recommend) is irrelevant. This explains why so many pianists belonging to different schools of piano playing *do not* develop physical problems. The answer is that they play without stiffening the muscles, they maintain joints and muscles in a harmonious state....The answer lies in "differential relaxation" when only the group of muscles needed to execute a certain movement should be active while the rest of the body remains alert, but in a balanced state (Grindea [year unknown], p. 12).

Aside from her influential presence in the global piano world, Grindea's straightforward approach—including exercises for liberating the body of unnecessary physical and mental tension—reflected her teacher Matthay's approach and reportedly

had outstanding results with students (Grindea, 1995). The Grindea Technique, however, like most of the methods and approaches in this review, remains largely uninvestigated.

One of the most widely known piano techniques is the Taubman Approach, created by Dorothy Taubman in the 1960s. Milanovic, the first certified Australian Taubman instructor, outlined its characteristics and understandably lamented some misconceptions of those with little knowledge of the Approach: its association with injury; the fear that a rational, more scientific approach to technique might diminish one's musical inspiration; and the concern that following biomechanical principles might homogenize musical interpretation (Milanovic 2005). The Approach focused on coordinate movement; a specific structural alignment of the forearm, hand, and finger bones; and rotations of the forearm that were said to reduce the need for awkward playing positions. Its purpose was to avoid strain, and to create a more reliable piano technique that would, in turn, help the pianist play more expressively. It did not, however, purport to utilize any of the body education disciplines such as the Alexander Technique or the Feldenkrais Method that might help promote greater kinesthetic awareness and ease of coordination throughout the entire body. Taubman also questioned the efficacy of certain techniques of the past, although she did acknowledge the contributions of Matthay, especially regarding rotation of the forearm. Aside from its originator, the most well known proponent of the Taubman Approach is Golandsky who directs the Golandsky Institute at Princeton University each summer (Schweitzer, 2012).

Unlike proponents of the Taubman Approach, researcher Riley—through *Piano Perceptions* and her company Proforma Vision—acknowledged the importance of alignment of the entire body, as well as of the state of the muscles beyond the traditional

playing apparatus of arms, hands and fingers. However, instead of cultivating the kinesthetic sense and proprioception, Riley used technology to train injury-preventive technique through physiologic monitoring. She combined surface electromyography (sEMG), with dual-angled video recording of the pianist's movements. With the aid of computer monitors, these two technologies allowed the pianist to monitor muscle tension by way of electrodes strategically placed on the arms and shoulders, as well as to view postural alignment of the body. Such immediate biofeedback and video feedback empowered the pianist to sense and see various maladaptive, compensatory movements that could lead to a risk of injury. The advantage of an approach that uses advanced technology is the immediate and measurable feedback it allows. Riley is an active and widely respected member of Performing Arts Medicine Association (PAMA). Her website materials referenced the two hallmarks of injury-preventive technique—optimal skeletal alignment and efficient muscle use. Graphic illustrations of progress made by pianists using this technology offered hope for this new development in reducing injury. More research is needed to reveal whether training that relies primarily on relatively costly technology can gain widespread acceptance among teachers (Riley, 2007, 2010).

Karpoff offered multiple pedagogical tools for teaching injury-preventive, well-coordinated piano technique, including books and DVDs. Karpoff's *3-D Piano* (2009) incorporated principles similar to the Alexander Technique for whole-body use, and offered some instruction in foundational technique (sitting, free fall of arm, bone alignment, levers, joints, etc.). It was largely a comprehensive collection of instructions on how to play chords, slurs, arpeggios, "vibrato technique," trills, scales, etc., rather than

a sequenced, step-wise method from simplest to most complex movements (Karpoff, 2009). An online learning module Entrada replaced the DVD series in 2015.

Fraser, like Karpoff, offered multiple options for instruction. He described his book *The Craft of Piano Playing* as a one-semester comprehensive course of instruction in a new approach to piano technique based largely on the function and innate structure of the human hand (Fraser, 2003, 2006, 2011). Fraser demonstrated an extensive knowledge of body mechanics, structure and physiology. His express purpose for writing was, "…not to say anything particularly new about piano technique, but to *find a way of saying it that was not open to misinterpretation* [emphasis added]*"* (Fraser, 2011, p. xxxiv). In a somewhat similar "menu" approach as Karpoff's, Fraser offered an ostensibly comprehensive collection of instructions on how to play or use all aspects of piano technique, one he called a system of movement physics. It included, like Karpoff's, sections on most aspects of piano technique, including key concepts, movement, legato, the thumb, octaves, chords, the arm, natural finger shape, rhythm, phrasing, orchestration, articulation, and emotional and spiritual content in music (Fraser, 2011). He also admitted to having integrated more of the principles of the Feldenkrais Method into the 2011 edition, as well as having modified certain aspects of technique based on new experiences and information.

As comprehensive as his approach was, the logic of Fraser's sequencing was elusive. Most importantly, the instructional components presumed years of prior study and playing. Additionally, this was not a step-by-step approach in a logical sequence from simplest to most complex motor coordination, but rather the application of a set of biomechanical principles to many unsequenced coordinations, both complex and simple.

Ironically, he lamented the lack of focus on technique in recent decades—as opposed to musicianship—and even called for world-wide systemization of a piano technique method, similar to that of the older Russian school. But Fraser then gave the reader permission to "jump around a bit," indicating that the crowning principle of learning complex motor skills—sequencing incrementally through kinetic patterns—was not being followed. In that sense, his writings, though lengthy and detailed, did not constitute a true method. Additionally, certain of Fraser's exercises should perhaps be further investigated for their potential to increase risk of injury, or exacerbate existing injury.

Only four contemporary methods—in the purest sense of the word—that this author could discover have recently been investigated through dissertation research. The Mikimoto Piano Method (Hosaka, 2009), the Korean Beyer Method widely used in Korea for over a century (Ko, 2005), the Brancart Piano Method (Steinberg, 2005), and the Lister-Sink Method (being herein investigated; Osada, 2009). Ko (2005) reported that even an updated version of the popular Beyer Method for teaching piano provided little explanation for each new technical exercise and concept, and technique was but one subject of several in the method. However, as Hosaka asserted, in the Mikimoto Method, Mikimoto—a well-known teacher in Japan—combined scientific knowledge of neurology and anatomy with older, traditional approaches. Her primary means of instruction were exercises for isolating specific muscles and muscle groups. Mikimoto's patented fingerboard aided the pianist in stretching tendons of the hand and developing hand muscles, supposedly for facility and speed. However, these exercises were in carefully sequenced order, according to Hosaka who also stated that Mikimoto's careful

analyses of the playing apparatus helped ascertain the causes of PRNDs, and aided in both rehabilitating and preventing injury (Hosaka, 2009).

The Brancart Piano Method, according to Steinberg, was a set of steps and procedures for adapting the pianist's hand to the keyboard. While Brancart apparently focused most of her technical training on the hand arch, she also understood the importance of good alignment of the torso, and of efficient muscle use. She echoed Fraser and Sandor and many of the more modern technique schools in stating that musical intensity should not be equated with physical tension. Brancart also understood, as do athletes and dancers, the need for exercises to be done daily and consistently. Steinberg's dissertation was accompanied by numerous photos of a pianist's arm and hand (Steinberg, 2005). Unfortunately, certain images of the arm and hand seemed stiff and artificially aligned. Also, the thumb was "cocked" out continuously, thus indicating that unnecessary muscle tension might be present in that area of the hand. Brancart is known for her formidable technique, but Steinberg's well-intended, detailed descriptions and photos increased confusion and prompted questioning of some of the underlying biomechanical assumptions. This ambiguity, contradiction, and confusion seemed typical of many writings on technique, regardless of their eloquence and thoroughness.

Section II will conclude with 1) a brief overview of two contemporary methods which, although not investigated, are worthy of study because of considerable anecdotal evidence of their success; and 2) a study out of New Zealand that reflected closely a number of the principles and practices embedded in the Method under investigation. Wirth, head the Wirth Center for Performing Arts for pre-college students in Minneapolis, MN produced a piano technique DVD *The Gravi-DVD* (Wirth, 2007). In it,

he outlined a step-by-step method for teaching injury-preventive, well-coordinated technique based on the laws of gravity. Like the Method being examined, he emphasized kinesthetic awareness, as well as skeletal alignment and muscle efficiency. Although certain of the exercises and steps on Wirth's DVD were biomechanically puzzling, his students performed advanced repertory with a consistent technical freedom and efficiency. Wirth's teaching methodology is deserving of further investigation.

In *Piano Olympics*, Peskanov attempted to recreate a method of learning injury-preventive piano technique that he was taught as a child in Ukraine. *Piano Olympics* is based on a VHS recording in English in 1990 and a series of piano books—usually accompanied by teacher-training workshops—that encouraged young pianists to learn technique within a non-competitive environment. He called this method *The Russian Technical Regimen for the Piano* (Peskanov, 1990). His system, like Wirth's, emphasized gravity-based playing. However, more importantly for this study, Peskanov's work attempted to recreate a methodology that seemed quite similar to the Method under study. He clearly acknowledged the need for a carefully sequenced, step-by-step approach to training a complex motor skill—as evidenced by his extremely graduated exercises—as well as the importance of regular guided and mindful repetition and practice with a teacher skilled in efficient piano technique. At times, Peskanov used potentially controversial terms such as relaxation, and also employed his own creative terminology. Refreshingly, however, he did not feign biomechanical expertise but admitted to simply desiring to pass on the legacy of the highly effective system he was taught in Russia. To the author's knowledge, this might be the only attempt in English on the market today to codify the methodology of at least one version of the Russian school of piano technique.

Coincidentally, concurrent with the release in the early 1990s of Peskanov's method, I was given a copy of the carefully graduated Russian National Curriculum for Piano, translated into English by Zuponcic (1993). It is called the *Program for Children's Music Schools* and was released by the Ministry of Culture USSA Methodology Committee of Fine Arts Studies in Moscow in 1973. Just as stated by Lhevinne earlier, there were seven levels, and piano students were required to complete during an academic year 18 to 20 works from five groups: polyphony, large forms, character pieces, etudes, and ensemble works. The majority of composers were Russian and even in the seventh year of study, only one specific Beethoven Bagatelle, Op. 33 and a particular Chopin Nocturne were listed among the repertory choices. A thorough study and comparison with American or European schools might reveal a much more rapid journey through repertory levels. It would seem that the older Russian school emphasis on building a thorough technical foundation was evidenced in this curriculum.

Finally, in a 2006 study, de Lisle investigated the efficacy of retraining three pianists with focal dystonia in a foundational approach based on sound biomechanics and minimal tension (De Lisle et al., 2006). Coincidentally, some of the components of the retraining program were similar to the Basic Stroke training in the Method being studied.

Synthesis of Section II

This section attempted both to trace the roots of the Method being studied in historical piano technique, and to find the resonances in current methods and approaches. However, the history of piano technique, as mentioned earlier, is replete with systematic methods and more general approaches for training technique, from the simplest coordinations to the most complex (Gerig, 2007). The difficulty lies in the scarcity of

research—in both the content and the effectiveness—of these potentially congruent historical methods. Therefore, little is known about their true efficacy beyond written descriptions, or even whether there is any true commonality with the Method in question.

Common Core Values Shared by the Method with Other Approaches

That being said, the literature review from 19th and early 20th century historical records, revealed a certain number of approaches that taught similar core pedagogical values as the Method being examined. Following is a list of the core principles of the Method followed by piano pedagogues, historic and contemporary, who shared a similar value:

1. Piano technique is a trainable but complex neuromusculoskeletal activity of the whole body, directed by the brain: Levinskaya, Matthay, Ortmann, Kochevitsky, Gat, Whiteside, Bonpensiere, Sandor, Lateiner-Grosz, Grindea, Fink, Fraser, Karpoff

2. The technical model used in teaching, like other athletic models, should be based on rational, biomechanical principles of efficient whole-body use, and taught with consistent, accurate, and understandable terminology. Ortmann, Kochevitsky, Gat, Sandor, Taubman, Fink, Fraser, Karpoff

3. Piano technique is best acquired through neuromuscular programming in a step-by-step, carefully sequenced manner, from the simplest coordinations to the most complex, allowing sufficient rest and time for the brain to process and master each step. Early Russian school, Vengerova, Bartok, Suzuki Piano Method, Wirth, Peskanov

4. Enhanced auditory, tactile and kinesthetic awareness through mindfulness training are essential to successful training, beginning with continual awareness of breathing. Kochevitsky, Grindea, Lateiner-Grosz

5. The teacher must teach kinesthetic and somatic awareness of whole-body coordination through appropriate and professional tactile guidance: Early Russian school, Suzuki Piano Method

6. Concurrent training in the Alexander Technique or other embodied cognition disciplines enhances proprioception, kinesthesia, and somatic awareness, as well as the rate and quality of learning: Grindea, Fraser, Karpoff

7. Modeling, mental practice, video and audio recording and self-assessment, and written self-reflection are all important tools for teaching: Kochevitsky, Riley

8. Teachers of students with playing-related injuries must work in partnership with a team of healthcare professionals, including traditional and complementary practitioners: Lateiner-Grosz, Taubman, Grindea, Riley

9. Piano technique—all coordinations, movements and sensations—must be chosen to best serve the musical requirements: Breithaupt, Deppe, early Russian school, Levinskaya, Matthay, Ortmann, Busoni, Kochevitsky, Gat, Whiteside, Bonpensiere, Sandor, Lateiner-Grosz, Grindea, Taubman, Fink, Fraser, Peskanov

10. The teacher must adapt appropriately and creatively to each student's individual learning style, training history, and state of health in a positive learning environment, potentially leading to psycho-physical transformation: Suzuki Piano Method, Kochevitsky, Grindea

Moreover, there are only a limited number of video recordings of pianists in the early 20th century to demonstrate the type of biomechanical model late 19th century and early 20th century pianists were taught. As a result, misunderstandings, distortions, and misinterpretations arose when one attempted to describe in written form a highly complex physical activity such as playing the piano. This would render any conclusions drawn potentially specious. However, a review of the literature seemed to reveal certain similarities between the biomechanical principles taught by the Method and those taught by historical and contemporary pedagogues. Certainly in the second half of the 20th century, as well as in the 21st century, there is ample video footage to give a clear visual indication of the type of biomechanical models that more contemporary pedagogues teach. Following is an outline of methods and approaches that have the most commonality with core principles of the Method's biomechanical model.

Commonalities of the Method's Biomechanical Model with Other Methods

1. Torso is balanced dynamically on sitting bones: Early Russian school, Grindea, Riley

2. Spine is lengthened in its four natural curves with minimal pressure on vertebrae: Early Russian school, Leschetizky, Ortmann, Kochevitsky, Gat, Grindea, Suzuki Piano Method, Fink, Wirth, Riley

3. Shoulders remain free of unnecessary tension: Deppe, Breithaupt, early Russian school, Leschetizky, Ortmann, Kochevitsky, Gat, Grindea, Suzuki Piano Method, Sandor. Peskanov, Fink, Riley

4. Neck remains free of unnecessary tension: Breithaupt, early Russian school, Leschetizky, Ortmann, Kochevitsky, Gat, Sandor, Grindea, Peskanov, Wirth, Riley

5. Head is balanced on top of spine: Early Russian school, Leschetizky, Ortmann, Kochevitsky, Gat, Sandor, Fink, Grindea, Suzuki Piano Method, Riley

6. Arms are supported efficiently from the torso, allowing the medial deltoid to release the upper arm into gravity between phrases: Deppe, Breithaupt, early Russian school, Ortmann, Kochevitsky, Gat, Sandor, Grindea, Peskanov, Riley

7. Forearm, hand, and finger bones form natural arches and are aligned optimally for support of pressure and efficient transmittal of energy into key: Deppe, Breithaupt, early Russian school, Leschetizky, Ortmann, Lateiner-Grosz, Sandor, Grindea, Taubman, Fink, Peskanov, Riley

8. Movement of the forearm and hand is primarily circumduction: subtle semi-elliptical, curvilinear movements are seen in the forearm and wrist as it moves economically from neutrality to flexion and back. Coordination is always smooth, from simple to complex combinations of lifting, rotating, and lateral movement of forearm: Deppe, early Russian school, Matthay, Ortmann, Sandor, Lateiner-Grosz, Grindea, Peskanov, Riley

9. Unnecessary co-contractions of flexors/extensors, or biceps/triceps are avoided to allow for ease of movement, optimal mobility at joints, and minimal muscle effort: Deppe, Breithaupt, early Russian school, Leschetizky, Matthay, Ortmann, Whiteside, Kochevitsky, Gat, Sandor, Lateiner-Grosz, Sandor, Grindea, Peskanov, Riley

10. Joints of supporting bones are stabilized appropriately at the moments of sound-production, and non-pressure-bearing joints are not stabilized (not stiffened): Deppe, Breithaupt, early Russian school, Leschetizky, Matthay, Ortmann, Whiteside, Sandor, Lateiner-Grosz, Grindea, Peskanov, Riley

11. Kinesthetic awareness and proprioception are used continually to monitor alignment, muscle state, and breathing: Early Russian school, Matthay, Ortmann, Kochevitsky, Lateiner-Grosz, Fink, Grindea, Riley

12. Mind is alert, calm and attentive while body is moving economically and efficiently: Early Russian school, Ortmann, Sandor, Kochevitsky, Lateiner-Grosz, Grindea, Taubman, Peskanov, Riley

Finally, since the development of various technologies—video, audio, surface electromyography (biofeedback), motion analysis, and brain imaging—we now have the means of documenting, measuring and analyzing both the biomechanical models produced by these methods, and their effectiveness. Section III addresses how these relatively new tools are being used to support new pedagogical approaches to injury-preventive piano technique.

Section III: Related Studies in Disciplines Relevant to the Method's Core Principles

In 2013, Arthur of London, England wrote the following letter to the editor of the *Medical Problems of Performing Artists*. Its message was clear: While there exits a large body of uninvestigated historical and contemporary writings on piano technique by writers claiming to apply logic and scientific knowledge—as well as numerous actual studies—consensus and a bridge between science and art would appear to be missing:

> *To MPPA Readers*—I am an amateur pianist enquiring into improving piano technique but feeling slightly disillusioned by the lack of attention given to technique in the field of piano teaching. And whilst, however, there are many books out there written by great pianists that seem to combine logic, empirical knowledge, and scientific knowledge in a very convincing manner, their assertions are void of being subject to strict scientific investigation and therefore, in my opinion, cannot be treated too seriously.
>
> This is why I have been looking at academic pieces on piano technique in journals such as *Medical Problems of Performing Artists* and have been slowly learning more credible information on technique. I have been able to get hold of a handful of pieces; however, it seems there are in fact hundreds of relevant pieces that have been written. In which case, it seems surprising that none of the books

> available on piano technique make use of, or reference to, the findings of the various studies and articles.
>
> Is it that there has not been enough consensus between these papers for any valid assertions to be made? Or is there in fact a wealth of valid information to be learnt from the studies, which pianists today can apply with much more faith than what the collections of piano technique books say without much proof or foundation (Arthur, 2013, p. 115)?

Multidisciplinary, Interdisciplinary and Transdisciplinary Definitions

As stated in the Chapter 1 Narrative, the Method for teaching the particular technical model was originally created from my own experiences as an injured pianist, and from my personal and professional experiences in other fields such as sports, dance, the Alexander Technique, performing arts medicine, yoga, t'ai chi ch'uan, and even neuroscience in its earliest stage. Additionally, my teacher Lateiner-Grosz employed in the 1970 certain innovative principles derived from Zen Buddhism, including awareness and mindfulness training, to retrain me and prevent recurrence of injury. However, her pedagogical approach did not include a specific biomechanical model of body use. To my knowledge, Lateiner-Grosz's approach to technique was based primarily on what she had learned from her own teachers, rather than on an investigation of the research literature in those fields. She did, however, mention casually that much of it was "Russian-based."

After teaching the Method—and the Model it espouses—for over 20 years, it became apparent that it could be deemed an interdisciplinary, or even transdisciplinary, pedagogical method. Unlike a multidisciplinary method, which approaches a topic from several angles without integrating them, this was an interdisciplinary one that created its own cohesive identity (Besselaar & Heimericks, 2001). "Multidisciplinarity draws on knowledge from different disciplines but stays within their boundaries. Interdisciplinarity

analyzes, synthesizes and harmonizes links between disciplines into a coordinated and coherent whole" (Choi & Pak, 2006, p. 351). As Barthes stated, "Interdisciplinary study consists of creating a new object, which belongs to no one" (Barthes, 1972).

Indeed, based on more recent research on the ambiguity of these terms, Choi & Pak (2006) concluded that transdisciplinarity integrated the various disciplines, but took the process one step further to transcend their boundaries, thus creating a new paradigm. While multidisciplinarity is considered interactive, transdisciplinarity is holistic (Choi & Pak, 2006). It might be argued that the Method under investigation is transdisciplinary, going one step further to integrate principles from various disciplines and create a new holistic pedagogical paradigm. However, such a discussion is beyond the scope of the present study. Therefore, the Method is referred to throughout this paper as "interdisciplinary."

Interdisciplinary Studies Related to Injury-Preventive Technical Models

This review of the literature in piano technique research revealed a number of worthy studies and writings related to injury-preventive methodology and piano technique in a number of disciplines (kinematics, biomechanics, neuroscience, etc.) over the past two decades. However, from a pedagogical and practical viewpoint—as Arthur (2013) pointed out—there seemed to be little connection between actual research and its practical application to the field of injury-preventive piano technique. Therefore, it would seem that a more interdisciplinary approach might be an avenue for future research. Thanks to the vigorous efforts of members of the Performing Arts Medicine Association, more integration of disciplinary knowledge is being achieved.

One intrinsic challenge to studying injury-preventive piano technique methodologies looms large: Unlike other pedagogies of complex motor skills, piano pedagogy does not assume a particular model or fundamental form that must be taught. In sports, kinematics—the sequencing, size, and timing of a particular sport's movement—is synonymous with technique or basic form; it is consistently defined as *how* one uses one's body in a specific activity (Hall, 2012). However, in piano playing, technique most frequently refers to *what* the pianist plays—scales, arpeggios, etudes, etc.—not *how* she uses her body to play. Gratefully, Manchester (2013) offerd a much-needed clarification to this ambiguity by stating that musicians' technique could be defined as the way one uses movements to create an artistic product.

In sports medicine, accepted models and principles for foundational, injury-preventive technique in, for example, basketball free-fall shooting, volleyball serving, and the golf swing have been developed. In turn, these models have led to more effective, efficient pedagogical strategies for maximizing performance and preventing injury (Araujo, Button, Davids, Hristovski & Renshaw, 2006).

More relevant to this study, in "artistic sports" such as gymnastics or figure skating—and by extension, classical ballet—the model (technique or form) is the starting point, both for what movements must be taught and for how they must be evaluated. The roots of the five positions of classical ballet, or *dance d'ecole*, may be traced to the dancing master Beauchamp of Louis XIV around 1700 (Foster, 2010). Obviously, the forms and specific movements of ballet evolved long before the fields of kinesiology, biomechanics, kinematics, and kinetics developed. However, ballet pedagogy begins with these basic forms as a given of the art. Likewise, artistic gymnastics presumes a

"technical form" which is considered to be synonymous with the performance outcome (Hanton, Irwin & Kerwin (2005).

As mentioned in Section II of this chapter, historical pianists and theorists attempted to establish such a model or basic form (Gerig, 2007; Ortmann, 1929). However, only recently has such an attempt been made through biomechanical research: Wristen, in a landmark qualitative study of 2000, attempted to develop a procedure for analyzing biomechanically certain technical skills (scales, arpeggios) "in terms of the cooperative work done by all involved parts of the anatomy," as well as "to theorize about normative motion patterns for selected skills" (Wristen, 2000, p. 55). Her study of more complex coordinations was prompted by Wristen's concern that most research focused primarily on very small, isolation motions of one anatomical part, rather than on more complex, integrated coordinations. She stated that many historical techniques of the late 19th and early 20th centuries relied on incorrect or incomplete anatomical knowledge, and consequently could be injury-inducing (Wristen, 2000). Wristen referenced Meinke's ergonomic study that identified four laws of motion as follows:

- Use of momentum to assist work
- Use of smooth curvilinear, rather than straight, jerky motions
- Use of the best sets of muscles to accomplish work
- Avoidance of wrist positions that deviate from neutral (Meinke, 1995; Wristen, 2000)

Interestingly, and previously unbeknownst to the author, Wristen's carefully described models of 2000 were largely congruent with the model taught by the Method.

In 2006, an interdisciplinary approach was called for by mechanical and aerospace engineer Russell at Carleton University in Ottawa, Ontario, Canada. In a review of literature in the areas of piano technique, pedagogy and playing-related

injuries, Russell attempted to establish a biomechanical basis for injury-preventive technique and piano pedagogy. He acknowledged the physical complexity of playing the piano, much the same as neuroscientist Pascual-Leone (2001) had done. However, Russell posited the need for interdisciplinary studies in the areas of limb biomechanics, neuromuscular control, keyboard mechanics, and muscle redundancy (the use of more muscles than required). This approach acknowledged both the complex biomechanical system of the pianist, and the equally complex mechanical system of the piano. Russell lamented that piano teachers often did not understand biomechanical or mechanical requirements of playing. He believed that musicians, medical professionals, biomechanical engineers and neuroscientists, and piano technicians, "…have unique bodies of knowledge all of which must be incorporated into work that aims at gaining a complete and in-depth understanding of piano playing and playing-related injuries" (Russell, 2006, p. 110). He stressed minimizing muscle use, proper alignment, avoiding joint stiffness, and the critical role of the brain and spinal cord. The latter corroborated recent studies on the importance of proprioception (self-sensing) and somatic education in defining and teaching injury-prevention in any complex psychomotor skill (Batson, 2009). Russell's conclusions were congruent with those of Ackland & Allsop (2010), Blackie et al. (1999), Gerig (2007), and Lister-Sink (1994).

In a 2007 interdisciplinary approach, I was directed by the 2008 Program Committee of the Music Teachers National Association (MTNA) to create and moderate a panel of experts from diverse fields to establish a model for 21st century piano technique. It was to be based on "irrefutable" laws of physics and biomechanics (Brende et. al, 2008). The title of the presentation was "Enlightened Keyboard Technique: A

Definitive Model for the 21st Century." The term "enlightened" was adopted by consensus of the panel members and taken from the title of the last chapter of *Famous Pianists and Their Technique* (Gerig, 2007). Experts represented the disciplines of performing arts medicine, exercise science and sport pedagogy, embodied cognition (Alexander Technique), technology-based piano pedagogy (motion analysis and surface electromyography or sEMG), and historical piano technique and pedagogy. Not coincidentally, these disciplinary fields were closely related to those embedded in the Method being investigated.

The primary purpose of the 2008 MTNA presentation was to establish core principles of efficient piano technique. Secondarily, I wished to scrutinize the technical model taught by the present Method in light of the aggregate knowledge of the panel of experts. The result of this interdisciplinary collaboration was corroboration on a number of conclusions (Appendix C - MTNA 2008 Conference Panel Handout). These included:

- A definition of well-coordinated, injury-preventive technique as the most biomechanically advantageous use of the whole body, directed by the brain, with the instrument, and included its two hallmarks—optimal skeletal alignment and efficient muscle use
- Inefficient body-use patterns that could lead to fatigue, pain and injury
- Mental, psychological and artistic benefits of such a technique (Brende et al., 2008).

In spite of these two more recent attempts at interdisciplinary collaboration, a review of the literature on injury-preventive piano technique revealed the need for more consolidated, coordinated efforts among researchers in related fields—biomechanics, piano manufacturing, performing arts medicine, sports pedagogy, cognitive psychology, piano pedagogy, neuroscience, cognitive embodiment, ergonomics, physics, and historical piano technique. Such collaborative research, while decidedly challenging,

might better utilize valuable resources of time, expertise, and funding to advance a field in urgent need of scientific support. Given the abundance of playing-related musculoskeletal disorders (PRNDs) that continue to plague the piano world globally (Ackland & Allsop, 2010), studies of injury-preventive or injury-inducing techniques, as well as methodologies for training such techniques, are disproportionately rare. This is in spite of hundreds of books written on the subject of piano technique during the last three centuries, many of which have addressed healthful, injury-preventive technique (Gerig, 2007; Lister-Sink, 1994).

Moreover, empirical and anecdotal evidence of pedagogical successes in the field of injury-preventive piano technique over the past several centuries exist in abundance (Gerig, 2007). However, in a review of the literature on injury-preventive piano technique since 1999, as well as a review of literature on injury-preventive technique pedagogical strategies over the last 200 years, few studies gave evidence of helpful results. Indeed, outcomes were notably inconsistent, and even definitions of injury-preventive piano differed widely. Additionally, the understandable lack of tangible, scientifically informed evidence before the 20th century increased the challenges of ascertaining characteristics of injury-preventive technique. While some studies seemed to be well designed and executed, this review of the literature revealed inconsistencies between empirical or anecdotal evidence of injury-preventive technique, and actual research findings. The findings in this review also revealed a need for greater communication between piano pedagogues and researchers in setting up goals for research that would lead to more practical applications.

Other disciplines that teach complex motor skills in the service of art—such as dance and gymnastics—have seen more advances in recent years. Researchers such as Batson in dance medicine have created noteworthy studies in overuse, injury-prevention, and dance pedagogy (Batson, 2006; Batson, 2009; Batson, 2011). However, in spite of a decades-long emphasis in sports medicine research on the relationship between quality of physical coordination and playing-related injury, this review yielded scarce evidence in PRND research of interest in that relationship. So overwhelming was anecdotal and clinical evidence of correlations between certain patterns of body use—including inoptimal skeletal alignment, inefficient muscle use and accumulation of muscle tension—that one might wonder why such correlations were not more a part of research design. Other factors, such as length of practice, upper body strength, finger spans, mental states, etc., might be considered less contributive to PRNDs when this essential aspect of playing the piano is more carefully scrutinized and understood.

The 2010 study from the University of Western Australia by Ackland and Allsop, cited earlier, finally placed emphasis on this critical variable of motor skills in pianists. A total of 505 professional and non-professional pianists responded to a questionnaire. Of those 505 respondents, 42.4% reported PRNDs: 71.9% of professionals reported PRNDs ($p<.05$) compared to 38.1% of non-professional pianists respondents. Those who practiced the most hours and had played piano the longest were more likely to have PRNDs. Other coordinative predictors for injury were playing with elevated shoulders and playing with a "neutral wrist." Unfortunately, such terminology was confusing; the medical profession considers the neutral position to be the healthiest alignment in the resting state. However, when the forearm is opposing gravity and the wrist is maintained

in the neutral position, muscles are needed to stabilize the wrist joints. This type of use might be what researchers were attempting to express. Again, inconsistent terminology and definitions continued to confound research. However, in this 2010 Australian study, it should be noted that an attempt was made by researchers to focus more on coordinative elements such as muscle use and alignment. Additionally, the term "overuse" of muscles was replaced with, arguably, the more appropriate term "misuse," implying that the use of optimal biomechanics might play a key role in preventing injury.

This 2010 study was perhaps the first of its kind to emphasize the fundamental importance of coordination and motor skills in playing the piano (Ackland & Allsup, 2010). Furthermore, unlike previous studies, the term "playing techniques" was used in this study in reference to the pianist's posture and movements, rather than to scales, chords, etc.—*how* the pianist played, not *what* was played. However, the study also stated that there was little research evidence for healthy practicing strategies, although there was much anecdotal evidence. While this report ventured into highly controversial analyses and comparisons of various historical piano techniques by certain noted pedagogues, it commendably addressed the neglected areas of motor skills, biomechanics and misuse of the body. By so doing, it acknowledged piano playing as the extraordinarily complex athletic, as well as artistic, activity it is. It also opened the door for research to eliminate potential red herring variables, after which it could focus on more appropriate, if complex, interacting factors related to playing-related injuries (Ackland & Allsop, 2010).

Movement Science

Kinematics & biomechanics. In the first decade of the 21st century, a number of studies of pianists were conducted by researchers in the fields of kinematics (the study of

motion) and biomechanics (the study of the action of mechanical forces on living organisms, Hall, 2012). Furuya and Kinoshita (2008); Furuya, Goda, Katayose, Miwa and Nagata (2011); and Furuya, Kinoshita, and Orsu (2009) published findings from studies of the biomechanics and kinematics of skilled, elite or expert professional pianists compared with amateur, recreational pianists. In all studies, the professional, elite pianists' sample was selected on the basis of having received at least 15 years of classical piano training, and of having won a prize in a national or international piano competition. Factors such as type of technical training or history of injury were not considered in the selection. From the outset of these rigorously designed studies, the assumption was made that winning a prize in a piano competition was *ipso facto* a determinant for superior pianist skills (Flanders, Furuya, & Soechting, 2011; Furuya et al., 2011). This assumption might fly in the face of evidence that competition winners are not necessarily superior examples of well-coordinated, injury-preventive piano technique (Fleisher, 2010).

In a 2008 study on the organization of upper arm motion in depressing the piano key, Furuya and Kinoshita (2008) found that eight expert pianists organized movement in a proximal (nearer to the body's midline) to distal (further from the midline) sequence, whereas eight novice pianists demonstrated no such organization. The hypothesis that expert pianists move their upper arms more efficiently was submitted. In terms of defining injury-preventive technique, these findings might suggest the efficacy of movement initiated from the upper arm and shoulder, as opposed to movement initiated from the lower arm and hand. The findings were also congruent with the concept of injury-preventive whole-arm coordination described by Gerig (2007) in his survey of historic piano techniques. However, the assumption by Furuya and Kinoshita (2008) that

expert pianists had acquired this biomechanical synergy for depressing the key through long-term training alone might be open to question.

Furuya et al. (2009) made further contributions to defining injury-preventive piano technique in a study of the use of gravity during the down-swing of the arm while playing. The researchers hypothesized a relationship between the level of skill of a pianist and the interaction between muscular force and gravity when depressing a piano key. They found that seven expert, classically trained players relied more on the use of gravity and were therefore more energy-efficient in their playing than seven amateur pianists (Furuya et al., 2009).

In a more recent study, Furuya et al. (2011) again compared the kinematics of arm and hand movements of professional and amateur pianists. The research team strove to determine whether coordination of multiple joints in the arm and hand in a large motion was related to skill levels while playing in a wide range of tempos. In this particular study, five expert pianists were defined as having had more than 20 years of classical music playing, and five recreational pianists had had no form of music education. Pianists were asked to repeat a tremolo in varying tempos. Findings showed that the professional pianists: 1) used smaller angles of extension of various fingers, 2) flexed the thumb and little finger less while rotating the forearm from the elbow joint more rapidly, 3) used less muscle force in the extrinsic finger muscles (in the forearm), and 4) experienced less joint stiffness in the fingers due to less coactivation of finger muscles. They concluded that expert professional pianists played with a larger number of "degrees of freedom" (DOF) and conserved energy considerably more than the novice pianists. This kinematic research would point to a number of coordinations that both conserve muscle energy and

place less stress on the musculoskeletal system in general (Furuya et al., 2011). However, the assumption that years of training and winning of competitions were sole indicators of a higher degree of coordination should perhaps be examined in further studies.

Taking a somewhat different starting point in another kinematic study, Lee (2010) stated that modern piano technique had evolved from the fields of biomechanics, kinematics, and anatomical observation. He, unlike Furuya et al. (2011), referenced the historic research and teaching of Ortmann and Kochevitsky, as well as famous piano virtuosi such as Liszt, Hofmann, Rachmaninoff, Carreno, de Pachman, Rosenthal, Sauer, and Busoni who all appeared to have played the piano with optimal physical coordination. However, his observations were confined to hand characteristics only, and not to what the virtuosi's own overall biomechanical approaches might have been. Lee's research addressed hand features in 12 pianists from 17 to 44 years old. The only common characteristic was that they were all able to play a double-thirds scale exercise from *Rational Principles of Pianoforte Technique* by Alfred Cortot on a touch-sensitive, electronic keyboard (Lee, 2010).

With one exception, Lee concluded that the pianists' hand biomechanics (hand span, hand length and width, finger length, arm and hand weight) were not correlated with performance features such as dynamic voicing, articulation and tempo. The exception was a positive correlation between ulnar deviation (sideways movement of the hand toward the little finger) and tempo. His research confirmed his hypothesis that ulnar deviation was necessary for playing in thirds. He also posited that wrist mobility and flexibility were essential components of injury-preventive piano technique. Such an assertion was congruent with the teachings and writings of numerous historic pianists and

pedagogues such as Mozart, Chopin, Liszt, Czerny, Leschetizky, Matthay, Cortot, Lhevinne, Hoffmann, Ortmann, Neuhaus, and Sandor (Gerig, 2007), as well as with modern-day writers on technique Grindea, Lister-Sink, Fink and Peskanov. However, the importance of ulnar deviation in playing scales in thirds ran counter to the teachings of contemporary pedagogue Taubman. Ironically, Lee concluded his article with a personal statement that, "…science in piano techniques study does not precede the age-old practice of the few well-regarded pedagogues; science helps to affirm the good pedagogy and gives tools to separate the misguided pedagogy" (Lee, 2010, p. 173).

Kinematics researchers Bella and Palmer focused on an even smaller component of the pianist's body. In 2011, they set out to investigate the effect of tempo on finger kinematics. They selected four "skilled" pianists from the Columbus, Ohio area who had performed an average of 16 years and who had little differences in anatomy. In an apparent contradiction of the findings of Lee and Furuya and the historically documented practices of great virtuosi, Bella and Palmer (2011) found a correlation between tempo and finger height above the keys. The faster the pianists played, the higher they lifted their fingers. They concluded, however, that "sensorimotor integration, rather than style or expressive goals, accounts for the need to raise fingers higher at faster tempi. More likely, the tendency of pianists' finger heights to increase with tempo may be related to goals of spatial and temporal precision in music performance…" They speculated further "By increasing finger movement amplitude, pianists may have increased tactile and kinesthetic feedback at keypress…" (Bella & Palmer, 2011, p. 8). Such contradictory findings only serve to further confound pianists and teachers who seek to define healthful biomechanical principles of piano technique. It might also be suggested that the lack of

rigorous criteria in choosing such a small sample size would weaken the study results, as would the secondary aim of the research: the investigation of whether kinematics could be an indicator of the personality of the pianist (Bella & Palmer, 2011).

Neuroscience and Neuropedagogy

In 2008, neuroscience researchers Altenmueller and McPherson stated that making music was one of the most complex, demanding activities of the human central nervous system (Altenmueller & McPherson, 2008). Research in neuroscience in recent years has revealed and explicated the extensive motor and procedural learning required in playing a musical instrument, as well as the resultant and enhanced neural plasticity. (Pascual-Leone & Robertson, 2003).

In a 2001 study, Pascual-Leone had already discovered that piano playing over time strengthend pre-established neural pathways and created new ones through notable enhancement of dendritic arborization. He also emphasized the "exquisite" coordination of both sensory and motor aspects (Pascual-Leone, 2001). However, his own apparent understanding of how pianists necessarily learn the music seemed to be limited. His description of the laborious, slow, inaccurate, and unrefined beginning stages of practice countered that of the Method being studied. The Method attempts to foster accuracy, fluidity and refined coordination from the outset of practice through sequencing the repertory from simplest to incrementally more complex, and develops sensory feedback—tactile, auditory, visual, and proprioceptive—to ensure accuracy and smooth motor coordination throughout the entire body.

It might be posited that such a pedagogical approach as embodied in the Method under investigation, though evidently little known by researchers, could possibly inform

the way research is designed, and could well give a very different representation in the brain. It would also suggest a more injury-preventive approach by enabling the brain to create a map of neural activity that promoted heightened sensory feedback, and more efficient coordination and motor control from the outset.

Pascual-Leone did, however, set the stage for studying the neurophysiological correlates of such highly skilled activities as piano playing. He also expressed concern about the potential for playing-induced focal dystonia, and suggested that further research in this area might lead to more appropriate, neurologically informed pedagogical approaches to injury-preventive piano technique (Pascual-Leone, 2001).

Gruhn, researcher and professor emeritus of music education at the University of Music Freiburg, Germany built on research in the relatively new field of neuroscience to pave the way for an alternate music pedagogy. In 2004, he took the lead at the 26th ISME International Conference in Tenerife, Spain, in championing the creation of a new field in music education (Gruhn, 2004). Called by various names—"neuroeducation," "neurodidactics" or "neuropedagogy"—this hybrid field combined the increasingly sophisticated technology and high volume of research in neuroscience with music education. (Gruhn & Rauscher, 2007).

Gruhn posited a reciprocal relationship between the types of music learning modes that affected functional neural activity and, conversely, the way the brain processes music. Such knowledge could inform and improve our teaching (Gruhn, 2007). Like researchers mentioned previously, He, too, suggested that the neural correlates of learning be used to improve the way we teach music, including the most recent findings regarding mirror neurons and imitative or implicit learning. Through understanding of

how the brain gathers, processes and stores information about such a complex activity as piano playing, Gruhn suggested that we might more readily discover better and more effective ways of teaching students how to learn music. Such knowledge might also lead to developing more fail-safe methods for teaching injury-preventive piano technique.

Additionally, Gruhn cited neurological research establishing the efficacy and long-term success of procedural, or implicit learning regulated by the limbic system, as opposed to the more neurologically vulnerable declarative, or explicit way of learning music involving the hippocampus and short-term memory—a way that is more frequently used in music education. He also mentioned research studies establishing the importance of a stimulating environment to the growth of dendritic spines on cortical neurons, more synapses per neuron, a thicker cortex, and more glial cells that improve synaptic function in animals (Gruhn, 2007).

Importantly, Gruhn concluded from neurological research that efficient learning was directly related to decrease in certain areas of neural activity. This would suggest that such training could then allow the music student to shift activation centers from the prefrontal areas of the brain to other areas that support long-term memory and, consequently, a more stabilized knowledge system (Gruhn, 2007). Such a shift would also enable the musician to direct attention and awareness to higher levels of auditory and aesthetic activities. Gruhn further stated that advances in technology and neuro-feedback should be utilized in this new field of neuropedagogy. Finally, he suggested that more and better dialogue among neuroscientists, researchers, educators, and musicians should be encouraged.

Correlates of learning could be found in neuroscience research in the areas of neuroplasticity, complementary sensorial modalities, mirror neurons and mental imagery, procedural (implicit versus explicit) learning, memory, and the brain's reward system. Knowledge of research in these areas could serve as a foundation for pedagogical innovation and even reform (Gruhn & Rauscher, 2008). Through understanding of how the brain gathers, processes and stores information about such a complex activity as playing the piano, Gruhn and Rauscher (2008) suggested that we might more readily discover effective ways of teaching students and better understand why some remain engaged in music and some do not. Such knowledge could also help teachers develop more effective ways of teaching technique that cultivates kinesthetic awareness, maintains musculoskeletal health, and enhances students' enjoyment in playing the piano and making music (Lister-Sink, 2011).

Learning complex motor and perceptual skills efficiently. To develop pedagogical methods for effective and efficient teaching of injury-preventive technique, it was necessary first to examine notable research literature in the field of motor skills acquisition. This included research in, among others, the effect of imagery and observation on motor learning; procedural learning, including implicit and explicit learning; and off-line—or between- practice—consolidation of learned motor skills. Knowledge of the latest findings in these areas might inform a pedagogical model and help prevent counterproductive and potentially harmful teaching methods that could lead to playing-related injury. It might also aid in developing teaching strategies for helping pianists unlearn potentially injurious, maladaptive coordinations.

Mental practice (creative imagery). The benefits of motor imagery, often referred to as mental practice, have been studied frequently by cognitive psychologists in the fields of sports (Frenkel, Maltese, & Schankin, 2012) and rehabilitative physical therapy. However, as early as 1995, Harvard neurophysiologist Pascual-Leone, a pioneer in transcranial magnetic stimulation (TMS), made a discovery from which pianists—injured or not—could improve their practicing and technique. In this study, he mapped the plastic changes in the motor cortex of pianists acquiring new fine motor skills. More pertinent to this study, he investigated the effects of mental vs. manual practice, defining mental practice as "the imagined rehearsal of a motor act with the specific intent of learning or improving it, without overt movement output" (Brasil-Neto et al., 1995, p. 1043). His findings were startling: Pascual-Leone discovered that "the mental stimulation of movements activates some of the same central neural structures required for the performance of the actual movement." And most surprisingly, he reported that:

> …mental practice alone seems to be sufficient to promote the modulation of neural circuits involved in the early stages of motor skill learning…Mental imaging of movements recreates the effects of physical practice on the modulation of the central motor system and may, therefore, be an important adjunct not only for the learning of new motor skills but also for the maintenance of motor skills in temporarily immobilized patients [injured pianists] and in the rehabilitation of patients with neurological disorders (Pascual-Leone et al., 1995, p. 1043).

Subsequent studies confirmed Pascual-Leone's findings that imagining a movement activates the same neuronal areas as executing the movement. A 2009 study at the University of Genoa (Avanzino et al., 2009) reported that adding imagery to motor practice influenced positively repetitive finger opposition movements. Indeed, motor imagery, when combined with physical practice, had been shown to have marked benefits on performance of motor skills. Furthermore, the study found that the more complex the

motor task, the greater the influence of motor imagery. More specifically, Avanzino et al. (2009) reiterated recent findings that kinesthetic imagery modulated the motor cortex more than visual imagery. They also cited a 2009 study by De Jong, Geertzen, Mulder, Nicolai and Stenkes giving evidence that repair of the flexor tendon during rehabilitation was influenced positively by motor imagery. Such findings could have positive implications for injured keyboardists in rehabilitation and retraining. Further research would be indicated in this potentially beneficial area.

Modeling (demonstration-based training). Similarly, neurophysiologists have shown evidence of a mirror neuronal system (neurons that are discharged when a movement is executed or when another is observed executing the movement) that supported learning through observation of a model. Researchers studied several types of motor imagery that could be pertinent to injury-preventive piano technique pedagogy. One was visual imagery, or observing the movement without executing it. The other was kinesthetic imagery, or imagining the feeling of the motion without seeing it.

In a 2011 study of observational learning (Bekkering, Hunnius, Lindemann, Paulus & Van Dam, 2011), researchers found that action-effect associations could be learned by observation. Building on an ideomotor (unconscious movement) approach, they posited that motor skills were learned by association with their sensory effects. Furthermore, perceiving another's action could facilitate the execution of that action by the observer. An alternative hypothesis, however, suggested that executing an observed action would occur only if the observer desired that effect.

Findings, therefore, regarding the benefits of imagery and observation have not always been consistently demonstrated. For example, Bekkering (2011) concluded that

perceiving an action resulted in the same neuronal motor code in the observer as in the active subject, but Frenkel et al. (2012) in a review of mental imagery studies, stated that while a number of neurophysiological methods had been used to prove such activation, findings were as yet inconclusive. Moreover, Hodges, Larssen and Ong (2012) posited that imagery without physical practice was less beneficial to learning. They did, however, submit that mental practice might be considered superior to physical practice in certain situations. Such variations in findings necessitate more research in these areas of complex motor skills learning theory.

In spite of these variations in studies, the weight of the evidence would suggest that selective imagery and observation could be useful tools in building an effective, efficient pedagogy for injury-preventive keyboard technique. Presently, there is little consensus among piano teachers as to the benefits of imagery and observation in the teaching of technique. Indeed, in the author's experience, many eschew the use of demonstrating or modeling a movement, fearing that offering any model might diminish the student's capacity for independent thought and artistic choice. However, one might suggest that if the teacher does not take advantage of such a powerful pedagogical tool, the student might be left to waste time in trial and error practice or, worse, to acquire habits that are potentially injurious.

Procedural/implicit versus declarative/explicit learning. Another means of learning complex motor skills such as playing the piano is procedural, or implicit, memory. This is defined as knowing *how* to do something, as opposed to declarative, or explicit, memory. The latter involves verbalizing knowledge about something. Procedural/implicit knowledge and declarative/explicit knowledge are represented

differently in the brain. However, procedural/implicit knowledge is more associated with the learning of fine motor skills, complex rules or algorithms, and habits or stimulus-response associations.

In a 2003 study about procedural sequence learning and awareness, Pascual-Leone and Robertson began to lay the groundwork for a neuropedagogical approach to the piano (Pascual-Leone & Robertson, 2003). They addressed the neurophysiological basis of awareness and the role of the prefrontal cortex in sequence learning, and established that a new sequence of finger movements at the piano could be learned either with awareness (explicit learning), or without awareness (implicit learning). In previous fMRI (functional magnetic resonance imaging) studies contrasting neural circuits during implicit and explicit learning, researchers found little overlap in neural areas. Hence, the idea arose that awareness was the reason for recruitment of more advanced areas of the prefrontal cortex, and for a dramatic increase in rate of learning. However, Pascual-Leone and Robertson demonstrated through their 2003 study, utilizing fMRI, that the prefrontal cortex was recruited in *both* modes of learning. Uncovering the nature of the role of the prefrontal cortex during piano playing, however, would seem to necessitate a more controlled setting in which the pianist subjects were more clear about their conscious, a priori decisions regarding what they would focus on during the explicit stage of the fMRI study.

Knowlton and Moody (2008) researched extensively the characteristics of procedural learning and its implications in cognitive versus motor activities. They also investigated the possibility of implicit/procedural motor learning being disrupted or undermined by explicit/declarative learning. Furthermore, habit learning—a large

component of learning to play a keyboard instrument—is not usually part of conscious awareness. This latter condition of unconscious action might be a critical factor in rehabilitating or retraining the injured keyboardist. Injuries are often the result of ingraining habits; the keyboardist has lost conscious control of coordination. Potentially injurious malcoordinations are part of the keyboardist's unconscious habits; those habits must be raised to conscious awareness to be replaced by more healthful, and eventually automatic, habits of coordination.

Taking this research even further, Gobel, Reber and Sanchez (2010) posited that robust implicit learning could be present without explicit knowledge. In a sequence-learning task, healthy participants in the study were unable to remember or express verbally how they had learned the task, which they had, however, performed successfully (Gobel, Reber & Sanchez, 2010). Such dissociation between the ability to execute a motor task and to explain how it was executed needs to be studied further. Piano pedagogues, even in the field of injury-prevention, are divided between the belief that cognitive/analytical knowledge about technique (the ability to verbalize what one has executed physically) is beneficial or detrimental to embodied knowledge (the ability to execute physically). Understanding more clearly how implicit/procedural and explicit/declarative learning interact and affect each other might hold a key to developing more effective methods for training injury-preventive keyboard technique.

The role of rest in consolidated, "off-line" learning. Rest is not only restorative for the body, it also allows the brain to process and integrate information. Consolidation or off-line learning is another means of learning that is essential to playing a keyboard instrument. It occurs in the brain between practice sessions, both during sleep and in

waking hours. Understanding how it works is critical to maximizing practice sessions, and to retaining and strengthening knowledge gained. This area of neuroscientific research could be beneficial in formulating more effective pedagogical methods for teaching as well as learning. In studying how keyboardists learn to play, researchers differentiated between the making of movements and the goal of those movements—playing notes. Cohen, Pascual-Leone, Press and Robertson reported in a 2005 study that there were multiple paths to consolidation and off-line learning. After pianists physically practiced the piano, the movement sequence was enhanced during the day. However, the goal of actually learning the notes was enhanced during a night's sleep (Cohen, Pascual-Leone, Press & Roberson, 2005). These findings contradicted the more prevalent idea that sleep alone aided in consolidation of motor skills. It would appear that learning is enhanced by two different neuronal mechanisms—one occurring during waking hours, and one during overnight sleep. In a similar study of 2009, researchers found that pianists who took extended breaks made dramatic improvements in performance, especially if taken early on in practicing (Allen, Cash, Duke, & Simmons, 2009). Such findings could increase the pianist's understanding of how learning occurs most effectively. It could also aid in making more healthful life-style and practicing choices.

The brain's reward system and the role of motivation. The neurotransmitter dopamine is a critical neurobiological link to attention, learning, motivation, and self-rewarding. These, in turn, are closely associated with a pianist's engagement in study. The dopaminergic system plays a central role in how rewarding stimuli are processed in the brain. Studies have shown that dopamine might also play an important role in

movement organization (Keitz, Leenders & Martin-Soelch, 2003). Natural rewards such as music study activate dopaminergic neurons.

Motivation to practice and stay engaged in music study is critical for young pianists especially. They have powerful and positive intrinsic motivation to explore this captivating instrument. Gruhn also cited studies suggesting the importance of a stimulating, positive environment in helping with motivation, but such an environment also supported growth of dendritic spines on cortical neurons, more synapses per neuron, a thicker cortex, and more glial cells that improve synaptic function (Gruhn, 2007).

Only in later stages of development do young pianists shift to more extrinsic motivation—playing to gain approval or for external reward such as piano competitions. However, studies showed that if external achievement were emphasized at too young an age, a a pianist could lose the sense of music as intrinsically engaging or emotionally satisfying. Making music would become instead a source of negative emotions and anxiety (Sloboda, 2005). Anxiety then was frequently accompanied by loss of motivation, as well as a tendency toward excessive muscle tension in practice and performance. As a consequence, a downward spiral could begin at an early age.

Movement Science and Neuroscience Research Applied to Sports Pedagogy

Sport(s) pedagogy is a subdiscipline of the much broader field of kinesiology. Not surprisingly, research in the field of sports in general far surpassed that in performing arts medicine, even though performing artists have a great deal in common with athletes (Manchester, 2011). However, according to Tinning (2010), sport pedagogy had not been studied systematically (Tinning, 2010). Nonetheless, there was a considerable body of

research in "artistic" sports activities (gymnastics, figure skating, dance) that might be relevant to piano pedagogy in general, and the Method under investigation specifically.

Pedagogical paradigms for teaching complex motor skills. In 1980, Allison and Ayllon examined behavioral coaching methods that were complementary to the traditional use of positive reinforcement. Elements added were: 1) systematic use of feedback and directives, 2) both negative and positive reinforcement, 3) "positive practice," and 4) rest and time-out. Such coaching was immediately successful. Gymnasts' performance outcomes showed an increase from 2.7% to 52.6%. Such startling results should assuredly prompt further research (Allison & Ayllon, 1980).

Twenty-five years later, in a study by Hanton, Irwin and Kerwin (2005) on skills progression development in artistic gymnasts, a conceptual teaching model was created from interviews with 16 elite gymnastics coaches. Skill progressions are considered the focal point of gymnastic development and are defined as:

> …preparatory exercises that are used to develop or learn a more complex skill. They identify the mental and physical attributes required for successful performance, forming the basis of all gymnastic work and allowing the safe and effective learning of gymnastics skills (Hanton, Irwin & Kerwin, 2005, p.1090).

Accuracy of skill acquisition was considered directly linked to the quality of the progressions (Hanton, Irwin & Kerwin, 2005). Researchers found that skill progressions were developed through reflection, experimental practice and critical inquiry. Furthermore, four sub-sets supported skill progression development: refinement of skill progression, coaching expertise, mental imaging, and biomechanical knowledge. The conclusion, however, was that coaches needed "a more objective approach to [skill] progression development and a greater understanding of the mechanisms that control skill development" (Hanton, Irwin & Kerwin, 2005, p.1098). Rink (1993) stated that an

essential pedagogical component was the ability to sequence progressions, and therefore to master the prerequisite skill of task analysis (Rink, 1993). Millman (1994) also underscored the pedagogical advantages of a step-by-step approach to learning a complex motor skill, breaking it down into the simplest component parts and taking the appropriate time to master each stage (Millman, 1994).

Relevant to the Method being studied were the following research findings: 1) the importance of breaking down complex motor skills to small component parts and teaching those parts sequentially, 2) the efficacy of practicing at the same speed and movement pattern as the final product, 3) the importance of the coach/teacher having adequate muscular and biomechanical knowledge, and 4) the helpfulness of the coach/teacher incorporating a reflective and rational pedagogical approach, experimentation, and problem-solving techniques (Hanton, Irwin & Kerwin, 2010).

Building on the importance of skills, Dail concluded that athletes' performances were enhanced through the cultivation of metacognition through the executive functions of planning, monitoring, and evaluating. Learning to strategize, to reflect on, and to evaluate oneself and one's teammates created a "thinking athlete" that was more likely to perform well (Dail, 2014).

Mental practice & modeling. Mental practice (also known as imaging, visualization, etc.) and modeling (also known as observational learning, imitating, demonstration-based training or DBT) were widely researched and used today in sports. These two skills have also begun to be promoted to piano teachers as effective learning tools, although modeling has not been universally accepted or used in the piano teaching field. However, booth are essential components of the Method being studied.

As a precursor to neuroscience research in the areas of mirror neurons and mental imaging, Palmer (1992) studied the effects of two types of mental practice on competitive figure skaters: 1) a self-talk technique that involved the use of verbal cues and walking through a routine off the ice, and 2) mental rehearsal of drawn diagrams. The latter form of mental practice—which required the more creative visualization of the two—yielded significant improvement, compared to the former approach or the control group using none (Palmer, 1992).

In the same year, another study by Austin and Miller (1992) examined the effectiveness of observational learning in acquiring a golf swing through the commercially produced SyberVision video recordings. (The author had acquired one of these tapes in the late 1980s). The SyberVision system seemed to incorporate principles of creative visualization that appeared in the 1969 best-selling book *Psycho-Cybernetics* by Maltz, a pioneer in affirmative self-talk and mental practice (Maltz, 1969). Both Maltz's ideas and SyberVision's operative principles had been corroborated by neuroscientific studies. However, in the 1992 blind study, there was no statistically significant difference in improvement rates between 10 golfers who read an instruction book, and 10 golfers who watched the SyberVision tapes. However, researchers believed that factors such as the small size of the group, the lack of experience of the golfers, and the limited exposure to the videotapes might have influenced the outcome. In similar pre-neuroscientific research during the 1970s and 1980s, the most commonly used approach was to compare the performance of three groups of athletes: 1) the group that observed the optimal execution of the skill, 2) the group that actually practiced the skill, and 3) the group that both observed the execution and practiced the skill (Bird & Rilki, 1983; Keele,

1977; Rothstein, 1980). Consistently, the group that practiced both physical and mentally performed the best. Researchers also found—prescient of later research—that combining cognition, reflection and analysis with physical practice was even more effective (Feltz & Landers, 1983; Weinberg, 1982). Driskell, Copper and Moran (1994) echoed these findings in a meta-analysis of the literature on the effects of mental practice. They reported skepticism of this technique that, at that time, was outside the mainstream of science. However, their findings supported supplementing physical training with mental training, citing the latter as especially useful in dangerous training tasks (Driskell, Copper & Moran, 1994).

Building on neuroscientific research in modeling, Batsche, Boyer, Fogel and Miltenberger (2009) found that four competitive female gymnasts improved in three skills after viewing performances of the skills by experts. However, they concluded that video modeling by experts, as well as video feedback, would be potentially more effective after a gymnast had already learned the skill at a fundamental level of execution (Batsche, Boyer, Fogel & Biltenberger, 2009). In 2010, Jensen et al. reviewed the literature on demonstration-based training, finding that 1) observers benefitted most from repeated viewings of tasks, including those broken down into simpler parts, 2) retention of the skill was greater when practice and DBT were alternated, and 3) viewers learned most from demonstrations by models of high status.

A cautionary note should be added: Barry (2009), in research on the wider influence of mirror neurons, stated that humans imitated the movements of other humans, even if those movements were not the most efficient to accomplish a task (Barry, 2009). Repeated viewing only strengthened neuronal connections. Coaches and piano teachers

would be wise to establish guidelines for skill-enhancing viewings on YouTube during training, for example.

Neuromuscular training (NMT). Neuromuscular training (or reprogramming) is a form of movement reeducation. In such training, and building on research in proprioception and brain plasticity (Doidge, 2007), an injured athlete or pianist might be given certain new coordinative patterns in sequence to create new neural pathways and habitual response patterns (Wagner, 2011). NMT is usually accompanied by proprioceptive and kinesthetic awareness training, as well. Its efficacy has long been established anecdotally in sports, dance, and the Method under investigation. It is shown to be necessary if a pianist desires to reconstruct his or her technique; remove maladaptive, compensatory body use patterns; and establish new, injury-preventive habits. It is especially critical in the rehabilitative stages of retraining injured pianists. Finding the most effective and efficient means of both dislodging the long-term knowledge system stored in the neocortex, and forming a new knowledge system for technique, is also essential to successful rehabilitation and prevention of recurrence of injury (Lister-Sink, 1996). However, although NMT has been widely used in rehabilitation, its efficacy in retraining injured athletes has not been established.

Regarding the prevention of injuries in female soccer players, Garrett et al. (2005) found that NMT might directly help decrease the number of anterior cruciate ligament (ACL) injuries (common in female athletes). As for the efficacy of NMT in rehabilitative training, Banzer et al. (2009) concluded that neuromuscular and proprioceptive interventions could be effective in improving joint function after injury, and in preventing further injuries after knee and ankle joint injuries. Barber-Westin and Noyes (2014) in

their study of neuromuscular retraining intervention programs, conducted a systematic review of 694 articles published between 1994 and 2013, out of which eight were included in their study. They concluded that noncontact ACL injury rates were successfully reduced in female adolescent athletes by three neuromuscular retraining intervention programs (Barber-Westin & Noyes, 2014).

Such studies might act as a catalyst for future studies of injury-preventive piano technique methods regarding neuromuscular retraining interventions. It would also appear from this study of the literature that findings from sports research in motor-acquisition skills, demonstration-based learning (modeling), mental practice, and neuromuscular retraining could be used to advantage in both prevention of and rehabilitation from PRNDs.

Dance Pedagogy

Dance, especially classical ballet and modern dance, combine artistic performance with highly demanding athleticism. A review of the literature in dance pedagogy might offer piano teachers helpful strategies for motivating students to take more seriously the learning of such a complex motor skill. Current research in dance pedagogy (including injury-prevention and performance enhancement) combined findings from movement science, neuroscience, sports pedagogy (as will be shown later), embodied cognition, and somatic education.

Classical ballet training – two holistic approaches. Most research in ballet pedagogy addressed either unquestioned theories and traditions before biomechanics and kinesiology evolved, or highly technical, inaccessible articles of little use to most ballet instructors. Research also revealed that most ballet teachers teach the tradition they were

taught, including misconceptions and misinformation—similar to the piano pedagogy field. However, Ayllon and Fitterling in 1983 studied the application of "a combination of behavioral techniques…found effective in dramatically improving the development of skills performance…" (Ayllon & Fitterling, 1983, p. 345). They gave evidence that behavioral modifications were useful not only in sports, but in ballet pedagogy as well, and suggested applying behavioral principles—that could be defined and assessed—to the development of higher levels of artistic performance.

Almost 30 years later, however, the ballet world remained resistant to change. Wilmerding and Krasnow (2011) wrote in a review of the literature that institutional requirements for ballet training were often in conflict with biomechanical soundness and injury-preventive (Wilmerding & Krasnow, 2011). Nonetheless, noted ballet pedagogue Foster in his 2010 book *Ballet Pedagogy: The Art of Teaching* suggested the creation of a new paradigm that would promote the integration of scientific research and ballet history to create a more enlightened ballet pedagogy. He credited the American Ballet Theatre National Training Curriculum of 2008 for representing a more holistic approach. The curriculum addressed not only traditional historical ballet techniques, but also kinesiology, anatomy, injury-prevention, nutrition, psychology, risk management, medical guidelines, and child development (Foster, 2010).

Acknowledging that dance is a plastic art that creates lines and shapes that change continually and that demand both internal awareness and focus, Foster stated that:

> …the effectiveness of any one school or training system does not lie intrinsically in the curriculum or syllabus. It is the teacher's art and skill of imparting that knowledge and the ability to solve technical and artistic errors in his/her students that bring the training process to a level of success (Foster, 2010, p. 1).

She advocated flexibility and modifications in classes to accommodate individual learning styles and rates, and insisted that students develop correct habits of posture, placement, and muscle memory from the very beginning (Foster, 2010). Equally important were mindful repetition, an analytical and reflective approach, knowledge of anatomy, the use of professional touch, and musical and kinesthetic components. Foster also firmly believed that the instructor must be an authoritative—not authoritarian—figure. However, she did not see such a position as mutually exclusive to nurturing, inspiring. and empowering students. (It should be noted that the core principles of the Method being studied are largely congruent with this pedagogical paradigm.)

One additional and critically important commonality between the Method under investigation and this integrated, holistic approach to ballet pedagogy was the presence of a carefully selected team of health-care professionals both to prevent and treat injuries.

In two studies from 2011, Krasnow and Mainwaring (2010) and Krasnow and Wilmerding (2011), echoed much of Foster's new paradigm, calling for a holistic approach that integrated scientific with cognitive research:

> The ability of a dancer to master a particular skill or technique depends on many factors: physical ability, motor and kinesthetic feedback and learning processes, physical practice, mental practice for skill enhancement, sufficient physiologic rest, motor memory consolidation, appropriate breakdown and acquisition of complex skills, growth and development, knowledge of results through appropriate external feedback mechanisms, and an environment that facilitates learning and a sense of joy and purpose (Krasnow & Mainwaring, 2010, p. 15).

Embodied Cognition and Somatic Education

The field of embodied cognition and its pedagogical counterpart, somatic education, have century-old roots in the Alexander Technique. However, although

embodied cognition has evolved out of the field of cognitive science, it has only gradually been accepted by the larger scientific world. Wilson stated that, "There is a movement afoot in cognitive science to grant the body a central role in shaping the mind" (Wilson, 2002, p. 625). Such a stance had grown out of the notion that we have "evolved from creatures whose neural resources were devoted primarily to perceptual and motoric processing…" (Wilson, 2002, p. 625). However, Wilson concluded that embodied cognition was not a "single viewpoint" but a number of differing viewpoints that needed to be researched more specifically. What then is the relationship of this field to injury-preventive piano technique?

The Method under investigation included as a learning component the use of principles embodied in the somatic education pedagogies in general, and the Alexander Technique specifically. Somatic education enhances kinesthetic awareness and proprioception—both important for achieving neuromusculoskeletal control through the various stages of skills acquisition. However, research regarding the efficacy of somatic education in training complex motor skills remained sparse.

Batson, a dancer, physical therapist, scientist, certified master Alexander Technique instructor and leader in the performing arts medicine field, is noted for her interdisciplinary research and for building bridges between scientific research and the performing arts. Not surprisingly, in the last 20 years she spearheaded considerable research in somatic education and embodied cognition. In recent years, building on studies in neuroscience, Batson focused attention on the importance of somatic models of intentional rest and distributed practice in dance, while exploring the role of proprioception—one's ability to sense the body moving in space—in dance pedagogy

(Batson, 2007; Batson, 2009a). She cited proprioception as being an effective means of reducing rehabilitation time and preventing further lower extremity injuries, both in athletes and in dancers (Batson, 2009b). (In the interest of full disclosure, I have been well acquainted with Batson's work for over 20 years. She functioned in my 1996 DVD *Freeing the Caged Bird* as the expert in anatomy and the Alexander Technique.)

As a bridge-builder between science and somatic education, Batson wrote several landmark articles. As early as 1990, she outlined the dissonance between science and art:

> …dance is an intensely subjective movement experience, a constantly changing dialogue between the sensory and motor components of the nervous system…. Dance researchers have labored to find research models that adequately define and encompass the scope of their studies. Likewise, body therapists have tried to find a satisfactory language of scientific inquiry that describes in the third person what is essentially a first-person experience (Batson, 1990, p. 28).

Much the same could be said for playing the piano. The pianist cannot play with her mind alone. The act of playing is intensely physical and, while subject to the laws of biomechanics, the advanced pianist must cultivate a self-sensing mechanism to gain ultimate mastery of the physical skill of depressing thousands of keys in rapid succession over a period of many hours. This might be best accomplished through intense training in one of the somatic pedagogies. Therefore, the Method being studied specifically incorporated the strategies developed by the British actor Alexander over a century ago.

The Alexander Technique. In another study of 1996, Batson attempted to supply missing scientific support and evidence for the efficacy of the Alexander Technique, a somatic, psychophysical method for helping primarily performing artists identify unwanted, excessive or maladaptive habits of movement that limit their ability to perform to their full potential. In "Conscious Use of the Human Body in Movement: The Peripheral Neuroanatomic Basis of the Alexander Technique," Batson gave in-depth

anatomical and neurophysiological descriptions of what was happening when one experienced the effects of Alexander Technique instruction. This included the "Alexander Paradigm" of the "indivisibility and integrity of whole-body organization" (Batson, 1996, p. 4), the central neuroanatomical function of the cervical spine, and Alexander's understanding of the role that kinesthesia plays in motor control (Batson, 1996). In spite of its highly dense technical terminology and its extended, science-based descriptions, Batson provided the performing arts medicine field with an unprecedented analysis of this anecdotally highly successful but theretofore uninvestigated somatic pedagogical paradigm. Very little research followed until some years later, and then not initially in the performing arts.

Finally, in the early 21st century, clinically controlled, scientific research began to focus on what many deemed a "new age" approach that had helped so many thousands of performing artists, anecdotally speaking, for over a century. In 2003, Ernst and Canter published a systematic review of the Alexander Technique in controlled clinical trials. Their results indicated encouraging evidence of the Technique's effectiveness in "reducing the disability of patients suffering from Parkinson's disease and in improving pain behavior and disability in patients with back pain" (Ernst & Canter, 2003, p. 325). Moreover, a 2008 randomized study of the Alexander Technique (AT) concluded that one-on-one AT lessons for patients with chronic back pain had long-term benefits, and that six lessons were almost as effective as 24 lessons (Little et al., 2008). Finally, Moore and Woodman conducted a systematic review of the effects of the Alexander Technique lessons on health and medical conditions. Their findings revealed that, "Strong evidence exists for the effectiveness of Alexander Technique lessons for chronic back pain and

moderate evidence in Parkinson's-associated disability" (Moore & Woodman, 2012, p. 98). Additionally, preliminary evidence suggested that the AT could lead to improvements in balance in the elderly, posture, stuttering, chronic pain, and respiratory function (Moore & Woodman, 2012).

Given the positive findings and results in the early part of the 21st century, integration of the Alexander Technique into a piano technique training program might be shown to improve overall posture, breathing, balance, mental and auditory acuity, and kinesthesia. Such was the assumption of the developer of the Method being investigated.

Finally, Dimon, a teacher of mind-body disciplines, integrated the teachings of Dewey and Alexander in his *Elements of Skill* (2003). He believed that skills acquisition "…is not so much a matter of reproducing certain movements as it is knowing what to pay attention to, how to intelligently break down problems, and how to direct one's own bodily activity through conscious awareness" (Dimon, 2003, p. xxi). Taking a fundamental approach, Dimon is concerned with teaching how we learn to learn.

Technology-Assisted Pedagogy

In the 21st century, we have used technology to monitor and assist in almost every aspect of our lives and, supposedly, to improve our quality of life and health. So, too, in the field of injury-preventive piano technique and pedagogy we may have reached an historical moment at which impressive tools of technology might help us reduce PRNDs considerably (Manchester, 2014d).

Various forms of technology—electroencephalography (EEG), electromyography (EMG), surface electromyography (sEMG), and multi-view cameras for motion analysis—have been used in sports pedagogy for some time and with increasing

sophistication. But more recent developments—3-D motion capture systems, motion analysis joined with MIDI and video technology, and the use of gyroscopes and accelerometers for capturing movement—all promise to be of great value in creating a new paradigm for teaching injury-preventive piano technique.

At the forefront of the movement to join technology with injury-preventive piano playing are Chong and Riley (Chong & Riley, 2010; Coons, Marcarian & Riley, 2005; Riley, 2007; Riley, 2011). Riley has helped develop multimodal biofeedback technologies that include:

> …playback through a Disklavier piano; simultaneous visual feedback displayed as a piano roll screen of what was played; video recording synchronized with the Disklavier and piano roll feedback; motion analysis of the arms, hands, and fingers; and electromyographical recordings of the muscle actions involved (Coons, Marcarian & Riley, 2005, p. 82).

Together, these give the pianist feedback regarding muscle use and skeletal alignment, performance results (dynamics, placement and duration of sound, etc.), and the correlation of the two (Jennings, 2014). Researchers have concluded that:

> Elucidating the psychomotor complexity of human music behavior has been a daunting research problem. Investigators have been striving to clarify the interplay of external parameters (sights and sounds of performed music) and internal parameters (anatomy, physiology, psychology of each individual) (Coons, Marcarian & Riley, 2005, p. 87).

However, Riley believed that using multimodal feedback technology could increase teachers' awareness and ability to assess and address muscle tension and skeletal alignment (Riley, 2011), as well as aid in the transfer of information and learning to students (Coons, Marcarian & Riley, 2005). Until recently, Riley's product was commercially available under the name ProForma Vision.

Another technological product that might aid in teaching injury-preventive piano technique was SYSSOMO—synchronization through score-following of somatic motion data (Aitenbichler, Hadjakos & Mühlhauser, 2008). Similar to Riley's ProForma Vision, it appeared to be more portable and used wireless technology, making it easier to use than wired sEMG technology. Most interestingly, it used the teacher's biomechanical model as a baseline for generating "advice" for the piano student. Additionally, its software could even be written into an application of the iPhone. While not easily affordable for most piano teachers, SYSSOMO might one day be mass-marketed at an affordable cost.

Smart phone applications (apps) perhaps offered some of the most readily accessible, least expensive, and most helpful technology. Apps choices are plentiful in human anatomy instruction. However, one of the most useful tools the author has used in the Method is a motion analysis application called CMV (*CoachMyVideo)*. This application is easily used to videotape and then replay in slow motion segments of students' lessons for feedback regarding motion, alignment and joint angle analysis. The pianist needs only an iPhone with its built-in video camera.

The aforementioned advances in technology could signal a new era in teaching and be most promising for the future of healthful piano technique. Manchester hoped to see more use of technology in rigorously assessing the biomechanics of performance (Manchester, 2014d). However, as Foster (2010) stated earlier, it is ultimately the teacher who must stay informed, guide the process of sorting through various technological options, and find creative, effective ways to help the student learn.

Transformative Learning, Zen and Mindfulness Training

The Method under investigation also incorporated certain principles found in the pedagogical paradigms of transformative learning and a subset of Asian pedagogy—mindfulness training. Although a review of the literature of these disciplines was beyond the scope of the present study, a brief synopsis of relevant components from these pedagogies was in order.

Since studying transformative learning theory in the last several years, the author realized that many of its components had been embedded in the Method being investigated. Cranton, building on an earlier definition by Mezirow, stated that transformative learning is "a process by which previously uncritically assimilated assumptions, beliefs, values, and perspectives are questioned and thereby become more open, permeable, and better justified" (Cranton, 2006, p. 2). On the face of it, one might not believe that teaching complex motor skills in the service of music would require questioning previous beliefs, values, assumptions, and perspectives. But that is, indeed, what might happen during training if students realized they must discard much of a deeply embedded but potentially injurious neuromusculoskeletal program, especially one that had served their technical and musical purposes in some fashion for many years. It is no less than a transformative experience when traditional approaches and support systems are scrutinized and frequently found wanting. Equally transformative (and unsettling) are the experiences of temporary loss of control as old habits and thought patterns that physically and mentally block artistry transition to new habits that potentially help the pianist heal from or prevent injury and maximize artistic potential.

Hoggan, Simpson and Stuckey listed five types of learning techniques that educators employed to stimulate creativity in the learning environment: "1) Imagining new possibilities, 2) Deep learning of course content, 3) Self-awareness, 4) Purposeful change, 5) Social change/Increasing awareness of others" (Hoggan, Simpson & Stuckey, 2009, p. 157). Each of these were embedded in some manner in the Method being studied: Students must already have had the courage—or desperation—to imagine a new and unfamiliar way of playing. Deep learning was experienced as the student excavated old, unconscious habits and established, layer by layer, new ones. Self-awareness was essential for bringing former unconscious patterns to full consciousness. A strong desire for purposeful change would help provide students with the patience, mental discipline, and courage required to make profound changes. And, finally, social change and awareness of others were organic results of such deep self-learning (Lister-Sink, 2014).

Ironically, the last discipline to be reviewed, albeit briefly, was the most important one for the Method being scrutinized. Lateiner-Grosz gave me Herrigel's *Zen in the Art of Archery* (1953) in which the German recounted his transformative experience as a student of a Japanese Zen master of archery. This small book blazed the trail for the eventual encounter of Eastern philosophies with the West. As Herrigel wrote, "In the case of archery, the hitter and the hit are no longer two opposing objects, but are one reality…he becomes one with the perfecting of his technical skill…" However, he continued with a disquieting irony, "…though there is in it something of a quite different order which cannot be attained by any progressive study of the art (Herrigel, 1953, p. viii). Further irony is found in the cautionary note for academics:

> As soon as we reflect, deliberate, and conceptualize, the original unconsciousness is lost and a thought interferes. We no longer eat while

> eating…Man is a thinking reed but his great works are done when he is not calculating and thinking" (Herrigel, 1953, p. viii).)

This approach to life was introduced to me in my first piano lesson with Lateiner-Grosz in 1969—awareness and egolessness as paths to becoming one with the piano. The state she was trying to help her students achieve might also have been likened to Csikszentmihalyi's state of "flow" (Custodero, 2005).

Over the last half-century, it could be said that many new concepts, practices, and research have been derived from this work (Langer, 1997). These included the practice of mindfulness meditation, used by such corporations as Google (Kabat-Zinn, 1994), and for musicians as enfolded into Gallwey's *The Inner Game of Tennis* (1972). Even a medical doctor and neuroscientist, who was also a decades-long Zen meditator, investigated from a neurological perspective the experience of "Zen awakening" (Austin, 2009). Transformative learning could be considered a partial derivative of this discipline and its elusive characteristics.

Synthesis of Section III

Components of the Method found in other disciplines. A review of the literature in movement science, neuroscience, sports and dance pedagogy, neuropedagogy, embodied cognition, somatic education, as well as transformative learning, Zen, and mindfulness training revealed numerous congruencies both with the Method as well as with the biomechanical model it taught. They were as follows:

1. Piano technique is a trainable but complex neuromusculoskeletal activity of the whole body, directed by the brain: Dance pedagogy, sports pedagogy, neuropedagogy, embodied cognition, somatic education, technology-assisted pedagogy

2. The technical model used in teaching, like other athletic models, should be based on rational, biomechanical principles of efficient whole-body use, and taught with consistent, accurate and understandable terminology: Movement science, sports and dance pedagogy, technology-assisted pedagogy

3. Piano technique is best acquired through neuromuscular programming in a step-by-step, carefully sequenced manner, from the simplest coordinations to the most complex, allowing sufficient rest and time for the brain to process and master each step: Sports and dance pedagogy, neuropedagogy

4. Enhanced auditory, tactile and kinesthetic awareness through mindfulness training are essential to successful training, beginning with continual awareness of breathing: Embodied cognition, somatics education, transformative learning

5. The teacher must teach kinesthetic and somatic awareness of whole-body coordination through appropriate and professional tactile guidance: Sports and dance pedagogy, embodied cognition, and somatic education

6. Concurrent training in the Alexander Technique or other embodied cognition disciplines enhances proprioception, kinesthesia, and somatic awareness, as well as the rate and quality of learning: Embodied cognition, somatic education, neuroscience

7. Modeling, mental practice, video and audio recording and self-assessment, and written self-reflection are all important tools for teaching: Sports and dance pedagogy, neuroscience and neuropedagogy, transformative learning

8. Teachers of students with playing-related injuries must work in partnership with a team of healthcare professionals, including traditional and complementary practitioners: Sports and dance pedagogy, performing arts medicine

9. Piano technique—all coordinations, movements and sensations—must be chosen to best serve the musical requirements: Dance and "artistic" sports pedagogy, embodied cognition and somatic education, technology-assisted pedagogy

10. The teacher must adapt appropriately and creatively to each student's individual learning style, training history, and state of health in a positive learning environment, potentially leading to psycho-physical transformation: Transformative learning, neuroscience and neuropedagogy, cognitive embodiment and somatic education

Regarding the biomechanical model used in the Method under investigation, a review of the literature revealed apparent commonalities with core principles of good coordination, efficient muscle use and optimal alignment established in the fields of

physics, biomechanics, and other movement sciences. These principles of optimal whole-body use were also embedded in scientifically informed sports and dance pedagogy.

The primary inconsistency—and a telling one—between research in sports and dance and research in piano playing was the lack of a fundamental model based on accepted laws of motion, physics, and biomechanics. In dance and artistic sports research, elite or expert subjects were chosen based on clear criteria of adherence to accepted guidelines of form and superior coordination. In research on piano playing, so-named expert or elite subjects were chosen for their accomplishments in competitions or as musicians, not on their superior physical coordination as defined by movement science—*what* they play, not *how* they play. In sports, superior performance is largely the result of superior technique or form. The ability of pianists to play with complete accuracy and with compelling artistry remains a confounding factor in establishing guidelines for physical coordination, complex motor skill learning, and injury-prevention.

Summary of the Literature Review

Section I of the Literature Review showed that, spite of considerable growth since the 1980s in the field of performing arts medicine research of PRNDs and risk factors, playing-related injuries among pianists of all ages had not been significantly reduced. Until recently, risk factors for injury varied widely from study to study, and also had not been statistically established. Even clear, consistent definitions for PRNDs had not been established among researchers. In spite of cautionary notes regarding the complexity of playing the piano and the difficulty in establishing biomechanical norms (Wristen, 2013), and the lack of randomized controlled trials of various alleged injury-preventive

techniques (Manchester, 2013b), some progress has been made toward both reaching agreement on risk factors and establishing guidelines for efficient body use at the piano. As of 2015, there seems to be a growing consensus, thanks to the collaborative efforts of organizations such as the Performing Arts Medicine Association (PAMA), the Music Teachers National Association (MTNA), the National Conference on Keyboard Pedagogy (NCKP), and the National Association of Schools of Music (NASM). For example, since the NASM in 2012 published guidelines and required all accredited music units to take more responsibility for the neuromusculoskeletal health of it students, an assumption might be made that there was sufficient agreement regarding risk factors for PRNDs that educational information regarding such risk factors, as well as core principles of injury-preventive technique, could be disseminated with some confidence. However, even as research is growing, consensus is building, and useful information is being shared between researchers and the piano and music profession, pianists might continue to remain uneducated to risk factors for injury. Unless pianists are associated with private teachers in their pre-college years, and with administrators and faculty in higher education who are concerned about PRNDs and who attempt to say informed, those pianists will continue to be at risk for playing-related injury. Additionally, if playing-related injury develops, pianists will continue to have difficulty finding physicians and other healthcare professionals outside of the relatively small performing arts medicine field who will understand the complexity of their PRND, who will give accurate diagnoses and who will recommend appropriate and effective treatments. Finally, even if pianists with PRNDs receive effective treatments, they may become

reinjured due to a lack of investigated strategies and methods for training injury-preventive piano technique.

In Section II, a survey of the literature on late 19th, 20th and 21st century piano technique revealed widespread distrust and skepticism of methodologies for teaching piano technique. However, in spite of such negative connotations, the review also revealed certain historical 19th, 20th and 21st century methods and approaches that, at least ostensibly, shared similar core pedagogical and biomechanical principles with the Method under investigation, as explicated in Section II: Common Core Values Shared by the Method with Other Approaches. However, most of the historical methods, and the biomechanical models they taught, were described in written form only, thus making them vulnerable to misunderstandings, distortions and misinterpretations. As videographic examples of pianists became available from the early 20th century, it was possible at least to see representative products of these methods and techniques in motion. However, it was still not possible to measure any pianist's actual muscle effort until late in the 20th century through surface electromyography (sEMG). Therefore, while overlapping pedagogical strategies might be accurately determined, biomechanical commonalities with the Method remained purely speculative.

In Section III, a review of the literature in movement science, neuroscience, sports and dance pedagogy, neuropedagogy, embodied cognition, somatic education, as well as transformative learning and mindfulness training revealed numerous congruencies and overlaps both with the strategies employed by the Method, as well as with the biomechanical model it teaches (as shown in Section III: Components of the Method Found in Other Disciplines). From sports and dance pedagogy, as well as neuropedagogy,

these included teaching complex motor skills in a step-wise, sequential manner through the senses, and gaining command of each stage of coordination before proceeding to the next stage; from movement science and sports pedagogy: using rational, biomechanical principles to establish norms for basic form; from somatic education, cognitive embodiment and mindfulness training: the importance of enhanced auditory, tactile and kinesthetic awareness, as well as the importance of optimal, dynamic skeletal alignment; from neuroscience and neuropedagogy: the efficacy of modeling, mental practice, rest, as well as the role of the brain in directing the body; and from neuropedagogy, transformative learning and mindfulness training: the importance of a positive, supportive environment and individualized attention.

Additionally, increasing interest among researchers in those various disciplines to pool information and resources for more interdisciplinary research was a hopeful sign for both investigating and developing other injury-preventive strategies and methods, and establishing relationships among piano pedagogy, piano technique and injury-prevention (Russell, 2006).

Most importantly, Section III revealed advances in technology that now enable researchers to actually quantify biomechanical use in piano playing (Chong, 2014). Unlike in the 19th and most of the 20th centuries in which biomechanical models of pianists' technique could not be precisely measured or quantified (including skeletal alignment, muscle effort, joint angles, etc.)—even as numerous books attempted to describe technique—advancing technology now enables researchers to precisely quantify various models through multi-modal means such as motion-capture and analysis, surface electromyography (sEMG), functional magnetic resonance imaging (fMRI).

Chapter III

METHODOLOGY

Purpose of the Study

The purpose of this study was to investigate students' perceptions of the effectiveness of one interdisciplinary method for teaching injury-preventive piano technique. This study examined its short and long-term outcomes in adult pianists who had studied the Method for two semesters or the equivalent. Both pianists who had experienced playing-related neuromusculoskeletal disorders (PRNDs) prior to training, and those who had not, were included in the study. It was hoped that this study would help increase understanding of how better to retrain pianists with PRNDs, and how to prevent further recurrence of PRNDs. Additionally, with respect to non-injured pianists, the study might also shed light on ways to teach piano technique that would help prevent playing-related injury from the outset. At the very least, this data might serve as a baseline, and this study as a model for the investigation of other methods and approaches to teaching injury-preventive piano technique.

This chapter provides a description of the research methodology that was used to study students' perceptions of the effectiveness of an interdisciplinary method that claimed to teach injury-preventive, scientifically informed piano technique. Included in this chapter are an outline of the purpose of the study, Research Questions, type of research approach and the rationale for its choice, a description of the research sample and setting, procedures used in the design plan, a description of the pilot testing used,

instrumentation and data collection procedures, the research plan, and plan of data analysis. Further topics that are addressed are the position and bias of the researcher, ethical considerations and issues of trustworthiness, and limitations of the study.

As both the researcher and developer of the Method under investigation, I began this research with certain assumptions and perceptions (Bloomberg & Volpe, 2013, p. 137). The tendency toward a strong bias was heightened because I was professionally and pedagogically connected with the subjects, sometimes for many years. I had heard their stories many times over, and felt I could almost predict the narrative of their musical autobiographies and histories.

Participants' stories I have heard over the last 30 years have followed a certain chronology: discovery and experience of playing-related disorders; attempts to find diagnoses and treatments; the effects of retraining in the Method on musical components; the effects of retraining with the Method on extra-musical components; positive and negative responses to the Method itself—its content, pacing, pedagogical philosophy and holistic, interdisciplinary nature

From my personal perspective of observing this chronology for many years, my overarching concern was that playing-related injury was a much more serious and prevalent aspect of the music profession than was generally understood and acknowledged. In spite of increased attention to PRNDs from the medical and music fields, pianists' negative experiences with PRNDs remained only minimally investigated. As a consequence, those who experienced PRNDs not only had to deal with challenges of feeling under-acknowledged, under-appreciated and frequently alone. They also often had to confront feelings of marginalization and isolation. However, except for anecdotal

evidence from these written stories, my daily experiences with them as their teacher, and their weekly lesson reflections, an actual in-depth study had never been conducted. Additionally, many students over the years had turned to the Method, widely acknowledged as a non-mainstream pedagogy, only as a last resort. In this study, I wanted to examine how my own perceptions of this troublesome and ongoing problem of playing-related injury were similar to those of my students.

As a consequence of my own experience with pianists with PRNDs, as well as pianists who wished to avoid PRNDs, the Research Questions and the survey and interview questions that ensued from them were created and organized to answer these questions in the aforementioned chronological sequence. The most important questions to be answered in this study, therefore, were Research Questions No. 1 and No. 2. Those two questions concerned 18 out of 26 pianists' (and organists' who play the piano) perceptions of their experiences with a wide range of PRNDs, their attempts to find solutions, and the role of the Method in their quest.

Research Questions

To determine the effectiveness of the Method under investigation in recovering from PRNDs and in preventing recurrence of PRNDs; the musical, technical and extra-musical results of studying the Method; and the challenges and benefits of training, the following Research Questions were addressed:

1. How do pianists with a history of playing–related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in recovering from those disorders?

2. How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in preventing recurrence of those disorders?

3. What effect, if any, do pianists perceive this Method to have on various aspects of musicality (such as phrasing, rhythm, structural cohesion, emotional content, communication with audience, performance anxiety, fulfillment of artistic potential, etc.) and technique (such as tone control, tone quality, dynamic control, voicing, facility, muscular suppleness, speed, power, etc.)?

4. What do pianists consider, if any, the extra-musical effects of this Method (such as mental focus, sense of well-being, increased kinesthetic and auditory awareness, enhanced flexibility and suppleness of movement, etc.)?

5. What do pianists perceive as challenges and positive aspects of studying the Method?

Rationale for Research Approach

For this study, a convergent mixed methods, qualitative-quantitative research paradigm was chosen (Jurs & Wiersma, 2009). Since I, as the researcher, wished to examine students' perceptions of my own Method, a mixed methods study that used several data-collection tools would likely obtain the most in-depth, reliable and detailed information from students concerning their perceptions of studying the Method (Jurs & Wiersma, 2009).

Furthermore, although the purpose of the Method under investigation was to teach pianists how to play the piano without injury and to maximize their musical potential, the Method represented the development of a new interdisciplinary pedagogical paradigm which combined science—movement science, neuroscience, embodied cognition, sports pedagogy, neuropedagogy, and somatic education—with musical art. Its mode of instruction combined the more subjective worldview of artistic endeavor with the more objective worldview of the scientific inquiry. One of the goals of the Method

was to teach students how to use scientific knowledge in the service of musical art and injury-prevention. As such, instruction sought to combine a quest for compelling music-making with reason and critical thinking skills regarding technique.

Interestingly, Manchester, as editor of the journal *Medical Problems of Performing Artists*, summed up the dilemma of finding appropriate methodology by quoting Alfred Einstein, "Not everything that can be counted counts, and not everything that counts can be counted" (Manchester, 2011b, p. 63). In the same editorial, Manchester, a physician, scientist and researcher, pointed out the weaknesses in both quantitative and qualitative approaches, "While there is ample opportunity for research bias to affect the results of quantitative research, the less structured nature of qualitative research may result in even greater concern on this front" (Manchester, 2011b, p. 64).

The purpose of the study represented, ultimately, a pragmatic worldview. Bloomberg and Volpe stated, "Qualitative research is pragmatic, interpretative, and grounded in people's lived experiences" (Bloomberg & Volpe, 2012, p. 30). It "focuses on context, and is emergent and evolving…holistic and complex…[and relies on] complex reasoning that moves dialectically and iteratively between deduction and induction" (Bloomberg & Volpe, 2012, p. 30). As such, a partial qualitative approach was essential to this particular study.

As Creswell pointed out, the emergence of mixed methods research is relatively recent (1980s), although as early as 1959, Campbell and Fisk studied psychological characteristics through multiple quantitative methods (Creswell, 2014, p. 14). Creswell asserted that all methods had inherent weaknesses and biases, so that collecting both qualitative and quantitative data would help to reduce those weaknesses (Creswell, 2014).

As a consequence of mixing these approaches, “a researcher collects both quantitative and qualitative data, analyzes them separately and then compares the results to see if the findings confirm or disconfirm each other” (Creswell, 2014, p. 219). Hence, triangulation of data is achieved (Creswell, 2014).

Therefore, a mixed methods approach was chosen because the combination of a quantitative survey designed to yield both descriptive and inferential statistics, and interview protocols had the potential to yield even richer data, using both open-ended and closed-ended questions. As a consequence, interpretation was possible across two databases, thus yielding a more comprehensive understanding of the research problem (Creswell, 2014). Finally, both survey design and questions, as well as interview questions and protocols, were based on information sought in the Research Questions.

Participants and Setting

The participants for both the survey and the interviews were criterion-based; they had studied the Method with its developer for at least two semesters, or the equivalent. Their contact information was taken from a computer database that had been compiled and periodically updated since 1990. Research Assistant 1(RA1) then contacted students via an email in which the study was not mentioned, to determine whether the email addresses were accurate.

Potential participants in the study ranged in age from 22 to 82 and represented a cross-section of college students, graduate students, post-graduate students, independent piano teachers, pianists who were also organ students or professional organists, professional pianists (classical, rock and jazz), and college teachers. The sample

consisted of a balance between pianists who experienced playing-related musculoskeletal disorders prior to training, and pianists who had never experienced PRNDs. Some of the more recent participants lived in North Carolina where they studied the Method at Salem College, a small liberal arts women's college, in its Professional Certificate Program in Injury-Preventive Keyboard Technique (a co-educational program) in Winston-Salem. A large percentage of potential participants, however, lived and worked throughout the United States, Canada, Europe, Central and South America, Asia, and Australia.

The survey component of the study was administered online and therefore the setting was not a consideration. The interviews were site-specific and were held either face-to-face or via Skype in one of two church parlors in Winston-Salem, North Carolina. Care was taken that interview locations had no relationship or association with the training site for the Method.

Procedures

This study had certain features in common with historic clinical control studies used in the scientific and medical fields in place of randomized clinical control studies. An historical control study compares a new treatment or approach with what is available in the literature on previous treatments or approaches. As such, a well-defined historical method or treatment might be compared to existing literature and examined in retrospect for its efficacy (Amzal, B. et al., 2014; Concato, Horwitz & Shah, 2000).

Initially, in an effort to examine critically the Method's claims of being scientifically informed, the study sought to identify the scientific and pedagogical principles—both historical and contemporary—on which the Method under investigation, and its technical model, were based. This was done through a review of the literature in

performing arts medicine, neuroscience, movement science, cognitive embodiment, neuropedagogy, sports pedagogy and somatic education. Additionally, an overview of the literature in historic and contemporary piano technique and pedagogy was included as piano pedagogues over the last several hundred years had expended considerable effort in trying to understand and illuminate the field of piano technique.

Preliminary Information Gathering, Focus Group and Pilot Study

Several means of establishing questions that would yield reliable data were used. First, in the fall of 2013, current and former students of the Method, both on site and via the Internet, were asked for suggestions of the types of questions they believed would be most relevant and helpful in acquiring a broad and deep data pool. Questions ranged from highly general to very specific but gave the researcher a sense of direction. These students, as well as several piano pedagogy and performance colleagues, offered diverse and helpful perspectives.

Next, a second Research Assistant (RA2), who had completed CITI Human Subjects training and who was also a statistician, was hired to help develop questions for the survey so that it would eventually yield inferential, as well as descriptive, statistical data. RA2 also helped develop interview questions and subscales to be used in later data analysis. Third, a focus group was formed in September 2014 to examine questions developed for the survey and the interview. The group consisted of an organ professor who was familiar with the Method but who had not studied it intensively, a music librarian with an Ed. D. in Music who was a researcher, and several other adult students of the Method who had not yet completed two semesters of training.

Fourth, a small pilot survey was then conducted in November 2014 in an effort to test the survey questions and Qualtrics survey tool procedures. Participants were former and current students of the Method who would not be participating in the research study, as well as students of assistant instructors who were teaching the Method under investigation. Results of the pilot survey were not used in the main study.

Application for approval was submitted to the Institutional Review Board for the Protection of Human Subjects at Teachers College, Columbia University in October 2014. After revisions were made, the IRB gave full approval to the study on December 19, 2014 and assigned IRB number 15-066 to the protocol (Appendix D – Institutional Review Board Official Documents).

Protection of Participants' Rights

Since the Method under investigation was one I developed, I was particularly concerned that participants in the survey and the interview not feel in any way coerced to participate, concerned that confidentiality would be breached, or that participation in the study would lead to any negative repercussions. Therefore, potential participants were informed by Research Assistants (RAs) that their participation in the study would be strictly voluntary, both for the survey and for the interview. Furthermore, they were also informed that, whether they chose to participate or not, I as researcher would not have any access to that information. As per IRB requirements, participants were reassured by RAs that I would not see or hear any raw data, that the survey was anonymous, and that all identifying markers in the interview would be eliminated as much as possible through randomly coded IDs for the surveys, and pseudonyms for the interviews. Additionally,

only Research Assistants would have access to the audio-recorded interviews, to raw data in the transcripts, or to the survey. All correspondence, contacting, administering of the survey, scheduling, interviewing, transmitting audio recorded data and transcribing of audio recordings would be done by four RAs trained and certified in CITI Human Subjects' Rights. Participants were fully apprised of the nature of the study, as well as of their rights, in both the survey and the interview, before informed consent was obtained.

Instrumentation & Data Collection

Two instruments for data collection were used in this mixed methods study. In addition to the preliminary tools outlined above of a focus group and a pilot study, the primary means of data collection was an online survey through Qualtrics, administered by RA2, and audio-recorded interviews with participants, either face-to-face or via Skype. It was hoped that these two means of data collection would yield sufficient information, achieve greater depth of understanding, reduce possible misinterpretation, and enhance validity, thus ensuring greater triangulation and clarity of meaning (Jurs & Wiersma, 2009; Bloomberg & Volpe, 2012). Interviews were conducted with 26 participants, while 74 (N =103) current and former students of the Method responded to the online survey (71.8%). A detailed description of these data collection methods follows in the Research Plan section.

Research Plan

It was necessary to design a new survey because a review of the literature revealed only one survey tool specific to piano technique and injury. That survey was sent out by the School of Human Movement and Exercise Science of the University of Western Australia in 2006 to ascertain the playing techniques, habits and postures of pianists, both professional and non-professional, and to acquire better insight into the relationship, if any, between injuries and these techniques, practice habits, and postures (Allsop, 2006). As such, although there was a small overlap regarding background of participants (age, amount of time studied, experience of injury, etc.) the 2006 survey did not address most of the questions relevant to the Method under investigation.

An official Qualtrics online survey was opened on December 30, 2014 and closed February 13, 2015. On that same date, a link to the survey, letter of introduction, and accompanying IRB-approved documents were emailed to 103 current and former students of the Method by Research Assistant 3 (RA3). None of the 103 emails were duplicates, and none were returned. However, two former students contacted RA1 and asked to be removed from the list. Of the 103 recipients, 74 participants responded and completed the survey. The survey response rate was 71.8%. The survey itself included questions regarding respondents' perceptions of the role of the Method in both recovering from and preventing recurrence of PRNDs. Other questions, based on the five Research Questions, addressed perceptions of any musical, technique or extra-musical results, as well as challenges and benefits of studying the Method.

Concurrently, in-depth interviews were conducted by RA2 between January 5 and January 13, 2015. This RA was a professional classical singer who had no personal or

professional connection with the researcher. Twenty-six interviews were held, yielding approximately 23 hours of audio-recordings. Initially, RAs compiled a list of 43 potential interviewees. The list of 43 included survey respondents who had expressed a desire to be interviewed, and additional students that would achieve a demographic balance (which I, as the researcher, requested of the RAs) among injured and non-injured pianists, organists and pianists, older and younger pianists, male and female, and pianists who had completed the Certificate Program in Injury-Preventive Keyboard Technique at Salem College. Additionally, six potential participants who had either left the training prematurely or who had expressed dissatisfaction with the Method, were included in the list of 43 pianists. All 43 pianists then were contacted by RA1 by email. Of the 43, 26 participants consented to be interviewed. I was not informed of the final list of 26 interview participants, although nine interviewees contacted me after the interviews to inform me that they had participated.

As mentioned above, the interviews, both face-to-face and via Skype, were held in one of two church parlors in downtown Winston-Salem, North Carolina. Two audio recorders of high quality were used to ensure that no data were lost. RA1 then uploaded each interview to a private, password protected Google account and sent the data to RA3 and RA4 for transcription. All Research Assistants were remunerated for their services.

Additionally, all data were safe-guarded from damage or loss in several ways: Two dedicated external hard drives were used to store data in a secured, fire-proof site by RA1. Data were also uploaded to a private, password protected Google account to which only RAs had access.

Plan of Analysis

Quantitative data from the survey were gathered and compiled using Qualtrics software. The data were organized and analyzed using IBM SPSS (Statistical Package for Social Sciences) Version 22. Data were then organized into subscales which were tested for reliability. Using these subscales, inferential testing was performed to determine whether the Method and various aspects of the Method impacted survey respondents in a positive manner. Testing was also carried out to determine if certain groups (injured vs. non-injured, pianists vs. organists, males vs. females, younger vs. older) perceived the Method and its aspects more positively than other groups.

Raw qualitative data were analyzed through the computer qualitative analysis software NVivo. Since both the survey and the interview questions were derived from the five Research Questions, data were organized based on participants' responses to those questions. NVivo was utilized in the coding of the data. A cluster diagram procedure was also carried out in NVivo to assist in the creation of themes. Although the patterns shown by the cluster diagrams created in NVivo gave a starting point for the division of the codes and data into themes, the final decisions on which codes belonged in which themes were made by the researcher. NVivo was also used to assist in the creation of correlation charts and word clouds that were used to illustrate a more in-depth examination of the data. Quotations that yielded a deeper look into each theme were sorted and chosen by the researcher for each theme to tell a fuller story of the interviewees' responses.

Ethical Considerations and Issues of Trustworthiness

The search for validity, credibility, objectivity, and accuracy, as well as trustworthiness and respect for participants' anonymity, is especially important when a researcher studies her own Method. The potential for bias, prejudice, and participant reluctance to speak the truth had to be addressed vigorously from the outset of the study. Triangulation was of utmost importance, given the researcher's position as developer of the Method under investigation. Validation, objectivity, and accuracy were achieved through multiple strategies, during both data collection and analysis as follows: the researcher's position was clarified; biases, orientation and prejudices were stated clearly and thoroughly; and participants were assured in their consent form and further correspondence of complete confidentiality. Through IRB-approved materials, participants were assured of their rights and their ability to discontinue participation without fear of negative consequences. They were further assured that four IRB-certified Research Assistants would conduct all correspondence, consent gathering, scheduling, interviewing, storage and transmittal of data, and transcribing of data.

Furthermore, a qualified person with no personal or professional affiliation with the researcher was employed to conduct the interviews. Certain qualities were required of the interviewer: knowledge of qualitative interviewing protocols; a non-biased, objective position vis à vis the Method under investigation; empathy, insight and flexibility to create an environment in which interviewees felt respected, at ease, listened to, understood, and safe to speak the truth about their experiences with the Method; and above all, personal and professional integrity.

Limitations of the Study

All studies have limitations; controlling those limitations begins with acknowledging them to the reader (Bloomberg & Volpe, 2012). Qualitative methods, such as interviewing, as well as quantitative surveys rely on questions. These questions when not carefully created can be biased, leading, imbalanced, exclusive, invasive, annoying, and even offensive, thus limiting and compromising data. The researcher as developer of the Method being investigated, tried to be especially vigilant regarding any such compromise, limitation, or contamination of data collection, analysis, interpretion, and reporting. All possible measures were taken throughout the duration of the study to protect its participants and to ensure the study's overall integrity.

Chapter IV

QUALITATIVE RESULTS

The purpose of this mixed methods study was to investigate systematically, through surveys and interviews, students' perceptions of the effectiveness of one interdisciplinary Method for teaching injury-preventive piano technique. This study examined its short- and long-term outcomes in adult pianists—both injured and non-injured—trained in this Method. This chapter will report results from interviews of 26 students using computer analysis software NVivo (QSR International, 2014).

Development of Interview Questions

Interview questions were developed over a period of several months to obtain both demographic information and answers pertinent to the Research Questions. This process of developing interview questions was aided, in part, by informal suggestions from students and former students of the Method, and from responses from a Focus Group that met in October 2014. The Focus Group consisted of six participants: two current students of the Method who would not be participating in the study, a music researcher with an Ed. D. degree, a music faculty colleague who had audited one of the Certificate Program courses, an-out-of-state colleague who was familiar with the Method, and a former lawyer who was also closely acquainted with the Method through her spouse. None of the Focus Group participants took part in any aspect of the IRB-

approved study (Protocol No. 15-099) and, therefore, were not included in the IRB application protocols.

Research questions for the study were:

1. How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in recovering from those disorders?

2. How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in preventing recurrence of those disorders?

3. What effect, if any, do pianists perceive this interdisciplinary Method to have on various aspects of musicality (such as phrasing, rhythm, structural cohesion, emotional content, communication with audience, performance anxiety, fulfillment of artistic potential, etc.) and technique (such as tone control, tone quality, dynamic control, voicing, facility, muscular suppleness, speed, power, etc.)?

4. What do pianists consider, if any, the extra-musical effects of this interdisciplinary Method (such as mental focus, sense of well-being, increased kinesthetic and auditory awareness, enhanced flexibility and suppleness of movement, etc.)?

5. What do pianists perceive as challenges and positive aspects of studying the Method?

Interview questions were edited, refined, reduced and clarified to gather data that would most thoroughly and specifically answer the aforementioned Research Questions without taxing the interviewees (Appendix E - Interview Questions). Additionally, many questions were left more open-ended so that participants could feel free to expand on their answers, as well as to make any comments that they considered relevant but that were not in the formal list of questions.

Questions 1-7 were to be asked of all participants and were demographic in nature. However, the eighth question was designed to determine which participants had actually experienced a playing-related disorder or injury prior to studying the method: “Prior to training in the Method, did you experience a playing-related

neuromusculoskeletal disorder (PRND)?" Participants who responded positively to Question No. 8, of which there were 18 out of the 26 interviewees, were then asked Questions 9-16 to gather data for answering Research Question No. 1: "How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in recovering from those disorders? " Those questions addressed the following:

- the nature and length of the PRND
- whether the PRND was medically diagnosed and treated
- what type of treatment or treatments were received prior to studying the Method and to what degree were they helpful
- whether the participant continued playing with the PRND
- what responses were experienced from teachers, colleagues, family, friends, etc.
- what were the most helpful aspects (if any) of the Method in recovering from injury
- what were the least helpful aspects of the Method in recovering from injury

Finally, and critically important for Research Question No. 2: "How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in preventing recurrence of those disorders?" Question No. 16 attempted to ascertain from the 18 participants who had experienced PRNDs prior to studying the Method to what extent the Method under investigation might claim to be injury-preventive in nature.

Questions 17-34 were asked of all participants. Their topics included questions pertinent to the three remaining Research Questions. Each Research Question and its codes, themes, and sub-themes will be addressed in detail in later in this chapter. (For a list of Research Questions matched with interview questions, please see Appendix F - Research Questions Matched with Interview & Survey Questions.)

Interviewee Contact and Scheduling Protocols

In an attempt to gather richer data and deeper insight into students' perceptions of this interdisciplinary Method, a qualitative component of interviews, in addition to the quantitative survey, was included in this mixed-methods study. The process of compiling a list of interviewees was two-fold: First, a question was included on the survey asking if the survey respondent would like to be interviewed. Research Assistant 3 (RA3) then gave RA1 a list of those willing to be interviewed. Second, to ensure a relatively balanced distribution of sub-groups (pianists vs. organists, injured vs. non-injured, female vs. male, student vs. professional, older vs. younger), a list of 43 students was drawn up by RA1. The list consisted of students who had expressed willingness to be interviewed, as well as students who represented each of the sub-groups. Additionally, to ensure investigative rigor that negative responses were equitably represented, six potential participants were added to the list who had at some point expressed dissatisfaction in some form with the Method.

The data collection was designed in an attempt to avoid researcher bias, since I had developed the Method under investigation and wished to avoid knowing the identity of those participating in the interviews and surveys, (RA1) contacted each of the 43 students and asked whether he or she would like to participate in an interview. The result was a list of 28 students, of which 26 were interviewed. All participants had studied the Method within the past 25 years for the equivalent of two semesters. I did not know the identity of any interview participant although 9 interviewees did contact me by telephone or email after the interview specifically to report that he or she had been interviewed. It was also nearly impossible for me to associate any of the particular interview transcripts

with any particular former student. The demographic distribution of the interview participants is shown in Table 1.

Table 1

Interview Demographic Variables, Percentages

Variable		Number	Percentage
Gender			
	Male	15	57.7%
	Female	11	42.3%
Age			
	Under age 30	11	42.3%
	Age 30 - 39	7	26.9%
	Age 40 - 59	4	15.4%
	Age 60 and older	4	15.4%
Musical Education			
	Bachelors degree*	19	25.7%
	Masters degree*	10	38.5%
	Doctoral degree*	2	7.7%
	Masters student*	1	3.8%
	Doctoral student*	2	7.7%
Type of Keyboardist			
	Pianist	17	65.4%
	Organist	9	34.6%
Professional Status			
	Professional performing musician	19	73.1%
	Teach piano or organ	17	65.4%
PRND Status			
	Never had one	8	30.8%
	Experienced at least one	18	69.2%
Type of Disorder			
	Carpal tunnel syndrome**	1	3.8%
	Focal dystonia**	1	3.8%
	Hypermobility**	2	7.7%
	Nerve entrapment**	1	3.8%
	Tendonitis**	7	26.9%
	Thoracic outlet syndrome**	3	11.5%
	Undiagnosed condition**	7	26.9*

* This list includes all music degrees earned by each participant. Degrees in non-music fields are not listed.
** Some interviewees had more than one disorder.

Interviews were scheduled by RA1 who contacted participants by telephone or email. RA3, a local singer who had no professional or personal connection with the researcher, held the audio-taped interviews. The interviews lasted 30 minutes to one hour and 20 minutes each, and averaged 50 minutes in length. As per IRB requirements, participants were apprised of the potential length of the interview. Participants were interviewed in an easily accessible room at two local churches in Winston-Salem, North Carolina. Interviews through Skype were also held at these two locations.

Addressing Risks of Researcher Coercion and Breach of Confidentiality

I, as the researcher of my own Method, was not present at these interviews. Additionally, as per IRB requirements, the Informed Consent form read by all participants further attempted to reassure participants of efforts to prevent coercion and to protect confidentiality of information (See Appendix D.) Participants were asked to read the Informed Consent form. They were then given the Participants' Rights form to read and, if they wished to continue in the study, to sign. The RA (RA3) conducting the interviews then reiterated that identifying markers would be eliminated as much as possible, and that the researcher, as developer of the Method, would never hear audio-recordings of the interviews. These measures were taken to encourage the interviewees to be open, honest, and forthcoming with their perceptions about the Method.

Audio-Recording of Interviews

During the interview, two high-quality audio recording devices were set up to ensure that no part of the interview was lost due to malfunctioning of a recorder. A

memory stick was used in each audio-recorder. After the interview, data were uploaded by RA1 to his password-protected computer. The data were then condensed, stored, and transmitted via a private Google Drive account accessible only by RA1, who sent the data to RA2 and RA4 for transcribing.

Once the audio-recorded data of each interview were received by RA2 and RA4, they were transcribed by RA2 and RA4 and raw data transcripts were generated. However, I as the researcher had no access to the raw data containing identifying markers. Those markers were removed systematically by RA2 to ensure a higher level of confidentiality, if not complete anonymity. (It should be noted that a number of participants voluntarily contacted me after the interviews to express their unsolicited responses to the experience.)

Rationale for NVivo Analysis Software for Qualitative Analysis

NVivo (QSR International, 2014) is a computer-assisted qualitative data analysis software (CAQDAS) program created to help manage and analyze large amounts of non-numerical data. It is useful as a tool to organize, store, correlate, and categorize (Bloomberg & Volpe, 2012). However, it is unable to think like the researcher and integrate and synthesize concepts the way the human brain can. It also "cannot reason about relationships that ought to occur in your data but seem to be missing" (Rubin & Rubin, 2012, p. 240). However, limitations of CAQDAS notwithstanding, I chose to use this particular means of analyzing data from 26 audio-recorded interview transcripts because it offered detachment from subjective perception of data and reduced researcher bias. The program NVivo can also compare and contrast both quantitative and qualitative

data, helping the researcher arrive in the final analysis to a greater, more integrated whole.

Generating Descriptors and Codes

Codes were created in several ways. First, a list of descriptors was created for each Research Question. These lists consisted of 10 to 20 relevant sub-topics, or descriptors, under each Research Question. Out of these descriptors, RA2 and I generated a lengthier list of codes to be entered into NVivo.

Second, in addition to the descriptors, I, as developer of the Method, generated hypothetical codes based on predictions of what would be contained in the data (Saldana, 2013). Personal and intensive experience with both the Method under investigation and with the students being interviewed enabled me to assume that a wide but familiar range of words, phrases and general responses would ensue from the interviews.

Meanwhile, RA2, who transcribed the audio-recordings of the 26 interviews, developed her own list of codes derived from the interview transcripts. However, since she was not a musician or pianist and had relatively little knowledge of the music field or the content of the Method, she consulted with me about modifying codes and phrases into the language of the professional field.

During this process of code development, I continued to have no access to the raw data. However, during the same time period, I received narratives from the Qualtrics survey from RA2. Since the questions on the survey were similar in nature to the interview questions, it was assumed that the survey respondents' narratives would have some commonality with the interview data. Therefore, I developed another list of codes

from the survey narrative data. Importantly, due to the nature of these brief and non-contextualized data narratives, the data could not be linked to any specific participant.

Finally, I was sent the interview transcripts from which all identifying markers had been eliminated. With these transcripts, I edited and refined the original list of code words and phrases, thus finally arriving at the codes used in the analysis of interview data.

Cluster Analysis

According to the NVivo 10 documentation, cluster diagrams can assist the researcher in seeing patterns of similarity and dissimilarity between the codes (QSR International, 2012). The software is used to examine the Pearson correlation coefficients between the codes and then employs a mathematical algorithm (Defays, 1977) to spatially represent the codes in a diagram based on the correlation coefficients.

This particular function of NVivo first calculated the Pearson's correlation coefficient between each pair of codes in this study. Then it placed the codes in a chart based on how closely correlated each code was to the other codes. Pearson's correlation coefficient shows the strength and direction of the relationship between any two codes or variables. A value of +1 indicates that the two codes are exactly positively correlated with each other. For example, "Can play with ease" and "Feel more released now" might be perfectly correlated with each other, since the two are almost identical. Conversely, a Pearson's coefficient of -1 means that the two codes have a perfect negative correlation, as in "Empowered to change old habits" and "Hard to change bad habits." Finally a Pearson's correlation coefficient of 0 means that the two codes or variables are not

correlated at all: “Now love playing the piano” and “Washing machine,” for example, are totally unrelated and would probably have a correlation coefficient of 0.

Cluster analysis is considered to be a powerful research tool. However, a responsible researcher generates a cluster analysis and then makes sure that the relationships expressed really do make sense. A cluster analysis serves to give the researcher new ideas or to confirm old ones. It does not stand on its own without the researcher's input and control (S. Braun, executive director of Anovision, personal communication, February 16, 2015).

Deriving Themes for Each Research Question

Themes were generated for each Research Question by entering all related codes into the Cluster Analysis function of NVivo. In analyzing the data, NVivo grouped codes together according to their correlation coefficients using a sophisticated mathematical algorithm (Defays, 1977). Codes that were spatially close together in the diagram were normally most highly correlated with each other. The information from the Cluster Diagram was combined with researcher judgment to create themes that were used to answer each Research Question. These themes were based on perceived interactions and interrelationships of the codes. Verbatim quotations from participants’ interviews were presented to support each theme or sub-theme. Relationships, interactions, and correlations were also explored. Additionally, seemingly contradictory groupings were examined and new themes uncovered. Since the survey contained a qualitative component of open-ended questions that were answered in narrative form, codes from these Survey narratives were also included and analyzed in this chapter.

Word Cloud

Finally, the interviews and qualitative portion of the survey were analyzed using a word frequency analysis tool. For this analysis, commonly known as a word cloud or a tag cloud, the actual words of the interviewees were compared. The questions themselves were not included in the word frequency analysis. The word cloud is a graphic representation of word frequency in the interviews. The relative size of the word indicates its frequency. "Stop words," such as "um," "yeah," "about," and "whatever," that have little value were excluded from the process of creating a word cloud (QSR International, 2012). The word cloud was a useful indicator of major topics the interviewees were discussing. The word cloud generated from all interviews and qualitative survey answers is shown in Figure 2. It is interesting to observe that "think" is the most prominent word.

Figure 2. Word Cloud for All Interviewees and Qualitative Survey Answers

Explanation of Percentages

Percentages assisted in the explanation and analysis of the themes. These percentages were calculated as the number of interviewees out of the total 26 who discussed the specific topic or code. Therefore, a percentage of 100% meant that all 26 interviewees discussed that particular topic. These percentages were derived from answers to both specific and open-ended questions. In the semi-structured interview, interviewees were encouraged by the RA interviewer to:

> Please feel free to speak openly with [the interviewer] about your experiences with the Method. Please feel free to expand on a particular question if you'd like, or take it in a different direction. If there's anything that you wish to be recorded, please make sure that you say that here today. All these questions are just guidelines for an open-ended interview. (Appendix D – IRB Official Documents)

Therefore, even topics that were referenced directly by the interviewer in a question were not necessarily answered by the interviewee; he or she may have, indeed, taken the question in a different direction. On the other hand, interviewees occasionally brought up—unprompted—a topic frequently enough that it rated a code and became a finding.

For example, when the interviewer asked specifically about "professional tactile guidance," all interviewees responded and discussed it. Other topics, such as "videotaping lessons" and "writing a synopsis," were not specifically inquired about in an interview question. However, some interviewees brought up these topics on their own and mentioned that they were very useful. That others did not bring up these topics did not mean that videotaping lessons was not useful or helpful to them. It simply meant that the interviewer did not ask about videotaping and most interviewees did not bring it up spontaneously. *A low percentage, therefore, does not necessarily mean that the topic in the code was not helpful* [emphasis added] or did not apply to most interviewees. The

difference between prompted and unprompted answers, specifically between answers to primary questions and unprompted answers to general questions, was made clear in the findings.

Research Question No. 1

How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in recovering from those disorders?

An NVivo cluster analysis of interview questions related to Research Question No. 1 from 18 in-depth interviews of pianists with PRNDs is illustrated below in Figure 3. Three themes emerged from the NVivo cluster analysis:

Theme 1 – Perceived consequences of experiencing PRNDs
Theme 2 – Perceived effectiveness of medical treatments vs. the Method for PRNDs
Theme 3 – Conflicting perceptions of the Method – skepticism vs. hope

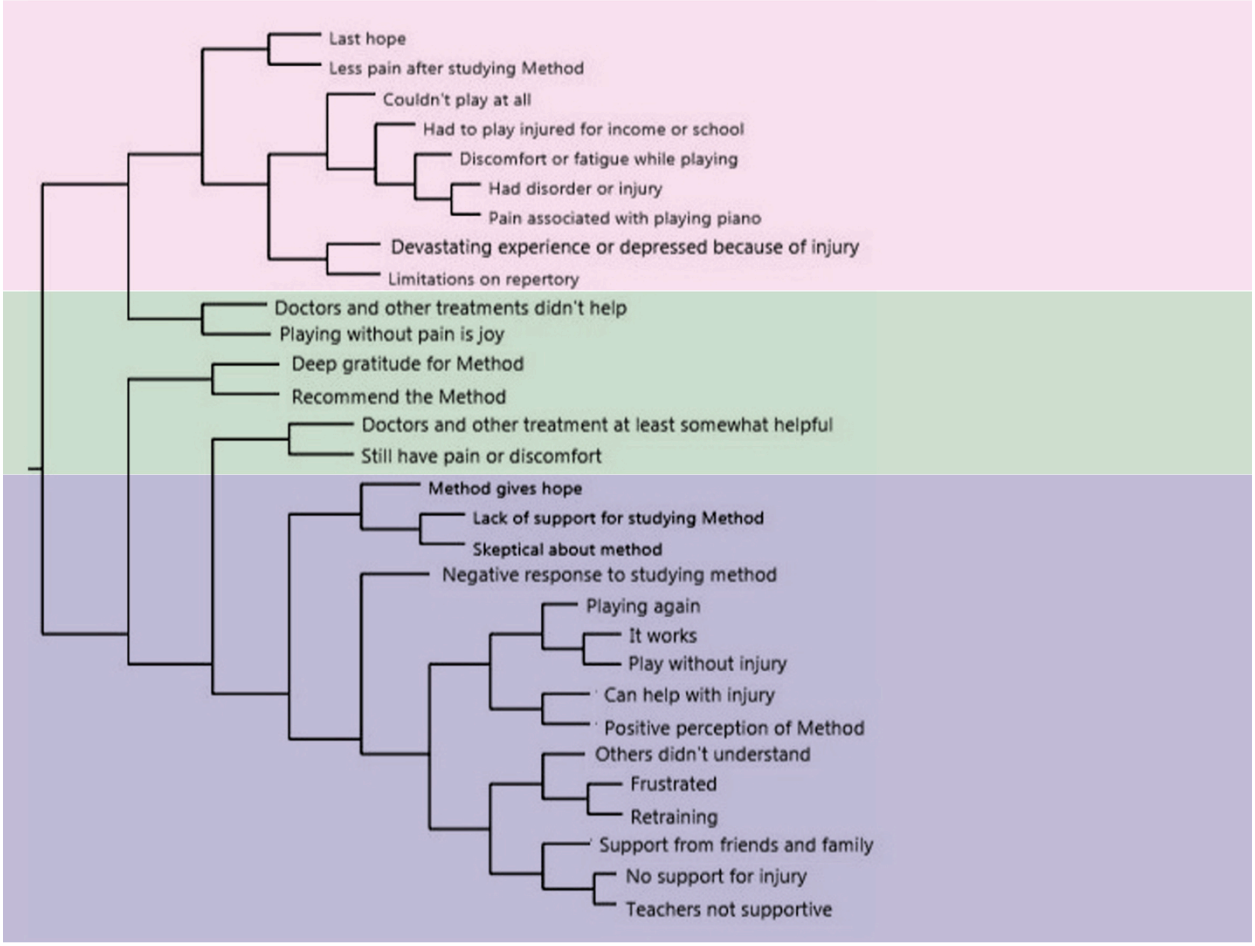

Figure 3. Cluster Diagram Using Codes Related to Research Question No.1

Research Question No. 1: Theme 1 - Perceived Consequences of Experiencing PRNDs

Finding 1: *When asked specifically whether they had experienced a PRND, 18 out of 26 participants reported themselves to be diagnosed or self-diagnosed with PRNDs. Of those 18, 58% or 15 had to stop playing altogether, 62% had discomfort or fatigue while playing, and 58% experienced pain while playing. When asked a general question about the effects of the PRNDs, 27% reported experiencing repertory limitations. When asked specifically whether they had to continue playing with the PRNDs, 58% reported having to continue, either for income or because a school*

required them to continue playing. Almost one-third of participants (31%) volunteered without prompting that it was a devastating experience or had led to depression.

Codes include the following: last hope, less pain after studying the Method, couldn't play at all, had to play injured for income or school, discomfort or fatigue while playing, had disorder or injury, pain associated with playing the piano, devastating experience or depressed because of injury, and limitations on repertory. The correlations between the codes that comprise Theme 1 are shown in Table 2. The cluster diagram shown in Figure 3 was calculated from a set of Pearson's correlation coefficients, as discussed above. As noted, the closer to +1 the correlation coefficient, the more closely related, or the stronger the relationship, between the two codes. The number of these codes is quite high, or over .60. This result is not surprising as many of the codes related to PRNDs indicate the consequences and pain caused by the PRNDs. The close relationship (.76) between "had disorder" and "had to play injured" should also be noted. This was a common theme as interviewees discussed how they were not able to stop playing even when experiencing pain because they were required by a school to continue, or they needed the income from playing to survive financially.

Table 2

Correlations Between Theme 1 Codes

	Pain	Limits on rep	Less pain after	Last hope	Had to play injured	Had disorder	Discomfort or fatigue	Devastating
Limits on rep	.42							
Less pain after	.54	.34						
Last hope	.44	.31	.50					
Had to play injured	.67	.55	.46	.44				
Had disorder	.81	.54	.56	.55	.76			
Discomfort or fatigue	.71	.51	.48	.39	.71	.79		
Devastating	.48	.49	.38	.37	.53	.63	.54	
Couldn't play	.67	.53	.40	.49	.64	.76	.56	.53

The overriding finding of Theme 1 was the multiple short and long-term negative consequences—musically, academically, professionally and emotionally—of having a PRND. Responses were often as complex as the playing-related disorders themselves. Angus[1] summed up the results of his developing of an injury while studying at a major American conservatory:

> I developed a severe injury. It was so severe, that I was in such bad pain, there were days I could barely get out of bed. It was horribly depressing….So I finally had to face facts, I was very emotionally distraught, it was very damaging….So I had to leave a full scholarship. You know I'm not the type of person that would kill myself but there are a lot of people who would over this. (Angus)

For Ben in another well-known undergraduate conservatory, desperation and confusion, as well as depression, ensued from his playing-related injury:

> I was so desperate I'd been looking up any book on piano technique I could get my hands on and just reached a dead end 'cause all these methods are conflicting. There's no consensus in the piano technique world. It's very mysterious…(Ben)

Yet another participant recalled his deep concern about the number of years he had invested in preparing for a career that seemed to be out of reach because of his injury, "Yes, because of course when you have an injury like that, I was really depressed. It was a big thing because I had put so much time and years…so suddenly you cannot play anymore. It's just really big." (Leo) Craig expressed frustration at practicing and performing difficulties, "I was having discomfort while practicing. Basically practicing was becoming unpleasurable for me….Again, those technical limitations when I would try to play gigs, I would try to do things and I couldn't execute them." (Craig) Another pianist in her thirties recounted the deterioration of her relationship with the piano and

[1] Pseudonyms were used throughout this report to protect the identity of participants. Names were randomly chosen to correspond with gender, but reflect no participant's name, either in the interviews or the survey.

playing, the limitations on repertory, and the lack of support from the college from which she was attempting to get a performance degree:

> My relationship with the piano didn't deteriorate until probably my junior year….I started to really dislike playing it because I was in so much pain. And the college didn't recognize that as a valid excuse for stopping practicing…the college actually had me come back for an entire additional year just to complete [my senior] recital….So by the time that was done I hated the piano and didn't want anything to do with it. (Lucy)

Not uncommonly for pianists experiencing PRNDs, Abby commented on a number of problems she believed had resulted from a PRND in high school:

> Because of my injury especially, it was very emotionally challenging to play the piano… um… some of my recollections are high level performance anxiety mostly because I didn't feel I had the control I wanted and that's because I was very tight physically. So because of that, I couldn't express what I wanted musically and I felt very insecure onstage, not to mention the fact that as the years progressed my injury got worse…I just found myself unable to express myself…so it became worse just being physically uncomfortable, emotionally uncomfortable, and just musically not there at all. (Abby)

Haddon succinctly described another challenge when a pianist begins experiencing a PRND—how to keep it a secret so that it will not jeopardize scholarships or professional engagements:

> Yeah, I mean I didn't have a choice and you dare not talk about it in conservatory. I mean I had a really loving and wonderful teacher but…I was like "they'll probably think I'm not good enough if I tell anyone" you know, and make a big deal of it. (Haddon)

One participant remembered the acute pain while performing, as well as the emotional trauma and the intense concern about the implications for her studies and her career:

> I'm trying to play loud….I'm holding my hand in an awkward position and there was…just very agonizing strong pain probably on the level of a six or a seven on a scale of one to ten and again the emotional attachment to that amount of pain, what it meant for my piano playing, for my career for my teaching and all of those things. (Clara)

Finally, an even darker side to the possible effects of PRNDs emerged from a survey respondent:

> I felt as if I were being punished for pursuing my love and passion. I felt imprisoned in my own body, not being able to express myself. I was envious of others practicing and playing in concerts while I was unable to play….Since music is the core of my soul, I felt that there was no purpose for me to live any longer. (Survey narrative)

Method as last hope. The code "last hope" had a positive correlation with the seven other codes with negative connotations. This might be because participants had experienced so much emotional devastation, depression, career and school jeopardy, and frustration that they perceived the Method, when they stumbled upon it, as a final desperate effort to successfully address their PRNDs.

As Zoe expressed it, "For the individual who is newly injured and lost, this [the Method] is a beacon of light." Another participant illustrated the relationship between being desperate for solutions and finding hope:

> I was injured about two years before I came and I had taken a year off from playing and I was desperate to find a way back to playing. I found out about [the Method]…and decided I wanted to study it 'cause I knew that was the only way back into playing. And it worked. (Simon)

Correlation charts. To take a more systematic look at each theme, one or two of the central codes from the theme were chosen, and the correlations of the other RQ1 codes with the central code were closely examined. Then five or six codes that had the strongest relationships with the central code were displayed in bar chart format. These other codes were from all RQ1 codes, not just Theme 1 codes. Figure 4 shows the five RQ1 codes that had the highest correlations with the "devastating experience" or "depressed because of injury" codes. The closer to +1, the higher the correlation between the two codes, or the more closely they were related. Therefore, "had disorder or injury"

was the code most highly correlated with the "devastating experience" code. Additionally, the latter code was also highly correlation with the "frustrated" code.

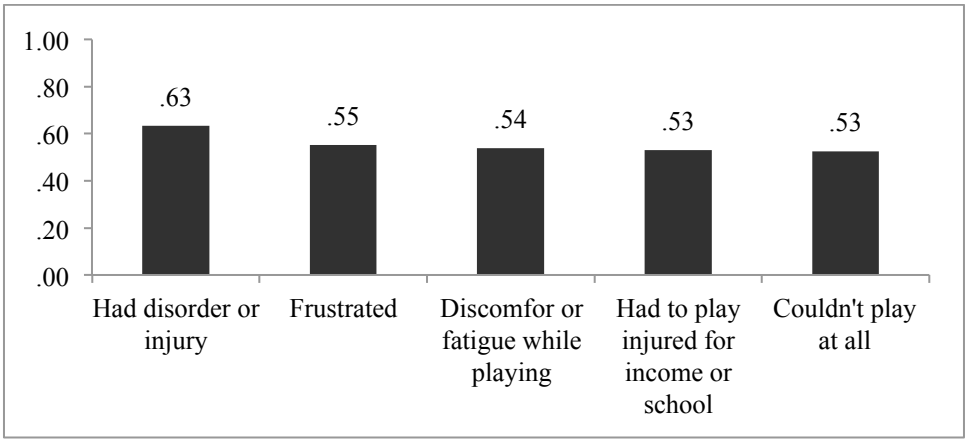

Figure 4. RQ1 Codes with Highest Correlations with "Devastating Experience "or "Depressed Because of Injury" Codes

Research Question No. 1: Theme 2 - Perceived Effectiveness of Medical and Other Treatments vs. the Method for PRNDs

Finding 2: *Of participants who had experienced PRNDs, when specifically asked, 54% reported traditional and complementary medical treatments to be somewhat helpful, while 35% reported that they were not helpful. Without being prompted or asked any specific question about these topics, 8% volunteered that they still experienced pain and discomfort, while 27% recommended the Method, 19% expressed deep gratitude for the Method, and 23% stated that playing without pain was a joy.*

Codes included the following: doctors and other treatments didn't help, playing without pain is joy, deep gratitude for the Method, recommend the Method, doctors and other treatment at least somewhat helpful, still have pain or discomfort. The correlations between the Theme 2 codes are displayed in Table 3. The correlation coefficients between these codes are relatively low compared to Theme 1. This could occur because

some codes were simply not closely correlated to other codes in the study. Such results might depend somewhat on the particular questions asked by the interviewer. For example, interviewees were not explicitly asked whether they would recommend the Method to other potential students. Some interviewees did bring up recommending the Method, but as it was not asked specifically, the placement of statements recommending the Method varied. Some may have brought it up in context of relieving PRNDs, but others may have brought it up in other contexts. According to Braun, often NVivo will place codes that are not as closely related to others into a cluster because, even though the correlation coefficients are not high, the codes do not closely fit into any other cluster (S. Braun, personal correspondence, February 16, 2015).

Table 3

Correlations Between Theme 2 Codes

	Still have pain	Recommend	Playing without pain	Others no help	Others some help
Recommend	.08				
Playing without pain	.22	.12			
Others no help	.15	.08	.29		
Others some help	.34	.13	.21	.33	
Deep gratitude	.11	.30	.12	.07	.11

Perception of medical support for PRNDs. A disproportionate amount of interview time was dedicated to participants expressing their frustrations regarding finding solutions for their disorders. Five categories were noticed:

1. Participants who believed their discomfort and pain were just "par for the course"
2. Participants who were unsure of the definition of PRNDs or injury, or denied that they had one, even though they went on to describe multiple symptoms

3. Participants who did their own research on the Internet and self-diagnosed their PRNDs

4. Participants who had received a successful medical diagnosis, but for which treatments only temporarily relieved symptoms

5. Participants who perceived that they had been diagnosed inaccurately and for which the only treatment was to discontinue playing

Clara, prior to retraining, fell into the first two categories, believing her muscle fatigue, or even pain, was not unusual:

> …I don't think anything else I was doing would have caused it, um, the first injury. I would really consider it an injury with the Beethoven sonata. The left arm, it was just tired…I would get fatigued. It never really hurt and I…that might be splitting hairs, but I never considered myself injured with that one. It just felt like I hit a wall and would have to change how I was playing just to try and get through it. But I never felt like I was injured. (Clara)

Prior to studying the Method, some participants had regarded playing-related fatigue and pain as normal and found their own solutions, such as taking more breaks:

> …as I would practice, the tension would get tighter and tighter until after a couple hours I would just kind of tuck my arm up and take it home and then the next day I wouldn't practice…and I would feel better and then the following day I would go back…and after two hours of practicing and playing I'd just like tuck my arm up and go home. I don't know why I continued to do it when it wasn't obviously working…(Phoebe)

In addition to taking more breaks, another solution was playing through the pain:

> I thought that if I trained my body to push through, I would be able to play for longer periods of time before having to take a break. *I would be very angry with myself* [emphasis added] if my fingers weren't moving as fast as I wanted them to and I hated that my shoulder ache would sometimes stop me from playing and I'd have to take a break. (Survey narrative)

Frustration mounted when even diagnoses and various medical and complementary treatments ultimately did not provide a solution, or even worsened the condition:

> I just really was getting to a point where I was like "you know I could probably just keep taking pain killers" because no doctor or acupuncturist, or massage therapist or chiropractor had really been able to pinpoint the problem other than to say "You should stop playing."…There was never a time where I could take…off

> to stop playing.…When I was in college I pinched my ulnar nerve…I went to the health center and they said, "Well you've go to go for a massage and take a break and not play for awhile." And that became my solution every other time I felt tension in my body from playing. I would stop for a little while and go have a massage. And I was like, there's got to be a better way, there must be a way to play that doesn't include all this tension. Then [the Method] came into my life. (Haddon)

> I didn't know I was hypermobile at the time….I knew I was flexible but I didn't know hypermobility was a bad thing. So I was getting chiropractic therapy which was harming me more than helping…medical care is not always the best thing if you don't have the best people. (Angus)

And sometimes, participants were confronted with conflicting treatment options:

> It was cortisone injections, splinting, rest, steroids, oral medication, pain medication. They would not let me go to a chiropractor. The hand surgeon that I saw told me he refused to treat me if I went to alternative medicine for help. At that point I didn't have the knowledge that I have now so I chose to stay with him. (Lucy)

Another complaint was that participants were treated with disrespect or condescension, or even accused of fabricating the condition:

> My family…sent me to doctors but the doctors really didn't know what to do. I think at one point I remember a doctor saying, "Maybe you don't really want to play the piano and this is a psychological, you know, thing that you've done to yourself." (Zoe)

Frustration was barely contained in one participant's assessment of the difficulty in getting an accurate diagnosis. He even felt compelled to diagnose his own condition:

> Well, diagnosis was quite difficult…with there being such a disconnect between music and medicine. First I was told I had carpal tunnel syndrome, which I did not have at all…it's the buzzword. Doctors will say carpal tunnel syndrome or tendonitis. The tendonitis was correct [but] it was part of a larger issue. I've struggled with some tennis elbow, but that's because the elbow is hypermobile. Most of my injury is likely caused…by upper body [nerve impingement…(Angus)

The overriding concern, however, among participants with PRNDs was that healthcare professionals would tell them they had to stop playing, which sometimes meant for good:

> … it never occurred to me to break down and go see a doctor, and part of that, especially the earlier injuries while I was in school, [was because] I didn't want anybody to tell me to rest or not play because I couldn't. I had to keep practicing because I had recitals and things I had to do, auditions and such…(Clara)

Gratitude for playing without pain. Not surprisingly, appreciation for the Method and recommending it were positively correlated. As interviewees were remembering their past negative experiences with PRNDs and pain, they frequently leapt to a more positive experience of being able to play pain-free after studying the Method, as well as to a feeling of gratitude for having found solutions:

> Now I'm like, most of the time I'm way happier than before…when you're in pain all the time it's just depressing. So I got out of pain and…I would say it changed my life. (Leo)

> I've been very fortunate to be pain free for close to thirty or twenty years or so now. And I thought that [the Method instructor's] help was invaluable. (Otto)

> …I am just so grateful that I had the opportunity to find out about it and then to study it and now to be able to teach it….It's been a wonderful gift to me and so I'm just so happy that I'm able to share it with others. (Lily)

Helpful treatments for PRNDs. Several participants did speak positively about their experiences with healthcare professionals, various treatments, and the ability to identify the condition:

> Yes, I met many, many different doctors, physical therapists, chiropractors. I went to see a neurosurgeon specialist. Well he told me I had a nerve entrapment in the elbow. And I did some massages, I went to see…a hand specialist. I did some cortisone shots. I have done basically everything in my life [laughs]…possible—Alexander Technique, Feldenkrais Technique, Reiki, I've done yoga… I mean everything. Yes, I think all of those treatments were helpful not only

> physiologically but also psychologically. It really helped me to just sometimes put a name, or just sometimes "I don't have this but I might have this." (Leo)

> I only got through…by having acupuncture every single week to counteract all of the tension that was building up. (Zoe)

> But I did physical therapy, I did Asian healing arts, I did Alexander Technique…a bit of cranial sacral therapy. (Aaron)

Persistence of pain. However, there seemed to be a positive correlation between somewhat helpful healthcare experiences and the persistence of pain and discomfort. In spite of a number of temporarily successful treatments to relieve pain and the disorder, for many it invariably returned: "The [treatments] made me feel good for the next… eight to twenty-four hours after the treatment but then when I went to play again, it [the pain] eventually came back." (Haddon)

Finally, not all responses were positive regarding the ability of the Method to eliminate pain and offer solutions to PRNDs. For one participant, studying the Method impacted his professional life negatively because he continued to have pain and discomfort after studying:

> I am disapointed [*sic*] that I still experience some discomfort while playing and that the instructor didn't seem to understand that I needed more hands-on and patient teaching instead of trying to push through the method exercises and feel pressure to perform for a jury….Consequently, it has negatively impacted my professional life. (Survey narrative)

Figure 5 shows the five other RQ1 codes most closely correlated with the "doctors couldn't help" code. The three highest correlations, not surprisingly, were injury-related codes. The fourth and fifth highest correlations, however, were codes related to the lack of support overall, as well as from teachers, for the injury or PRNDs.

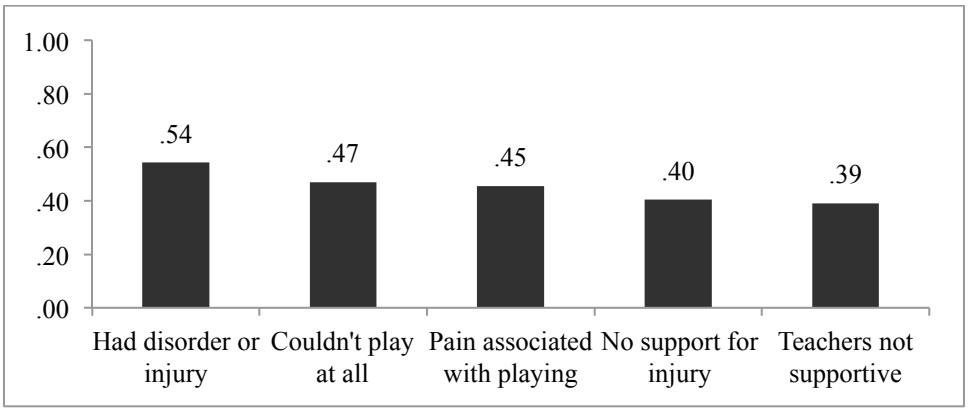

Figure 5. RQ1 Codes with Highest Correlations with "Doctors and Other Treatments Didn't Help" Code

Research Question No. 1: Theme 3 – Conflicting Perceptions of Method – Skepticism vs. Hope

Finding 3: *Of the 18 interview participants with PRNDs, 46% reported, without being asked specifically, that they had experienced skepticism about the Method from persons not studying the Method, and 31% reported a lack of support of the Method. However, when specifically asked whether they were playing again without injury, there was a positive correlation of 38% responding that they were playing again without injury, while 73% volunteered, without being asked a specific question, that the Method works, and 100% also volunteered that they had a general positive perception of the Method. However, when asked specifically what the response was from teachers, colleagues, friends, and family, 31% reported a negative response from outsiders, while 73% stated that friends and family were supportive. However, 50% reported a lack of support from their teachers. Additionally, without being asked, 77% of participants reported frustration with various aspects of retraining with the Method.*

Theme 3 of Research Question No. 1 pinpointed various types of external negative perceptions of the Method versus students' positive perceptions of the efficacy of the Method. Interviewees' primary response was frustration that the Method was little known and frequently misunderstood. Several interviewees who reported success with the Method in recovering from injury and in returning to playing, also reported skepticism from colleagues, friends, and fellow students regarding the Method.

The specific correlations between the Research Question No. 1, Theme 3 codes are shown in Table 4 and Table 5. Many of these codes were again, as with Theme 1, highly correlated with each other. In particular, there were very high (.90) correlations between "no support for injury" and "no support from teachers" codes. It would appear that interviewees believed that their teachers, more than others, were least supportive of their injuries and disorders.

Table 4

Correlations Between Theme 3 Codes

	Teachers, no support	Support from friends	Skeptical	Retraining	Positive perception	Playing again	Play, no injury
Support from friends	.52						
Skeptical	.49	.46					
Retraining	.56	.55	.58				
Positive perception	.44	.55	.54	.63			
Playing again	.46	.40	.39	.61	.52		
Play, no injury	.50	.43	.43	.62	.57	.67	
Didn't understand	.57	.50	.56	.60	.45	.41	.44
No support, injury	.90	.53	.42	.51	.39	.43	.46
Negative response	.47	.29	.55	.52	.37	.32	.39
Gives hope	.38	.33	.47	.44	.41	.40	.49
Lack of support	.36	.34	.61	.42	.34	.24	.30
It works	.54	.48	.61	.71	.66	.66	.70
Frustrated	.62	.54	.61	.74	.58	.54	.60
Helps with injury	.45	.47	.37	.49	.57	.50	.54

Table 5

Correlations Between Theme 3 Code, Continued

	Didn't understand	No support	Negative response	Gives hope	Lack of support	It works	Frustrated
No support, injury	.59						
Negative response	.54	.38					
Gives hope	.38	.36	.29				
Lack of support	.41	.30	.38	.41			
It works	.51	.46	.47	.49	.46		
Frustrated	.60	.58	.47	.44	.46	.69	
Helps with injury	.42	.44	.32	.36	.26	.53	.48

Method gives hope. Findings in Research Question No. 1, Theme 2 revealed a number of frustrations, and even anger, at the perceived confusing diagnoses and inadequate treatment options (rest, splints, cortisone injections, massage, and physical therapy) that only temporarily alleviated symptoms, and that did not lead to more permanent resolutions of the PRNDs. Consequently, when many participants almost serendipitously stumbled upon the Method, or took the weeklong intensive technique-training workshop, they finally felt hope that there were solutions. As Simon remembered, "I could see that there was hope. So for me it was just the hope factor being instilled inside of me…"

Given the sense of isolation and shame that often accompanied PRNDs, one pianist stated:

> …one of the things that's really significant about that week [of intensive retraining]…is finding out that there was a safe place to go and talk about your injuries. And there was a hopeful place….I think that one of the hardest things for injured musicians is to know that they're separate now from the rest of their peers. (Zoe)

Hope also came in the form of empowerment that resulted from acquiring knowledge and understanding. Zoe continued:

> So not only am I learning how to use myself everyday so that I don't have these recurring things, but more importantly, if I do have something happen, I don't feel

> like a sense of desperation….I know how to fix myself, which is really amazing. (Zoe)

Skepticism and lack of support for studying Method. As can be seen in the NVivo cluster diagram for Research Question No. 1, the third theme, beginning with the code "method gives hope," is also positively correlated with skepticism and lack of support for the Method, as well as "negative response to studying method" in close proximity. Paul believed that "…people's perception of what this is about, I think that's the scariest thing with this whole Method, to be honest." Clara underscored this concern, "…even still today, um, when I mention to someone that I train in the Method, I get the look of skepticism." This sentiment was further emphasized by Clara's European friend who was, "… extremely skeptical of it and [it was] almost but not quite hogwash or voodoo, but this idea that she's doing this weird thing that if you're not injured, you don't need." Rosalie's comment echoed these sentiments, "…most folks are usually skeptical when they hear, you know, 'method'….So a lot of my musician friends were pretty skeptical and they asked me a lot of questions about it." And Jake rounded out the skepticism on a more personal note regarding the Method's developer:

> I get there's a lot of misconception from colleagues as to what it is she actually does, what the Method is. So I find that people come at me sometimes like, "Oh, are you studying with that kooky woman?" or whatever….The proof is in the pudding, I suppose, right? (Jake)

Skepticism and distrust of the notion of a method, and this Method in particular, influenced some pianists and organists negatively, at least in the beginning of training. This was compounded by their having to do an "innovative thing," as Paul called it, that required them to return to fundamentals temporarily, even as they had to maintain playing jobs. He also felt "a little separated from people" while he was retraining, in part because of the mental discipline and time required to eliminate old habits and acquire new ones.

Teachers and former teachers were also highly distrustful of the Method. “I didn’t actually have any support from my teacher. He thought it was crazy,” remembers Randall.

Finally, distrust of the Method by one healthcare professional bordered on fear of what it might do to one pianist’s musicality. Sylvia recounted her healthcare professional exclaiming, “‘Oh, no, you shouldn’t do that [the Method]!’...But I think he was meaning that I wouldn’t be able to express myself in the same way, which surprised me coming from him, to be honest…”

The Method “works”. However, even as participants recounted their and others’ skepticism and used descriptive adjectives such as “crazy,” “harmful,” and “kooky,” they also began to describe their perceptions of how the Method had affected their lives and careers. Aaron expressed his own response to studying the Method, “…I’m hugely grateful to [the instructor] because I don’t think I would have been able to be a performing pianist again…it gave me back my playing. That’s huge.”

Lily described an experience with a fellow student of the Method:

> There’s one woman that I started the [Certificate] Program with and she could hardly play anything because she’d been in so much pain for several years and… she was afraid that if she tried, she’d be back in her pain cycle…[but] she was able to retrain her brain and free her body and free her, uh, musicality….Hearing the pieces on her…recital was…such a profound experience because she was free at the keyboard, she made beautiful music interpretively….I’m almost in tears every time I see her and hear her play now because it’s such a transformation. (Lily)

Other responses were more pragmatic. Simon stated that “…using the concepts that [the instructor] taught me and consulting with her along the way has actually enabled me…to get back into playing, which then meant that I could work.” Statements regarding the Method’s efficacy were also found in the narrative sections of the survey. Returning

to a playing career was a recurring theme, "…the Method has allowed me to continue my career and not be forced to give up playing due to injuries" and "I could not be playing at all without the…Method. I am gainfully employed as a professional musician." And finally, one participant expressed almost incredulity, "The fact that I can play the piano again after my completely debilitating injury is enough to [call the instructor] a genius…"

Regarding perceptions related to whether the Method works, Ben explained, "…there's no consensus in the piano world about technique, so I learned pretty much everything from [the Method]." What Ben learned, in part, might be expressed in his description of the technical model that the Method trains, "It's that this is the most biomechanically efficient way of playing." And Craig summarized it thus, "I think it's a beautiful marriage between all of those things…basically…the Method teaches you a very efficient, natural, biomechanically sound way to play the piano."

Haddon, who had experienced a PRND, also liked the scientific components in the Method, as well as other aspects that were somewhat contradictory, "There's nothing about the technique I would change. I think it's brilliant and it's all based on science and… analysis. You can't really argue with science." Jake liked the Method simply, "Because it works…" Recovering from injury and regaining one's ability to play again—and play even more challenging pieces—perhaps led some participants to a somewhat hyperbolic view of the Method's effectiveness. Randall claimed that "There isn't a piece that I can think of right now that I could say, 'Oh, I can never play that!'" And Ted echoed that perception, "…with [the] Method, you can play anything you want." Finally, two survey respondents summed up their responses to the Method with statements such

as, “It truly saved my career. I hope it becomes mainstream!” and “This is a revolutionary technique that will be discussed…for centuries to come.”

Perhaps more to the point was a statement in the survey narrative that encapsulated why the participant thought the Method worked:

> For me, the Method simplified and presented piano technique in the most practical light possible. It met and exceeded my expectations. A sound piano technique is now a skill set that I can finally not only comprehend but actually experience. What certain great masters of the Golden Age sought to lay out in writing, the Method demystifies, communicating with clarity and accuracy. (Survey narrative)

Method’s efficacy in recovering from PRNDs. A number of interviewees described in more concrete, practical terms what effect the Method had had on their PRNDs. Angus reported that the Method and its technique:

> …got me out of my injury…[enabling me] to manage those bad days… I feel more confident, but physically I don’t hurt as much, which is so important. I can practice for a long time and not feel the consequences of it. (Angus)

Adam stated that the Method “…really helped me to back out of the vast majority of my playing-related problems….I now have a way of playing that frees me from physical discomfort ninety percent of the time.” Otto reported that, “It’s obviously proven to work because I have yet to hear anybody who’s had a failure or been not happy with it.” Given the mixed results of this study, such a statement demonstrates why anecdotal experience must be combined with rigorous investigation of any method. But Otto continued, “I would definitely give it a 99.9 % chance of being something extremely positive for anybody who has a problem or wants to improve their playing.”

Frustration with retraining and lack of support. As noted earlier, interviewees’ reactions to studying the Method itself, as opposed to the actual results of studying, were often complex. One of the primary frustrations—although students were explained the

neuropedagogical rationale for it—was having to return to fundamentals of coordination and body awareness, in a step-wise progression, incrementally acquiring control and coordination from the simplest to the most complex motor skills. As Aaron explained, "…for somebody who is at the highest level of playing, it's very humbling to have to go back and very, very, very frustrating." Abby expressed it in another way, "…it does take a lot of patience because…you start from the ground up no matter how many times you've played big pieces….It was frustrating to have to realize that it does take time to redevelop a new neuromuscular program…"

Moreover, although participants frequently expressed satisfaction with the outcome of studying the Method, certain aspects were especially challenging. Haddon commented, "I think I got frustrated with the pacing because [the instructor] wouldn't let me go on until I had actually mastered it." Another challenge, along with having to return to foundational coordination, was having to stop practicing higher levels of repertory for a while and focus on step-by-step retraining:

> …when I really started retraining, I stopped all learning of lit [*sic*] and worked on strictly retraining....And I think that is why only people who are seriously injured will do it because of the work it takes to retrain. I know that [the instructor] feels you have to always go back to the beginning, she doesn't like to just do quick fixes….I think that that's the best way, but it's not always possible for people to do that. (Angus)

Occasionally, however, participants did report that they had support during their experience with PRNDs. Simon acknowledged, "I had a lot of support from family, and friends, and colleagues, especially when I could no longer really do anything. It got that bad." But inevitably, complaints of lack of support for the injury, especially from their piano or organ teachers, surfaced again. Participants had usually turned first to their own teachers for help with PRNDs. However, while most teachers expressed concern, the

response from their teachers was often as Angus described, “They don’t understand….If you mention to a teacher even that you are having injury, they don’t know what to tell you.” Abby repeated that theme, and commented on her perception of teachers’ resistance to any “method” for retraining PRNDs, “When I was not diagnosed but…was complaining of discomfort, my main [piano] professor…was adverse to the idea of any kind of methodology that might help you retrain.” Haddon’s experiences with teachers and PRNDs were slightly different:

> She was sort of helpful because she had said, ”Well, I’ve had injuries as well.” But there wasn't really a lot of discussion about how I could change my playing to make the pain not be there…which I think is pretty typical of teachers. I think they just don’t know how to correct it…(Haddon)

Otto received other advice from teachers:

> A lot of the times… teachers will tell you, “Just rest, go see a doctor, go see a physical therapist.” I found this could have been better addressed by targeting the actual way of playing…finding a solution instead of a fix…(Otto)

Clara perceived that the student was somehow to blame for the injury:

> The impression I got from the teacher was that this was a negative, bad thing on the part of the student. Not quite her fault but sort of was. And so to bring an injury to a teacher—no, no, no, no, no! I’ll deal with this on my own. (Clara)

Finally, in Research Question No. 1, Theme 3, the closest correlations with two of the important codes were examined, namely “no support for injury” and “it works.” The five highest correlations with “no support for injury” are shown in Figure 6 while the five codes most highly correlated with “it works” are shown in Figure 7. Again, there was a strong relationship between “no support for injury” and “teachers not supportive.” The code “frustration” was also highly correlated with “no support for injury.” “Frustration” was also highly correlated with “it works”. Frustration likely arose in the retraining process because of the time and patience required, as discussed in RQ5.

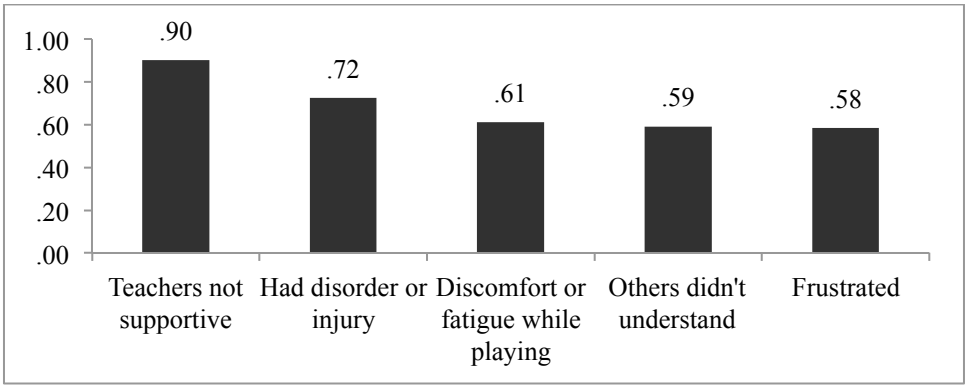

Figure 6. RQ1 Codes with Highest Correlations with "No Support for Injury" Code

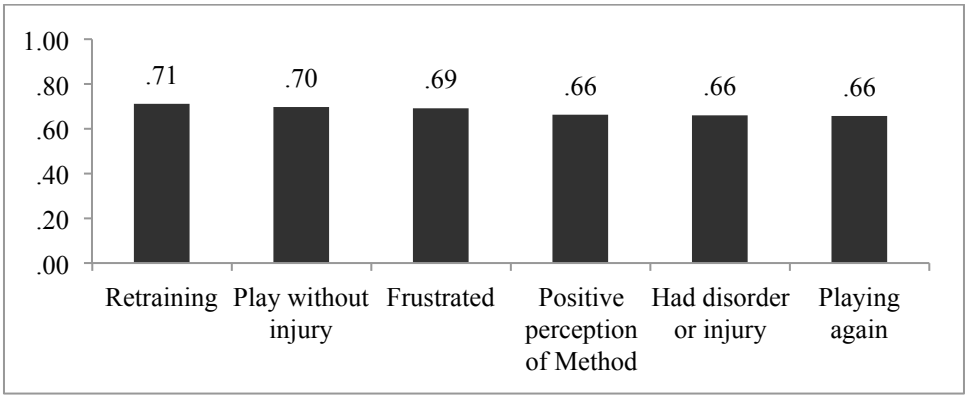

Figure 7. RQ1 Codes with Highest Correlations with "It Works" Code

Theme Coverage. Not all interview participants discussed all themes equally. Table 6 shows the percentage of coverage of each theme by each study participant. This table also shows whether any interviewees had a disproportionately large or disproportionately small influence on any of the themes. If a theme was discussed equally by each interviewee, each percentage would be approximately 3.7% or each participant (plus the survey qualitative portion) covered 1/27 of the theme. Percentages significantly higher than 3.7% indicated that the interviewee spent more time discussing the theme than other participants. Percentages under 3.7% indicated that the interviewee spent a disproportionately smaller amount of time discussing the theme topic. Jacob, Jake, and Ted, for example, each covered 0% of Theme 1. These interviewees were not injured and therefore did not discuss any of the theme topics. Zoe, Leo, and Angus, on the other hand, spent more time discussing the Theme 1 topics than other interviewees. Angus and Haddon spent more time discussing the Theme 2 code topics, while Zoe and the qualitative portion of the survey were most concerned with the Theme 3 topics.

Table 6

Percentage of Theme Covered by Each Interviewee, RQ1

Pseudonym	Theme 1	Theme 2	Theme 3
Aaron	4.66%	0.85%	2.98%
Abby	7.31%	5.01%	6.24%
Adam	0.76%	1.79%	3.27%
Angus	10.05%	11.02%	6.42%
Ben	2.66%	0.77%	3.75%
Calvin	0.12%	0.34%	2.71%
Clara	6.11%	1.76%	5.64%
Craig	0.58%	2.53%	2.2%
Haddon	5.93%	11.76%	6.15%
Isabelle	0.19%	0%	1.76%
Jacob	0%	1.22%	0.87%
Jake	0%	0%	1.41%
Leah	0.71%	0.94%	1.6%
Leo	10.14%	8.54%	5.83%
Lily	1.83%	1.74%	4.23%
Lucy	4.41%	5.18%	3.5%
Otto	2.63%	7.06%	1.74%
Paul	2.08%	0%	4%
Phoebe	4.29%	1.51%	2.92%
Randall	6.56%	8.82%	3.95%
Rosalie	0.91%	0%	1.24%
Simon	2.33%	1.14%	2.86%
Sylvia	4.46%	9.71%	5.31%
Ted	0%	0%	2.13%
Tess	0.95%	0%	0.79%
Zoe	11.14%	9.17%	8.15%
Survey Qualitative Answers	9.19%	9.14%	8.34%

Summary of Research Question No. 1 Findings

As the cluster diagram illustrates, the three themes that emerged from questions related to Research Question No. 1 indicated a number of conflicting patterns. For the 18 out of 26 interview participants who had experienced some sort of PRNDs, more than half had had to discontinue playing for a while. Many expressed difficulty in finding an accurate diagnosis and effective treatment and often cited those frustrations as reasons to

view the Method as a last hope for recovery and a return to playing. Interviewees' desperation at losing their ability to play without pain, as well as their perceived lack of support, especially from their teachers, often led to depression. This sense of hopelessness might have accounted for their trying a method of which they and others were admittedly skeptical. However, after studying the Method, perceptions of the Method's effectiveness were largely positive and many participants perceived that it worked in helping them recover from their PRNDs and return to playing.

Research Question No. 2

How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in preventing recurrence of those disorders?

The Method was designed not only to help pianists and organists recover from playing-related neuromusculoskeletal disorders, it also sought to equip students with sufficient knowledge to prevent recurrence of PRNDs. Embedded in the training were numerous components that were intended to help students acquire that knowledge. Research Question No. 2 attempted to ascertain participants' perceptions of their own ability to prevent PRNDs. An NVivo cluster analysis of interview questions related to Research Question No. 2 is illustrated below in Figure 8:

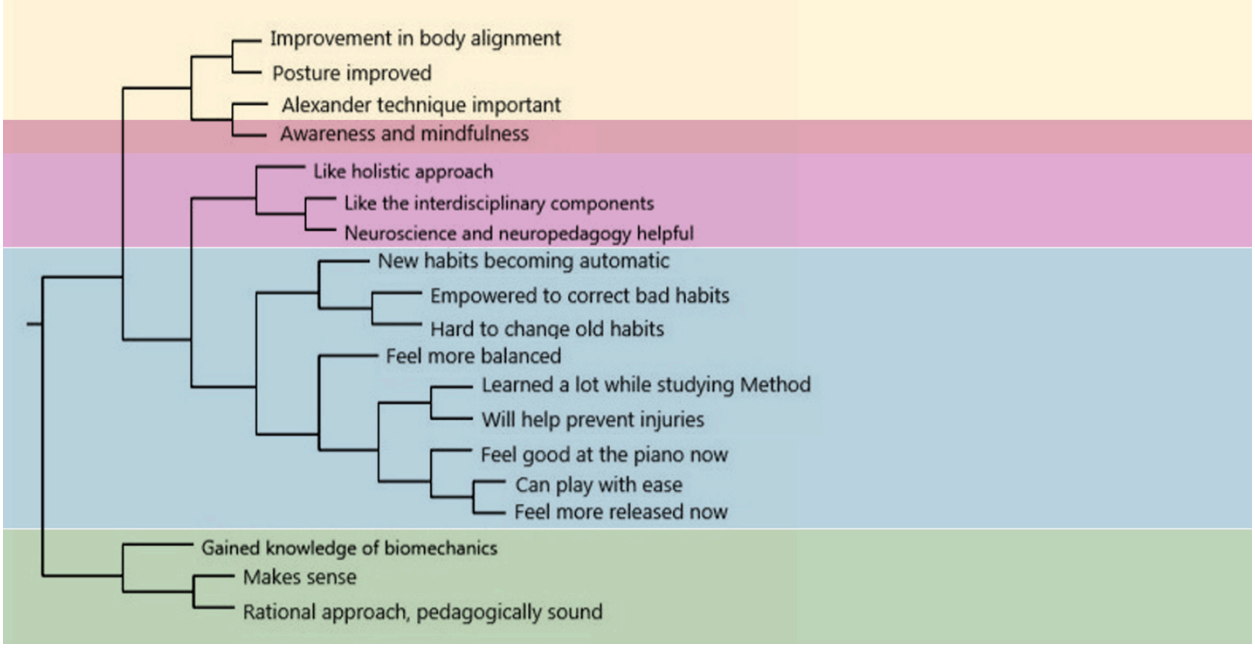

Figure 8. Cluster Diagram Using Codes Related to Research Question 2.

Four themes emerged from the NVivo Cluster Diagram. They were:

Theme 4 – Role of the Alexander Technique in the Method
Theme 5 – Interdisciplinary, holistic approach to technique
Theme 6 – Effectiveness of the Method in preventing recurrence of PRNDs
Theme 7 – Rational, biomechanically-informed approach to technique

Research Question No. 2: Theme 4 – Role of the Alexander Technique in the Method

Finding 4: *When asked specifically how they viewed the Alexander Technique as part of training in the Method, all participants (100%) reported they perceived the Alexander Technique as important. They then volunteered, without prompting, that it helped them cultivate better body alignment (58%) and better posture (50%). All participants (100%), without being prompted in any way, reported that the Alexander Technique had enhanced their kinesthetic awareness and mindfulness.*

Theme 4 included the following codes: improvement in body alignment, posture improved, Alexander Technique important, awareness and mindfulness. The correlations between the codes that comprised Theme 4 are shown in Table 7. All of these codes are high, or over .60. This result is not surprising since these codes are all related to awareness, body alignment, and the Alexander Technique—all of which are intertwined.

Table 7

Theme 4 Correlations

	Posture improved	Improvement in body alignment	Awareness and mindfulness
Improvement in body alignment	.83		
Awareness and mindfulness	.68	.75	
Alexander Technique important	.69	.80	.75

Alexander Technique important. One finding to emerge in Theme 4 was the importance (100%) of the Alexander Technique instruction in successful training in the Method. Indeed, many participants viewed it as inseparable or inextricably linked to the Method. The majority of interviewees reported that the Method would not have been as effective without concurrent Alexander Technique instruction, since the very foundation of the whole-body technique taught by the Method was built upon principles of the Alexander Technique.

Abby summarized the relationship between the Alexander Technique and success in training in the Method:

> …the Method is so much about kinesthetic awareness—listening to your body, sensing your muscles and how your muscles are doing….Alexander [Technique] ties right in with that because [it] is all about just tuning in and really helping the body to release any unnecessary tension….So the two go hand in hand. I don't see how I would have gotten through the basics of the Method without the Alexander Technique actually. (Abby)

Underscoring this line of thinking was Clara's statement that the Alexander Technique "…is absolutely integral, that you can't learn about the Method without learning Alexander Technique, that you need both actually for it to really work, and the principles of the Alexander Technique are very much a major part of the Method." Craig gave further justification for the inclusion of a certified Alexander Technique instructor in the Method:

> Those two hitting me at the same time was just like the perfect marriage because…she's [the instructor] not licensed and trained in being able to give you that sensation [of arms supported by torso muscles] so having an Alexander Technique instructor on staff…is a key to success…(Craig)

Isabelle not only echoed most participants' opinion that the Alexander Technique was necessary for the success of the Method, but that it also contributed to building another essential component of the Method for recovering from and preventing PRNDs—self-awareness. This affirmed the positive correlation in the cluster diagram of Alexander Technique and greater awareness. Isabelle stated that for the Method, "to be its fullest effectiveness, it's almost necessary for the Alexander Technique—not just for the body alignment—for the depth of the self-awareness that comes with it...I think the two combined really maximize that." Lucy even credited this same awareness in helping change harmful habits:

> …the biggest eye opener for me was the development of whole body awareness through [the Method] whole-body scan that [the Method's developer] does in the beginning, and also through the Alexander Technique…that's the first major step, and probably the first major breakthrough that I had, in terms of starting to break down all the bad habits that I had developed. (Lucy)

However, while all of participants acknowledged the importance of the Alexander Technique, a few disagreed with the idea of it being inseparable from the Method. As Ben expressed it, "…I'm glad that I studied it…it was definitely useful [but] I think its

importance in the program is a little overstated." It may be that participants who had experienced PRNDs were more likely to appreciate the Alexander Technique in retraining. However, Calvin, who had never experienced a PRND, while valuing the Alexander Technique, believed the Method itself was essential to learning to play:

> Alexander, I would say, could really change the way you go about in the world, but [the] Method in particular, um, easily for me has changed how I approach the instrument, and it's in conjunction with the Alexander Technique. But the Method…takes that even further because it's specifically for the piano or the organ. (Calvin)

Jacob took a slightly different viewpoint of the perception of the Alexander Technique by the music and medical fields, "I really think Alexander was extraordinarily smart…so I guess in lieu of opposition both from musicians and from physicians, I think it's made its way and, um, I think it's all to the good." Most interviewees, however, seemed to reflect Angus's thoughts, "…the Alexander Technique is invaluable for sort of resetting the postural, maladaptive habits that develop as we age…In a word, it was life-changing." Due to the positive response to the Alexander Technique, its code was examined in more detail to determine which of the other RQ2 codes were most closely related to it. Figure 9 shows those closely correlated codes. As can be seen, body alignment was the most affected by the Alexander Technique.

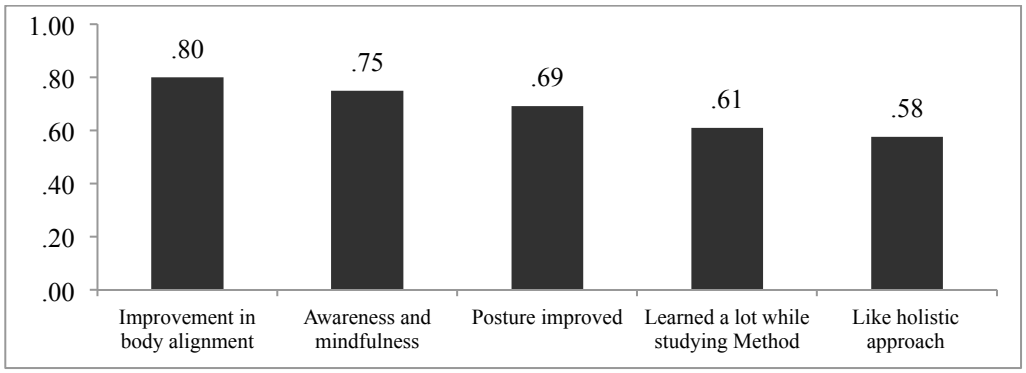

Figure 9. RQ2 Codes with Highest Correlations with "Alexander Technique Important" Code

Research Question No. 2: Theme 5 – Interdisciplinary, Holistic Approach to Technique

Finding 5*: Participants asked how they perceived various aspects of the Method, including the interdisciplinary components. However, they were responding from a list of various components the interviewer mentioned to them. Because they began speaking often before the entire list was read, their responses reflected unprompted responses. A majority of the participants liked the interdisciplinary (65%) aspect of the Method, mentioning neuroscience in particular, while a smaller number (35%) reported the neuropedagogy components to be particularly important. Some participants (26%) also volunteered their approval of the Method's holistic approach.*

Theme 5 included the following codes: awareness and mindfulness, like holistic approach, like the interdisciplinary components, neuroscience and neuropedagogy helpful. The specific correlations between the Theme 5 codes are shown in Table 8. As in Theme 4, these codes are all highly correlated with each other. Note that "awareness and

mindfulness" are highly correlated with the Theme 5 codes as well as with the Theme 4 codes. The reasoning behind the inclusion of the code in both themes is explained below.

Table 8

Theme 5 Correlations

	Neuroscience and neuropedagogy helpful	Like interdisciplinary components	Like holistic approach
Like interdisciplinary components	.81		
Like holistic approach	.57	.71	
Awareness	.56	.66	.71

Awareness and mindfulness. These codes were also included in Theme 5 because "awareness" here referred not only to kinesthetic awareness of the body but to attentiveness or "mindfulness" of oneself, of others, and of one's total environment. Lucy noted what she had learned about awareness in a broader context, "…increased self-awareness, increased perception of how we may be perceived by other people because we're more aware of ourselves…and interacting with people." Phoebe expressed her acquired mindfulness in another way, "I've learned a lot through the Method about being in the moment and also being present in my body and being aware of the different parts of my brain and…using it."

Interdisciplinary approach. Some interviewees reacted positively to the unique interdisciplinary nature of the Method that incorporated knowledge from movement science, sports pedagogy, neuroscience, neuropedagogy, educational psychology, mindfulness training, embodied cognition, and transformative learning. As Leo explained, "But what this Method is doing is giving you tools to just think about what you're doing….[The Method's developer is] talking psychology, biomechanics, musicality, holistic methods. It's really the whole package…" Tess reacted favorably to

the high level of cognitive skills required: “I really like… the analytical thinking, the precise language, the medical terms, everything—because to my knowledge no other pianists have such a detailed and really scientific language.” One participant who had experienced PRNDs felt empowered to communicate better with doctors because of the interdisciplinary components of the Method:

> And then the medical side of it....We actually had quite a few things that we had to study—terminology—so that we could at least speak appropriately to be able to describe what was happening to a physician. I learned many things…where things were and what tests were often given so I would know what a physician was talking about. (Simon)

Calvin, who had never experienced a PRND, spoke of the scientific components in the Certificate Program courses as being challenging but ultimately helpful:

> They were phenomenal courses, but for me they were very intense….But it was all so comforting to always see how it connected. There was always a direct correlation between what [the instructor] was doing and the reasoning behind it…(Calvin)

Some believed that its very multifaceted nature, however, made it challenging to explain the Method to outsiders:

> It’s really hard to define what it is…so I think, again, if we could get kind of an umbrella term like where does this thing fit in, and how do you come up with a new language to talk about it that makes sense to people who are kind of on the outside. (Zoe)

But for a previously injured pianist, scientifically-informed course content had changed her pedagogical approach:

> …if nothing else, it gave a lot of knowledge with the breadth of injury that occurs with pianists, how often pianists are injured. And in my own teaching I’ve been able to use a lot of those statistics and a lot of knowledge that we’ve gained from the performing arts medicine articles…What [the] Method really does is objectively try to bring together all of the best of the research and pull it together and present it [to] students in a very systematic way…(Clara)

Neuroscience and neuropedagogy. Participants seemed consistently drawn to neuroscience, and neuropedagogy in particular. One interviewee described her discovery of neuroplasticity and observational learning while studying the Method:

> …but once we started the course and had the [neuroscientific] readings and learned about the plasticity [of the brain], it just opened my mind to a whole other avenue of understanding to why this Method…takes a long time to learn…I am still in awe of how one can learn just being very watchful…(Lily)

Angus reported how studying neuropedagogy had altered his perspective of teaching, "…but specifically neuropedagogy, understanding how the brain takes in information, completely changed my view of how to teach, how to present information in a compelling way." Paul was especially enthusiastic about the neuroscience components, "Knowing about the brain and how it learns, that's like probably at the top of the list in my opinion." And Clara, a self-proclaimed skeptic, commented:

> …the exploration…of neuroscience and neuropedagogy I personally found to be very, very helpful in understanding the Method and why it worked. And that's me coming from the scientist point of view and the skeptic that I am and wanting to see facts and data and observation. And it's not just what you see. It's trying to do what you think it is. But here are facts for why it is working. And so exploring the neuropedagogy evidence and how the brain learns, and how the brain reacts itself, and how we can retrain not only our muscles but also our brain and our neural pathways—and it is all interconnected. And I think that is extremely beneficial to understanding how the Method works. (Clara)

Finally, Paul described how learning was not always easy, "One of the things I really like about [the] program—that I at the same time sometimes hated because it cost so much reading—[it] was really good with the neuroscience and neuropedagogy."

Holistic approach. Several participants commented on how the holistic approach—viewing technique as a function of the entire body directed by the brain, incorporating knowledge from other disciplines, and viewing the totality of each individual student—was what made the Method unique. Randall stated, "All of that

knowledge is what sets [the] Method apart …[others] put a lot of emphasis on playing the piano, but they don't talk about the whole body. [This] approach is so holistic. You take care of the whole body." Ted echoed Randall's observation, "…but you use more of a—what's that word for it? A *holistic* [emphasis added] approach with the whole body and you get a tone that's beautiful…" And Zoe commented, "That's why I'm saying the holistic approach is very, very powerful." However, Zoe also admitted to an initial challenge:

> …there's a little bit of a hump to get over that this is a very different approach. It's…a holistic approach that covers multiple thought processes. But once you get there, there's an immediate impact. You can feel exactly what you're doing at the keyboard…what may be right and what may be…contributing to your pain. (Zoe)

Because of the interesting nature of the "awareness and mindfulness" code and its inclusion in two themes, this particular code was examined in more detail. The six RQ2 codes that were most closely correlated with "awareness and mindfulness" are shown in Figure 10. The codes included in the chart all have very high correlations with the "awareness and mindfulness" code and are mainly a combination of the Theme 4 and Theme 5 codes, again proving that the overlapping of the code made sense.

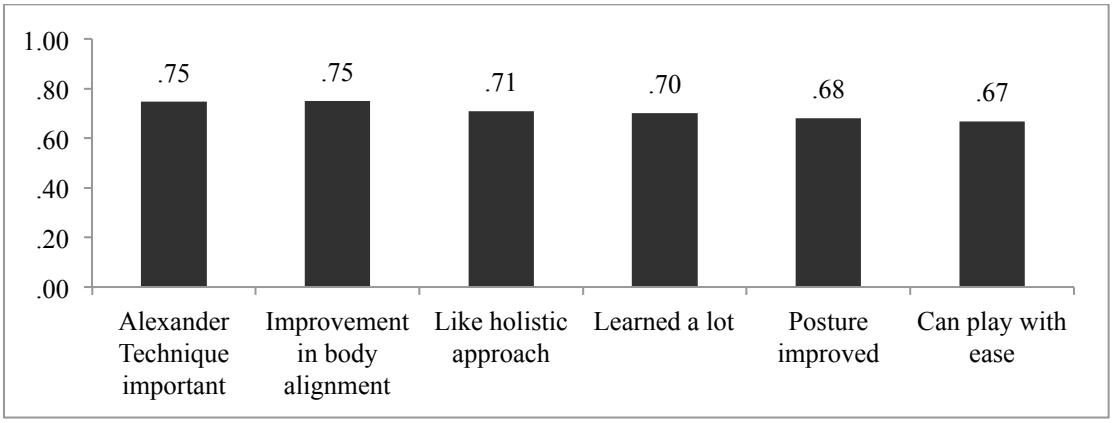

Figure 10. RQ2 Codes with Highest Correlations with "Awareness and Mindfulness" Code

Research Question No. 2: Theme 6 – Effectiveness of Method in Preventing Recurrence of PRNDs

Finding 6: *When asked specifically whether they felt they could successfully prevent injuries from recurring after studying the Method, 65% of the participants felt that they could successfully prevent injuries. And when asked whether their new habits were becoming more automatic, 69% reported that they were. Likewise, when asked directly whether they had difficulty changing old habits, 88% responded affirmatively and most participants (85%) were aware when they were reverting to old habits and felt empowered to overcome those habits. A few (27%) interviewees volunteered that they felt more balanced, and even more reported, without prompting, feeling more released (54%). When asked specifically how they felt at the keyboard, a majority (81%) reported that they could play with more ease at the keyboard. And a number of participants (62%) volunteered without being asked that they had learned a lot while studying the Method.*

Theme 6 included the following codes: new habits becoming automatic, empowered to correct bad habits, hard to change old habits, feel more balanced, learned a lot while studying Method, will help prevent injuries, can play with ease, feel more released now. Table 9 shows the correlations between these codes. It is interesting to not that although many of these correlations are not as high as the correlations between the Theme 4 and Theme 5 codes, they are .40 or higher.

Table 9

Theme 6 Correlations

	Will help prevent injuries	New habits becoming automatic	Learned a lot while studying Method	Hard to change old habits	Feel more released now	Feel more balanced	Feel good at the piano now	Empowered to correct bad habits
New habits becoming automatic	.48							
Learned a lot while studying Method	.67	.53						
Hard to change old habits	.50	.52	.44					
Feel more released now	.53	.48	.57	.44				
Feel more balanced	.44	.40	.49	.41	.48			
Feel good at the piano now	.54	.42	.59	.41	.66	.44		
Empowered to correct bad habits	.54	.54	.58	.56	.48	.45	.49	
Can play with ease	.61	.51	.65	.47	.79	.50	.76	.55

Challenges of neuromuscular reprogramming. This particular part of the cluster diagram flowed organically from the previous findings in Theme 5 regarding participants' responses to components of neuroscience and neuropedagogy. Theme 6 addressed how participants perceived "neuromuscular reprogramming," the process of changing from old habits (which were less biomechanically efficient) to new habits, or in neurological terms, the process of forming new neural pathways and connections in the primary motor cortex. This process, a central part of the Method's pedagogical philosophy, may be loosely divided into the following stages:

> **Stage 1** - Old patterns throughout the whole body of inefficient muscle use and inoptimal alignment are identified through cultivation of both cognitive and kinesthetic awareness.
>
> **Stage 2** - New, more biomechanically efficient patterns (neural pathways) of coordination are developed in a step-wise manner, in increasing complexity, through continual conscious awareness and control.
>
> **Stage 3** – New patterns (habits) of body use become more automatic in the brain.
>
> **Stage 4** – External stressors (insufficient preparation time, high-pressure performance venue, lack of sleep, etc.), if new habits are not fully automatic, can cause a temporary reversion to old, less efficient, patterns of body use.

> **Stage 5** – Old patterns are identified more quickly and student consciously shifts to new "neuromuscular program."

It was these stages to which students were referring in the interviews and survey narratives when they responded to questions about the process of learning and retaining the biomechanical and neuromuscular principles taught by the Method.

Empowered to create new habits, but old ones sometimes return. Participants' responses to this stage of training frequently vacillated between their feeling of empowerment to change old habits and the ongoing difficulties in doing so. Lucy echoed other participants' belief about the importance of cultivating conscious awareness of the whole body:

> The biggest eye-opener for me was the development of whole body awareness...And that's the first major step—and probably the first major breakthrough that I had—in terms of starting to break down all of the bad habits that I had developed. (Lucy)

However, many participants commented on the need for mental discipline in developing conscious awareness of inefficient body use patterns and acquiring new patterns. Sylvia elucidated the cost versus the benefits of the reprogramming process:

> It's mentally demanding to retrain when you've been especially…doing something for a long time. To learn how to redo it is mentally tough and *takes a lot of mental discipline* [emphasis added]. But it's all beneficial, it's all necessary if you really want to do it [retrain]. (Sylvia)

Clara put it succinctly, "I'm really having to consciously think about, OK, how do I want to use my musculoskeletal structure for this?" Or as Haddon expressed it, "You suddenly start watching yourself more and more carefully…" However, Leo took his cultivation of awareness even further to correct inefficient body use patterns in general:

> I didn't just change the way I play the piano, *I changed every movement in my life* [emphasis added]; the way I tie my shoes, the way I walk. I mean I started to think about every movement—It just gave me really important knowledge of what it means to move…(Leo)

Changing habits of any kind is difficult, but changing neuromuscular patterns that have been engrained over thousands of hours of practicing is time-consuming and fraught with temporary obstacles. As Tess explained, "It takes awhile. You have your setbacks and the old program comes creeping in…" Abby described the process in another way, "…there's always the process of actually downloading that program that does take time." Lucy viewed the old habits as constantly threatening to return, "The old neuromuscular program just wants to keep coming back. You have to always be vigilant…all of those things…need to be practiced I think consistently…to keep those old habits from creeping back in." However, one survey participant described the cost-benefit factor in a more optimistic light, "I'm confident about the direction I am moving in. The occasional lapse of concentration that results in symptoms returning is discouraging when it happens, even though I know why they are happening and how to get out of them."

Rosalie spoke of her disappointment when old, inefficient patterns returned, even after she thought the new coordinations were automatic. Her initial fear was that she "would always have to lean on her [the instructor] as a crutch." However, Rosalie finally realized that, "…[the instructor] gives me this information and you can either choose to really be aware of it or not." She concluded, "...but I am really comforted by the fact I have these really good principles that I have memorized and that I can focus on and use in everything I do." As Leo summarized the training, "It's the beginning of a long journey. And it's taught with the basics—and the basics are really huge."

Learned a lot while studying the Method. The NVivo cluster diagram revealed participants' perception that they had acquired a considerable amount of knowledge from studying the Method that would help them prevent a recurrence of a PRND. Much of

what they reported to have learned from studying the Method has already been noted in findings under Themes 4 and 5 of Research Question No. 2. These included awareness of the body and how it functions optimally through interdisciplinary components in the Method such as neuroscience and neuropedagogy, and principles of the Alexander Technique. Additionally, in a report of findings for Research Question No. 3 and No. 4, additional perceptions will be brought to light.

Self-empowerment emerged as a common theme. Some participants felt they had acquired tools to empower them to solve technical problems and play more advanced literature with ease, and to recovery from injury and to avoid injury. As Phoebe pointed out, "Certainly all the pain and discomfort has become much, much better…I've gained a lot of technical skills and knowledge and I play literature that's far more advanced than I did before."

Interdisciplinary knowledge was credited by some participants as being particularly helpful. Sylvia notes that, "I don't know that I've ever heard of performing arts medicine before, and so that was nice to open up some of those avenues." A survey respondent commented on how her teaching had improved, "I learned a lot. I was greatly helped in my infirmity. I am now a better teacher and I am able to help students with keyboard injury." Abby, on the other hand, seemed interested not only in the aforementioned tools, but in acquiring character traits that helped her learn:

> It's a lot of good tools...and patience…hard work. There's all those things that come into learning anything from the ground up and say ok, I did a lot of that before. I can take the time and go back and then just build up again and again… (Abby)

Preventing injuries. Regarding whether the Method helped the participants avoid or prevent recurrence of playing-related injury, Clara stated, "…as far as avoiding injury,

I really do feel like I've learned quite a bit from the Method and that I do have the tools to avoid injury." And Abby reported, "I have gained a lot which I think will really help safeguard me, um, from injury." However, she continued with a cautionary note, "…what I would say though, as I get into…harder repertoire, is where I still want to continue learning it [the Method] and just really downloading all the steps because, otherwise, if I'm not careful, I could get reinjured." Sylvia described in detail what resources she had acquired and what she had learned regarding injury-prevention:

> Yeah, I definitely feel that that's one of the biggest things I have is preventative, in having a really great knowledge base to…help me sort out either technical issues, or things as they relate to musicality…I'm much better equipped to know how to deal with them, where to go, what to do.... (Sylvia)

Leah expressed confidence that she had, "…very sufficient knowledge and not only in terms of playing the piano but just in terms of…good body use." She also added, "…I started playing more difficult literature, more technical literature and *never had a problem with tendonitis again* [emphasis added]." Leo expressed it a different way, "…and I don't think I would get injured again because I know my body, I know my limits, I know what I can play, I know what I cannot play." However, Leo also went on to add a more personal comment about another component of the Method—acquiring self-knowledge, "That's also what this Method…showed me. I know myself much better." Finally, Randall makes a heartening comment, "I don't even think about injury anymore, not playing-related…but because of my Alexander work and because of my technique… I don't have pain when I play, ever." He adds, "And even those pieces I played before…that I was just dying to get through because they hurt me. Now I just play them and it feels like nothing."

Can play with ease, feel good at the piano now. Along with recovery from discomfort, pain, or injury, as well as a new knowledge of how to use their bodies efficiently at the piano, came an often-repeated observation: Pianists and organists enjoyed playing much more after studying the Method, and felt a sense of ease at the piano [and organ]. Participants commented on how the Method had helped them play with more muscular efficiency; more sense of balance, ease and release; and in general, to feel good at the piano—all characteristics of a pianist not struggling with discomfort, pain, or injury. Aaron stated, "I think the main thing is the ease of playing. If you have more ease, then you have more than likely a wider range of things you can do musically." Although he went on to comment about degrees of ease, "I'll be honest, there's another level that people go to. I think that [the instructor]…is at that level. Truth be told, for my purposes, this is good enough." The musical results of the increased sense of ease was something Craig wanted to point out, "When you're feeling at ease in your body, you're much more likely to convey…your musical intention." Haddon's experience was more fundamental, "In some ways…I feel more at ease in my own skin when I play now." Rosalie described her experience with performance after studying the Method, "When I'm performing music…it feels better, it feels good to do it, it feels very natural and *it doesn't feel like I'm struggling to create something*…[emphasis added]." Adam summarized what he had learned from the Method about economy of motion and calming the mind, "…so I think…that aspect of sort of quieting down extraneous physical motions and sort of quieting down your mind to really be able to concentrate, that has both positive technical and musical ramifications in your playing." For Haddon, after the

vicious cycle of pain and stress ended, the experience of playing was profound, "I just feel like it's been really great to sort of reclaim who I…my old self again."

The code in Theme 6 most central to this study was the "will help prevent injuries" code. The six RQ2 codes most highly correlated with the "will help prevent injuries" code are shown in Figure 11. In particular, "learned a lot while studying the Method" is highly correlated with "will help prevent injuries," as is the "awareness and mindfulness" code again.

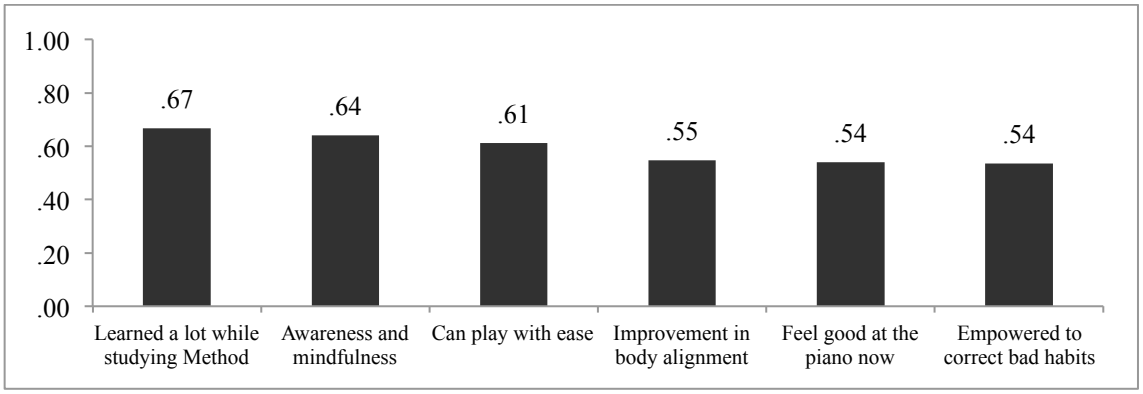

Figure 11. RQ2 Codes with Highest Correlations with "Will Help Prevent Injuries" Code

Research Question No. 2: Theme 7 – Rational, Biomechanically-Informed Approach to Technique

Finding 7*: The Method, which helped impart knowledge of biomechanics to participants, made sense to them because of its rational, pedagogically sound approach.* The three codes in Theme 7 were as follows: gained knowledge of biomechanics, makes sense, rational approach and pedagogically sound. The correlations between the Theme 7 codes are shown in Table 10. Note that the two codes "rational approach" and "it makes sense" are not closely correlated with the "gained biomechanical knowledge" code. The

latter code was also not highly correlated with any other RQ2 codes, perhaps because of the way interview questions were asked. It seemed to fit into Theme 7 more by default.

Table 10

Theme 7 Correlations

	Rational approach	Makes sense
Makes sense	.68	
Gained biomechanical knowledge	.30	.31

The NVivo cluster diagram correlated positively all previous themes that emerged from Research Question No. 2 with participants' perception that the Method made sense and was rational, and biomechanically and pedagogically sound. As Craig stated, "the…Method teaches you a very efficient, natural, biomechanically sound way to play the piano." One survey participant expressed the Method's dual content, "The combination of biomechanical creativity and musical insight is overwhelming." Regarding whether the Method made sense and was perceived as being scientifically informed, Isabelle commented, "I've always had kind of a scientific interest anyways, and, yeah, it just made sense." Randall, who had experienced a PRND, had a more emotional response when watching a DVD of the Method, "I almost wanted to cry because everything all of a sudden made a lot of sense…[it] seems like [it] has all the science to back [the] theories up." And a survey participant, after completing an intensive training workshop, noted, "It just made so much sense and I wanted to continue learning so that I could have the same ability to play with freedom that [the instructor] demonstrated." Additional survey respondents underscored their confidence in the Method's rational, science-based approach. One such survey participant stated, "The

Method is the most sensible answer to the challange [*sic*] of consistently imparting technical mastery to the piano student that I have encountered."

The "rational approach, pedagogically sound" code seemed to emerge as particularly dominant. The RQ2 codes most closely correlated with it are shown in Figure 12. Not surprisingly, the "makes sense" code is highly correlated with "rational approach." Note also the presence of the "awareness and mindfulness" code again as one of the high correlations.

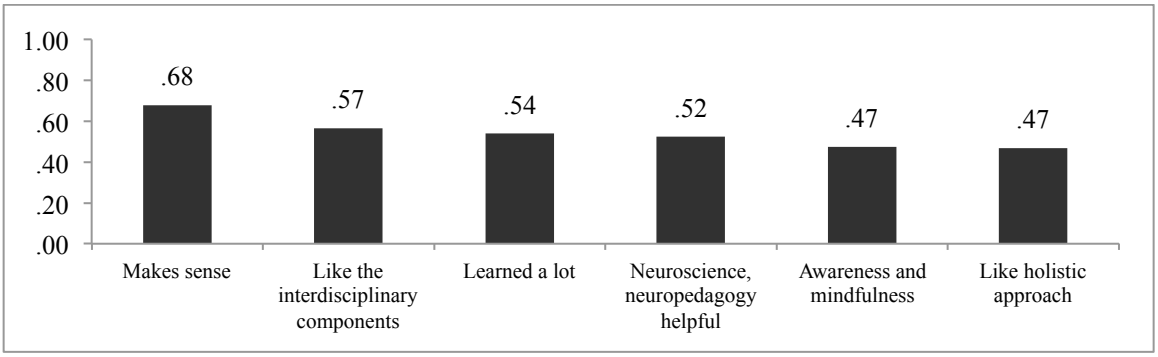

Figure 12. RQ2 Codes with Highest Correlations with "Rational Approach, Pedagogically Sound" Code

Theme coverage. Again, if the theme was discussed equally by each interviewee, each percentage would be approximately 3.7%, thus indicating that each participant (plus the survey qualitative narratives) covered 1/27 of the theme (26 interviewees plus the survey qualitative narratives). An exceptionally large number would indicate that one person was dominating that theme. The coverage percentages of the RQ2 themes are shown in Table 11. Note that Paul (10.65%) and Zoe (9.9%) dominated Theme 5. Zoe spoke often about how she liked the holistic approach of the Method. Likewise, Ted was disproportionately represented in Theme 6 at 10.64% in discussing recurrence of injury, while Lily (11.37%) and Abby (10.89%) dominated Theme 7, commenting on whether

the Method was rational and biomechanically informed. In the qualitative portion of the survey, Theme 7 was dominant (11.49%).

Table 11

Percentage of Theme Covered by Each Interviewee, RQ2

	Theme 4	Theme 5	Theme 6	Theme 7
Aaron	1.3%	0.39%	2.9%	1.86%
Abby	4.32%	2.45%	4.64%	10.89%
Adam	6.45%	2.87%	2.57%	0%
Angus	5.44%	4.97%	4.92%	0%
Ben	1.75%	1.87%	1.71%	0%
Calvin	3.15%	0.58%	0.58%	4.07%
Clara	10.49%	9.09%	5.42%	7.78%
Craig	1.78%	3.52%	4.07%	1.62%
Haddon	2.48%	1.54%	4.23%	4.31%
Isabelle	3.52%	2.73%	2.32%	6.82%
Jacob	1.57%	0.21%	1.1%	1.92%
Jake	3.49%	3.45%	1.89%	0%
Leah	1.62%	1.4%	1.92%	3.41%
Leo	2.98%	3.28%	3.83%	8.14%
Lily	4.26%	5.92%	6.3%	11.37%
Lucy	3.5%	3.02%	2.32%	0%
Otto	0.49%	0.07%	2.84%	0%
Paul	4.26%	10.65%	2.74%	9.75%
Phoebe	3.83%	3.77%	2.91%	0%
Randall	6.79%	5.98%	6.23%	6.34%
Rosalie	2.24%	2.22%	3.09%	0%
Simon	3.44%	4.42%	6%	3.11%
Sylvia	3.22%	2.75%	3.76%	0%
Ted	3.78%	6.27%	10.64%	0%
Tess	1.07%	2.17%	1.66%	7.12%
Zoe	8.36%	9.9%	5.61%	0%
Survey	4.41%	4.54%	3.8%	11.49%

Summary of Research Question No. 2 Findings

Interview participants' perceptions of the efficacy of the Method in preventing recurrence of PRNDs were consistently favorable. Both concurrent training in the Alexander Technique and Alexander Technique principles embedded in the Method were regarded as important to the success of the Method. The interdisciplinary components

were also valued by a number of interviewees. Participants felt empowered with sufficient knowledge to correct inefficient body use patterns in their technique and to acquire new habits, although retaining the latter took conscious awareness and vigilance. Many participants reported an increase in ease, fluidity, and freedom while playing, as well as an enhancement of their ability to play musically. The Method appeared to make sense and was considered rational, biomechanically informed, and pedagogically sound.

Research Question No. 3

What effect, if any, do pianists perceive this interdisciplinary Method to have on various aspects of musicality and technique?

An NVivo cluster analysis of interview questions related to Research Question No. 3 from 26 in-depth interviews is illustrated below in Figure 13:

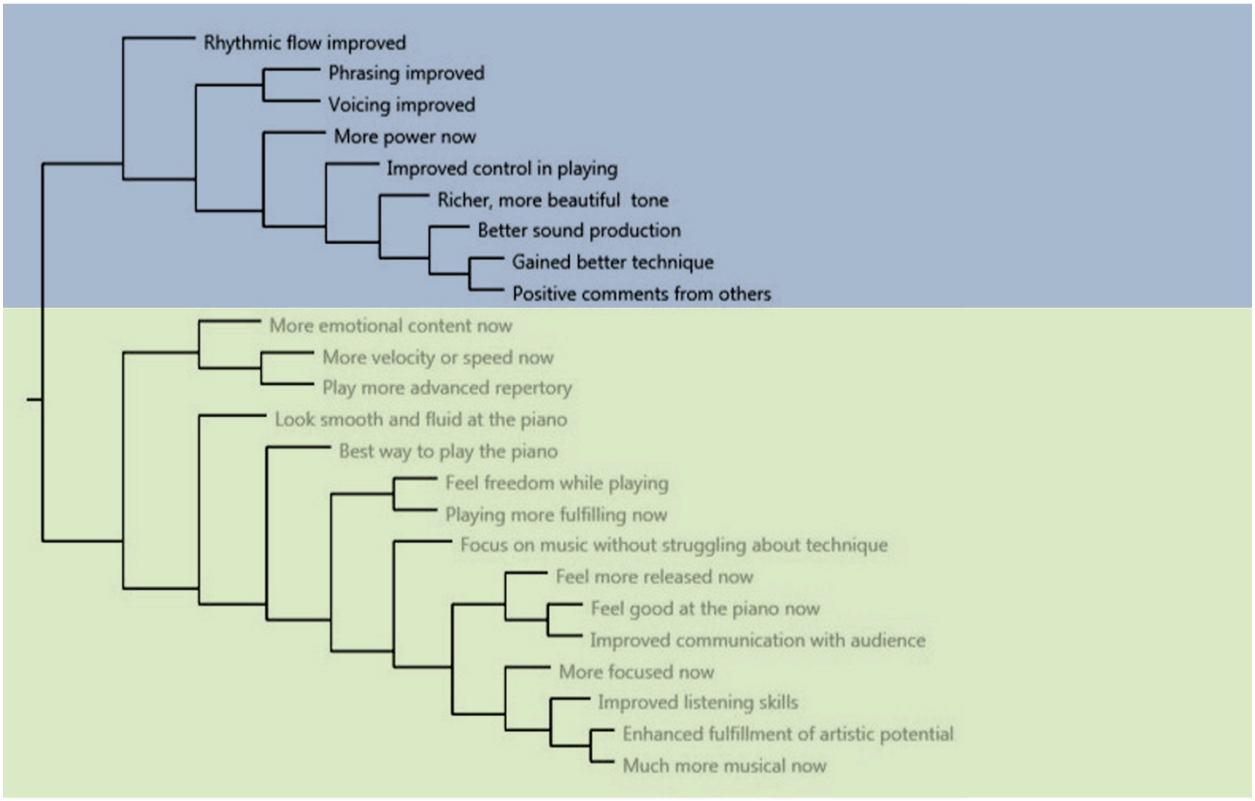

Figure 13. Cluster Diagram Using Codes Related to Research Question No. 3

Interview questions were designed to separate musical results from technical results. Question 19 of the interview (Appendix E) asked the participant to, "Please describe what effect, if any, studying this Method has had on your musicality in terms of phrasing, rhythmic flow, structural cohesion, emotional content, communication with audience, performance anxiety, fulfillment of artistic potential, etc." Question 20 asked, "Please describe what effect, if any, studying the Method has had on your technique in terms of tone control and quality, dynamic control, ability to voice, facility, muscular suppleness, speed, power, etc." In the NVivo Cluster Analysis in Figure 13 showing positive correlations between the RQ3 codes, these two elements were somewhat separate. However, both clusters contained elements of technique and musicianship (such as "more emotional content" correlated with "more velocity or speed now" and "playing

advanced repertory"). This seemed to indicate how interrelated musicality and technique were in the perceptions of the participants. It also might have indicated how the Method emphasized and enhanced this synergistic relationship, even though training focused in the very beginning stages on pure technique (physical coordination) and sound production, not musical elements. Participants in the interview and survey, however, had developed considerably beyond the foundational stage and were already applying their technical skills to music-making. Therefore, they would not be likely to separate the two, but rather would address how the pure technical training in the Method had affected the musical results.

The two themes that emerged from the two main clusters were:

Theme 8 – Perceived results of Method on technical control of musical elements and sound production
Theme 9 – Perceived results of Method on experience of music-making at the piano

Research Question No. 3: Theme 8 – Perceived Results of the Method on Technical Control of Musical Elements and Sound Production

Finding 8: *In the first of two main clusters, when the 26 participants were asked directly what studying the Method had yielded regarding their technique and the response of others to their playing, 92% reported they had a better technique, and 92% reported having positive comments from others. When prompted from a list of other potential results from studying the Method, 62% of participants perceived they had a richer, more beautiful sound; 58% reported more control in playing; 58% had better sound production; 42% felt they could phrase better; 31% believed they could voice better; 27% felt more rhythmic flow while playing; and 23% mentioned having more tonal power.*

The following codes were included in Theme 8: rhythmic flow improved; phrasing improved; voicing improved; more power now; improved control in playing; richer, more beautiful tone; better sound production; gained better technique; positive comments from others. The Pearson correlation coefficients between the Theme 8 codes are shown in Table 12. The codes within this theme ranged from moderate ("rhythmic flow improved" code at around .31) to high ("gained better technique" and "positive comments from others" at .76).

Table 12

Theme 8 Correlations

	Voicing improved	Richer, more beautiful tone	Rhythmic flow improved	Positive comments from others	Phrasing improved	More power now	Improved control in playing	Gained better technique
Richer, more beautiful tone	.52							
Rhythmic flow improved	.28	.36						
Positive comments from others	.37	.62	.33					
Phrasing improved	.47	.54	.31	.54				
More power now	.37	.54	.31	.42	.34			
Improved control in playing	.41	.57	.28	.54	.50	.41		
Gained better technique	.40	.57	.47	.76	.50	.45	.58	
Better sound production	.41	.68	.41	.70	.47	.62	.52	.69

Theme 8, for the most part, tracked participants' responses to effectiveness of studying the Method on sound production and on their ability to control musical elements. While the percentages on the cluster diagram represent the responses to these various elements, participants tended to speak about these elements interdependently or all at once, rather than addressing them separately.

In describing the musical results of studying the Method, Lucy's comments reflected a tendency of some participants to group certain elements together and identify them as defining characteristics of the Method, "People will comment on the voicing, on

the sound, on the phrasing…it's a trademark for her students—the voicing and the phrasing." And one organist related the reaction of his listeners to his piano playing:

> When I do play, I really enjoy it and I actually get a lot of compliments on my piano playing. People say, "You have really beautiful tone and you shape phrases really beautifully"…Even though I am an organist, there are things that went beyond just [the instructor's] technique—[the] approach to musicality. (Randall)

One survey respondent expanded those characteristics of the Method in the narrative portion, "More satisfied with my tone, my ability to phrase and voice, my dynamic range, speed, power and agility, and my ability to coordinate my movements with the tempo and meter of the piece." Abby spoke specifically of gaining tonal power in the wake of recovery from her PRND, "I had a very hard time with my injury getting…a lot of power and a lot of big sound. And the big sound is something that I have finally been able to get through learning the Method." Lucy reported her newfound ability to voice (to play one note louder than other notes sounding at the same time), but quickly moved to tone color, articulation, listening and her general technical command:

> I never voiced prior to studying [the Method] and now it's wonderful because I can create all kinds of different colors, and not only create them, but I can hear them and…command my body to do what I need…It has opened up a while new world in terms of voicing, articulation, musicality, technique…(Lucy)

Enhanced listening helped Randall phrase better:

> The thing is, my ears are always open now when I'm playing the piano. And I'm always listening to phrasing…even if it's just a choir piece I'm playing at church…I make is as beautiful as I can in the way I'm shaping the phrases. (Randall)

Beauty of tone quality. One particular characteristic of the Method emerged as an outcome—beauty of tone. Jake commented, "If I had to say that there was a universal comment that I get when I play a concert from people [it] is, 'Wow! The piano sounds so great!'" As Otto expressed it: "I have heard all…students [of the Method] have an

absolutely beautiful tone…and all that goes across the spectrum of whether you're male, female, very tall, younger, older…" And Ted noted that, "As I perform in public the biggest comment has been the beautiful tone…wow, the piano sounds like it's singing…"

Ben connected voicing with a richer tone, "I think it's [the Method] done wonders for my tone production. From the very beginning of the Method you focus on creating sound and…voicing....So I think it's much richer than before." And Randall, as an organist, "…ended up falling in love with the sound that I was able to get on the piano." Aaron summarized his thoughts with, "I would say, yeah, there is more fluidity…to the line, the sound I think is better, more beautiful sound." And for Lily, the Method helped her fall in love with the piano's sound, "I really love to play now…I really love practicing and I love the piano and the sound that it makes. I didn't really even like the sound of the piano that much before, but it's made a huge difference I think in my musicality."

Improved technical control leads to enhanced musicianship. One sub-theme that kept emerging was improved command at the piano. As Phoebe described it, "… I really have the skills to make changes…now I can get the speed…the power…the agility, um, I can get the tone that I want…the volume that I want." Otto remarked that the Method, "really made me…an overall better pianist…being able to control the keyboard much better…" Ted commented further, "With [the] Method, you've got this total control…you get a tone that's beautiful…you can voice almost instantly." And Zoe connected technical control with musicianship, "You're right there and you're not afraid to make that sound because you are more in control…it allows you to be a much better musician." Clara reflected on audience response regarding her tone and expressiveness,

"I received comments about how beautiful my tone was and how emotional those pieces were for the audience." Commenting on the response to her playing after studying the Method were Rosalie's husband and fellow musicians, "My husband…said I definitely sound much more natural and more expansive now, and my fellow musicians also said that the difference was overwhelming in my playing." Finally, Jake commented on how the Method did not stop with technical skills. Its aim was compelling music-making, "The concept of sound, the concept of emotion, the concept of phrasing, rhythm, all that is very intrinsic in [the] teaching…Technique is just the tools…" And Randall summed it up, "What I love about [the Method] is that everything [the instructor] does technically serves the music."

In Theme 8, two codes "better sound production" and "gained better technique" were examined in greater detail. The RQ3 codes most highly correlated with each of these codes are shown in Figure 14 and Figure 15. The code "much more musical now" had the highest correlation with each of these codes, even though it was not a Theme 8 code itself. The correlation coefficient with "gained better technique" in particular was high at .85. This might be another indication of participants' perceptions of the close interweaving of the technical and musical aspects in studying the Method.

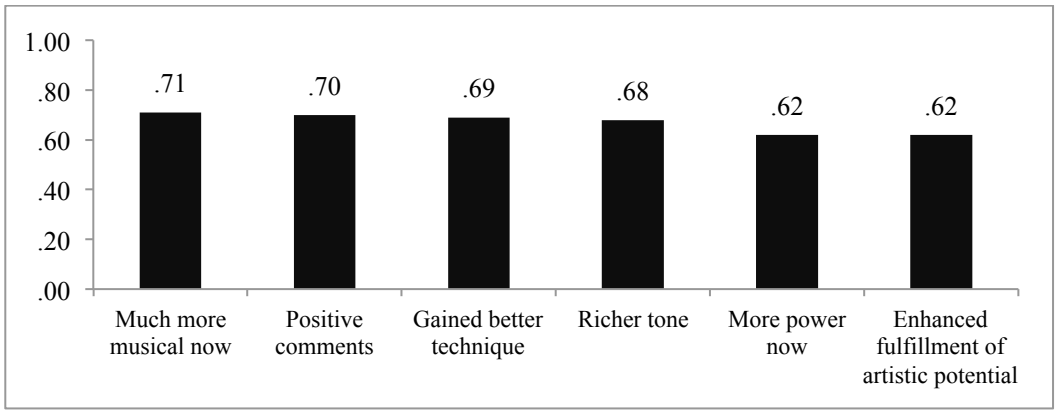

Figure 14. RQ3 Codes with Highest Correlations with "Better Sound Production" Code

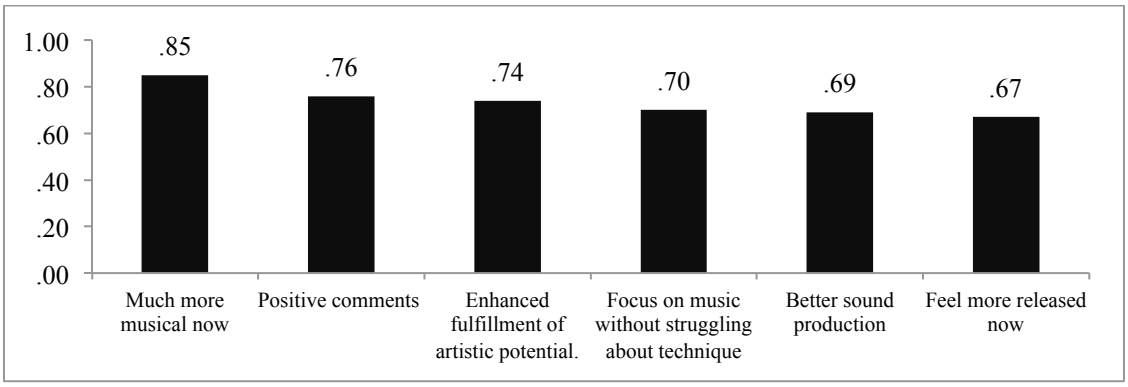

Figure 15. RQ3 Codes with Highest Correlations with "Gained Better Technique" Code

Research Question No. 3: Theme 9 - Perceived Results of Method on Experience of Music-Making at the Piano

Finding 9: *In the second cluster, when all 26 participants were asked specifically what effect studying the Method had on musicality, 100% reported perceiving that they were much more musical now, while 92% volunteered without prompting that they felt good at the piano now; 77% also volunteered that their artistic potential was enhanced, while 69% reported, without prompting, having improved listening skills. When asked specifically about their level of repertory pre- and post-studying as well as their communication with the audience, 65% reported the ability to play more advanced*

repertory and 65% felt improved communication with their audience. When asked from a general list to describe what effect, if any, studying the Method had had on their technique, the following responses were volunteered: 62% reported feeling more focused now, 54% felt more released, 54% felt freedom while playing, 50% said this was the best way to play the piano, 42% looked smooth and fluid at the piano, 35% felt playing was more fulfilling now, and 27% had more velocity and speed. Straying somewhat away from responses regarding pure technical aspects, 27% reported without prompting that they played with more emotional content now, and 27% volunteered that they could focus on the music without struggling with technique.

Codes included the following: more emotional content now, more velocity or speed now, play more advanced repertory, look smooth and fluid at the piano, best way to play the piano, feel freedom while playing, playing more fulfilling now, focus on music without struggling about technique, feel more released now, feel good at the piano, improved communication with the audience, more focused now, improved listening skills, enhanced fulfillment of artistic potential, much more musical now. The correlation coefficients between these Theme 9 codes are displayed in Table 13 and Table 14. As in Theme 8, these codes ranged from moderate (the "more velocity" and "look smooth at the piano" codes in particular) to high (especially the "much more musical now" codes).

Table 13

Theme 9 Correlations

	Playing more fulfilling	Play more advanced rep	More musical	More velocity	More focused	More emotional content	Look smooth
Play more advanced rep	.50						
More musical	.61	.58					
More velocity	.28	.52	.39				
More focused	.50	.44	.64	.28			
More emotional content	.36	.45	.55	.41	.41		
Look smooth	.35	.46	.54	.23	.40	.27	
Improved listening	.40	.48	.71	.30	.62	.46	.34
Improved comm. with audience	.61	.51	.74	.35	.65	.44	.46
Focus on music	.41	.41	.69	.24	.49	.40	.34
Feel more released	.51	.54	.70	.28	.60	.38	.65
Feel good at piano	.68	.51	.72	.30	.56	.36	.44
Feel freedom	.64	.59	.67	.39	.44	.39	.45
Enhanced artistic potential	.56	.55	.90	.43	.63	.60	.44
Best way to play	.41	.41	.54	.27	.42	.30	.38

Table 14

Theme 9 Correlations, Continued

	Improved listening	Improved comm. with audience	Focus on music	Feel more released	Feel good at piano	Feel freedom	Enhanced artistic potential
Improved comm. with audience	.62						
Focus on music	.49	.48					
Feel more released	.53	.68	.49				
Feel good at piano	.54	.75	.45	.66			
Feel freedom	.48	.56	.45	.55	.59		
Enhanced artistic potential	.69	.72	.62	.65	.65	.64	
Best way to play	.43	.51	.38	.41	.55	.39	.46

More musicality and enhanced fulfillment of artistic potential. All participants (100%) perceived that they were more musical as a result of studying the Method, and along with that was a correlation with enhanced fulfillment of artistic potential. Zoe echoed participants' belief that the Method was not only for injury-prevention:

> It allows you to be a better musician. I think it frees up not only your mental approach to it, but also your physical approach so that it allows the music to flow more freely….And that is more than just a methodology on how to use…your body at the keyboard. It's like unlocking a little door that brings you to another place….I would not want people to see this Method as only a way to prevent…or

> recover from injuries….It's much broader than that...because it's all-encompassing. That makes it even more powerful so you can be a better interpretative musician as a result of this. (Zoe)

Angus, an organist primarily, connected the technique with his musicality, "I feel like I'm a more musical player…better able to convey musical concepts because I can connect them to the technique to initiate that musical idea…" And Calvin, who had never experienced a PRND, stated that the Method allowed him, "…to get all the technical stuff out of the way and really focus on music making." The image of a door opening is repeated by Jake, "…the Method opens up the door to musicality and artistry." Leah also believed she was "…delivering a musical product to the audience being very quiet at the keyboard and just producing the music." However, she remarked that perhaps "…the audience wants a lot more physical involvement and more visual things…" But a survey respondent stated that:

> It [the Method] has profoundly changed the way I approach both technically demanding and more simple pieces and increased my overall musicality. I have played for small groups since studying the Method and have received very positive feedback on my performances. (Survey respondent)

Enhanced fulfillment of artistic potential (77%) was positively correlated with a perceived increase in musicality. One survey respondent commented on the results of unlocking his musical voice:

> In a manner of speaking, it has helped me find and unlock my voice as a musician. The need for expression is a very basic one, and things have a way of going wrong when a person feels his/her voice is being stifled. Being able to express myself musically has helped teach me to express myself more eloquently, naturally, and effectively in a host of other situations in life. (Survey respondent)

Jake expressed the idea of unlocking artistry in a slightly different way, "You have to have something to say, that's part of who we are as people. It [the Method] just unlocks the ability to be able to actually say it clearly." And Lucy echoed that idea, "It's

allowed me to experiment and express the ideas that I already had inside me that were kind of locked up because…technically I wasn't able [prior to studying the Method] to break through a lot of tension." Finally, Adam stated, "…it removes so many physical barriers that it allows the music, my musical ideas to come through."

Feeling good at the piano and more released. A large majority of participants (92%) also reported feeling good at the piano after having studied the Method (some of which quotes have already been cited in Research Question No. 2 findings). This was correlated positively with "feeling more muscularly released," as well as "improved communication with the audience" (65%). Lily articulated her experience with her audience in terms of conveying beauty through the piano:

> ...to know that the music is going to be more musical perhaps than it was before…and a sense of to me more beauty that's coming out of the piano. I mean, to me that's something I'm giving to the audience…(Lily)

Abby described a similar experience, as well as feeling safe:

> A lot of it is about being in the moment listening to what you're doing and also just really being present in your own body…It helps free you up emotionally and that's where you can really connect with your music and with your audience and when you feel safe because you've been focusing so much on just being as free as you possibly can in both areas…(Abby)

Leo described his changed relationship with the piano, "I feel now that I have much more of a cooperative relationship with the piano rather than me trying to conquer it to get what I want out of it." And Ted, an organist, spoke of an even closer connection, "…but it is a dramatically different feeling. I mean it's just such a…it's kind of a *unity with the piano* [emphasis added]."

Greater focus and improved listening skills. Improved listening skills (69%) and enhanced focus (62%) were closely correlated. Randall stated, "I think my mind is

just more available to the music, to focusing on practicing…" Jake viewed the two as one, "[The Method] gets your body out of the way and gives you the ability to really focus more and really actually listen." And focus was extended to the playing, according to one survey participant, "I think my overall playing from a pianistic standpoint has become better focused and more self-assured." For Clara, actually listening to what she was doing at the piano became a means of playing more musically:

> It's definitely made me listen more…it's not just going through the motions of the physical aspect of it, but then you do listen truly to what's happening and, to some extent, tuning out what's going on in your head and just listening. That's also had an impact on my playing…I'm listening for longer lines…I am just listening which then lets me really shape the phrase the way I want to. (Clara)

A survey participant summed up the impact of listening on musicality, "With [the] Method, students can learn to hear and feel the sound which helps them to connect with music at a deep personal level and beyond." Of those participants who considered the Method the "best way to play the piano," Otto remarked, "…I would definitely give it a 99.9% chance of being something extremely positive for anybody who has a problem or wants to improve their playing."

Two codes were chosen from Theme 9 for closer examination: "enhanced fulfillment of artistic potential" and "better communication with the audience". The RQ3 codes that had the highest correlations with each of these two codes are shown in Figure 16 and Figure 17. There was an extremely high correlation between "enhanced artistic potential" and "much more musical now." As these two codes were quite similar, this result was not unexpected. But the high correlation of "enhanced fulfillment of artistic potential" with "gained better technique" could, again, illustrate the close relationship between technique and musicianship in the perceptions of the interviewees. Also,

"feeling good at the piano" was the code most closely associated with "better communication with the audience" in interviewees' perceptions.

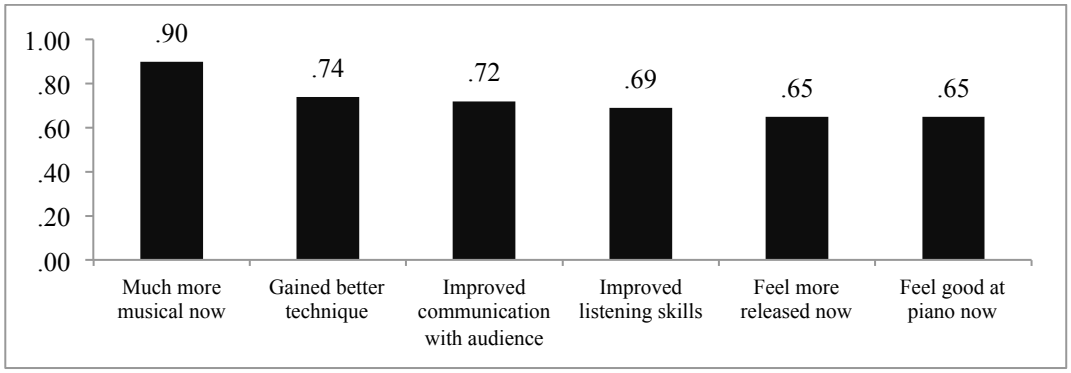

Figure 16. RQ3 Codes with Highest Correlations with "Enhanced Fulfillment of Artistic Potential" Code

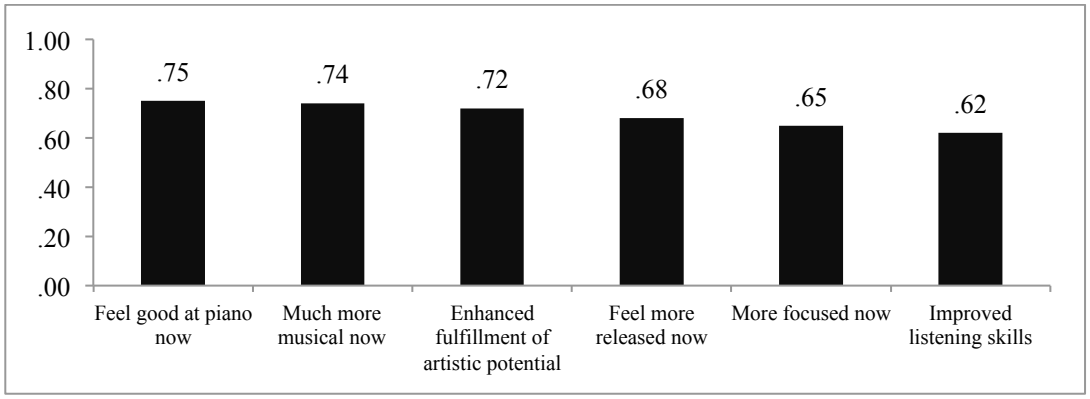

Figure 17. RQ3 Codes with Highest Correlations with "Improved Communication with the Audience" Code

Theme coverage. As stated earlier, if the theme were discussed equally by each interviewee, each percentage would be approximately 3.7%. High percentages meant that the interviewee in question contributed disproportionately to that theme. The coverage percentages for Theme 8 and Theme 9 are shown in Table 15. Ted (9.46%) and Angus (7.62%) had the highest percentages for Theme 8. These two interviewees, and to a lesser extent Randall (6.76%), were concerned about improving their technique and sound

production. Similarly, Randall (8.83%) and Ted (8.43%) focused on Theme 9 topics regarding perceptions of the effects of the Method on musicality.

Table 15

Percentage of Theme Covered by Each Interviewee, RQ3

	Theme 8	Theme 9
Aaron	2.11%	1.64%
Abby	4.09%	6.96%
Adam	2.9%	2.18%
Angus	7.62%	3.66%
Ben	0.82%	0.64%
Calvin	3.13%	3.6%
Clara	2.75%	4.55%
Craig	5.7%	4.16%
Haddon	3.84%	2.79%
Isabelle	1.97%	1.94%
Jacob	3.28%	1.77%
Jake	2.82%	2.03%
Leah	1.21%	2.05%
Leo	4.34%	1.67%
Lily	5.39%	7.59%
Lucy	1.87%	1.85%
Otto	2.76%	1.94%
Paul	0.83%	5.09%
Phoebe	4.48%	4.42%
Randall	6.76%	8.83%
Rosalie	3.41%	3.6%
Simon	4.25%	3.94%
Sylvia	3.1%	1.64%
Ted	9.46%	8.43%
Tess	1.31%	1.65%
Zoe	3.05%	3.55%
Survey	6.76%	7.81%

Summary of Research Question No. 3 Findings

Even though interview participants were asked separate questions regarding technical versus musical results of studying the Method, their answers frequently interwove both elements, indicating a perceived synergistic relationship between technique and musicality. While interviewees appreciated the Method's effectiveness in

recovering from and preventing PRNDs, they repeatedly stated that technique was only a means for achieving their primary aim—more musical playing. All interviewees felt that studying the Method had made them more musical, and a large majority felt much better while playing, believed they had gained a better technique, and that others viewed their playing positively. A majority of interviewees reported improvement in technical control, communication with the audience, focus and listening skills, and an enhancement of their ability to fulfill their artistic potential. Interviewees also emphasized the importance of the Method in unlocking their musicality and creating a more beautiful sound.

Research Question No. 4

What do pianists consider, if any, the extra-musical effects of studying this interdisciplinary Method?

An NVivo cluster analysis of interview questions related to Research Question No. 4 from 26 in-depth interviews of pianists is illustrated below in Figure 18:

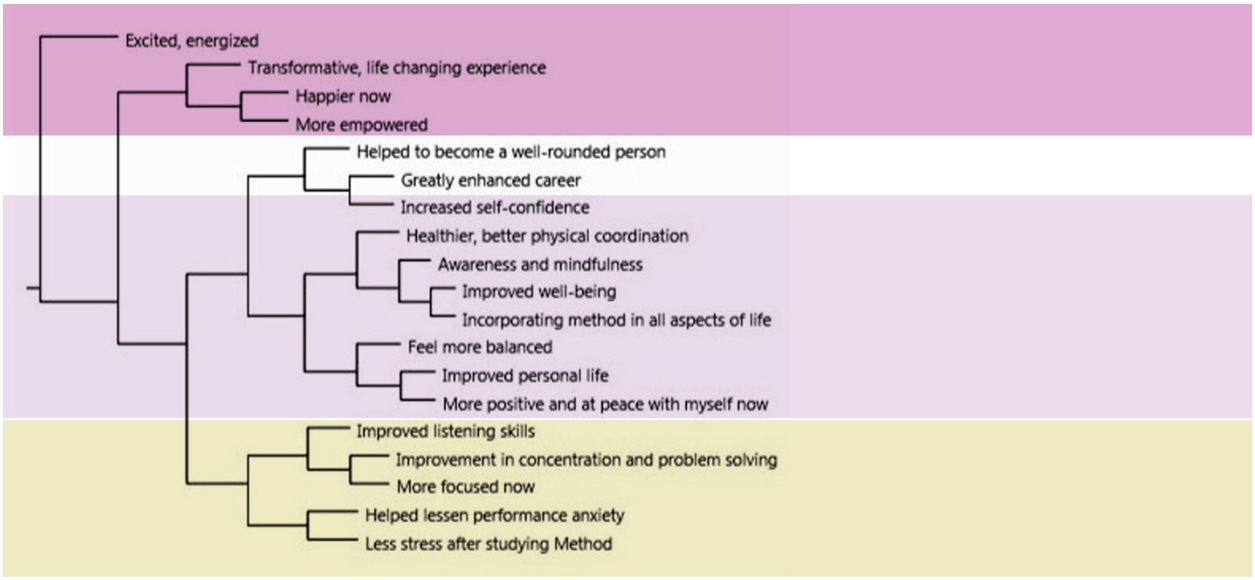

Figure 18. Cluster Diagram Using Codes Related to Research Question No. 4.

Questions designed for Research Question No. 4 yielded data related to improvement of overall health and well-being. Interview participants reported that their emotional, physical and psychological health was enhanced through study of the Method, and that this impacted positively not only their relationship with the piano and music, but their personal and professional lives as well.

The following three themes emerged from the data:

Theme 10 – Transformative, life-changing experience
Theme 11 – Enhanced professional and personal life
Theme 12 – Improved listening skills and lessened performance anxiety

Research Question 4: Theme 10 - Transformative, Life-Changing Experience

Finding 10: *All 26 interviewees were asked what impact, if any, studying the Method had had on their extra-musical lives. No specific questions were asked and interviewees expressed various responses without any prompting. The codes that emerged from Theme 10 reflected participants' perception that studying the Method had had a positive effect on their emotional, psychological and even spiritual lives in general: 46% interviewees volunteered that they felt more empowered, while 42% reported having transformative and life-changing experiences, and 31%, without prompting, said they felt happier, and 19% were more excited and energized after studying the Method.*

Codes for Theme 10 included the following: excited and energized, transformative life changing experience, happier now, more empowered. Table 16 shows the Pearson correlation coefficients between the Theme 10 codes. The highest correlations appeared to be between the other codes and the "happier now" code. While none of these correlations were very high, it should also be noted that these codes were all volunteer responses.

Table 16

Theme 10 Correlations

	Transformative experience	More empowered	Happier now
More empowered	.43		
Happier now	.50	.54	
Excited, energized	.31	.21	.49

Exciting, transformative experiences. Zoe expressed her rekindled feelings for the piano, "I am excited and energized to return to the study of piano with such optimism. I have not felt this way about the piano since before I was injured many years ago. It's a great feeling!" And Lily described how her approach to work and music had changed, "It's a joy, it's a joy to play and it's a joy to work…um…it's just so different from what it was before and it's…much more fun!" And Leo stated, "…it's just great. It's changed everything…but not just technique because when I started to get interested in this Method, I just changed. I didn't just change the way I play the piano." Survey respondents volunteered, "The…Method has changed my life." and "I'm grateful for this life-changing experience in so many ways." Another remarked, "It's an incredibly important method, and one that has changed my life. "And Clara reported, "It's just had a huge positive impact on me…and I know I'm better for it." Lily expressed her reaction to studying the Method in a more expanded manner, "It's been a life-changing experience to realize that less effort is much more...uh...is gonna help you get a lot farther…It's not just helped me in the piano, it's just helped me in my whole life journey…" And Paul mentioned the effects on his whole life, "It's opened up different doors for me in life in general. It's amazing what this program has done, like, for everything else in my life." The transformative nature of embracing change during the training was expressed by

Ted, "…you give everything to it. I mean you're giving up the old way of life and coming to an entirely new thing."

Happier and more empowered. Participants like Zoe reported an increase in overall happiness because of her reunion with the piano, "…I'm so happy, I'm so happy now. I haven't been happy for a lot of years, and there's something about being reunited with a musical instrument that was your voice." And Leo states, "Now I'm, like, most of the time I'm way happier than before, I'm way happier than before." Lily expressed her gratitude as a teacher, as well as her happiness, "I am just so grateful that I had the opportunity…to study it and now to be able to teach it. It's an absolute gift to me...and so I am just so happy that I'm able to share it with others." (Lily) And a survey participant described the source of her happiness, "I believe the ability to communicate is an important key to happiness and I am grateful for the tools I've been given."

The "transformative life changing experience" code was examined in more detail. The six other RQ4 codes that had the highest correlations with the transformative experience code are shown in Figure 19. The highest correlation was with the "incorporating Method in all aspects of life" code. Interviewees perceived that learning the Method was transformative and useful in a number of other extra-musical aspects of their lives.

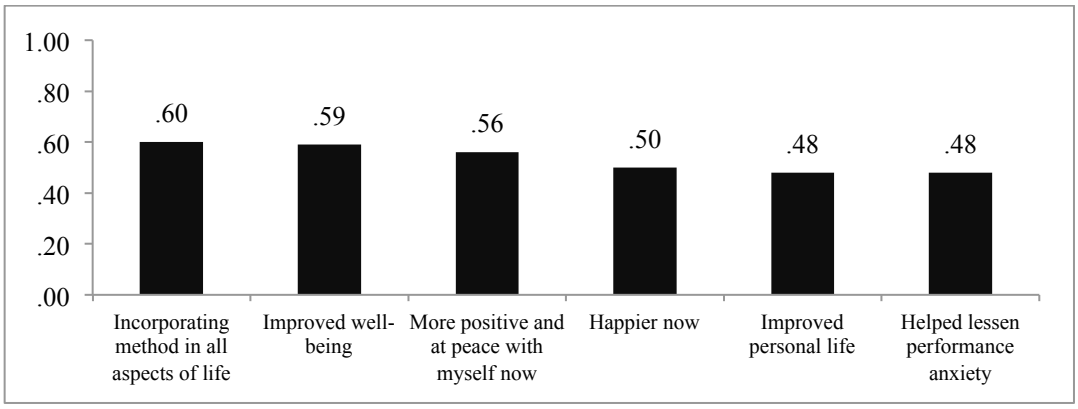

Figure 19. RQ4 Codes with Highest Correlations with "Transformative Life Changing Experience" Code

Research Question 4: Theme 11 - Enhanced Professional and Personal Life

Finding 11: *The codes that emerged from Theme 11 revealed more specific results of studying the Method that would impact participants' lives personally and professionally. Without prompting, all participants volunteered that they had acquired a greater awareness of themselves and others. When asked specifically about their personal life, a large majority (92%) felt their personal life was improved. Another specific question about their perception of what, if any, impact studying the Method had on their career, 85% reported that their career was greatly enhanced. Also, when asked to comment on their perception of their overall sense of well-being after studying the Method, 77% reported experiencing improved well-being. Without being asked specifically, 58% volunteered that their self-confidence had increased, and 54%, without prompting, reported a more positive outlook and feeling at peace with themselves. Other participants reported, without being asked, that they felt healthier and better physically coordinated (35%), had become more well-rounded people (27%), and felt more balanced (27%).*

Codes in Theme 11 included the following: increased self-confidence; greatly enhanced career; helped to become a well-rounded person; healthier, better physical coordination; greater awareness of self and others; improved well-being; incorporating method in all aspects of life; feel more balanced; improved personal life, more positive and at peace with myself now. The correlational relationships among the Theme 11 codes are shown in Table 17 and Table 18. There is a high correlation between "improved well-being" and "awareness and mindfulness." This awareness code appears to relatively highly correlated with a number of codes in different themes.

Table 17

Theme 11 Correlations

	More positive	Self-confidence	Incorporating Method	Well-being	Personal life
Self-confidence	.58				
Incorporating Method	.63	.51			
Well-being	.74	.57	.84		
Personal life	.71	.59	.65	.64	
Well-rounded person	.63	.58	.57	.59	.57
Healthier	.52	.49	.60	.71	.51
Enhanced career	.59	.59	.60	.62	.55
Awareness	.59	.61	.75	.81	.59
More balanced	.61	.50	.51	.61	.59

Table 18

Theme 11 Correlations, Continued

	Well-rounded person	Healthier	Enhanced career	Awareness
Healthier	.47			
Enhanced career	.60	.45		
Awareness	.56	.66	.62	
More balanced	.43	.48	.49	.63

Increase in self-confidence and self-esteem. Increased self-confidence manifested itself in various forms. One survey respondent wrote, "The musical and physical freedom it's given me has improved my confidence, my happiness…and my sense of fulfillment." Another stated, "These changes in performance/academic environment and playing habits have helped me to rediscover my love for playing and restored my self confidence." A survey respondent also referred to an increase in self-identity:

> I am happier and filled with a greater sense of self-confidence. My sense of self-identity is much stronger, and I am generally less stressed about other factors. I dwell on things less, and feel as though I can handle issues, that there are answers to problems. (Survey respondent)

Abby described her trajectory of losing, and then regaining, her sense of self-worth after studying the Method and recovering from her PRND:

> I'd lost a lot of self-esteem with my injury. I kind of tied a lot of myself—maybe too much of myself—to my music…so it was like, ok, if you give it up, you kind of feel like a part of yourself is gone and you're not worth as much. So self-confidence came back from just retraining and also knowing…your music is not everything in the world. But still, getting it back is a wonderful thing. (Abby)

Isabelle, who had reported her recent training in a medical field, described the effects of studying the Method on both her personal and her professional life:

> I think personally…I'm very pleased with what I'm capable of and the confidence that I've gained and…the way that this [Method] *has turned my life around professionally in the music world* [emphasis added], and now going to the medical world as well. So I'm really excited about the changes there. (Isabelle)

Paul described how studying the Method had increased his belief in himself as a musician and helped him gain courage to be himself:

> I've noticed a difference in feeling good about my own self as a musician. It's given me confidence in the performing sense and…confidence to…grow in directions I desire. It's made me think I don't have to be doing what everyone else is doing. I can do my own thing. (Paul)

Greatly enhanced career. A majority of interview participants reported professional benefits from studying the Method. Adam described renewed confidence in his ability to have a music career after he recovered from his PRND:

> It has absolutely helped my career...I was experiencing significant discomfort in my neck and shoulders on a daily basis prior to studying the Method and it was getting to the point where I thought I might have to drop out of my Master's degree... the [Method] enabled me to complete my Doctorate…and to go on to have a really great job in professional music. (Adam)

Craig reported that studying the Method had lessened stress over getting jobs:

> Also in my professional life I don't feel like I'm deathly attached to something. If I don't get a gig…I can just let go and then I'll get another one soon. Just being able to roll with the punches in the business is a really good effect of [the Method]. And also, like I said, being able to get more work because I play better. (Craig)

Several piano teachers commented in the interview on how studying the Method had enhanced their business and improved their teaching ability, or even prompted them to become teachers in the first place:

> I never really wanted to be a piano teacher before…It's definitely inspired me to teach piano…and it also really allowed me to finish my undergraduate degree in music…something I had not really thought was possible before I studied the Method…I really enjoy teaching and feel like I have something to contribute…to the music world. (Phoebe)

Another teacher reported more transformative effects of studying the Method:

> [I] am back to playing (practicing and performing) from not playing at all for several years. It made me a better musician and a teacher. Through my training, I've developed patience, love, compassion for my students and learned to teach the joy of music-maing [*sic*] through safe and effective technique. (Survey respondent)

Jake, a performer and teacher, stated that studying the Method had had, "…definitely positive effects on the professional life in that I have students seek me out….But also my playing's better. You get more jobs. People like you. People want to

come hear you…" Simon described his career path after recovering from a PRND, and his discovering how he could help others through teaching the Method:

> It's opened up opportunities…to be able to get back into playing which then meant that I could work…I could teach this Method to pass it on to my students…It's made a huge difference in…*the ability to be able to help other people* [emphasis added], which is what I all along wanted to do. (Simon)

Survey respondents reported varying ways their careers had been affected: "It made my professional life possible. It truly has freed me and empowered me to do what I'm doing today." One survey respondent wrote, "The Method has allowed me to continue my career and not be forced to give up playing due to injuries." One pianist credited the instructor, "It has made a world of difference. The fact that I can play the piano again after my completely debilitating injury is enough to call [her] a genius." And one survey participant stated, "*It truly saved my career* [emphasis added]."

Improved well-being, improved personal life. A majority of interviewees saw an improvement in their well-being after studying the Method. As Craig expressed it, "…what we're getting at here is just your overall use of self, your mind. You know, your mind is part of your body, so when you start doing that, everything…improves." Paul described the effect on his mental state, "So it's helped my health in that sense, my mental well-being also. It's calmed my anxiety down because it puts you in a place of always growing—kind of an effort-based learning rather than an ability-based learning." Lily's gain in her personal life included trusting her intuition more:

> I've gained again confidence…listening to my intuition, more listening to my inner voice of what I feel is really better for me….The whole process has made me realize…I don't want to be going in any direction that is harmful to myself or to my growth. (Lily)

Abby saw her increased compassion as an improvement, "… it has helped me to be very much more into the needs of others because it is about sensing…I can sense myself better. It's easier to sense others' problems as well, and helpful. Kind of a compassion." One survey respondent wrote, "I think the self-reflection and community that comes with studying the Method helped me mature in other relationships, as well." And Phoebe reflected, "It's just been a (pause) really great experience for moving me out of negative places that I might get stuck in and into…a place of possibility and choice."

Two codes from Theme 11 were examined more closely: "improved well-being" and "greatly enhanced career" shown in Figure 20 and Figure 21. The code "improved well-being" had a very high correlation with "incorporating Method in all aspects of life" and the "awareness and mindfulness" code. The "improved well-being" code was also closely related to "improved personal life" and was the code most closely related to the "greatly enhanced career" code. The code "awareness and mindfulness" was closely correlated with another code, "greatly enhanced career."

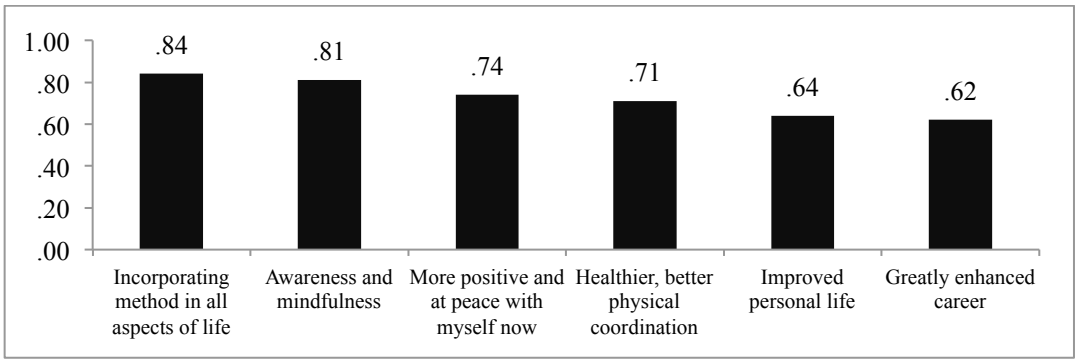

Figure 20. RQ4 Codes with Highest Correlations with "Improved Well-Being" Code

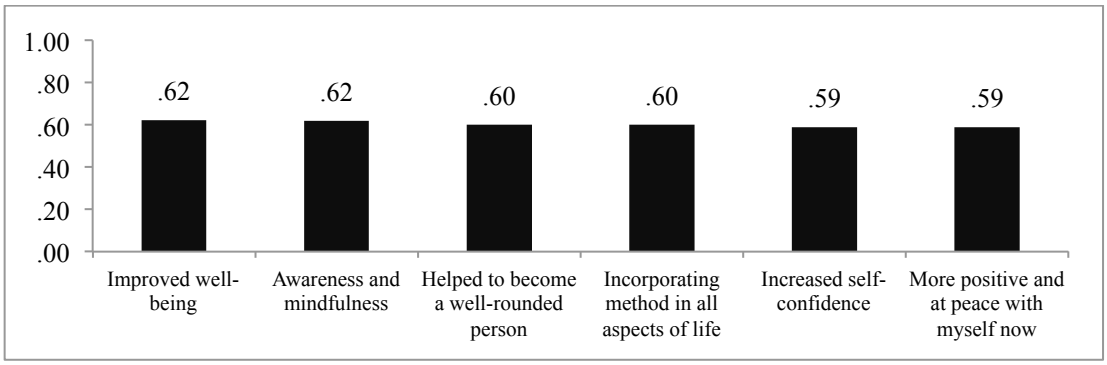

Figure 21. RQ4 Codes with Highest Correlations with "Greatly Enhanced Career" Code

Research Question No. 4: Theme 12 - Improved Listening Skills and Lessened Performance Anxiety

Finding 12: *Theme 12 resulted from interviewees being asked if they noticed any positive or negative changes in their ability to move, listen, interact with others, concentrate, etc. Most of the time, the interviewer reported that the interviewee did not wait to hear any prompts, but simply started responding in their own words. Of the 26 interviewees, 69% reported an improvement in their ability to listen after studying the Method, 62% volunteered that they felt more focused, and half of the participants reported improvement in their ability to concentrate and solve problems. Performance anxiety was voluntarily reported by 38% to have been reduced and correlated with 23% noting, without prompting, that they felt less stress after studying the Method. Improvements in listening, focusing, concentrating, and problem-solving were closely correlated, as were a reduction in stress and a lessening of performance anxiety.*

Codes related to Theme 12 were as follows: improved listening skills, improvement in concentration and problem solving, more focused now, helped lessen performance anxiety, and less stress after studying Method. Table 19 shows the correlations among the Theme 12 codes.

Table 19

Theme 12 Correlations

	More focused now	Less stress	Less performance anxiety	Improved concentration
Less stress	.45			
Less performance anxiety	.52	.48		
Improved concentration	.64	.45	.35	
Improved listening	.62	.50	.40	.60

Better concentration and problem solving. Interviewees' reports of improved listening skills have already been documented in Research Question 3 findings. Regarding the ability to concentrate better, Angus related it to a reduction in unnecessary muscle tension, "My concentration has improved just because releasing muscles…is very meditative. And if you have just a lot of tension, physically, it manifests mentally, I find." Ted reported both on concentration and focus, "…it really helped me learn to concentrate. I've always been a little ADD, but…it really helped me learn to focus on what I'm doing at the moment…" Clara, like Angus, correlated excess tension with performance anxiety. She stated that, "…it's definitely also helped much with performance anxiety in that I have more specific tools for how to release tension that might be building up before a performance." Jake credited feeling more in control with reduced performance anxiety as a consequence of studying the Method:

> I'd say the anxiety level goes down when it comes to performing and stage fright. Just because you feel like it's never a crapshoot. You know what's going to happen when you get out on stage. You know how to keep things from going wrong technically… (Jake)

Leo attributed the lowering of performance anxiety to increased knowledge:

> I would say after now two years, my performance anxiety is way less than before because I know my body better. I know I have a better technique, I have a

> better understanding of what I want to do. I know what works and what doesn't work. (Leo)

Lily's potentially crippling performance anxiety was reduced after studying the Method because she could be more released and musically engaged:

> I used to get almost blackouts when I couldn't see the notes… Since I learned the technique, um, I can perform now and feel much more relaxed, much more musically involved, and I haven't had any of that, um, note blackout issue… (Lily)

An organist explained why his performance anxiety was reduced:

> …it has greatly helped with the performance anxiety in the sense that when you sit down, you're more focused on the body…[the Method]…teaches you to focus on different things going on in the body….You don't forget the audience is there because you are performing with them. But at the same time, you are so into the music you don't worry about that. You're so confident with [the] Method that you'll play the right notes at the right time in the right place…the worry kind of disappears… (Ted)

Phoebe had another perspective on why performance anxiety was reduced, "…one of the most important things about [the Method] is it just sort of establishes the ability to stay calm and sort of *eliminates the whole fear response* [emphasis added]."

Finally, one survey respondent summed up the extra-musical effects of studying the Method in the following statement:

> I have gained more awareness of myself, others and the world around me, a stronger connection with reality and ability to be in the present moment, more positive thinking, better problem-solving skills, more skill at managing my energy and focus, better pysical [*sic*] coordination, a more fulfilling life path, more confidence in myself and my abilities, more courage, a network of new friends and probably other things I can't think of now. (Survey respondent)

The code chosen to be scrutinized in Theme 12 was "helped lessen performance anxiety." The six highest correlations with this code, shown in Figure 22, were all more in the high, rather than extremely high, range. Again "the awareness and mindfulness"

code is in evidence. Interviewees also perceived that becoming more focused through the Method helped them to lessen their performance anxiety.

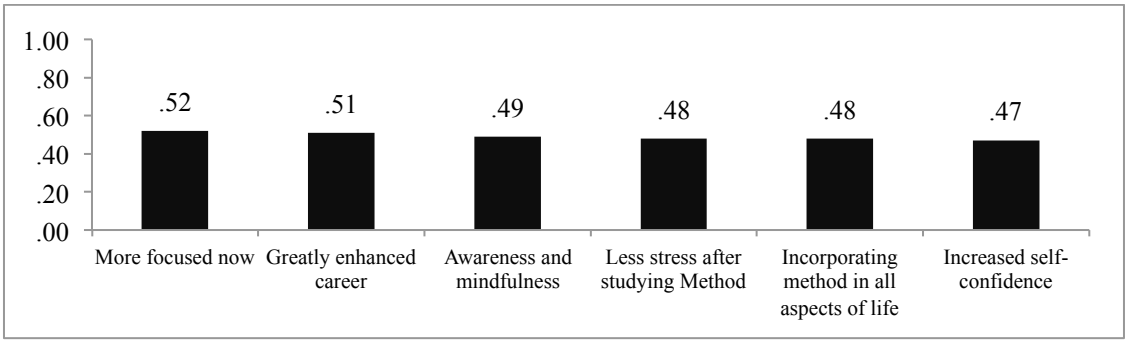

Figure 22. RQ4 Codes with Highest Correlations with "Helped Lessen Performance Anxiety" Code

Table 20 shows the coverage percentages of the RQ5 themes. The Theme 10 coverage statistics indicated that some interviewees were far above the expected value of 3.7%. The survey qualitative section seemed to dominate this Theme 10, accounting for 18.74% of the quotes. Zoe also dominated the discussion of Theme 10 topics at 16.54%. Survey respondents' qualitative comments also dominated Theme 11, representing 12.4% of the coverage. Ted (10.98%) and Clara (10.61%), on the other hand, were disproportionately represented in Theme 12.

Table 20

Percentage of Theme Covered by Each Interviewee, RQ4

	Theme 10	Theme 11	Theme 12
Aaron	0.18%	1.47%	1.99%
Abby	3.24%	4.6%	5.28%
Adam	2.93%	3.18%	1.84%
Angus	2.44%	4.5%	3.39%
Ben	2.2%	0.6%	0.5%
Calvin	1.71%	0.46%	4.36%
Clara	1.47%	6.71%	10.61%
Craig	0.24%	2.94%	4.97%
Haddon	0%	1.57%	0.85%
Isabelle	0%	3.28%	3.57%
Jacob	9.04%	0.94%	1%
Jake	0%	3.19%	1.51%
Leah	0%	2.34%	0.8%
Leo	9.52%	3.89%	1.44%
Lily	11.05%	4.53%	9.4%
Lucy	2.08%	3.26%	1.25%
Otto	0%	0.35%	0%
Paul	3.91%	5.05%	3.64%
Phoebe	0%	4.63%	4.99%
Randall	4.4%	7.42%	8.99%
Rosalie	0%	2.87%	1.07%
Simon	3.6%	3%	5.26%
Sylvia	4.88%	2.38%	0%
Ted	1.83%	4.87%	10.98%
Tess	0%	2.06%	0.55%
Zoe	16.54%	7.51%	7.18%
Survey	18.74%	12.4%	4.59%

Summary of Research Question No. 4 Findings

Participants consistently reported positive extra-musical effects on their personal and professional lives from studying the Method. A large majority of participants experienced an improved personal life and a majority felt studying the Method had enhanced their careers and professional lives. Many reported transformative, life-changing experiences and improved well-being. The ability to listen, concentrate, and focus better was correlated positively with a reduction in stress and performance anxiety.

Research Question No. 5

What do pianists perceive as challenges and positive aspects of studying the Method?

Part A: What do pianists perceive as the challenges of studying the Method?

Part B: What do pianists perceive as the positive aspects of studying the Method?

An NVivo cluster analysis of questions related to Research Question No. 5A from 26 in-depth interviews of pianists, as well as survey narratives, is illustrated below in Figure 23:

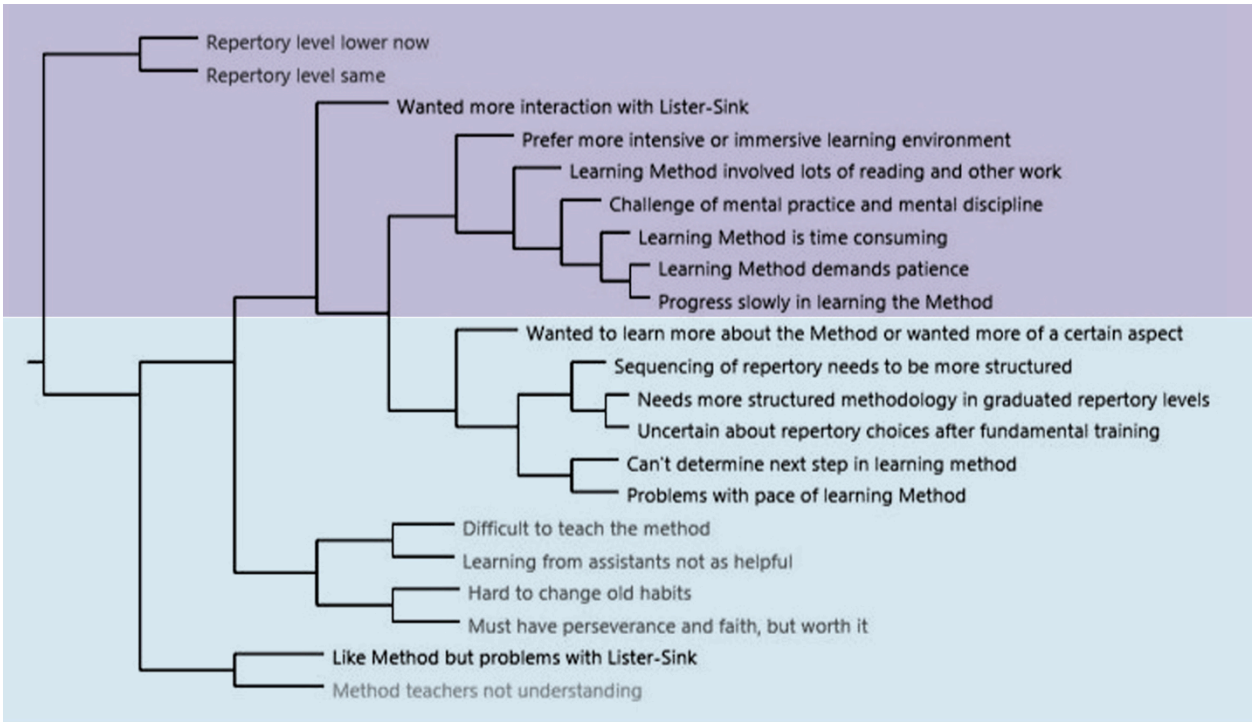

Figure 23. Cluster diagram using codes related to Research Question No. 5A

Questions designed for Research Question No. 5A yielded data related to the overall challenges of studying the Method and learning the technique taught by the Method. Specific topics included pacing of sequenced steps; the learning environment; the amount of patience and mental discipline required; interactions with the instructor; difficulties in changing old habits; the need for more structured methodology in later stages of training; the psychological and emotional difficulties of returning to fundamental coordinations and repertory in the beginning of training; difficulties with instructors; and the challenges of teaching the Method in contemporary society.

The following two themes emerged from the data in Research Question No. 5A:

Part A: Theme 13 – Progress feels slow in early stages of training
Part A: Theme 14 – Need for more structure in upper levels of training

Research Question No. 5A: Theme 13 – Progress Feels Slow in Early Stages of Training

Finding 13: *When asked to comment on what they felt were the most challenging aspects of studying the Method, a large majority of the 26 interviewees commented on their rate of progress, feeling that it was slow (92%). Unprompted, a majority stated that studying the Method demanded patience (81%), many felt learning the Method was time-consuming (62%), and some felt that it required mental practice and mental discipline (46%), and that learning the Method required considerable reading and work (31%). A few volunteered that they preferred an even more immersive learning environment (12%) and wanted more interaction with the instructor (12%), while 4% reported problems with the Method's developer, and 19% regarded assistant instructors as not as helpful. When asked specifically about their level of repertory after studying the Method, 38% reported their repertory was the same and 15% reported that it was lower than when they had begun studying.*

Codes included the following: repertory level lower now, repertory level same, wanted more interaction with the instructor, prefer more intensive or immersive learning environment, learning Method involved lots of reading and other work, challenge of mental practice and mental discipline, learning Method is time-consuming, learning Method demands patience, progress slowly in learning the Method. The correlation coefficients between the Theme 13 codes are shown in Table 21. The correlations between the code "progress slowly," and the codes "learning Method demands patience" and "learning Method is time consuming" were high. This was expected as all codes

emphasized that the Method did require time and patience to be fully effective. The two codes related to repertory had moderate to low correlations with the other codes.

Table 21

Theme 13 Codes

	Wanted more interaction	Rep level same	Rep level lower	Progress slowly	Learning environment	Time consuming	Lots of reading and work	Demands patience
Rep level same	.08							
Rep level lower	.01	.49						
Progress slowly	.49	.33	.27					
Learning environment	.49	.12	.07	.49				
Time consuming	.44	.26	.20	.84	.59			
Lots of reading and work	.31	.17	.16	.61	.52	.76		
Demands patience	.48	.30	.23	.95	.50	.88	.64	
Mental challenges	.38	.20	.17	.71	.69	.83	.69	.74

Progress is slow in beginning, and demands patience and mental discipline.

The combination of a slow rate of progress and the requirement to return to the most fundamental level of coordination and sound production in the beginning stages of training was almost universally cited by participants as being extremely challenging. Aaron articulated this challenge, especially in light of the proclivities of present-day society:

> I mean there were elements that were frustrating…wanting to go faster and maybe at first not understanding what was possible…I don't argue that it's [going back to the simplest coordinations] probably the most effective, but it is hugely time-consuming. Let's face it, in our culture, people want things chop-chop, they want them fast, they want them now. So this Method is not something that goes with the cultural times. (Aaron)

Aaron described other aspects of studying the Method that were particularly difficult:

> Given the amount of focus it demands and the stillness it demands…yeah, those are things I had trouble with. To just listen to the sound and do nothing. It made me insane. Particularly when I was going through trying to overcome the pain….This was really, really challenging, really challenging. (Aaron)

One of the greatest challenges for a highly advanced performer, even one who had experienced a debilitating PRND, was to have to return to the basics of coordination. Again, Aaron reported, "…for somebody who's at the highest level of playing…it's very humbling to have to go back and very, very, very frustrating." Haddon described his frustration another way, "…it can be pretty maddening for a professional musician to sit there and play Schumann's Children's Pieces…It's a tall order to ask someone to retrain." Haddon, who had experienced a PRND, later added:

> I mean, I swear in the summer workshop, I played one note for an entire week! It was just so mentally taxing that there was one day that I really just *wanted to run out of the room and scream* [emphasis added]. (Haddon)

Although Ben liked the concept of a step-wise method, he questioned the pacing, "I really like the pedagogical approach step-by-step. I think sometimes with some students, [the instructor] spends too much time on a certain step…and that makes them feel like they're not really going anywhere…" On the other hand, Craig felt that students should be rescued from their own perfectionist tendencies, "…in the beginning…you want to get it [the coordination] perfect, and you get bogged down. So it's the teacher's responsibility to move the student through when that happens…" Jake, however, while admitting to the challenges of the slow pacing on the foundational stage, questioned whether the Method could be further streamlined, given the diversity of students' needs:

> I would love to see if there was a way for people to get through it faster, but I'm not sure…because everybody's different and everybody's problems are different, and everybody's body is different. So some people progress very quickly and some people don't. I really think that [the Method has been] streamlined…to the point that it's going to go as fast as it can. (Jake)

On the other hand, Rosalie, an advanced pianist who had never experienced a PRND, echoed other interviewees' response that although the Method was challenging, she believed in it:

> [It was] kind of challenging to my vanity I guess…not playing for my friends at the conservatory. They'd be like, oh, I'm playing like Rachmaninoff's 2nd Concerto and I'd be, like, I'm playing one-note strokes. And so that was a challenge. But you know, I'm not really complaining. I really believed in what I was doing so that made it all worth it. (Rosalie)

One survey respondent took responsibility for her own frustration with the training, "I sometimes wished things would move faster along…but understand that sometimes my own lack of patience with myself and my retraining are what was really holding me back." Another interview participant, however, viewed a slower pace in a more positive light:

> …several others in the group had severe injuries and I realized that that was actually good for me because it made me…slow down a little…because any time I would start trying to play, I would go right back to my old habits and…wanted to go faster in the training, not realizing how long it takes the brain to relearn… (Lily)

Zoe had a slightly different perspective, "…this is such a powerful and rich methodology, there's so much to learn. It's just like anything, *you can't get it in a sound bite* [emphasis added]." Finally, Lily expressed her view of the considerable challenges to studying the Method:

> It's just made me realize that if things really are going to change, it's going to take a long time and a lot of work and, um, a lot of mindfulness. And that those lessons I will never forget, so they're being applied in every area of my life…I'm aware now. (Lily)

Repertory levels, before and after training. Interview participants commented on their present level of repertory compared to their pre-training level. For the most part, responses were positive, even if they had not yet returned to their previous level of

repertory: “I’ve been told the repertoire I was playing before my injury was actually graduate level which I was…bumped up to probably much too prematurely…” Another interviewee who was at an advanced level prior to study admitted, “It’s definitely below where I want to be, for sure.” Adam, however, reported that, “…I don’t think I’m necessarily playing more challenging repertoire…which includes some very hard music, [but] I’m playing it with much greater ease.” And Leo echoed that sentiment, “I’m playing repertoire…at the same level as before, but with ease, more understanding, more maturity than before.”

Immersion training versus academic environment, professional challenges. Several interviewees reported difficulties with studying the Method within a college setting with its stricter academic requirements. Abby had wanted, “…a general setting where it's like, ok, let’s focus on this and you’re not doing anything else…I mean actual immersion …no other courses, no jobs…it would make things easier to learn.” Lucy had a similar perspective on the counterproductivity of studying the Method within the confines of academia:

> If I could have studied…away from a college setting…it would have been a much better experience for me, instead of feeling the pressure of juries, exams, and how can we make progress. It just took me back to that very negative space that I was trying to get away from….Feeling the tension of having to perform for people and progress at a certain rate when your body might not be quite ready to be there. (Lucy)

While reflecting Abby’s desire for an immersion experience, a survey respondent expressed a slightly different opinion regarding the setting for the Certificate Program:

> The environment needs to be set up more like an intensive [workshop]…In the current environment, it can be very difficult to focus intensively on the neuromuscular programming. Sometimes the structure of the [Certificate Program] courses feels a little too relaxed, making it harder to really focus… (Survey respondent)

Ted expressed the challenge of trying to combine intensive training in the Method in the Certificate Program with an undergraduate degree program, "…you should never couple it with an actual degree program...do not try to couple it with anything else in life…you can get the most out of it if you put everything you have into [the] program for that year…there's information overload..." However, Haddon felt that combining study of the Method with full-time work was even more challenging than combining it with college studies, "The biggest challenge is fitting it into your professional life…to try to manage a career and change what you're doing and how're you're playing, because then you're changing your musical voice."

Finally, one participant expressed the primary challenge for many—that of going back, at least temporarily, to the beginning of playing:

> …you have to strip down from whatever you were playing before and go down to playing pretty much nothing because that's really the only way you can—and I shouldn't say the only way—maybe the most effective way of really retraining. But I found that really difficult…*it's tough, it's tough mentally and it's tough emotionally* [emphasis added]….But it's all beneficial, it's all necessary if you really want to do it. (Sylvia)

For Theme 13, the code "progress slowly in learning the Method" was examined in greater detail. The highest correlations with this code are shown in Figure 24. There was an extremely high, almost perfect, correlation between "progress slowly" and "learning Method demands patience." As expected, the "time-consuming" code was also highly correlated with "progress slowly."

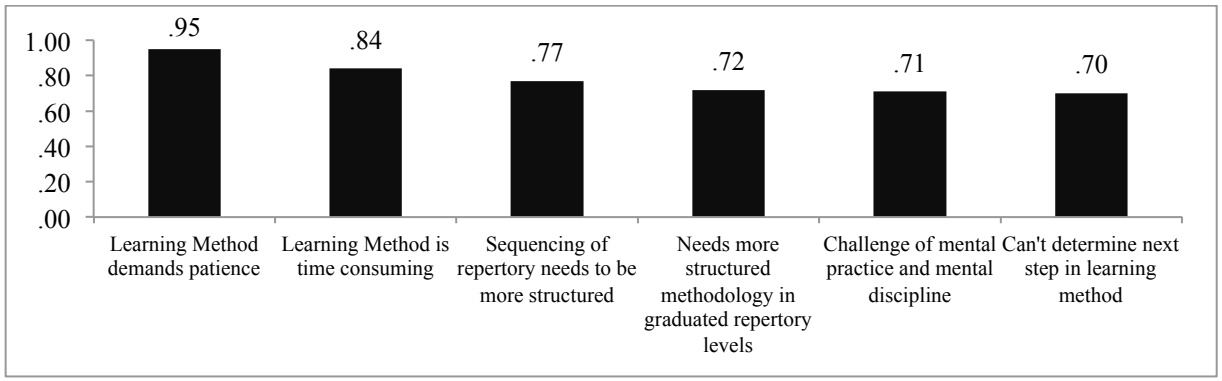

Figure 24. RQ5A Codes with Highest Correlations with "Progress Slowly in Learning the Method" Code

Research Question No. 5A: Theme 14 – Need For More Structure in Upper Levels of Training

Finding 14: *Interview participants were asked to discuss what the most difficult parts of learning the Method were, what its positive or negative aspects were, and what improvements could be made in the Method itself. Answers were voluntary and not specifically prompted. As a result, interviewees expressed a need for clarification, improvement or enhancement of the Method and how it was taught in a number of areas. Interviewees also articulated various challenges in teaching the Method to others. The need for structured methodology in graduated repertory (42%) was correlated with an uncertainty regarding repertory choices after the foundational training stage (38%). Problems with pacing (46%) were also correlated with ambiguity about the next step in training (27%), and some participants wanted more of a certain aspect of the Method (42%). Uneven quality of assistant instructors (19%) was correlated with perceived difficulties in teaching the Method (19%). A few said that although they liked the Method, they had difficulties with its developer (4%). Some interviewees felt that studying the*

Method took faith and perseverance (58%) and a majority agreed that it was hard to change old habits (88%).

Codes for Theme 14 were as follows: wanted to learn more about the Method or wanted more of a certain aspect; sequencing of repertory needs to be more structured; needs more structured methodology in graduated repertory levels; uncertain about repertory choices after fundamental training; can't determine next step in learning method; problems with pace of learning Method; difficult to teach Method; learning from assistants not as helpful; hard to change old habits; must have perseverance and faith, but worth it; like Method but problems with [its developer]; Method teachers not understanding. The correlation coefficients between the Theme 14 codes are displayed in Table 22 and Table 23. There was a very high correlation (.91) between the "sequencing needs more structure" and "uncertainty about repertory" codes. There was also a relatively high correlation between "uncertain about repertory choices after fundamental training" and "can't determine next step in learning Method" (.72), as well as between "sequencing of repertory needs to be more structured," and "needs more structured methodology in graduated repertory levels" (.85).

Table 22

Theme 14 Correlations

	Wanted to learn more	Uncertain about rep choices	Sequencing needs more structure	Problems with pace	More structured methodology	Must have perseverance
Uncertain about rep choices	.48					
Sequencing needs more structure	.52	.78				
Problems with pace	.44	.54	.56			
More structured methodology	.50	.91	.85	.55		
Must have perseverance	.34	.43	.50	.43	.43	
Teachers don't understand	.09	.05	.08	.27	.05	.04
Like Method	.16	.12	.26	.15	.13	.18
Assistants not helpful	.43	.42	.58	.42	.44	.40
Hard to change	.33	.38	.47	.40	.43	.37
Difficult to teach	.34	.31	.51	.44	.36	.37
Can't determine next step	.45	.72	.59	.62	.64	.48

Table 23

Theme 14 Correlations, Continued

	Teachers don't understand	Like Method	Assistants not helpful	Hard to change	Difficult to teach
Like Method	.10				
Assistants not helpful	.08	.25			
Hard to change	.04	.12	.39		
Difficult to teach	.15	.25	.44	.26	
Can't determine next step	.05	.14	.41	.38	.36

Need to specify graduated exercises and repertory in advanced levels. Some study participants in both interviews and the survey addressed in detail the need for more formalized structure beyond the foundational stage of training, including more specification of graduated exercises and repertory through all levels. One survey respondent wrote:

> There needs to be a much better structured methodology of graduating students from one phase of coordinations to the next, by means of specific repertoire types and levels…there needs to be a way to learn pieces that gradually help establish a neuromuscular program with different musical patterns. (Survey respondent)

The same survey respondent spoke further about the need for specific methodology in the more advanced levels of study in preventing recurrence of injury,

"Without a complete sequencing of repertoire, there is a danger of jumping to a piece which is too difficult and then getting reinjured again, before all the primary neuromuscular coordinations have been mastered." Ben, another advanced pianist who had experienced a PRND, echoed this need: "It wasn't really established what should be done with higher levels of repertoire…[The instructor] just sort of…gave you tips as it [repertory] came along…" Abby also agreed that the Method needed this improvement in sequencing, "…the biggest thing…is the sequencing of repertoire to help somebody get back to a previous playing level…it needs to be a much more complex methodology…" Another participant felt that the Method instruction manual was, "fantastic for the beginning and the early intermediate stages." However, he added that, "…the only way that you can get the rest of it is if you study with her intensively." A similar sentiment was expressed by Rosalie, "…I think having a way of integrating the technical [with the musical repertory] and having kind of a base plan for year two would be [helpful]." Leo summarized his opinion, "…it's just the deeper you go [into the training], the harder it is to put into words…it is a great method, *but it's missing lots of steps* [emphasis added]."

Contradictory responses to pace of learning. A number of participants expressed their concerns with the pacing of their learning as they moved through each step of the Method, and even with its emphasis on mastering the fundamentals before proceeding to higher levels:

> I think I would try to move students through the initial steps faster and with the knowledge that you may need to come back every now and then and review those initial steps…I think the impact can be greater if you see results a little bit quicker than what I did. (Clara)

And Abby also expressed her desire for a quicker pace, "…if there could be a way to speed up the process of downloading [the fundamentals] so that we can focus much

more on music-making, that would help…" On the other hand, several participants expressed the opposite reaction to pacing, feeling that the pacing was too rapid:

> The pacing was at times a bit too fast…Pacing is the big thing for me. At least in my case, I needed more time on some concepts and was kind of pushed to move ahead quicker than what I probably should have… (Lucy)

Tess also agreed with Lucy that, "…for a lot of students, the Method as it's laid out goes too fast and then when you go to literature, I felt that maybe we should have taken another step in between before jumping to a big piece." Yet another contradictory viewpoint on pacing was expressed by a survey respondent:

> Most of the negative aspects of the training I experienced stemmed from the failure on the part of the instructor to adhere to the Method's principles. Despite my objection, the instructor moved me through some of the basic stages too quickly. I later found it necessary to undergo remedial training under the guidance of a fellow former student. (Survey respondent)

One survey respondent expressed disillusionment thus: "I was disappointed that I continued to have problems with pain and discomfort and that the training was not as thorough as it should have been for me. Consequently, it has negatively impacted my professional life."

Perseverance and consistent, mindful practice needed. The need for consistent practice—mindful repetition—as a way to establish a new set of habits (a neuromuscular program) was voluntarily underscored by 31% of the participants: "I mean it's just like any skill that you learn. You need to be doing it." And Lucy stated that, "And if you're not practicing consistently…that's when the biggest problems start to happen. That old neuromuscular program just wants to keep coming back. You have to always be vigilant." Sylvia admitted, "It's mentally demanding to retrain when you've…been doing something for a long time. To learn how to redo it is mentally tough…but it's all

beneficial, it's all necessary if you really want to do it." As one survey respondent stated, "It takes a lot of perseverance and faith that your efforts will be rewarded."

Challenges of teaching the Method and its survival in the future. Difficulties with trying to teach the Method were reported by some participants. As Leo put it, "This is not an easy method to teach. This Method is not for everybody the way it is built right now." Another participant agreed and connected the challenges to sociological trends. Angus noted that:

> From a teaching standpoint, it's hard to teach because when you're dealing with our current generation of people, they don't want to spend the time to be thorough. They want to learn a piece quickly and go on to the next thing (Angus)

A survey respondent who taught the Method reiterated that opinion, "I find teaching the…Method to be difficult and easy. Difficult to explain to prospective students and parent [*sic*], difficult for transfer students to adjust to and difficult to incorporate into any of the existing method books that I have seen."

Several interview participants expressed concern about the ability of the Method to survive well into the future and not be dependent on its developer:

> What are we going to do in 20 years? [The developer of the Method] might still be alive, but what are we going to do in 40 years? She'll be a hundred and something. I really hope that there's some way for somebody to help her write all this down in a book and also get some other experts to teach this… (Ben)

Leo stated, "So I'm a little bit afraid that she will retire and just go away and this Method will disappear because not enough people really know about it or have been students in it." Several participants connected the survival of the Method partially with the quality of teaching of the assistant instructors, both in the present and in the future:

> …the part that was difficult for me was that some of her assistants were quite a bit less capable keyboard players than I was or am…it wasn't that they couldn't do the technique well enough, but even then some of them, they just couldn't play

> very well…I keep telling her [the developer of the Method], she needs really top-notch people….to help her because she understandably wants everything to be very carefully…controlled. So she sort of does 98% of this teaching herself. (Haddon)

> I give kudos to the AIs [assistant instructors]…but I really feel she needs people who are as experienced… when you're learning from somebody who isn't like at the very top themselves and can't answer the questions exactly or…even demonstrate the wrong way, it can really interfere with the progress you're going to make. (Ben)

Problems with the Method's developer. The survey yielded several concerns about the effectiveness of the developer of the Method due to perceived personal character flaws:

> Her method is impeccable, and every single lesson you will receive gems of insight, but sometimes in her studio (and way too often outside of the studio), she lets her personal problems permeate throughout her interactions with students. It isn't professional…(Survey respondent)

Finally, another survey respondent, while appreciative of the Method itself, was highly critical of the Method's developer:

> …the irony lies in the fact that [the Method's developer], while being fully intellectually capable of communicating the tenants of her method, lacks the emotional and psychological maturity to consistently produce acceptable results…She can also be falacious [*sic*], inconsistant [*sic*] and verbally abusive. Although I am grateful for the knowledge that I acquired…I found her interest in my personal affairs to be so persistently invasive, that I was behooved to discontinue my study with her. I have continued to apply the principles of the Method to my playing and have gained a great deal from my interactios [*sic*] with other [Method] students. (Survey respondent)

For Theme 14, codes "needs more structured methodology in graduated repertory levels" and "must have perseverance and faith but worth it" were more closely examined. The RQ5A codes with the highest correlations with these two codes are shown in Figure 25 and Figure 26. There were very high correlations among "needs more structure," "uncertain about repertory choices," and "sequencing of repertory needs to be more

structured" codes in Figure 25. The correlations in Figure 26 emphasize the close relationships between codes "must have perseverance" and "progress slowly in learning the Method."

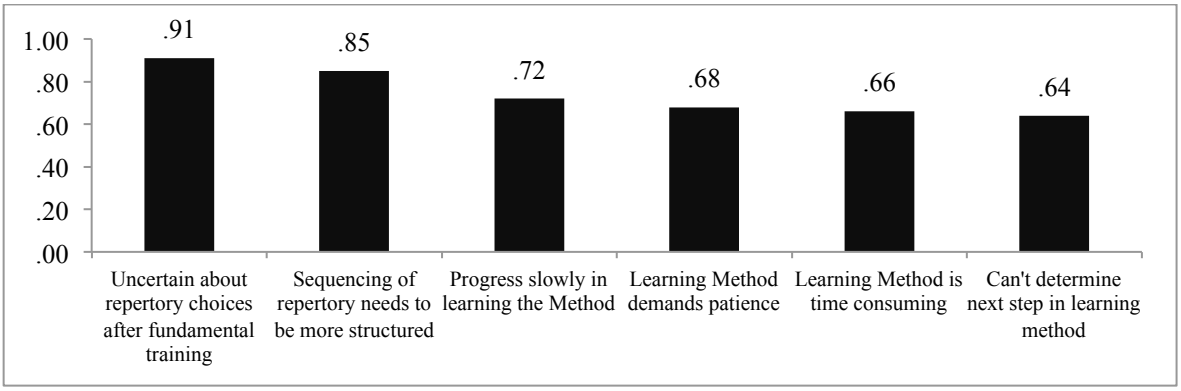

Figure 25. RQ5A Codes with Highest Correlations with "Needs More Structured Methodology in Graduated Repertory Levels" Code

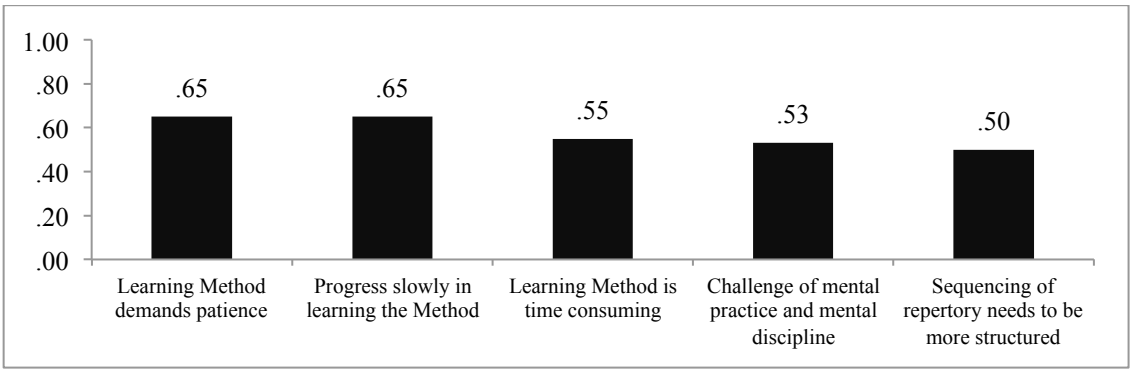

Figure 26. RQ5A Codes with Highest Correlations with "Must Have Perseverance and Faith but Worth It" Code

Research Question No. 5B

What do pianists perceive as the positive aspects of studying the Method?

Research Question No. 5B: What do pianists perceive as the positive aspects of studying the Method?

An NVivo cluster analysis of questions related to Research Question No. 5B from 26 in-depth interviews of pianists, as well as survey narratives, is illustrated below in Figure 27:

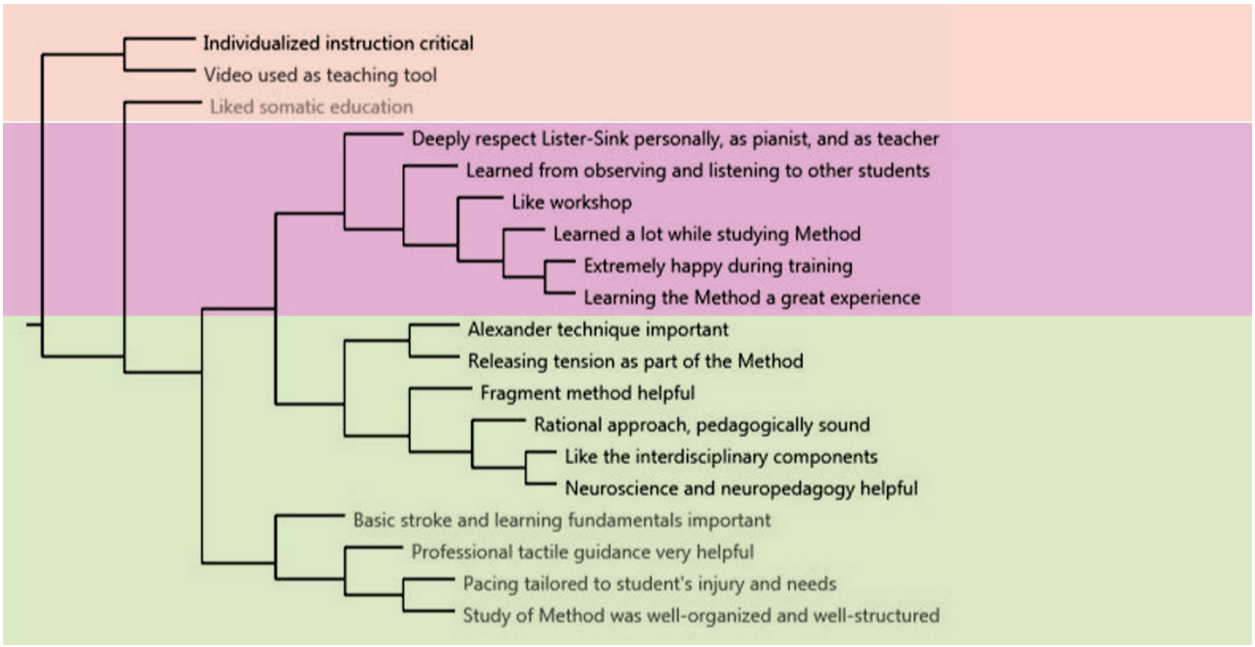

Figure 27. Cluster diagram using codes related to Research Question No. 5B

Questions designed for Research Question No. 5B yielded data related to the overall positive aspects of studying the Method and learning the technique taught by the Method. Three topic areas emerged. They included value of individualized instruction, video-recording of lessons, and somatic education; increased happiness while training, especially in a supportive community of kindred minds and a respected, caring teacher; and, predominantly, unique and identifying characteristics of the Method that were particularly beneficial. These included the Alexander Technique; the Method's specific components of Professional Tactile Guidance©2009; the Basic Stroke©2007; individualized pacing according to student's needs and history of PRNDs; the "fragment method" of

repertory preparation; and interdisciplinary components, especially neuroscience and neuropedagogy.

The following three themes emerged from the data in Research Question No. 5B:

Part B: Theme 15 – Individualized training with video-recorded lessons and somatic education
Part B: Theme 16 – Happier learning in a supportive community
Part B: Theme 17 – Uniquely defining components of the Method

Research Question No. 5B: Theme 15 – Individualized Training with Video-recorded Lessons and Somatic Education

Finding 15: *Out of 26 interview participants, 42% voluntarily reported that writing synopses of weekly video-recorded lessons was helpful, while 27% stated that the various forms of somatic education embedded in the Method were helpful, and 19%, without prompting, reported that they perceived individualized instruction as especially important to successful learning. The topics in Finding 15 were brought up by some interviewees on their own. They were not part of primary interview questions answered by all interviewees.*

Codes in Theme 15 included the following: Individualized instruction critical, video used as teaching tool, like somatic education. The correlations between the Theme 15 codes are shown in Table 24. These three codes were not highly correlated with each other; it was likely that the codes did not fit closely in any of the other clusters and were, therefore, included together by default.

Table 24

Theme 15 Correlations

	Video	Liked somatic education
Like somatic education	.17	
Individualized instruction	.30	.18

Efficacy of video-recorded lessons. A unique component of the Method—that reflected evidence in the literature on neuroscience and neuropedagogy of the mirror neuronal system—was the requirement to write a detailed synopsis and reflection on each video-recorded lesson. The synopsis-reflection was then emailed to the instructor and used as a springboard for the subsequent lesson.

Sylvia reflected on both the challenge and the benefit of the video-recorded lesson and writing a synopsis of it each week:

> I found going over my videos and doing lesson synopses challenging, but again, it's…one of the more important aspects of doing it, and I totally recognize…it's very tough but it's absolutely necessary…you learn an enormous amount if you're willing to really dig into your videos and…go through it in depth and write up the best kind of response or synopsis that you can. (Sylvia)

Another pianist commented on the value he found in transcribing in detail video recordings of his lessons, "It's a treasure…I look at my notes in great detail because it's almost measure by measure…from statements of general principles to everything in particular to a passage…Occasionally I go back to the video and check…" And Leah commented that, "I'll go review video tapes of old lessons to get myself kind of in the mind frame…" Lucy correlated the transcriptions of video-recorded lessons to retaining what she had learned, "I have a notebook sitting right here that's full of all of those notes that we had to take from our lesson videos. I would say I *retained at least 90% to 95% of it* [emphasis added]."

Somatic education. Somatic education—learning about and sensing one's own body—was an essential component of the Method. While the Alexander Technique was the primary somatic discipline incorporated into the Method, students read about and experienced other forms of somatic education such as Feldenkrais Method, yoga, tai chi, and Pilates. Haddon commented on the value of somatic education in studying the Method, "It really is much more effective. So I think that that's the golden ticket [somatic education] for this technique." That perspective was echoed by Lucy, "Somatic awareness and Alexander Technique—I guess I tend to clump those two together—honestly, I think without those we would not have the level of success that we have in the program…"

Research Question No. 5B: Theme 16 – Happier Learning in a Supportive Community

Finding 16: *Interview participants were asked to share whatever they wished related to studying the Method. Without prompting, a number of interviewees reported that learning the Method was a great experience (65%), which was correlated positively with being extremely happy during training (62%) and learning a lot while studying the Method (62%). Some interviewees (31%) voluntarily commented on how they had learned from listening to and observing other students, and 42% commented on their respect for the Method's developer as a pianist and teacher. When asked specifically about their response to the intensive week-long technique training workshop, a majority of participants (81%) said that they liked it.*

Codes that emerged from Theme 16 were the following: deeply respect [the developer of the Method] personally, as pianist, and as teacher; learned from observing

and listening to other students; liked workshop; learned a lot while studying Method; extremely happy during training; learning the Method a great experience. Table 25 shows the Pearson correlation coefficients among the Theme 16 codes. These correlations were considerably higher than the Theme 15 correlations. Not surprisingly, "extremely happy" was closely related to "learning the Method a great experience." However, "extremely happy" was also closely related to the "learned a lot while studying the Method" code.

Table 25

Theme 16 Correlations

	Liked workshop	Great experience	Learned from observing	Learned a lot	Extremely happy
Great experience	.66				
Learned from observing	.51	.52			
Learned a lot	.66	.68	.54		
Extremely happy	.62	.82	.55	.71	
Deeply respect the developer	.46	.49	.47	.50	.52

Participants commented on how important various aspects of what they perceived as a unique learning environment were to the success of the training. In Theme 16, the various codes viewed together seemed to indicate the importance to the participants of a supportive learning environment, including a teacher they respected, students who were understanding and compassionate, and a place where they felt safe to be themselves and, in some cases, talk freely about their experiences with PRNDs.

Role of the Method's developer. Deep respect for the developer of the Method, and appreciation for her support and understanding were correlated with a positive learning experience. Aaron stated that she, "…is so compassionate and…incredibly patient…She was really terrific in terms of absolutely understanding everything that one

was going through and being supportive, but yet still making you stick to it and not compromising her principles." Several participants commented on the Method's developer as being unusual, tying that into the innovative nature of the Method. Leo noted that, "…she has a method that I have not found anywhere else." And Jacob remarked:

> You know she's one of a kind. I don't know anybody else who does what she does because of the way she does it….She is a genius for having come to all this herself…she's a unique…person. As a human being, she's extraordinary and I have to say it's a privilege that I ran into her. (Jacob)

Jake noted, "I mean, she totally changed my life. And I really owe her everything and I know most of her students feel that way about her." A number of survey respondents expressed their respect for the instructor's playing and teaching, "…her musicianship is wonderful which she conveys admirably" and "...[she] is, in my opinion, a genius teacher and a passionate one." One survey participant noted that she, "…is a wonderful role model—as performer, teacher, thinker, and kind, caring human being. She has influenced me enormously." Abby stated, "I could tell with her it was a very scientific approach and *in the end, it was about music-making* [emphasis added]…" Finally, another survey respondent reported:

> In fact, she has saved my life that I wanted to end because I could not play the piano to make music that meant everything to me. In the darkness I was in, she showed me the light through the music and her teaching. I hope to create music to inspire others and spread her teaching to help others. (Survey respondent)

Supportive community for PRNDs. Angus described what it was like to be together with other students with PRNDs:

> …when you have a lot of people that are injured…around each other, that can…be depressing because you're all struggling. But in a way…you have that supportive environment of people that understand what you're going through….The more that I tell my story, the more they tell theirs. And it really

> gets people to engage in some really honest discussions about injuries….I find that to be very good because…the biggest problem is that we don't want to talk about it, and so…we can't fix what we don't talk about. (Angus)

And Leo expressed relief, "Suddenly, I was like, well, I'm not alone because there's a big shame in this field when you are injured. People don't like to talk about that because...nobody really knows what to do." Lucy noted one advantage of such a community, "So if anything, it improves our ability to interact with other people." One interviewee who had dealt with a long-term PRND remarked on the ability to learn just from observing: "Once I could actually sit down at the piano, I had actually learned it all simply by watching…and hearing, even though I wasn't able to do it physically."

Intensive week-long workshop and immersion training. One of the most positive experiences for a majority of participants (81%) was the week-long intensive technique training workshop. Simon commented, "That week, it was a fabulous week just the way it was all set up with other musicians, some of them in the same boat [injured], or others just wanting to further their own technical capacity." Adam described its impact on him, "…that week was very positive in every respect. It introduced me to the Method, but it also made me aware that I could make changes in my own playing…" and Clara stated, "What was a huge positive impact…having that week of very intensive work every day, eight hours a day of talking about this, thinking about it, seeing other people do it." Leah echoed, "I think it was very positive. It really kick-started me again into thinking a lot about technique…the whole week was really a positive atmosphere…" Phoebe expressed her reaction, "It was…very helpful…a very eye-opening week, and it was very reassuring…it was…like going through a door and being in a very new world…" Finally, Randall reported, "…that week is so crucial and I think the people that don't get that

week are at a disadvantage…you're getting eight to ten hours a day…[in] a very small group, you're getting a lot of attention."

Extremely happy with training. A number of participants expressed their satisfaction with the training. Ben reported, "I'd say it was overall a wonderful experience." And Isabelle stated, "I have been pretty much nothing but pleased with the results of taking the time out of my life to retrain." Survey respondents commented, "I really couldn't be happier with my experience during my training" and "Loved it and so grateful I received the education I did." Another stated, "…the Method soon becomes a highly positive experience. I began to count progress I was making more than flaws still to be overcome!" And Calvin reported, "So it's just been one big wholeness of really good…" Finally, Simon summed up his experience with the training and the environment:

> For me, it was a great experience both for coming out of an injury and then musically getting all the way back to playing. Being able to support myself using that was a fabulous experience. It was also just a great experience being able to work with musicians on that level because we had to meet sometimes many times a week…and then and to figure out exactly what was going on and help each other, which was fabulous.…I personally enjoyed it on just so many levels because of what it did for my own life and my own music-making. (Simon)

For Theme 16, the "liked workshop" code was chosen for closer scrutiny. The charts showing the RQ5B codes with the highest correlations with this code are shown in Figure 28. The top three codes related to "liked workshop" were "learning the Method a great experience," "learned a lot," and "extremely happy during training." This seemed to indicate a positive perception of the workshop in the participants' viewpoints.

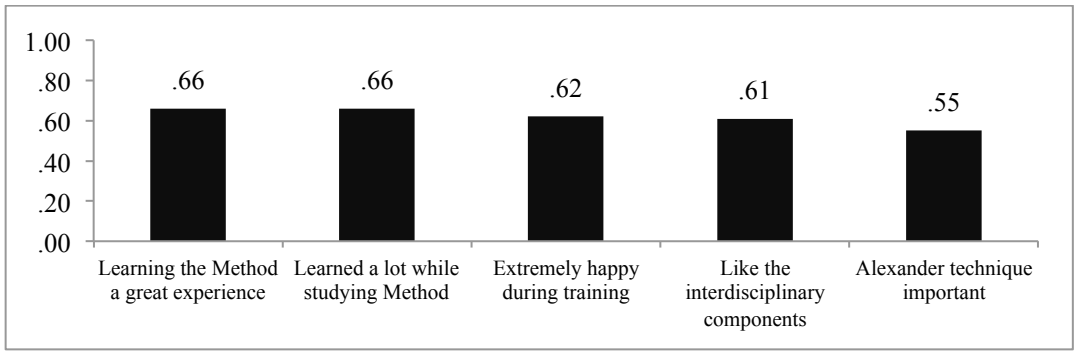

Figure 28. RQ5B Codes with Highest Correlations with "Liked Workshop" Code

Research Question No. 5 B: Theme 17 – Uniquely Defining Components of the Method

Finding 17: *Without prompting or specific questions, a number of unique aspects of the Method were reported by interview participants as helpful and positive. Somewhat contradicting findings in RQ5A, a majority (73%) found the pacing of learning to be tailored to their needs, and some mentioned that the Method was well-structured (38%). Many liked the interdisciplinary components (65%), especially neuroscience and neuropedagogy (35%), and learning to release unnecessary muscular tension was mentioned favorably by many (62%). The Basic Stroke, one of three particularly defining components of the Method, was considered by many to be positive (65%), along with the practice of learning pieces in fragments in tempo (38%). When asked specifically to comment on the Alexander Technique and Professional Tactile Guidance, all participants found the Alexander Technique important and helpful (100%), and all participants (100%) spoke of the value and essential need for Professional Tactile Guidance.*

The following codes were included: Alexander Technique important; releasing tension as part of the Method; fragment method helpful; rational approach, pedagogically sound; like the interdisciplinary components; neuroscience and neuropedagogy helpful;

Basic Stroke and learning fundamentals important; Professional Tactile Guidance very helpful; pacing tailored to student's injury and needs; study of Method was well-organized and well structured. The correlation coefficients among the Theme 17 codes are displayed in Table 26 and 27. Only one of these relationships exhibited a high correlation in Table 25 ("liked interdisciplinary components" and "neuroscience, neuropedagogy helpful"), but the other correlations were primarily in the moderate range.

Table 26

Theme 26 Correlations

	Well-organized	Releasing tension	Rational approach	Professional tactile guidance	Pacing
Releasing tension	.37				
Rational approach	.35	.38			
Professional tactile guidance	.47	.42	.33		
Pacing	.55	.40	.40	.47	
Neuroscience, neuropedagogy	.46	.43	.53	.52	.52
Like interdisciplinary components	.51	.49	.57	.55	.57
Fragment method	.30	.48	.41	.29	.37
Basic stroke	.45	.45	.29	.32	.41
Alexander technique	.36	.57	.42	.35	.38

Table 27

Theme 27 Correlations, Continued

	Neuroscience, neuropedagogy	Like interdisciplinary components	Fragment method	Basic stroke
Like interdisciplinary components	.81			
Fragment method	.45	.52		
Basic stroke	.36	.40	.38	
Alexander technique	.44	.55	.38	.32

Continually releasing unnecessary tension as helpful in avoiding injury. Interview participants discussed one of the primary characteristics of the Method—efficient muscle use and non-accumulation of muscle tension. They spoke of the importance of learning to both identify unnecessary muscle tension, and to release it. They also credited their concurrent study of the Alexander Technique with enhancing

their learning, citing this particular identifying component as central to their progress in the Method. Randall explained its importance to his studies:

> I had nothing built into my technique for releasing tension that accumulated. That is the hallmark of [the] technique…the release mechanism is built into the way you play…[the] emphasis on the release mechanism with the work with the Alexander Technique was what helped me avoid any further discomfort or injury. (Randall)

Fragment approach to fast passages. Another defining component of the Method was an approach to learning fast passages in fragments up to tempo without accumulating any unnecessary tension. Some participants noted its helpfulness in playing fast, even virtuoso, repertory. Randall explained the fragment method of learning a fast piece, "You learn a virtuosic piece in a certain way, you break it down, you don't practice slowly necessarily, you practice these fragments very quickly, make sure that there's no unnecessary tension, and then you piece them together." Angus reported on its efficacy in learning advanced, virtuoso repertory. "Fragment practice method has been invaluable…certainly [for] the hard literature….That's the biggest thing I've gotten out of the Method…practicing up to tempo in fragments. The big rep [*sic*] is no problem if you break it down like that." And Adam stated, "…that is something that applies more to virtuoso repertoire....It's a technique that…works really, really well." Simon found the approach useful in other ways, "I could learn that piece so much more deeply and so much more quickly." And one survey respondent wrote, "No one else in the world (to my knowledge) is teaching a method like this for the learning of virtuosic passagework."

Basic Stroke. The Basic Stroke, as defined in Chapter I, was one of the most recognizable components of the Method. In sports terminology, it would be equivalent to

basic form. Randall described how students learned the Basic Stroke during the week-long intensive training workshop:

> That's the genius behind [the] Method in that week because you learn the Basic Stroke. You learn [the] basic form. And everybody leaves, and I'd say 99.9% of the people get it well because it's so intense, and you're spending hours on the most basic thing. (Randall)

Professional Tactile Guidance (PTG). Another uniquely defining component of the Method was Professional Tactile Guidance. All participants believed that hands-on guidance through PTG—a technique for helping students sense their muscle state through light, targeted touch of certain muscles in the neck, shoulders, arms, and hands—was essential to successful learning. As Clara explained it, "Extremely helpful, extremely helpful…[the instructor] would touch my elbow and I would become aware that there was tension there and then release…[the instructor] telling me wouldn't have had nearly the impact that the tactile guidance has." Adam stated, "…I think it would have been very challenging to learn the technique without the Professional Tactile Guidance." And Calvin agreed, "…for me [it] was crucial." Jake claimed that, "I don't think it [training] can be 100% effective without hands-on guidance." In Leo's opinion, "…you cannot do the Method without doing hands-on work.…I think this is really, really important. This Method without touching the student would not make any sense." Zoe agreed, "Absolutely essential …exponential learning." However, while affirming its value, Randall mentioned the potential hazards of such a hands-on approach in today's society:

> I don't think you can teach it any other way. We're dealing with an athletic task... [but] everybody's afraid of lawsuits. But the thing is, it's just a good thing. I like [the] title "Professional Tactile Guidance."…I don't think I could have learned it if we didn't have it. (Randall)

Advantages of a methodology for teaching technique. In spite of considerable professional distrust of any methods for teaching technique, a number of interviewees found a step-by-step approach to learning a complex coordinative skill to be helpful. As Simon reported, "I came in at one level and it just step-by-step took me up and brought me out of injury, which was fabulous." Or as Haddon stated it, "I think that the slow, very careful, methodical layering of the Method is really very helpful." And Isabelle added a pedagogical imperative, "As long as the progression of things can be adaptable to each person as it should be, I think that's one of the most important things."

Interviewees were specifically asked their opinion of Professional Tactile Guidance and its helpfulness in learning the Method. Because this question was asked separately and not as part of a larger question, the code "Professional Tactile Guidance very helpful" was selected to be examined in more detail with those RQ5B codes most closely related to it. The relationships are shown in Figure 29. It should be noted that even though these codes were closely correlated with Professional Tactile Guidance, they were not extremely high.

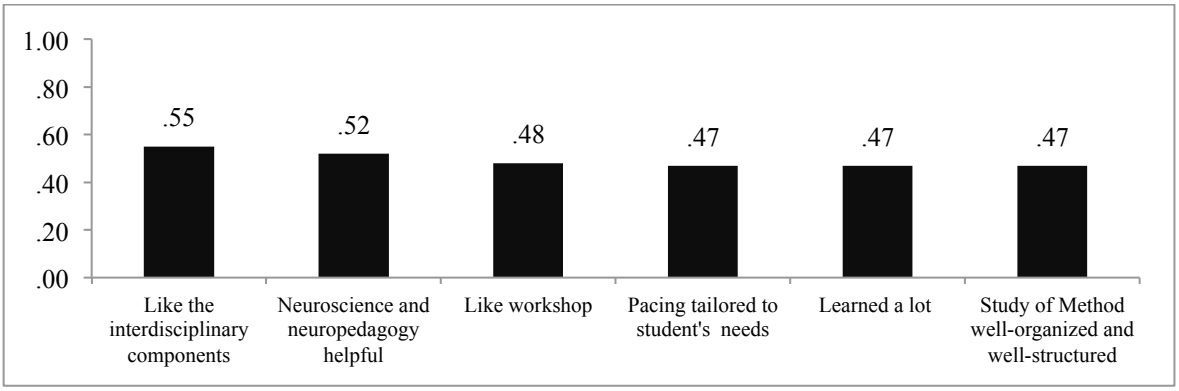

Figure 29. RQ5B Codes with Highest Correlations with "Professional Tactile Guidance Very Helpful" Code

Although the "rational approach, pedagogically sound" code was previously examined in RQ2, it was interesting to see which RQ5B codes were closely related to it. These relationships are shown in Figure 30. This chart shows that the major codes closely related to the "rational approach and pedagogically sound" code were also codes included in RQ2, namely, "learned a lot," "liked the interdisciplinary approach," and "neuroscience, neuropedagogy helpful."

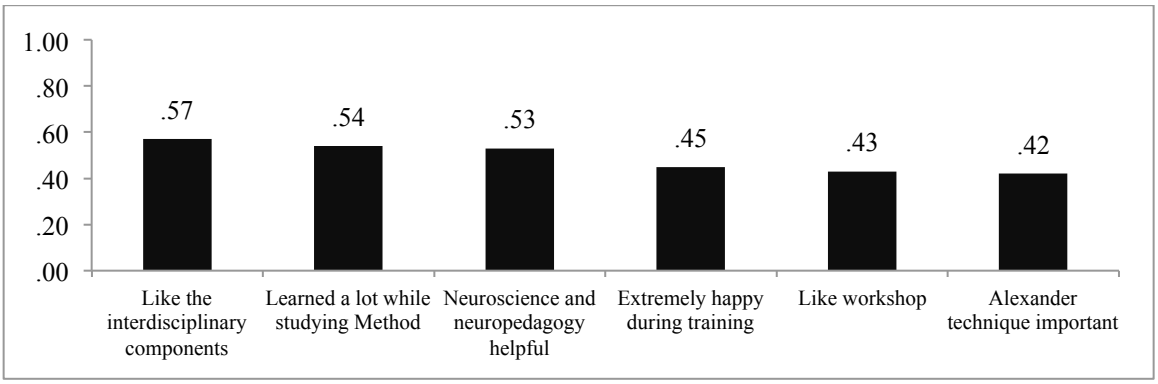

Figure 30. RQ5B Codes with "Rational Approach and Pedagogically Sound" Code

Theme Coverage. The RQ5A and RQ5B theme coverage statistics were combined into one table, Table 28. Theme 13 was dominated by Abby who accounted for 11.21% of the quotes within the theme. This was not surprising as the slow pace and a preference for a more intensive learning environment were major topics of her interview. Theme 14, on the other hand, was dominated by the survey qualitative answers at 11.38%, as well as by Abby again at 10.84%. Again, this was not unanticipated because most complaints about the teaching of the Method came from the survey rather than from the interviews. However, Abby expressed in detail a need for structure in advanced repertory, and her perception of not knowing the next step forward after a certain point in studying the Method. Jacob dominated Theme 15 at 15.98%, largely because he went into great detail in his interview about the efficacy of video-taping lessons. The discussions of

Theme 16 were somewhat more evenly divided among the interviewees, with Angus (6.93%), Ted (6.91%), Randall (6.65%), and Haddon (6.21%) disproportionately represented to a degree. Finally, Theme 17 appeared to be dominated by Clara at 9.01%.

Table 28

Percentage of Theme Covered by Each Interviewee, RQ5

	Theme 13	Theme 14	Theme 15	Theme 16	Theme 17
Aaron	6.62%	2.71%	4.6%	4.48%	3.04%
Abby	11.21%	10.84%	0%	5.84%	4.78%
Adam	0.63%	2.57%	0%	2.43%	5.91%
Angus	4.34%	6.07%	7.26%	6.93%	7.8%
Ben	2.91%	2.9%	0%	1.96%	2.66%
Calvin	2.29%	0.58%	0%	2.21%	2.77%
Clara	6.69%	3.25%	9.2%	3.84%	9.01%
Craig	5.87%	1.4%	0%	0%	2.95%
Haddon	5.67%	6.27%	4.75%	6.21%	2.83%
Isabelle	1.96%	0.67%	0%	5.09%	2.07%
Jacob	0.42%	0.55%	15.98%	3.44%	1.39%
Jake	2.39%	2.94%	0%	1.1%	0.93%
Leah	0.73%	1.57%	1.5%	0.55%	1.44%
Leo	2.39%	4.79%	9.39%	5.61%	2.15%
Lily	5.7%	2.15%	0%	2.49%	5.81%
Lucy	3.43%	6.87%	8.38%	2.59%	2.5%
Otto	0%	1.04%	7.02%	0.35%	0.4%
Paul	5.11%	8.63%	0.24%	2.2%	7.28%
Phoebe	1.71%	1.69%	5.81%	3.8%	2.58%
Randall	5.28%	5.38%	6.3%	6.65%	7%
Rosalie	1.44%	3.99%	2.42%	0.62%	1.25%
Simon	0%	0.9%	0%	8.4%	2.76%
Sylvia	5.71%	2.85%	5.52%	3.97%	2.97%
Ted	6.39%	3.52%	4.21%	6.91%	7.32%
Tess	0.71%	1.89%	0%	2.62%	1.38%
Zoe	5.17%	2.59%	6.1%	4.64%	5.6%
Survey	5.21%	11.38%	1.31%	5.06%	3.43%

Summary of Research Question No. 5A and No. 5B

In Research Question No. 5A, the perceived challenges of studying the Method could be divided into two categories. In the first category, participants had encountered difficulties arising from the Method's perceived weaknesses. These included the need for

better structuring and codification of stages beyond fundamental training; problems with pacing of learning and sequencing of repertory in advanced stages; and personality concerns regarding the Method's developer. The second category was comprised of the emotional, psychological, intellectual, and societal challenges specifically related to the Method. These included the difficulty of changing old habits; the demands on time; professional conflicts; and the need for cultivating character traits such as patience, perseverance, focus and mental discipline.

In Research Questions, No. 5B, the perceived benefits of studying the Method fell into two categories. In the first category, participants were happy with a number of components unique to the Method. These included the Alexander Technique, interdisciplinary components such as neuroscience and neuropedagogy, video-recording and transcribing of lessons, individualized instruction, and the perceived well-structured nature of the Method itself. This first category also included more specific aspects of the Method such as Professional Tactile Guidance; the Basic Stroke; the in-tempo, impulse-fragment method of learning virtuoso repertory; and the muscular release mechanism that prevented accumulation of unnecessary tension. In the second category, participants were very happy with the safe and pleasant learning environment; the unique, compassionate and respected instructor; the supportive community of kindred musicians; the practice of immersion training; and observing, hearing and interacting with other students of the Method. In the discussion segment of Chapter VI, certain contradictions that surfaced from the interviews will be addressed.

Chapter V

QUANTITATIVE RESULTS

Introduction

The purpose of this mixed methods study was to investigate systematically, through surveys and interviews, students' perceptions of the effectiveness of an interdisciplinary Method for teaching injury-preventive piano technique. The study examined the Method's short and long-term outcomes in adult pianists—injured and non-injured—trained in the Method. This chapter will report the quantitative results, in both descriptive and inferential statistical form, of a Qualtrics survey of 103 (N=74) current and former students of the Method under investigation. All quantitative analysis was carried out using IBM SPSS (Statistical Package for the Social Sciences) Version 22.

The survey was available on Qualtrics from December 30, 2014 through February 13, 2015 (Appendix G – Survey). The link to the survey, letter of introduction, and accompanying IRB-approved documents were emailed to 103 current and former students of the Method by Research Assistants. None of the 103 emails were duplicates, and none were returned. However, two former students contacted RA1 and asked to be removed from the list. Of the 103 recipients, 74 pianists responded and completed the survey. The response rate for the survey was, therefore, 71.8%.

Demographic Data

The average age of the 74 survey respondents was 45 years old. Of the respondents' sample, 58.6% were female and 41.4% were male, 29.7% held a masters degree in music and 16.3% held a doctorate, while 73.5% were pianists, and 26.5% considered themselves primarily organists. Of those surveyed, 48.6% had experienced at least one playing-related neuromusculoskeletal disorder (PRND), and 51.4% had never had a PRND, while 70.3% classified themselves as professional musicians. Additional demographic information about the survey respondents is shown in Table 29.

Table 29

Survey Demographic Variables, Percentages

Variable		Number	Percentage
Gender			
	Male	29	41.4%
	Female	41	58.6%
Age			
	Under age 30	17	23.9%
	Age 30 - 39	20	28.2%
	Age 40 - 49	9	12.7%
	Age 50 - 59	3	4.2%
	Age 60 - 69	14	19.7%
	Age 70 and older	8	11.3%
Highest Level of Keyboard Training			
	Bachelors	19	25.7%
	Masters	22	29.7%
	Doctorate	12	16.3%
Type of Keyboardist			
	Pianist	50	73.5%
	Organist	18	26.5%
Professional Status			
	Professional musician	52	70.3%
	Teach piano or organ	41	55.4%
PRND Status			
	Never had one	37	51.4%
	Experienced at least one	35	48.6%

Results

Research Question No. 1

How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in recovering from those disorders?

Research Question No. 1 was answered by first creating three subscales from the survey data. The three subscales were:

1. "Effect of PRNDs on life" subscale.
2. "Effectiveness of other help in dealing with PRNDs" subscale.
3. "Perceived effectiveness of Method on PRNDs" subscale.

All questions used in the subscales were asked on a sliding scale basis. The slider ranged from a value of -1 (much worse) to 0 (no effect) to +1 (much better). The subscales were created as means and therefore had the range of values. The lowest value of the subscale was -1, which would indicate that the PRNDs made life much worse, other help made the PRNDs much worse, or the Method made the PRNDs much worse. Conversely, values of +1 would indicate that the PRNDs made life much better, other help made the PRNDs much better, or the Method made the PRNDs much better. Likewise, a value of 0 would indicate that the PRNDs, other help, or the Method had no effect.

Table 30 shows the questions included in the "Perceived effectiveness of PRNDs on life" subscale. The means of these 11 questions were averaged together to form the subscale. Each of these questions was negative, indicating that the PRND had a negative effect on that aspect of the survey respondent's life. The question with the most negative

mean (-.63) was Question 1: "How did you feel about the level at which you were able to play while you were injured?"

Table 30

Subscale 1: "Effect of PRNDs on Life" Subscale, Questions Included in Subscale

	N	Minimum	Maximum	Mean	Std. Deviation
1. How did you feel about the level at which you were able to play while you were injured?	26	-1.00	.59	-.63	.40
2. What effect has PRND had on your life?-Studies	28	-1.00	1.00	-.28	.55
What effect has PRND had on your life?-Professional life	30	-1.00	1.00	-.38	.59
3. What effect has PRND had on your life?-Personal life	28	-1.00	1.00	-.33	.56
4. What effect has PRND had on your life?-Sense of well-being	30	-1.00	1.00	-.42	.57
5. What effect has PRND had on your life?-Mental focus	29	-1.00	1.00	-.32	.57
6. What effect has PRND had on your life?-Kinesthetic awareness	29	-1.00	1.00	-.03	.62
7. What effect has PRND had on your life?-Auditory awareness	27	-1.00	1.00	-.11	.58
8. What effect has PRND had on your life?-Flexibility	30	-1.00	1.00	-.10	.63
9. What effect has PRND had on your life?-Suppleness of movement during everyday activities	28	-1.00	1.00	-.16	.58
10. What effect has PRNDs had on your life?-Overall health and well-being	28	-1.00	1.00	-.18	.60
11. How was your playing while you were injured?	25	-1.00	1.00	-.20	.71

Table 31 shows the questions that comprised the "Effectiveness of other help on PRNDs" subscale. As with the first subscale, the means of the eight questions were averaged together to form the subscale itself. The means of these eight questions were quite varied—some were negative and some were positive. The most positive results

seemed to have come from healthcare professionals. The most negative results seemed to have come from colleagues. Teachers also appeared to have been unhelpful.

Table 31

Subscale 2: "Effectiveness of Other Help in Dealing with PRNDs" Subscale, Questions Included in Subscale

	N	Minimum	Maximum	Mean	Std. Deviation
1. How effective was the treatment?	27	-.60	1.00	.22	.40
2. To what extent did the following people help you deal with your PRND?-Teachers	30	-1.00	1.00	-.01	.51
3. To what extent did the following people help you deal with your PRND?-Family	27	-1.00	1.00	.06	.50
4. To what extent did the following people help you deal with your PRND?-Partner	24	-1.00	1.00	.03	.49
5. To what extent did the following people help you deal with your PRND?-Colleagues	26	-1.00	1.00	-.06	.48
6. To what extent did the following people help you deal with your PRND?-Friends	27	-1.00	1.00	.11	.52
7. To what extent did the following people help you deal with your PRND?-Mental health professionals.	22	-1.00	1.00	.08	.46
8. To what extent did the following people help you deal with your PRND?-Healthcare professionals.	31	-.72	1.00	.35	.43

The final subscale, "Perceived effectiveness of the Method on PRNDs," included only two questions that are shown in Table 32. Both of these questions dealt with the overall efficacy of the Method in helping survey respondents recover from their PRNDs. The mean values of both questions were relatively high. Both means were closer to +1 than 0, indicating that the survey respondents perceived the Method as being helpful in recovering from PRNDs.

Table 32

Subscale 3: "Perceived Effectiveness of Method on PRNDs" Subscale Questions

	N	Minimum	Maximum	Mean	Std. Deviation
To what extent did studying the Method help you recover from your PRNDs?	35	.01	1.00	.65	.32
What effect, if any, did studying the Method have on your PRNDs?	32	.11	1.00	.74	.23

The descriptive statistics for the three subscales are shown in Table 33. The mean for the "Effects of PRNDs on life" subscale was negative (-.28), while the "Perceived effectiveness of the Method on PRNDs" subscale was relatively high at .69. The Cronbach's alpha values were also relatively high for each of the subscales, thus indicating that all three subscales were reliable.

Table 33

Descriptive Statistics of Three Subscales

	N	Minimum	Maximum	Mean	Std. Dev.	Cronbach's Alpha
Effects of PRNDs on life	32	-1.00	1.00	-.28	.46	.937
Effectiveness of other help in dealing with PRNDs	34	-.72	1.00	.11	.37	.796
Perceived effectiveness of the Method on PRNDs	35	.14	1.00	.69	.27	.841

Inferential tests of Research Question No. 1 subscales. The three subscale values were tested to determine whether they were significantly different from zero. To perform this test, a one-sample *t*-test was used, with 0 as the test value. This test calculated a *t* statistic that was used to test the null hypothesis that the mean value for the entire population of pianists who had studied the Method was actually 0. A *p*-value of .05 was used.

When the mean of the "Effects of PRNDs on life" subscale was tested to determine whether it was significantly different from zero, the one-sample *t*-test yielded

the results: $t(31) = -3.46$, $p = .002$. In this case, since $p < .05$, the actual mean of this subscale was significantly different from zero. Assuming a large effect size of .8, the power for this one-sample *t*-test was .99.

Next, the "Effectiveness of other help in dealing with PRNDs" subscale was tested to determine whether the mean was significantly different from zero. This test yielded the result: $t(32) = 1.66$, $p = .106$ indicating that the mean of the subscale and zero was not statistically significant. The power for this test was also .99.

Finally, the mean of the subscale "Perceived effectiveness of the Method on PRNDs" was tested to determine whether it was significantly different from zero. This test yielded the result: $t(34) = 15.11$, $p < .001$. The power for the test was > .99. The conclusion was that the mean value of the "Perceived effectiveness of the Method" subscale was statistically significant, and in this case the mean value of the subscale was positive. Therefore, survey respondents perceived that the Method was effective in helping them to recover from their PRNDs.

Types of PRNDs and "Perceived effectiveness of the Method on PRNDs" subscale. Next, the value of the mean of the "Perceived effectiveness of the Method on PRNDs" subscale was viewed by type of disorder. In SPSS it was possible to select a type of disorder, create descriptive statistics, and run inferential tests on each disorder separately. First, the mean value of the subscale for seven different types of playing-related disorders (PRNDs) was examined. These disorders included muscle fatigue, extensor tendonitis, and carpal tunnel syndrome, as well as anatomical anomalies such as joint hyperlaxity. The mean values for the subscale are shown in Figure 31.

It should be noted that survey respondents were allowed to select more than one PRND. Because of that option, adding up the number of respondents in each PRND category would yield more than 35, the overall number of injured survey respondents who answered at least one of the two survey questions comprising the "Perceived effectiveness of the Method" subscale. It is noteworthy that the mean subscale value appeared quite high for each type of disorder. The overall mean for the subscale (as shown in Table 33) was .69. From the chart, it appeared that tendonitis and medial epicondylitis sufferers had a higher than average perception of the efficacy of the Method, while carpal tunnel syndrome and thoracic outlet syndrome sufferers had a slightly lower perception.

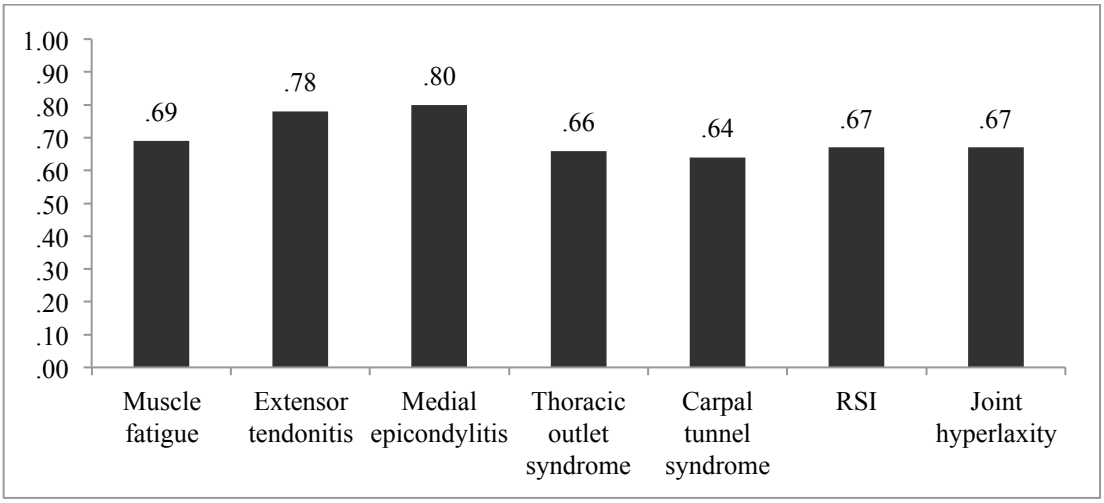

Figure 31. "Perceived Effectiveness of the Method on PRNDs" Subscale by Type of Disorder.

A test was then performed to determine whether the mean "Perceived effectiveness of the Method" subscale value was significantly different from zero for each of the disorders in Figure 31. However, the number of observations, or *N*, was not great enough for most of the disorders to have sufficient power to carry out the one-

sample *t*-test. In general, a power of .80 has been cited as sufficient power for social science research with an alpha value of .05 (Tomcho & Foels, 2009). A power level of .95 is considered the desired level. To obtain the minimum power of .80, *N* must have been at least 15 for this particular statistical test. However, because most disorders reported were too low in number, this was not possible.

It should be noted that, for the remainder of the chapter, all statistical tests had at least a power of .80; in most cases the power was .95 or greater. Therefore, it was possible to run inferential tests for muscle fatigue and extensor tendonitis participants. The one-sample *t*-test on survey respondents with muscle fatigue yielded the results: $t(26) = 14.42$, $p < .001$, while the test on the participants with tendonitis yielded the results: $t(16) = 14.19$, $p < .001$. The results of the one-sample *t*-tests were significant at a .05 level in both cases. It could, therefore, be concluded that survey respondents with either muscle fatigue or extensor tendonitis perceived the Method as having a positive influence on recovering from their PRND.

Different aspects of the Method and PRNDs. One other set of questions seemed to relate to Research Question No. 1. As with the other questions, this was a slider question that ranged from -1 (made it much worse) to +1 (helped me recover completely). "Individualized attention" had the most favorable score with a mean of .75 out of 1.00, followed closely by the "Alexander Technique" at .70. The descriptive statistics showing the perceived effectiveness of various aspects of the Method on the survey respondents' PRNDs are shown in Table 34.

Table 34

Descriptive Statistics: How did the following aspects of studying the Method affect your PRNDs?

	N	Minimum	Maximum	Mean	Std. Deviation
Alexander Technique	30	.00	1.00	.70	.25
Training environment	29	-.12	1.00	.55	.35
Instructors' attitudes	31	-1.00	1.00	.64	.46
Individualized attention	30	-0.39	1.00	.75	.31
Individualized pacing	31	-.30	1.00	.68	.37
Fellow students' support	28	-.02	1.00	.63	.31
Time away from life stressors	26	.00	1.00	.49	.34
Cost of training	24	-.10	1.00	.31	.37

Inferential testing of differences between categories – "Perceived effectiveness of Method on PRNDs." As the final step in the quantitative analysis of RQ1, a test was run to determine whether organists and pianists perceived the "Perceived effectiveness of the Method on PRNDs" differently, as well as whether the perceptions of males and females, and then younger and older participants, were the same or different. Figure 32 shows the "Perceived effectiveness of the Method on PRNDs" mean subscale values for each of these demographic categories. The age category was split down the middle so that equal numbers of participants were in the older and younger groups. The cutoff age was 38; therefore, the younger group included survey respondents age 38 and younger.

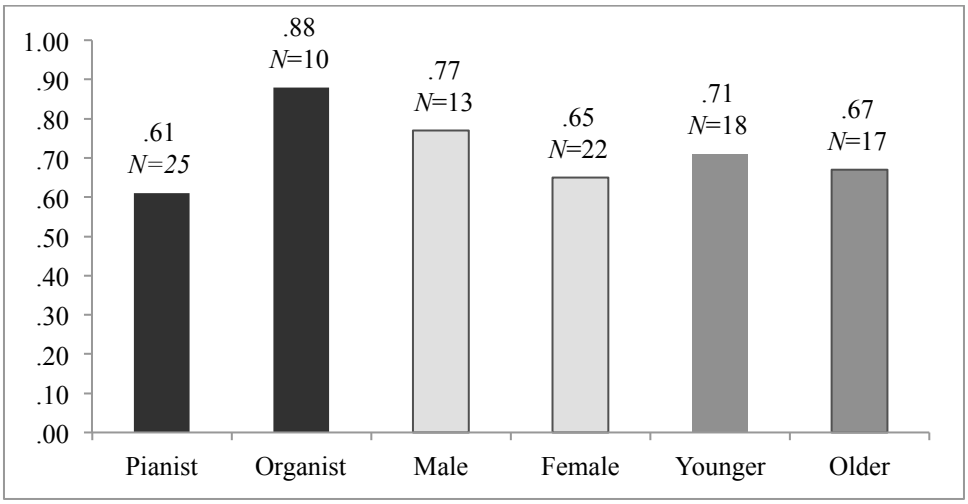

Figure 32. "Perceived Effectiveness of the Method on PRNDs" Subscale by Demographic Category.

Of those surveyed, while responses were all favorable, organists appeared to have had a more positive perception of the effectiveness of the Method than pianists, and males appeared to have had a more positive perception than females. The perception of younger participants was slightly more positive than older participants, but the difference did not appear great. Whether any of these differences were statistically significant could be determined by an independent-samples *t*-test. This test examined whether the mean value of each group was actually the same for the overall population.

The independent-samples *t*-test for organists and pianists yielded the results: $t(33) = -2.92$, $p = .006$, indicating that a statistically significant difference existed in the perceptions of the Method for organists and pianists. Organists had a significantly more positive perception of the Method in recovering from PRNDs than pianists.

The independent-samples *t*-test for males and females yielded the results: $t(33) = 1.28$, $p = .21$, indicating that the difference in perception between males and females was not statistically significant. Therefore, even though in Figure 32 males appeared to have

had a more positive perception, inferential testing showed that males did not have a significantly more positive perception of the Method in recovering from PRNDs than females.

Younger participants had only a slightly more positive perception of the Method than older participants. The independent-samples *t*-test for younger and older participants yielded the results: $t(33) = 0.50$, $p = .62$. As with gender, $p > .05$ which indicated that the difference in mean perception by younger and older participants was not statistically significant. Therefore, even though in Figure 32 younger participants appeared to have had a slightly more positive perception, inferential testing proved that younger and older participants had perceptions of the Method that were not significantly different from each other.

Overall perception of the Method. An interesting subscale appeared in the survey data that was not a part of Research Questions Nos. 1-5. It was included here with analysis of data for Research Question No. 1 because one of the codes in the qualitative analysis of RQ1 was "Positive perception of the Method." This emergent subscale could be labeled "Overall perception of the Method," and was created from four questions in the survey addressing the survey respondents' overall perception of the Method. The subscale had a respectable Cronbach's alpha value of .80, thereby indicating that it was a reasonably reliable subscale. For each of the questions, the most negative perception of the Method was represented by -1 and the most positive perception by +1. The questions used to create the subscale are shown in Table 35.

Table 35

"Overall Perception of the Method" Subscale and Questions Used to Create the Subscale

	N	Minimum	Maximum	Mean	Std. Dev.
Overall perception of the Method subscale	70	-.17	1.00	.78	.28
How committed are you to the Method?	67	-1.00	1.00	.71	.44
What are your overall feelings about the Method?	70	-.19	1.00	.87	.25
Compared to how you used to feel while playing, how do you feel while playing since studying the Method - Physically?	64	-.05	1.00	.79	.29
Compared to how you used to feel while playing, how do you feel while playing since studying the Method – Emotionally?	64	-.29	1.00	.73	.36

A one-sample *t*-test showed the "Overall perception of the Method" subscale to be significantly greater than zero with the results: $t(69) = 23.012$, $p < .001$. A comparison of the values of this subscale between groups is shown in Figure 33.

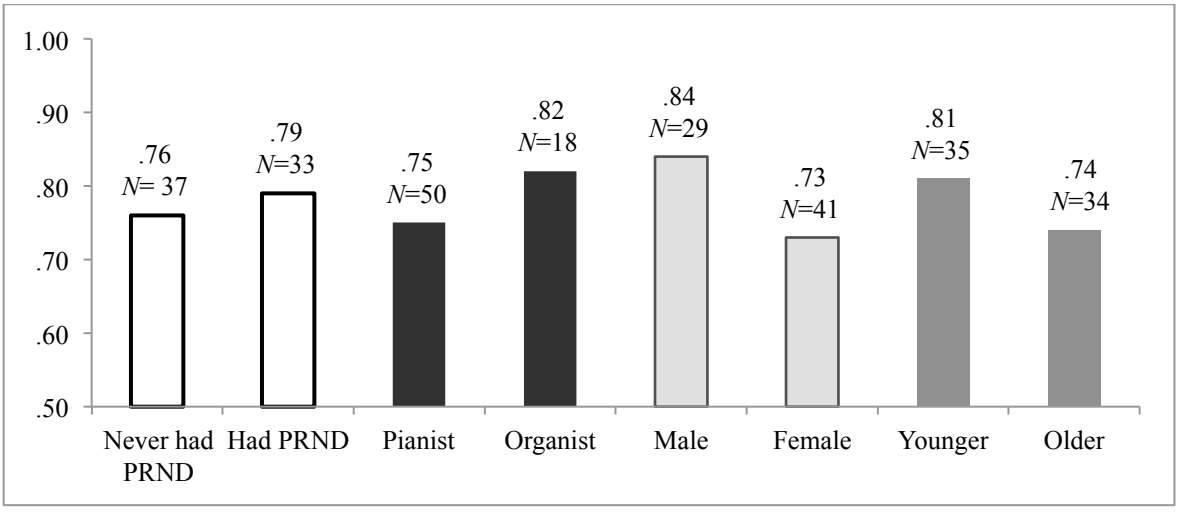

Figure 33. "Overall Perception of the Method" Subscale by Sub-Group.

Organists appeared to have had a more positive perception than pianists, males appeared to have had a more positive perception than females, and younger participants appeared to have had a more positive perception than older participants. The differences

were tested by means of an independent-samples *t*-test to determine if they were statistically significant. The test results between injured and non-injured survey respondents yielded the results: $t(68) = -0.40$, $p = .69$. The test between pianists and organists yielded the results: $t(66) = -0.91$, $p = .37$. The results of the independent-samples *t*-test also showed no significant difference between males and females with the results: $t(68) = 1.60$, $p = .11$. Finally, the results of the inferential test between younger and older survey respondents yielded the results: $t(67) = 1.51$, $p = .14$. The differences between all of these sub-groupings were not statistically significant.

Research Question No. 2

How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in preventing recurrence of those disorders?

Injury status of participants. Before looking at whether the Method helped to prevent recurrence of injury, it was important to consider the current PRND status of the survey respondents. The results are shown in Figure 34. Half of the survey respondents had experienced a PRND at one time; 13.5% of those had had no recurrence.

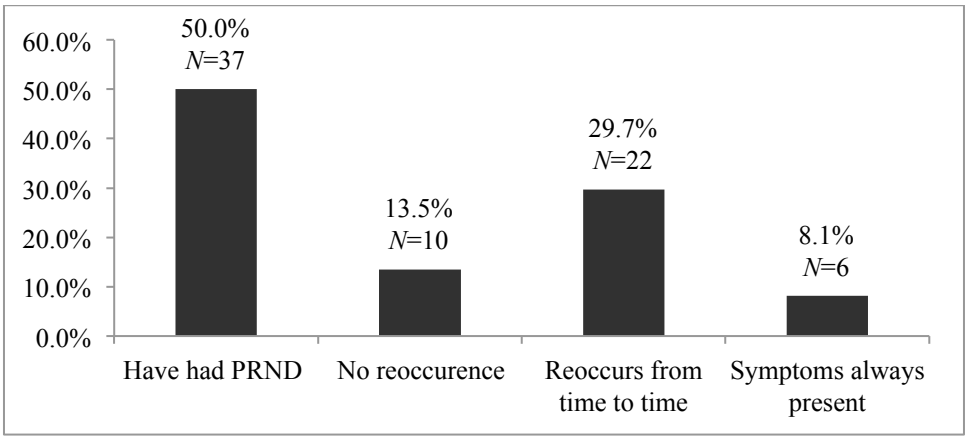

Figure 34. PRND Status of Survey Respondents.

Survey respondents were also asked the question: How is your PRND now? The answers ranged from -1 (much worse than before the injury) to +1 (much better than before the injury). With 31 survey respondents answering this question, the mean was .68. A one-sample *t*-test was performed to determine whether the actual mean was significantly different than zero. The test yielded the results: $t(30) = 11.09$, $p < .001$. Therefore, the mean value of this question was significantly greater than zero, meaning that respondents perceived that their PRNDs were better than before the injury.

Alexander Technique and other interdisciplinary components of the Method. Next, various interdisciplinary components of the Method were examined**,** including the Alexander Technique. Survey respondents were asked the question: "How did the following aspects of studying the Lister-Sink Method affect your PRND?" A subscale comprised of those aspects of the Method was created. This was determined to be a reliable subscale with a Cronbach's alpha value of .80. The questions used in the compilation of the subscale are shown in Table 36.

Table 36

"Method Aspect Helpful for PRNDs" Subscale and Questions Used to Create It

	N	Minimum	Maximum	Mean	Std. Dev.
Method aspect helpful subscale	.32	.05	1.00	.63	.24
Alexander Technique	30	.00	1.00	.70	.25
Training environment	29	-.12	1.00	.55	.35
Instructors' attitudes	31	-1.00	1.00	.64	.46
Individualized attention	30	-.39	1.00	.75	.31
Individualized pacing	31	-.30	1.00	.68	.37
Fellow students' support	28	-.02	1.00	.63	.31
Time away from life stressors	26	.00	1.00	.49	.34

A one-sample *t*-test was used to determine if the results were statistically significant. This test yielded the results: $t(31) = 15.061$, $p < .001$ indicating the results were, indeed, statistically significant ($p<.05$). It is interesting to note that the mean for the question on the Alexander Technique itself was more positive at .70 than the subscale mean at .63. In fact, this was the second highest of the "Aspects" means, lower only than "Individualized attention" (.75).

Does the Method help prevent future injury? Survey respondents were asked whether the Method helped them to prevent future PRNDs. Two survey questions addressed this issue. The second question was asked in reversed form, meaning that, for the original question, a more negative value meant a more positive perception of the Method. For consistency in the analysis, the answers (as reported below) were reversed. The descriptive statistics for these two questions are shown in Table 37.

Table 37

"Method Helps Prevent PRNDs" Questions

	N	Minimum	Maximum	Mean	Std. Dev.
To what extent has the Method provided you with the technical training and knowledge to help you prevent PRNDs?	66	.12	1.00	.87	.22
To what extent did you gain your knowledge of preventing PRNDs through your study of the Method? (reversed)	63	-1.00	1.00	.53	.58

Originally, these two questions were to be combined to form a subscale. However, a Cronbach's alpha test showed that the two questions did not combine together to form a relative subscale, yielding an α of .05. Upon more careful scrutiny, it appeared that the two questions were actually asking two different things. The first question dealt with *whether* the Method gave the participant the knowledge to prevent PRNDs. The answers were in slider form ranging from -1 (extremely unhelpful) to +1 (extremely helpful). The second question asked *where* the respondent gained his or her knowledge of preventing injury. A value of -1 represented "I learned everything that I know about preventing PRNDs through studying the Method," while a value of +1 represented "I gained no knowledge about preventing PRNDs through my study of the Method." Again, the answers were reversed for analysis. It should be pointed out that saying the Method taught the survey respondent everything he or she needed to know to prevent injury was distinctly different from saying the Method was extremely helpful. Many survey respondents who felt the Method was very helpful may have also gained additional knowledge for preventing future PRNDs from other sources. Therefore, these two questions were not asking the same thing. Because of this, each question was analyzed separately, rather than combined into one subscale.

The first question that asked whether the Method was helpful had a mean value of .87, a very high mean. A one-sample *t*-test to determine whether the mean was actually greater than zero yielded the results: $t(65) = 32.34$, $p < .001$. The one-sample *t*-test on the second question concerning where knowledge was gained, yielded the results: $t(62) = 7.31$, $p < .001$. Therefore, even though the mean value for the second question on whether all respondents gained their knowledge from the Method only appeared to have a lower

mean value, it was still significantly greater than zero. The results showed that the Method was perceived to be helpful in preventing PRNDs and respondents also perceived that they gained most of their information for preventing future PRNDs from the Method.

The answer to Research Question No. 2 might best be found in the answer to the first question above: "To what extent has the Method provided you with the technical training and knowledge to help you prevent PRNDs?" Because of its importance, other sub-groupings were examined to ascertain whether certain groups of survey respondents perceived the Method to be more effective in preventing recurrence of injury than other groups. Figure 35 shows the mean values of this question for non-injured vs. injured, pianists vs. organists, males vs. females, and younger vs. older participants.

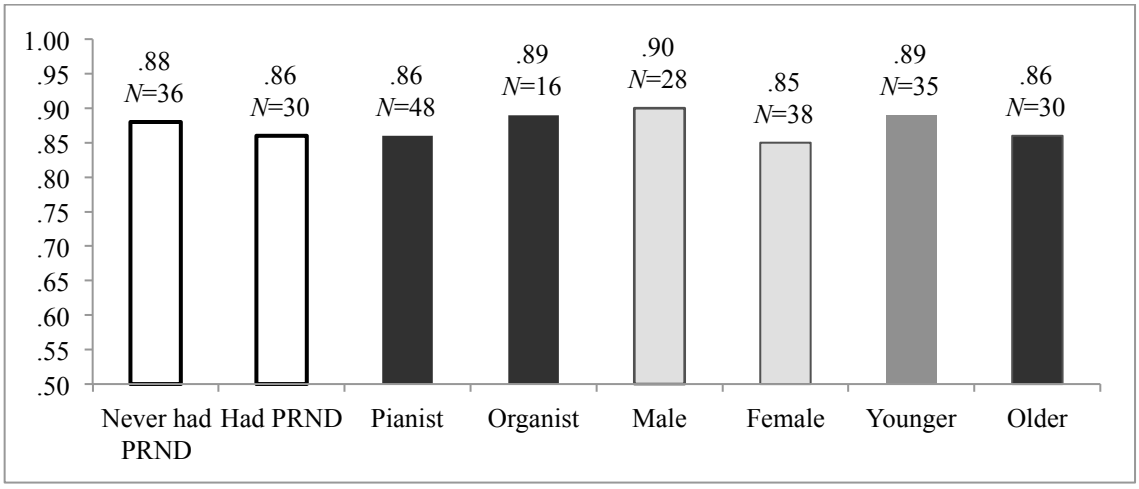

Figure 35. Perception of the Method in Providing Training to Prevent PRNDs, Various Groups.

Note that all groups appeared to have relatively similar and high mean values. Independent-samples *t*-tests were performed to determine whether the difference between any of these pairs was statistically significant. The test between injured and never-injured survey respondents yielded the results: $t(64) = 0.30$, $p = .77$. The test between organists

and pianists yielded the results: $t(62) = -0.38$, $p = .71$. The test between male and female participants yielded the results: $t(64) = 0.88$, $p = .38$. The test between younger and older participants yielded the results: $t(63) = 0.57$, $p = .57$. All tests were not statistically significant at a .05 level. Therefore, each pair had statistically the same perception of the effectiveness of the Method in providing the tools and training to prevent injury. No difference existed between either injured or non-injured participants, organists or pianists, males or females, or between younger or older survey respondents.

Research Question No. 3

What effect, if any, do pianists perceive this interdisciplinary Method to have on various aspects of musicality and technique?

While the salient purpose of this study was to investigate students' perceptions of whether the Method helped in recovery from and prevention of playing-related injury, another important question for the developer of the Method was whether students perceived the Method to enhance their technique and musicality. Therefore, a number of survey questions touched on different aspects of musicality and technique. To test the perceived effect of the Method on musicality and technique, and to test whether differences existed between the different groups of respondents, a number of musicality- and technique-related subscales were created. The first was an overall subscale that included all music-related survey questions. This was called the "Overall music" subscale. The questions included in this all-inclusive subscale are shown in Table 38. For all questions, -1 represented the most negative answer to the question (extremely negative, made it much worse), while +1 represented the most positive answer (extremely positive, greatly improved it). Zero represented neutral or had no effect.

Table 38

All Music-Related Questions Included in "Overall Music" and Other Music Subscales

	N	Minimum	Maximum	Mean	Std. Dev.
M1. How have your teachers, colleagues, friends, physicians, or family responded to you and your playing?-Teachers	40	-.08	1.00	.71	.35
M2. How have your teachers, colleagues, friends, physicians, or family responded to you and your playing?-Colleagues	48	.00	1.00	.81	.26
M3. How have your teachers, colleagues, friends, physicians, or family responded to you and your playing?-Friends	53	.00	1.00	.78	.27
M4. How have your teachers, colleagues, friends, physicians, or family responded to you and your playing?-Family	52	.25	1.00	.84	.21
M5. How have your teachers, colleagues, friends, physicians, or family responded to you and your playing?-Audience	46	.01	1.00	.82	.27
M6. How has studying the Method affected your musicality?-Phrasing	62	.00	1.00	.84	.23
M7. How has studying the Method affected your musicality?-Emotional content	59	-.15	1.00	.79	.29
M8. How has studying the Method affected your musicality?-Communication with audience	59	-.11	1.00	.71	.33
M9. How has studying the Method affected your musicality?-Performance anxiety	58	-.11	1.00	.60	.36
M10. How has studying the Method affected your musicality?-Fulfillment of artistic potential	60	.00	1.00	.76	.30
M11. How has studying the Method affected your musicality?-Structural cohesion	58	.00	1.00	.73	.34
M12. How has studying the Method affected your musicality?-Rhythmic flow	61	-.20	1.00	.78	.31
M13. How has studying the Method affected your ability to listen and hear yourself while playing?	64	.00	1.00	.81	.25
M14. To what extent has your training in the Method affected your ability to play difficult pieces?	64	-.25	1.00	.72	.37
M15. At what skill level are you playing now relative to how you played before studying the Method?	64	-.50	1.00	.56	.43
M16. How has studying the Method affected your perception of music-making while playing?-Overall perception	66	-.01	1.00	.75	.28
M17. How has studying the Method affected your perception of music-making while playing?-Ability to listen and hear myself at the piano or organ	64	-.52	1.00	.74	.33
M18. What effect, if any, did studying the Method have on your technique?-Tone control	62	-.28	1.00	.78	.28
M19. What effect, if any, did studying the Method have on your technique?-Dynamic control	61	-.27	1.00	.79	.27
M20. What effect, if any, did studying the Method have on your technique?-Tone quality	61	-.09	1.00	.82	.24
M21. What effect, if any, did studying the Method have on your technique?-Ability to voice	60	.00	1.00	.80	.26
M22. What effect, if any, did studying the Method have on your technique?-Facility	62	-.18	1.00	.78	.31
M23. What effect, if any, did studying the Method have on your technique?-Muscular suppleness	63	-.01	1.00	.80	.28
M24. What effect, if any, did studying the Method have on your technique?-Speed	62	-.02	1.00	.74	.33
M25. What effect, if any, did studying the Method have on your technique?-Power	61	-.04	1.00	.77	.32

In addition to this all-inclusive subscale, music-related questions were divided into four, more specific, subscales. The "Musicality" subscale included questions M6-

M12, M16, and M17, shown in Table 38. The "Technique" subscale included questions M14, M15, and M18-M25. Finally, the "Listening" subscale included questions M13 and M17 while the "Others' comments on playing" subscale included questions M1-M5. The descriptive statistics for the five subscales are shown in Table 39. The Cronbach's alpha values were high for all of the subscales, therefore indicating that they were indeed reliable.

Table 39

Descriptive Statistics of Music-Related Subscale

	N	Minimum	Maximum	Mean	Std. Dev.	Cronbach's Alpha
Overall music subscale	66	.08	1.00	.74	.25	.959
Musicality subscale	66	.00	1.00	.73	.26	.914
Technique subscale	66	-.37	1.00	.72	.31	.943
Listening subscale	65	-.20	1.00	.78	.27	.878
Others' comments on playing subscale	57	.22	1.00	.78	.24	.875

All five mean subscale scores were tested using the one-sample *t*-test to determine whether they were significantly different from zero. The test results on the "Overall music" subscale were: $t(65) = 24.22$, $p<.001$. The test results on the "Musicality" subscale were: $t(65) = 22.98$, $p<.001$. The test results on the "Technique" subscale were: $t(65) = 19.24$, $p<.001$. The test results on the "Listening" subscale were: $t(64) = 22.94$, $p<.001$. Finally, the test results on the "Others' comments on playing" subscale were: $t(56) = 24.91$, $p<.001$. All subscales were significantly greater than zero.

Music subscales, differences between groups. Next, subscales were tested for differences between sub-groups, namely PRND status, type of keyboardist, gender, and age group. Figure 36 shows the "Overall music" subscale mean score for each of these sub-groups. It is noteworthy that the survey respondents who never had a PRND had a more positive mean score on the "Overall music" subscale than injured participants,

while males appeared to have had a more positive music score than females. These differences were tested by performing independent-samples *t*-tests.

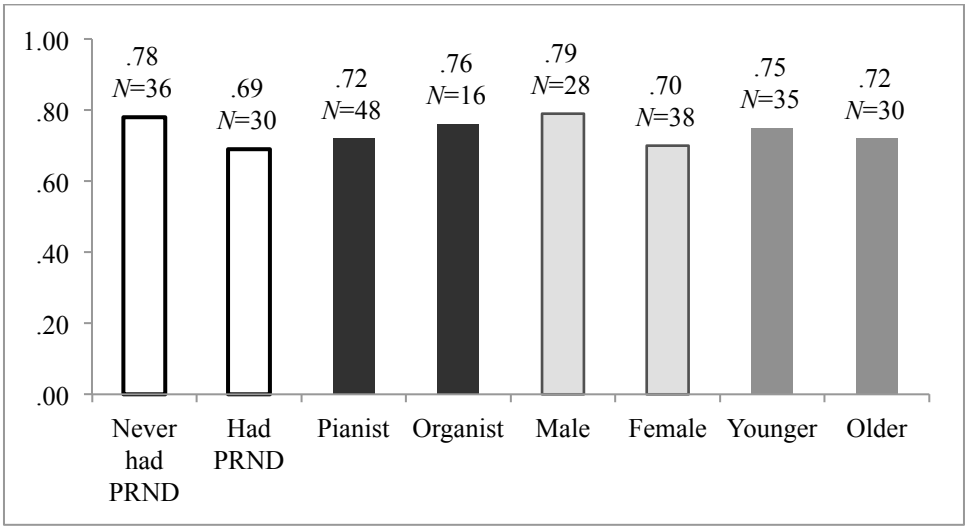

Figure 36. "Overall Music" Subscale by Sub-Group

Independent samples *t*-tests were performed on the overall music subscale by injury status, keyboard type, sex, and age. The test between injured and never-injured participants yielded the results: $t(64) = 1.47$, $p = .15$. The test between organists and pianists yielded the results: $t(62) = -0.51$, $p = .62$. The test between male and female participants yielded the results: $t(64) = 1.49$, $p = .14$. The test between younger and older participants yielded the results: $t(63) = 0.61$, $p = .55$. Since the *p*-value in all cases was above .05, one could conclude that no statistically significant difference existed between the sub-groups. Therefore, injured and non-injured survey respondents had the same "Overall music" subscale score, pianists and organists had virtually the same score, males and females had the same score, and that younger and older survey respondents had subscale scores that were not significantly different from each other.

The same process was repeated for the "Musicality" subscale. The subscale means for all sub-groups are shown in Figure 37. The mean values for the subscale appeared slightly more positive for never-injured, male, and younger survey respondents.

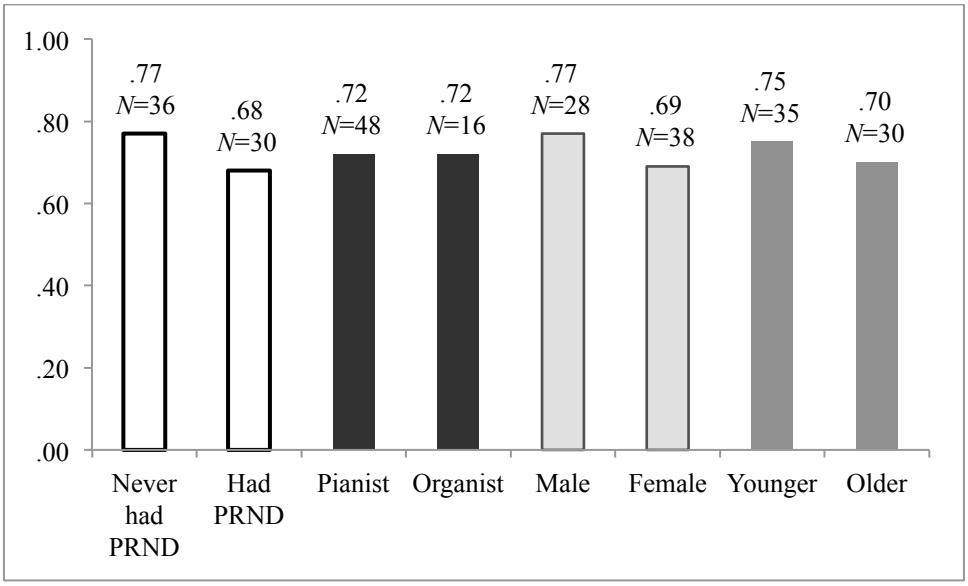

Figure 37. "Musicality" Subscale Means by Sub-Group.

Again, whether these differences were statistically significant needed to be determined by an independent-samples *t*-test. The test between injured and never-injured survey respondents yielded the results: $t(64) = 1.38$, $p = .17$. The test between organists and pianists yielded the results: $t(62) = -0.02$, $p = .99$. The test between male and female participants yielded the results: $t(64) = 1.30$, $p = .20$. Lastly, the test between younger and older participants yielded the results: $t(63) = 0.66$, $p = .51$. Once again, the results of the *t*-tests indicated that the means for each of these sub-groups were not significantly different from each other. The means for the "Technique" subscale for each sub-group is shown in Figure 38. It was interesting to note that the mean subscale score for non-injured respondents appeared higher than the score for injured participants, while the

score for males appeared more positive than the score for females. These differences were tested for significance using independent-samples *t*-tests.

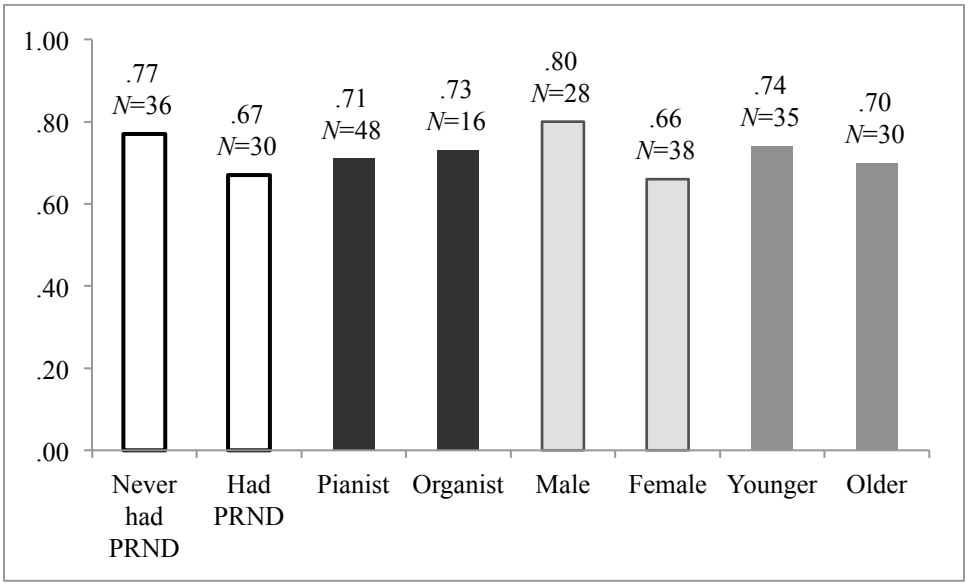

Figure 38. "Technique" Subscale Means by Sub-Group.

The test between injured and never-injured survey respondents yielded the results: $t(64) = 1.33$, $p = .19$. The test between organists and pianists yielded the results: $t(62) = -0.24$, $p = .81$. The test between male and female respondents yielded the results: $t(64) = 1.78$, $p = .08$. The test between younger and older respondents yielded the results: $t(63) = 0.43$, $p = .67$. As before, the results of the *t*-tests indicated that the means for each of these sub-groups were not significantly different from each other. However, the *p*-value for gender was lower than the others, at .079. This value was still above the .05 value needed for statistical significance, but the *p*-value was below .10. At times, a *p*-value between .05 and .10 is "marginally significant." The difference between the mean male "Technique" subscale score and the mean female score was not great enough to be statistically significant, but it was great enough to be marginally significant, or to raise some interest. The possibility that males perceived more technical improvement than

females perceived technical improvement might warrant further study. Such findings, however, could be related to ergonomic issues of hand size, as well as corroboration in the literature that female pianists are at greater risk for PRNDs than male pianists (Manchester, 2014b).

The means for the "Listening" subscale for each sub-group are shown in Figure 39. Interestingly, the mean subscale score for organists appeared higher than the score for pianists, while the score for males appeared more positive than the score for females. These differences were tested for significance using independent-samples *t*-tests.

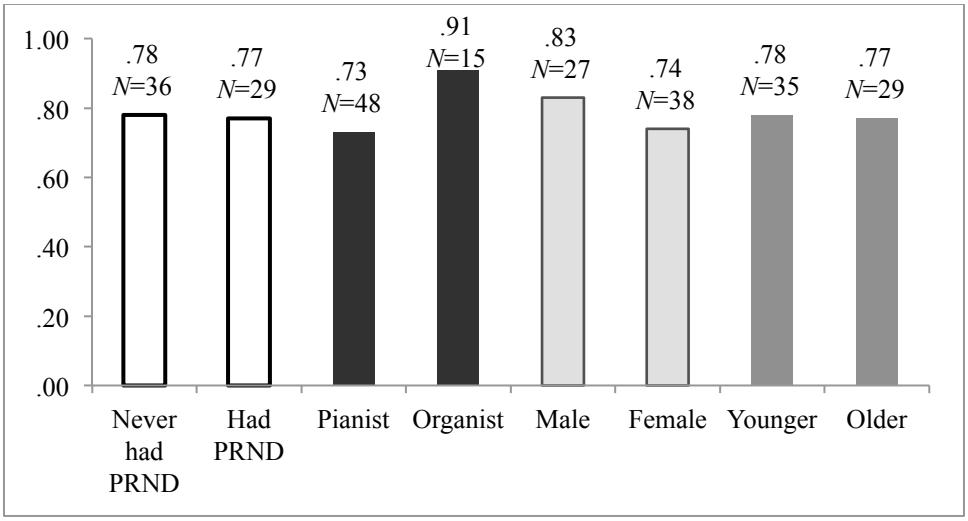

Figure 39. "Listening" Subscale Means by Sub-Group.

The test between injured and never-injured survey respondents yielded the results: $t(63) = 0.24$, $p = .81$. The test between organists and pianists yielded the results: $t(61) = -2.31$, $p = .03$. The test between male and female respondents yielded the results: $t(63) = 1.27$, $p = .21$. Lastly, the test between younger and older survey respondents yielded the results: $t(62) = 0.04$, $p = .97$. The results of the *t*-tests showed that the means for three of the four sub-groups were not significantly different from each other. The difference

between pianists and organists, however, should be noted. The *p*-value (.03) for the inferential test of the "Listening" subscale on this sub-group was statistically significant. The test showed that organists had a more positive perception of the improvement in their listening skills than did pianists.

The means for the "Others' comments on playing" subscale for each sub-group are shown in Figure 40. The mean subscale score for non-injured keyboardists appeared higher than for injured keyboardists, while the score for organists appeared higher than the score for pianists. These differences were tested for significance using independent-samples *t*-tests.

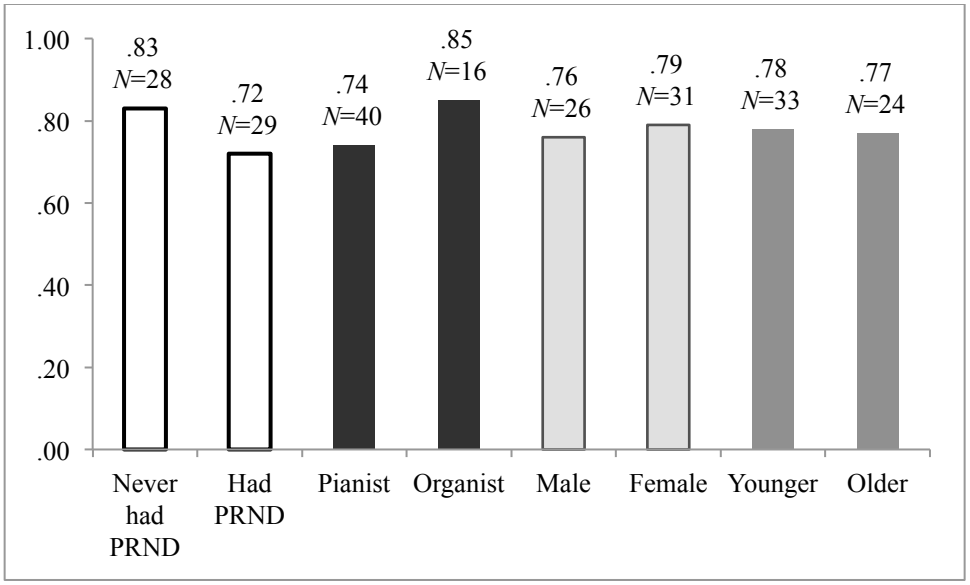

Figure 40. "Others' Comments on Playing" Subscale Means by Sub-Group.

The test between injured and never-injured participants yielded the results: $t(55) = 1.75$, $p = .09$. The test between organists and pianists yielded the results: $t(54) = -1.47$, $p = .15$. The test between male and female participants yielded the results: $t(55) = -0.40$, $p = .69$. Lastly, the test between younger and older respondents yielded the results: $t(55) = 0.26$, $p = .80$. For this final subscale, the results of the *t*-tests showed that the means for

each of these sub-groups were not significantly different from each other. However, the *p*-value for injury status was lower than the others, at .085. As with the gender results from the technique subscale, this result could be called "marginally significant." The difference between the mean non-injured "Others' comments on playing" subscale score and the mean injured score was not great enough to be statistically significant, but it was great enough to be marginally significant, or to raise some interest. A slight possibility existed that survey respondents who never had a PRND perceived that others' comments on their playing were more positive since studying the Method than survey respondents who had experienced PRNDs.

Research Question No. 4

What do pianists consider, if any, the extra-musical effects of studying this interdisciplinary Method?

Anecdotal evidence existed prior to this investigation that suggested that studying the Method might yield not only musical results, but non-musical changes, as well, in the lives of participants in this study. Therefore, questions were formulated in both the interviews and the survey to ascertain what, if any, these changes might be. Survey respondents were asked to answer questions based on a sliding scale that ranged from no life changes (-1) to important life changes (+1). In the survey, 64 respondents answered these questions; their answers ranged from -1 to +1 with a mean score of .63. With these questions, however, survey respondents were not asked whether these life changes were positive or negative. Therefore, while interesting, these questions could not be combined into a subscale that examined whether participants perceived the Method as having a positive or negative effect on aspects on their extra-musical lives.

Another question, however, asked survey respondents how they perceived that the Method had changed them, if at all, in other ways outside of playing the piano, with a very specific list of extra-musical aspects of their lives. Survey respondents were again asked to answer on a sliding scale ranging from much worse (-1) to much better (+1). These questions were combined into an "Extra-musical life" subscale that also ranged from -1 (most negative perception) to +1 (most positive perception). This was a reliable subscale as shown by the Cronbach's alpha score of .95. Descriptive statistics of the questions comprising the subscale and the subscale itself are shown in Table 40.

Table 40

Descriptive Statistics - How has the Method changed you in other ways outside of playing the piano? Individual Questions and "Extra-Musical Life" Subscale

	N	Minimum	Maximum	Mean	Std. Deviation
Extra-musical life subscale	62	-.01	1.00	.57	.30
Ability to concentrate	55	-.01	1.00	.53	.36
General movement	62	-.01	1.00	.67	.33
Hearing	57	-.01	1.00	.53	.38
Interactions with other people	53	-.06	1.00	.36	.35
Accomplishing goals	53	.00	1.00	.54	.36
Self confidence	57	-.15	1.00	.62	.34
Personal life	50	.00	1.00	.47	.38
Professional life	59	-.39	1.00	.61	.39
General sense of well-being	57	-.01	1.00	.70	.34

It should be noted that the mean of the "Extra-musical life" subscale was lower than the means of the previous subscales. All other Method-related subscales had mean scores greater than .60 and often greater than .70. The relatively wide variety of means of the questions comprising the subscale "Interactions with other people," in particular, had a quite low mean value, as did the "Overall effect on participants' personal lives." Interesting, however, was the relatively high mean value of the question relating to "General sense of well-being." Given this discrepancy, the mean value of the "Extra-musical life" subscale was tested to determine whether it was significantly different from

zero. Once again a one-sample *t*-test was performed on the subscale which yielded the results: $t(61) = 14.93$, $p < .001$, indicating that the "Extra-musical life" subscale mean was significantly greater than zero. Therefore, survey respondents perceived that the Method had a positive effect on their extra-musical lives.

"**Extra-musical life" subscale, differences among groups.** Next, subscales were tested to see if they differed between sub-groups, namely PRND status, type of keyboardist, gender, and age group. The subscale means for all sub-groups are shown in Figure 41. The mean values for the subscale appeared slightly more positive for organists and younger survey respondents. Again, whether these differences were statistically significant needed to be determined by an independent-samples *t*-test.

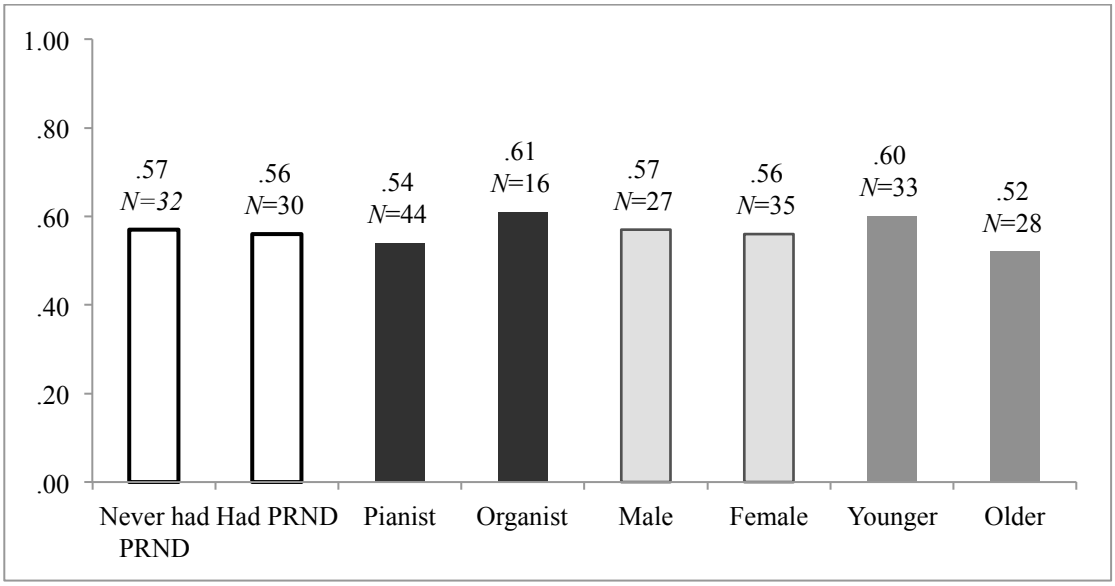

Figure 41. "Extra-Musical Life" Subscale Means by Sub-Group.

The test between injured and never-injured survey respondents yielded the results: $t(60) = 0.22$, $p = .82$. The test between organists and pianists yielded the results: $t(58) = -0.82$, $p = .42$. The test between male and female respondents yielded the results: $t(60) = 0.10$, $p = .31$. Lastly, the test between younger and older survey respondents yielded the

results: $t(59) = 1.03$, $p = .59$. As stated previously, for an independent-samples *t*-test, a *p*-value < .05 is necessary for a difference to be considered statistically significant. All inferential tests on the "Extra-musical life" subscale showed that no statistically significant differences existed between any of the sub-groups.

Research Question No. 5

What do pianists perceive as challenges and positive aspects of studying the Method?

Research Question No. 5 could be considered the third most important question, from the researcher's viewpoint as the developer of the Method. This Research Question and the related survey questions were formulated to gather data on perceived strengths and weaknesses of the Method itself, so that it could be improved and that students could be better served. Survey respondents were asked to rate their responses to the various aspects of studying the Method. The answers to the set of questions were on a sliding scale ranging from -1 (extremely hard) to +1 (extremely easy). It is important to note that these questions did not inquire as to whether a particular aspect of studying the Method was helpful or beneficial, but simply whether it was difficult or easy. Therefore, *a low score did not imply a negative perception of that aspect of the Method; it simply indicated a perception that the particular aspect was difficult to learn.*

For this question, 17 different aspects of learning the Method were listed. A subscale called "Learning the Method" was created. A Cronbach's alpha test showed the subscale to be reliable with a score of .89. As with the individual questions, the subscale itself ranged from extremely hard to learn (-1) to extremely easy to learn (+1). The

descriptive statistics for the subscale and for the question used to create the subscale are shown in Table 41.

Table 41

Descriptive Statistics - Please rate your response to the various aspects of studying the Method.- Individual Questions and "Extra-Musical Life" Subscale

	N	Minimum	Maximum	Mean	Std. Dev.
Learning the Method subscale	62	-.63	1.00	.09	.32
The pace at which new material was introduced	60	-.65	1.00	.26	.46
Sequencing of steps	60	-.63	1.00	.35	.45
Length of time spent at each stage of learning	59	-.89	1.00	.22	.50
Time spent away from playing music	59	-1.00	1.00	.06	.49
Changing old habits	61	-1.00	1.00	-.36	.53
Mental discipline required	59	-1.00	1.00	-.36	.49
Patience required	61	-1.00	1.00	-.33	.52
Perseverance required	61	-1.00	1.00	-.31	.51
Feeling in control of playing	58	-1.00	1.00	.04	.54
Having to acquire some biomechanical and anatomical knowledge	59	-.63	1.00	.28	.46
Writing self-reflections	54	-1.00	1.00	.20	.50
Writing synopses of video-recorded lessons	56	-1.00	1.00	.14	.50
Accepting an alternative technical model	58	-.66	1.00	.40	.49
Encountering reactions of outside teachers, colleagues, students, family, and friends	58	-.77	1.00	.27	.52
Video-taping all lessons	56	-.80	1.00	.40	.50
Modeling	56	-.72	1.00	.38	.46
Mental practice	58	-1.00	1.00	.10	.60

Although the "Learning the Method" subscale was considered to be reliable because of its relatively high Cronbach's alpha score, it was surprising to observe the large differences among the means of the questions comprising the subscale. The subscale itself had a mean value of .09. This value appeared to be close to zero, which would indicate an average difficulty almost exactly in the middle—neither difficult nor easy. A one-sample *t*-test performed on the subscale to test whether the mean was significantly different from zero or not yielded the results: $t(61) = 2.16$, $p = .04$.

Although the mean score appeared very close to zero at .09, this difference from zero was still considered statistically significant, as the *p*-value was below .05 at .04. Therefore, survey respondents found the various aspects of the Method slightly easy, rather than difficult, and this result was statistically significant.

As noted above, however, the means ranged from a low (meaning difficult) of -.36 for "Changing old habits" and "Mental discipline required," to a high (easy) of +.40 for "Accepting an alternative technical model" and "Video-taping all lessons."

For the next section, when the difference in the sub-scale for the various sub-groups was examined, inferential independent-samples *t*-tests on the individual questions were also run to determine if any significant differences in groups existed. This was done to ascertain whether certain groups were having greater difficulty in learning aspects of the Method than other groups. This information could possibly be used later to modify or improve various aspects of the Method, and better to help struggling sub-groups.

"Learning the Method" subscale - selected individual learning aspects, differences between groups. First, the differences in the overall "Learning the Method" subscale were examined to determine if any variances existed between sub-groups. The mean subscale score for the different groups is shown in Figure 42. Note that the mean scores appeared higher for non-injured participants, organists, males, and older participants. It should be remembered that more positive scores meant the survey respondents felt that the aspects of learning the Method were easier. The differences in these mean subscale scores were again tested for significance by performing independent-samples *t*-tests.

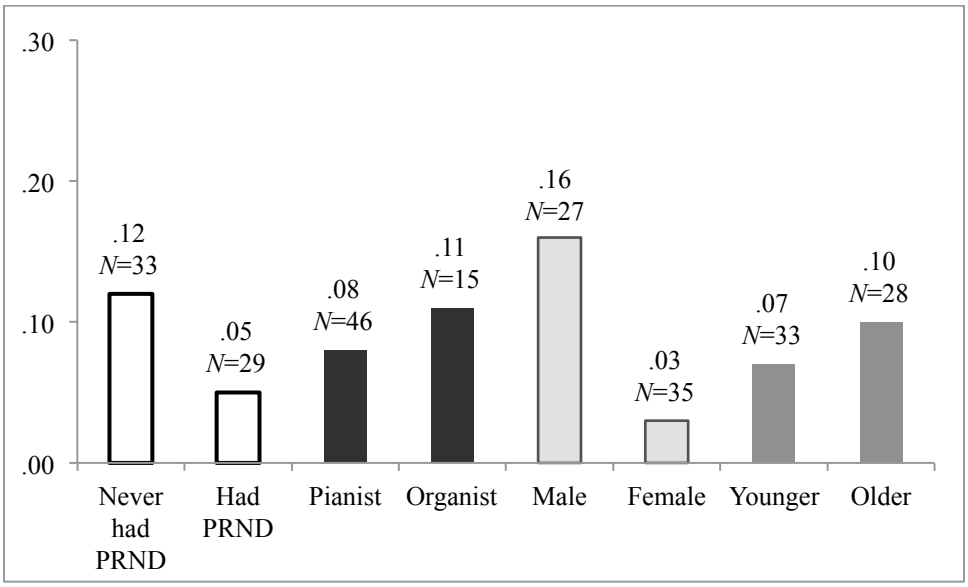

Figure 42. "Learning the Method" Subscale Means by Sub-Group.

The test between injured and never-injured survey respondents yielded the results: $t(60) = 0.90$, $p = .37$. The test between organists and pianists yielded the results: $t(59) = -0.32$, $p = .75$. The test between male and female participants yielded the results: $t(60) = 1.52$, $p = .13$. Finally, the test between younger and older participants yielded the results: $t(59) = -0.37$, $p = .71$. For all tests on the "Learning the Method" subscale, the *p*-values were above .05. This means that the differences between the means were not statistically significant: Injured and non-injured survey respondents had the same "Learning the Method" subscale score, as did pianists and organists, males and females, and younger and older survey respondents.

Next, independent-samples *t*-tests were run on all of the individual questions that comprised the "Learning the Method" subscale. Most differences between groups were not statistically significant. Therefore, only those questions with statistically significant differences between sub-groups were reported, or those where the *t*-test yielded a *p*-value less than .05. Only six aspects yielded statistically significant differences between sub-

groups. Four of the differences in difficulty of learning an aspect of the Method were between men and women, and are shown in Figure 43.

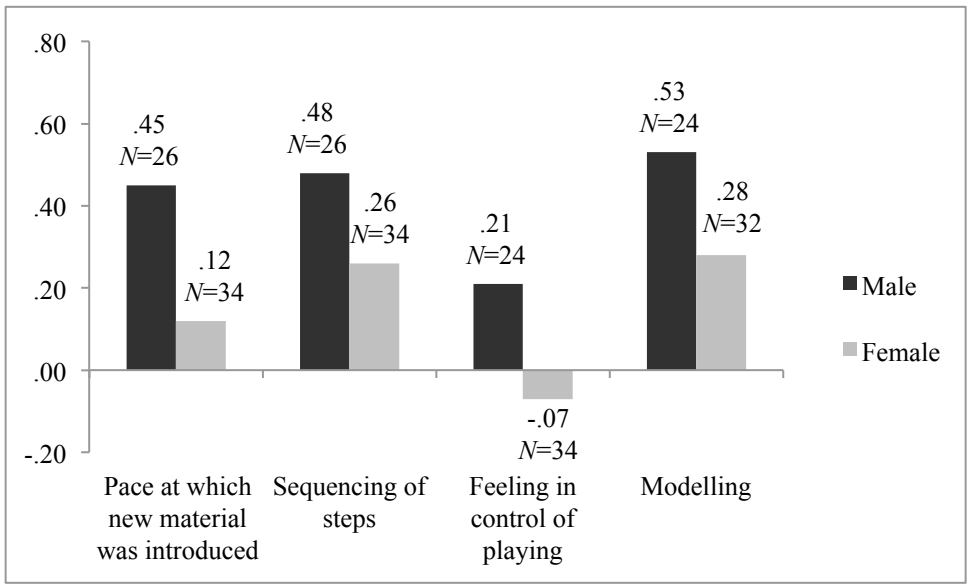

Figure 43. Aspects of Learning the Method with Significant Differences in Perceived Difficulty Between Males and Females.

The test for "The pace at which new material was introduced" between male and female respondents yielded the results: $t(58) = 2.94$, $p = .005$. The test for "Sequencing of steps" between males and females yielded the results: $t(58) = 1.99$, $p = .05$. The test for "Feeling in control of playing" by gender yielded the results: $t(56) = 2.05$, $p = .05$. Lastly, the test for modeling between male and female participants yielded the results: $t(54) = 2.13$, $p = .04$. Two of the aspects that had significant differences between men and women were "pacing" and "sequencing of steps." Both of these aspects of learning the Method were heavily discussed by several female interviewees in the qualitative section. As shown in Figure 43, females perceived all four of those aspects of learning the Method as being more difficult than did males. In fact, for "Feeling in control of playing," the mean score was negative: females perceived this aspect as difficult.

Two other aspects of learning the Method showed different mean subscale values between groups, namely "Feeling in control of playing" by injury status and "Time spent away from music" by type of keyboardist. The mean subscale scores are shown in Figure 44.

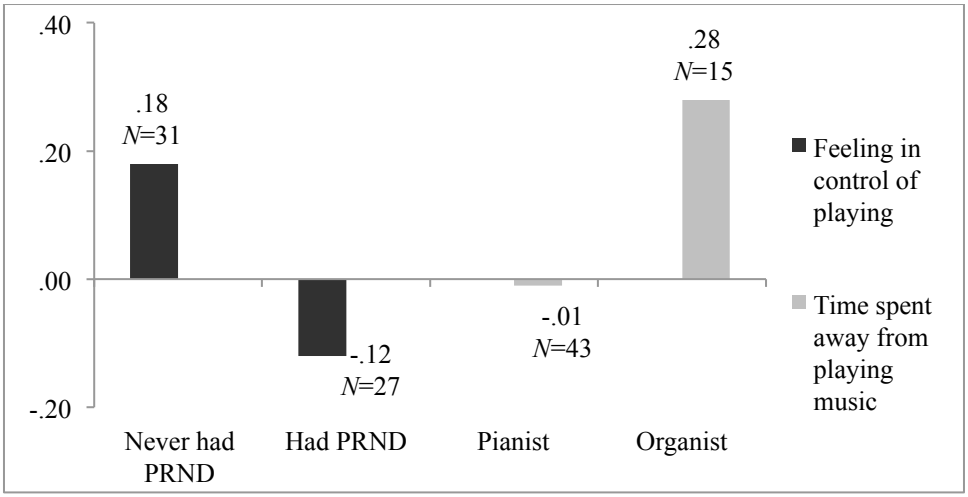

Figure 44. Aspects of Learning the Method with Significant Difference Between Sub-Groups.

The independent-samples *t*-test on "Feeling in control of playing" by injury status yielded the results: $t(56) = 2.20$, $p = .03$. Survey respondents who had never had a PRND perceived it to be significantly easier to feel in control of their playing while learning the Method than respondents who had experienced PRNDs. The *t*-test on "Time spent away from playing music" yielded the results: $t(56) = -2.07$, $p = .04$. In this case, organists perceived it to be significantly easier to adjust to the time spent away from playing music while studying the Method than did pianists.

Professional Tactile Guidance (PTG). Survey respondents were asked how effective hands-on, Professional Tactile Guidance (PTG) was in learning the Method's biomechanical model. The answers to this question were on a sliding scale ranging from

extremely detrimental (-1) to made no difference (0) to extremely beneficial (+1). This survey question was answered by 67 out of 74 survey respondents. The mean score of the question was an extremely high and positive .91. However, even though this question yielded such a high result, a one-sample *t*-test was performed to examine whether the mean was significantly different from zero. It yielded the results: $t(62) = 45.79$, $p < .001$. As expected, the mean score of the "Perceived effectiveness of Professional Tactile Guidance" was significantly greater than zero, therefore indicating that survey respondents found this aspect of the Method extremely beneficial. Additionally, the means of the various sub-groups were tested to determine whether some survey respondents found PTG more beneficial than other respondents. The means are shown in Figure 45.

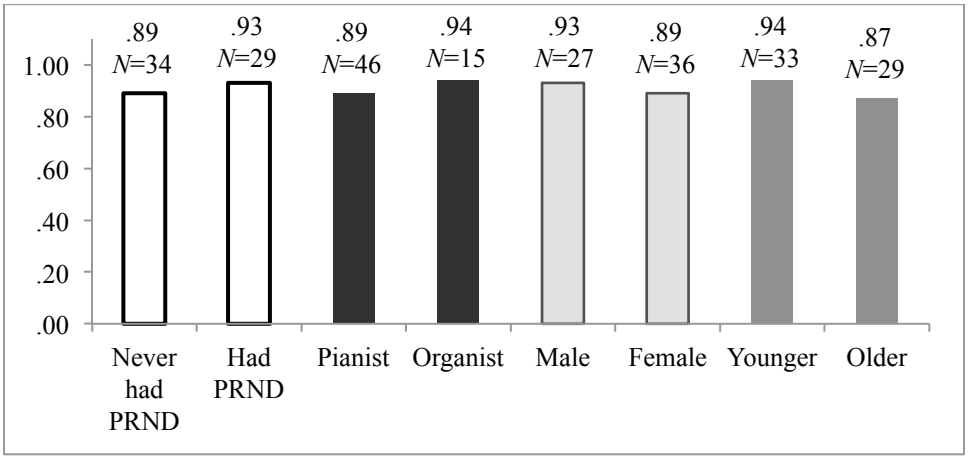

Figure 45. "Perceived Effectiveness of Professional Tactile Guidance" Means by Sub-Group.

The test between injured and never-injured survey respondents yielded the results: $t(61) = -0.96$, $p = .34$. The test between organists and pianists yielded the results: $t(59) = -1.08$, $p = .28$. The test between male and female respondents yielded the results: $t(61) = 0.83$, $p = .41$. Lastly, the test between younger and older survey respondents yielded the

results: $t(60) = 1.75$, $p = .09$. In the case of Professional Tactile Guidance, injured participants, organists, males, and younger participants appeared to perceive it as slightly more effective, as shown in Figure 45. The differences, however, were not statistically significant as all of the *p*-values were above .05. In the case of age, the difference between younger and older participants appeared to be marginally significant, as it was between .05 and .10. Overall, however, all sub-groups appeared to have had a very high perception of the effectiveness of Professional Tactile Guidance as a tool for learning the Method.

Summary of Quantitative Results

Results from both descriptive and inferential statistical analysis of the Qualtrics survey questions regarding survey respondents' perceptions of the Method were consistently positive and frequently statistically significant. Survey respondents indicated favorable response to the efficacy of the Method in both recovering from PRNDs and in preventing recurrence of PRNDs. Survey respondents also perceived that studying the Method had positive musical and technical results, as well as extra-musical results. However, there were several significant differences in perceived difficulty between males and females regarding certain aspects of studying the Method. Four of these differences proved to be statistically significant through inferential testing.

Chapter VI

DISCUSSION

Introduction

The purpose of this mixed methods study was to investigate systematically, through surveys and interviews, adult students' perceptions of the effectiveness of one particular interdisciplinary Method for teaching injury-preventive piano technique. Participants in the study included 26 pianists, and pianists who were primarily organists, from a list of 43 current and former students of the Method, and 74 survey respondents out of a list of 103 current and former adult students who had studied the Method for at least two semesters, or the equivalent, since 1990. Interviewees were also included in the list of 103 students.

Since the Method purported to teach injury-preventive piano technique, and since 69.2% of the qualitative study interviewees and 48.6% of the quantitative study survey respondents had experienced a playing-related neuromusculoskeletal disorder (PRND) prior to studying the Method, specific focus of the research, as reflected in Research Questions Nos.1 and 2, was placed on students' perceptions of the role the Method played, if any, in both recovery from playing-related neuromusculoskeletal disorders (PRNDs) and prevention of recurrence of the disorders. Additionally, Research Questions Nos. 3 and 4 focused on students' perceptions of musical and technical results, if any, from studying the Method. Finally, to improve the Method and to better serve the various

populations studying the Method, Research Question 5 addressed students' perceptions of the particular challenges, if any, and beneficial aspects, if any, of studying the Method.

In this chapter, qualitative results from the interviews in Chapter IV and quantitative results from the survey in Chapter V are discussed and compared. The chapter was organized by Research Questions and the themes that arose during the data analysis of each of the Research Questions. First, quantitative and qualitative results for each Research Question and its themes were compared. Second, emergent patterns were compared and contrasted to related topics in the literature review, highlighting possible conflicts. Finally, broader and deeper understanding and interpretation of the issues were sought (Bloomberg & Volpe, 2012).

I would like to add a note about researcher credibility and bias. As the researcher of my own Method, as one who has lived with the topic of playing-related disorders and injuries for several decades, and as one who is closely acquainted with the participants in this study, I recognized the potential for unconsciously shaping my analysis and interpretation according to my own subjective assumptions and predispositions. For that reason, I attempted throughout this chapter to maintain an open mind, to seek contradictory patterns and competing interpretations, and to construct a larger picture that went beyond the narrow confines of my own experience. Ultimately, my goal with this study was to improve my own Method—thereby, hopefully, contributing something of value to the professional piano world—rather than to promote the Method.

The Conceptual Model was created as a visual and theoretical representation of the various disciplines and knowledge fields that informed the content of the Method under investigation. In this chapter, I attempted to uncover participants' perceptions of

the relevance of these interdisciplinary fields, and how knowledge and research from each field had impacted, if at all, their perceptions of studying the Method. The Research Questions were created, in part, to determine what aspects of the Method and its interdisciplinary content were perceived by participants as relevant, helpful, or unhelpful. I also expected to uncover weaknesses and strengths of the Method, as well as participants' new insights that would lead to its improvement. The Research Questions were as follows:

1. How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in recovering from those disorders?

2. How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in preventing recurrence of those disorders?

3. What effect, if any, do pianists perceive this interdisciplinary Method to have on various aspects of musicality (such as phrasing, rhythm, structural cohesion, emotional content, communication with audience, performance anxiety, fulfillment of artistic potential, etc.) and technique (such as tone control, tone quality, dynamic control, voicing, facility, muscular suppleness, speed, power, etc.)?

4. What do pianists consider, if any, the extra-musical effects of studying this interdisciplinary Method (such as mental focus, sense of well-being, increased kinesthetic and auditory awareness, enhanced flexibility and suppleness of movement, etc.)?

5. What do pianists perceive as challenges and positive aspects of studying the Method?

Research Question No. 1

How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in recovering from those disorders?

Theme 1 – Perceived consequences of experiencing PRNDs
Theme 2 - Perceived effectiveness of medical treatments vs. the Method for PRNDs
Theme 3 – Conflicting perceptions of Method – skepticism vs. hope

Research Question No. 1: Theme 1 - Perceived Consequences of Experiencing PRNDs

Before analyzing students' perceptions of studying the Method on their PRNDs, it was necessary to ascertain what their experiences were with PRNDs, both professionally and personally. Over half of the interviewees reported negative consequences, and many were "depressed" and called it a "devastating experience." Some reported they were often required to play injured or in pain often because they either needed income or their school or teachers required them to continue to play to maintain scholarships or grades. Others could not continue to play under any circumstances (53% of interviewees) because of their injury or disorder. These circumstances were emotionally, psychologically, and sometimes financially devastating to some of the interviewees. A few study participants even mentioned the word suicide. Survey respondents' results supported the qualitative findings, with many respondents experiencing unfavorable results from their PRNDs, as shown by the mean negative value for the "Effect of PRNDs on life" subscale. Inferential testing showed this subscale mean to be significantly lower than zero. Leo's words encapsulated many interviewees' and survey respondents' perceptions of the negative effects of PRNDs on various aspects of living:

> Yes, because of course when you have an injury like that, I was really depressed. It was a big thing because I had put so much time and years…so suddenly you cannot play anymore, it's just really big. (Leo)

A sense of isolation and loneliness also emerged as a pattern among pianists with PRNDs. Participants frequently had to hide their injury for fear of jeopardizing their positions:

> Yeah, I mean I didn't have a choice and you dare not talk about it in conservatory. I mean I had a really loving and wonderful teacher but…I was like "they'll probably think I'm not good enough if I tell anyone," you know, and make a big deal of it. (Haddon)

Literature and discussion. The rate of perceived playing-related injury in this study was 49% among survey respondents and 69% among interviewees. These rates could be considered comparable to results from several recent studies out of the United States, Australia, and Japan of pianists with PRNDs. This study's rate of injury was especially similar to the 59% PRND-rate result from a University of North Texas Musician Health Survey of 2001 in which 455 keyboardists were surveyed through the Internet (Chesky & Pak, 2001). Reported rates of injury from the present study also fell directly between findings in a 2006 systematic review in which pianists' documented PRNDs varied between 26% and 93% (Bialocerkowski, Bragge & McMeeken, 2006a). This study's results, however, were somewhat lower than those from a 2006 study in Japan of 203 pianists that reported a PRND rate of 77% (Furuya, 2006), or those from a 2010 study in Australia in which 72% of professional pianists reported experiencing PRNDs (Ackland & Allsop, 2010). Therefore, it can be concluded that, in spite of continuing efforts in research and practice, injury rates remain unacceptably high. And, as Manchester (2014b) wrote in an editorial for the *Performing Arts Medical Journal*, playing the piano continues to be associated with the highest rates of PRNDs. However, aside from studies of the general stressors that musicians face (Sternbach, 2008), little is understood about the long term implications of injury and dysfunction for pianists.

Research Question No. 1: Theme 2a - Perceived Effectiveness of Treatments for PRNDs

The 18 interviewees who reported experiencing PRNDs indicated seeking some sort of outside treatment ("Other help"). However, several other interviewees, who did not claim to have experienced a PRND, also reported seeking treatment for fatigue and other non-playing-related conditions. Therefore, the percentages of interviewees who did or did not report benefiting from these treatments had to be based on the total number of interviewees (26), rather than the number of interviewees who self-reported having a PRND (18). Out of all 26 interviewees, over half reported treatments as being somewhat beneficial, while over a third reported that the treatments were not beneficial at all. However, interviewees indicated that treatments from health care professionals had the most positive effect of all treatments. A number of interviewees pointed out that teachers, in particular, were not helpful in dealing with injuries or other disorders, although colleagues, family and friends often were highly sympathetic of the interviewee's PRND. As Simon reported, "I had a lot of support from family, and friends, and colleagues, especially when I could no longer really do anything."

The survey results were also mixed regarding perception of treatments helping with PRNDs. The "Effectiveness of other help in dealing with PRNDs" subscale had a mean score of only .11. Although this score was determined to be significantly different from zero, it was close enough to zero so that the perceived effectiveness of the treatment and help for PRNDs was relatively small.

Treatments included traditional or complementary medical help from, among others, family physicians, orthopaedists, neurologists, physical therapists, massage

therapists, acupuncturists, chiropractors, and mental healthcare professionals. Treatments also included help from practitioners of yoga, tai chi, Feldenkrais Method, reiki, and various Asian healing arts. Finally, the subscale "Other help" also included help from family, friends, colleagues, and piano and organ teachers, who were reported to have been the least helpful. One interviewee's experience was representative of the experiences of others participants with their teachers:

> I just [told my teacher] what was happening and the answer was not at all what I was expecting. It was "Well maybe you should take a break and come back later." So I was expecting…"Well, don't worry, we're going to look at it together, we're going to fix it, I'm going to help you"….But now I know it's not their fault, they don't know. It was the same [with] all of my teachers. They were listening…but they just didn't know what to do. (Leo)

A number of interviewees continued to play without seeking medical assistance, either not realizing that something was amiss or fearing that they would have to stop playing:

> …at that point I didn't know I was injured, so I was having pain in my hands but I just thought that was normal. Like being a piano student, you have pain in your hands. (Lily)

In interviews, many participants with PRNDs were eager to share their frustration and even anger with lack of accurate diagnoses, treatments that did not work, and feelings of not being listened to or respected as having a legitimate problem:

> My family…sent me to doctors but the doctors really didn't know what to do. I think at one point I remember a doctor saying, "maybe you don't really want to play the piano and this is a psychological, you know, thing that you've done to yourself." (Zoe)

Several interviewees, however, expressed gratitude for the various treatments they had received that were helpful:

> Yes, I met many, many different doctors, physical therapists, chiropractors… I have done basically everything in my life [laughs]…possible—Alexander Technique, Feldenkrais Technique, Reiki, I've done yoga… I mean everything.

> Yes, I think all of those treatments were helpful not only physiologically, but also psychologically.

Literature and discussion. This study corroborated what the literature revealed: In spite of exponential growth in the field of performing arts medicine research of PRNDs, the risk of a pianist developing a PRND has not been reduced (Manchester, 2014b). Historically, the confusion had even extended to the establishment of risk factors among researchers, as well as to definitions of playing-related disorders themselves. (Bialocerkowski, Bragge, & McMeeken, 2005). It is not surprising that this confusion also encompassed treatments for PRNDs.

Research in treatments for PRNDs seems to have focused on focal dystonia, a task-specific movement disorder (de Lisle, Speedy & Thompson, 2010, 2012; Altenmüller, Jabusch & Vugt, 2013) although only approximately 1% of professional musicians develop it. A study from 2010 showed that a very small minority of musicians with focal dystonia regained normal motor control with currently available treatments (Altenmüller & Jabusch, 2010), although a later study by the same researchers indicated some treatments were more successful (Altenmüller, Jabusch & van Vugt, 2013). Harper discussed alternatives to surgery for injured musicians (Harper, 1996), and Pascarelli, former physician at the Miller Healthcare Institute for Performing Artists at Columbia University, wrote in 2004 that obtaining an accurate diagnosis and appropriate treatments was fraught with difficulties because of the complex nature of most repetitive syndrome injuries, such as playing the piano (Pascarelli, 2004).

On a positive note, the literature showed that considerable progress was being made, however, in the performing arts medicine field and with professional music organizations. The Performing Arts Medicine Association (PAMA) has taken a

leadership role in the 21st century in injury-prevention for musicians, establishing guidelines for risk factors. The National Association of Schools of Music (NASM) has also published new guidelines for all accredited institutions regarding health and injury-prevention (*NASM Handbook*, 2011-12). And the Music Teachers National Association (MTNA) published a series of articles on musicians' wellness in 2014 and 2015, addressing risks and strategies for injury-prevention (Berenson, 2014; Horvath, 2014; Lister-Sink, 2015; Wristen, 2014). And Manchester (2014e) suggested looking to sports and occupational medicine research for greater knowledge regarding injury-prevention.

Another indication of progress in this area was evidenced at the 2014 MTNA Annual Conference where past presidents of the Performing Arts Medicine Association Dawson and Manchester, and current president Chong presented workshops on musicians' health, risk factors, and suggestions for treatment and rehabilitation. These presentations pointed to a strengthening of collective agreement (Chong & Manchester, 2014; Dawson, 2014), as well as to a desire to combine forces with musicians and music organizations. Musicians with pain and injury are increasingly being respected and listened to, especially at performing arts medicine clinics and by healthcare professionals informed by the latest research in this area. Moreover, professional music organizations such as the MTNA, NAfME, NASM and NATS are making concerted efforts to help educate their constituents in injury-prevention, diagnosis, and treatment.

However, in spite of such progress, this study seemed to indicate that pianists continued to be less than satisfied with their ability to obtain an accurate diagnosis and appropriate treatment for their PRNDs. Confounding that problem, as this study demonstrated, were findings that revealed that participants often elected to continue to

play, in spite of their pain. This was corroborated by a 2007 study (Guptill, Park & Sumsion, 2007) showing that pianists' deep commitment to playing overrode the risk of injury. Therefore, the results of this study would indicate that more research should be directed toward obtaining accurate diagnoses of PRNDs, as well as effective treatments.

This study also indicated that pianists' (and organists') teachers did not consistently offer sound advice to students with pain or injury, and in some cases, were unsupportive or counterproductive in their responses. As Guptill and Zaza pointed out, the teacher's role is critical in instilling healthful technique, but most teachers believe they do not know enough to offer good advice when their student has pain or injury (Guptill & Zaza, 2010). Little wonder that the participants in this study sought other options, including alternative treatments and as yet uninvestigated injury-preventive piano methods. This study underscored that dilemma, as well as the need to intensify efforts in the research and medical communities to reduce risks of injury (Manchester, 2014d).

Research Question No. 1: Theme 2b - Perceived Effectiveness of the Method, Both Overall and in Recovering From PRNDs

This investigation sought to determine how pianists with PRNDs perceived the role, if any, of the Method in helping them recover from their PRNDs. Many of the interviewees reported that the Method worked in helping them to recover from their PRNDs. All interviewees (100%) had an overall positive perception of the Method, and 73% perceived that it worked in helping them recover from PRNDs and return to playing. Some interviewees spoke of how happy they were to be able finally to sit down and play without pain:

> I'll never forget the first recital I played without pain medication. It was just an incredible sense of freedom. I finished and I thought I could easily go back out and play the recital again. That was amazing. (Haddon)

Evidently, the Method also had a transformative effect on some interviewees as they were able to resume studies and careers that had been abandoned. And as one survey respondent expressed it, **"**Sometimes when I go to the piano in the morning I feel deep gratitude for this training and the work [the instructor] has done with me."

Even before resolving their PRNDs, interviewees reported that studying the Method gave them a sense of renewed hope, a feeling of safety, and a lessening of isolation. As Zoe stated, " One of the things that's really significant…is finding out that there is a safe place to go and talk about your injuries."

As part of the qualitative study, interviewees were separated into their demographic groups and a word cloud was created for each group. The word cloud for pianists is shown in Figure 46 and the word cloud for organists is shown in Figure 47. As evidenced in the word clouds, "technique" appeared to be a much more important word for organists. "Barbara" was also a more popular word in the organists' word cloud, possibly showing a stronger personal connection to the Method's developer and primary instructor. This could be a possible reason for the more positive quantitative results for the organists. However, it could also lead one to wonder if organists responded more readily to training with a non-organist, or if the Method addressed the specific challenges of playing the organ better than it addressed challenges of playing the piano. It was also interesting to note that the word "think" was the most prominent in these two word clouds and, indeed, in all word clouds in the study. Such a strong association of thinking

with the Method might be explained by the Method's emphasis on a scientifically-informed, rational approach to understanding piano technique.

Figure 46. Word Cloud for Pianists Only.

Figure 47. Word Cloud for Organists Only

From the survey results, along with the "Overall effectiveness of the Method" subscale, an "Overall perception of the Method" subscale was created. This subscale showed a very high mean of .78 (in the -1 to 1 range) that tested out to be significantly greater than zero. When the individual groups were tested against each other (with the addition of injured vs. never injured), no statistically significant differences were shown

to exist between any of the pairs. Word clouds for the other groups were compared in later analyses of other Research Questions.

Survey respondents also spoke to the Method's efficacy in the narrative portions with comments such as, "…the Method has allowed me to continue my career and not be forced to give up playing due to injuries." and "I could not be playing at all without the …Method. I am gainfully employed as a professional musician."

The quantitative results of the study showed that survey respondents had a positive perception of the Method in dealing with PRNDs. Inferential testing on the subscale "Overall effectiveness of the Method on PRNDs" showed the mean of the subscale to be positive (.69 on a scale of -1 to 1). The subscale was also tested to uncover any differences among certain groups—pianists vs. organists, males vs. females, and younger vs. older survey respondents. No significant differences were noted in the "Overall effectiveness of the Method on PRNDs" subscale by gender or age. However, organists had a significantly more positive mean subscale than pianists.

Literature and discussion. One might posit a number of reasons for the overall positive perception of the Method, and specifically in helping study participants recover from PRNDs. One possible explanation would be the holistic, interdisciplinary nature of the Method itself. Since the Method received positive results in both the qualitative and the quantitative parts of the study in both recovering from PRNDs and in preventing recurrence of PRNDs, discussion of the literature was included in Research Question No. 2 – Theme 5 regarding injury-prevention.

Research Question No. 1: Theme 3 – Conflicting Perceptions of the Method

A striking theme arose in the qualitative portion of the study regarding an apparent conflict between the perceived efficacy of the Method in helping interviewees recover from PRNDs, and an initial skepticism on the part of the interviewee about the unusual and non-traditional nature of the Method. This skepticism was also echoed, even after interviewees returned to playing and their jobs, by colleagues and teachers. In the survey, the "Method gives hope" subscale was also positively correlated with "Negative response to studying Method." One survey respondent reported, "After studying the Method, I came home to my piano teacher who refused to acknowledged that I'd gained anything." In the interviews, Leah articulated part of the problem:

> I would like to see…the Method…become more mainstream so it doesn't seem like we are doing this weird piano technique that's not weird. It makes sense.…It's odd because once people really get into the Method, they see how much sense it makes. But I think there are a lot of skeptics out there…(Leah)

Another concern associated with studying the Method that came to light in the interviews was that studying the Method would somehow diminish one's musicality and individual artistry. Such findings certainly merit future study and might be indicative of the need for improvements in the way the Method is presented to the music field in general. Otherwise, whatever positive impact it might have would continue to be undermined by such negative perception.

Literature and discussion. The literature revealed one electronic journal article and one dissertation written about the Method under investigation. Lister-Sink described the Method in a peer-reviewed electronic journal article for the Music Teachers National Association, but this did not offer an investigation of its efficacy (Lister-Sink, 2009). In the same year, Osada (2009) corroborated the findings in this study that the Method

worked for many participants and helped them recover from PRNDs and successfully resume playing. Osada described her own perception of studying the Method over several years and how it enabled her to partially recover from a PRND and to return to performing and teaching. However, as such, the study expressed only one viewpoint, however valid, from a former student of the Method.

What the literature over the last 200 years did reveal was an historic skepticism of methodology in general, as applied to teaching piano technique specifically. (Popular contemporary pedagogical piano methods offer a comprehensive approach that includes theory, musicianship, and reading skills, but with only a page or two of technical instructions.) This widespread skepticism could account somewhat for the negative correlation of .54 that emerged in the qualitative results between interviewees' perception that the Method worked and teachers' lack of support for the Method. Historically, the keyboard world has seen numerous methods for learning technique over the last 250 years, from Couperin to Suzuki (Gerig, 2007). While many of these methods worked well, apparently many did not. A review of the historic literature revealed that one particular technical method taught in the Lebert-Stark School of Stuttgart in the mid-19th century—promoting high, stiff fingers and stiff arms—has since been declared injury-inducing. Gerig wrote of how challenging it was to understand how so many teachers of that era could be, as he put it, blinded to the musical and physical evils of such a method (Gerig, 2007). Pianist Leschetitzky, known for his renowned Leschetitzky Method, claimed that he had no method (Gerig, 2007), and pianist Godowsky echoed Leschetitzky's caution about methods in his "The Best Method Is Eclectic" of 1933 in which he stated that innovative methods invariably lead to "fallacious statements,

contradictions and misunderstandings" (Godowsky, 1933). Ironically, Czerny, Leschetizky, Godowsky, and Vengerova developed detailed methods for teaching piano technique, while eschewing the very idea of a method, believing that, as Leffler wrote, "Individualism would make it impossible to develop a single definitive method" (Leffler, 1998, p. 96).

Such a repudiation of the concept of a successful method for teaching technique rests on a false assumption that a method cannot be tailored to each pianist's individual needs without sacrificing the fundamental principles on which the method rests. However, given the history of methods failing and even promoting injurious technique, piano teachers' skepticism revealed in this study was not surprising. It does pose a challenge to the developer of the Method to discover better ways to represent accurately the results of studying the Method, and to allay fears of this particular methodology.

Inconsistencies, ambiguities, and alternative patterns. Regarding pain and playing-related disorders, there were no inconsistencies. Qualitative interview participants with PRNDs were clear about the physical, emotional, psychological, financial, and professional impact of pain and PRNDs in their lives. However, their frequent motivation to resist medical intervention and to play through the pain was corroborated in the literature.

There were also few ambiguities regarding the interviewees' perceptions of the actual effectiveness of the Method in helping with recovery from PRNDs. However, there was occasional frustration with the pacing (which will be addressed later) and with the perceived humiliation of having to return to basic technique. As Aaron described it, "…for somebody who is at the highest level of playing, it's very humbling to have to go

back and very, very, very frustrating." Interviewees themselves expressed initial skepticism. However, the primary ambiguity and inconsistency was the high level of skepticism of the Method itself shown by colleagues, teachers and family, even as participants gave evidence of it working.

Research Question No. 2

How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in preventing recurrence of those disorders?

Theme 4 – Role of the Alexander Technique in the Method
Theme 5 – Interdisciplinary, holistic approach to technique
Theme 6 – Effectiveness of Method in preventing recurrence of PRNDs
Theme 7 – Rational, biomechanically-informed approach to technique

It might be said that Research Question No. 2 addressed the most important and relevant question regarding a method that purports to teach injury-preventive piano technique, namely: Did all pianists perceive they were able to prevent PRNDs, and did previously injured pianists perceive they were able to prevent recurrence of their PRNDs? These questions were at the very heart of the original *raison d'etre* for the Method under investigation.

Research Question No. 2: Theme 4 – Role of the Alexander Technique in the Method

A foremost theme that emerged from Research Question No. 2 was the important, and even to some participants, the invaluable and indispensable role of the Alexander Technique in studying the Method. When specifically asked, all (100%) interviewees

praised the Alexander Technique training that they received concurrently with the Method, discussing how it helped improve their body alignment and their overall awareness of themselves, others, the piano, the sound, and the general environment—all goals of the Method under investigation. Most importantly, however, the Technique's role in both recovery from PRNDs and prevention of PRNDs was also heavily and favorably discussed by interviewees in the qualitative portion. Zoe commented on the interdependence of the Alexander Technique and the Method:

> The Alexander Technique is essential for this Method… and I think it is more powerful if you learn it in conjunction with [the Method] so you see how they fit together. It's not easy to learn. But it is absolutely essential to this methodology. (Zoe)

The survey in the quantitative portion of the study also included some questions and statements regarding the Alexander Technique. A "Method aspect helpful for PRNDs" subscale (Table 36) was created that included the Alexander Technique, as well as seven other aspects of the Method such as training environment, individualized pacing, and individualized attention. When this subscale as a whole was statistically tested, the mean was found to be significantly greater than zero. The mean for the Alexander Technique was actually greater (.70 on a -1 to 1 scale) than the mean for the overall subscale (.63 on the -1 to 1 scale[1]). This particular result indicated that survey respondents found that concurrent training in the Alexander Technique was one of the more helpful aspects of the Method in recovery from and prevention of PRNDs.

> Despite seeing many medical professionals, I never received an accurate diagnosis (I understand this is typical with RSI type disorders). Even after studying the Method, when the symptoms recurred (less often) I sruggled [*sic*] to get a real diagnosis. Alexander Technique helped the most. (Survey respondent)

[1] Unless otherwise indicated, all means of questions and subscales are out of the -1 to 1 scale.

Literature and discussion. Considering that the Alexander Technique has been taught in the arts for well over a century with consistently positive, albeit anecdotal, success, it is puzzling that so little research existed. Batson (1996) attempted a scientific analysis of its underlying principles, including the central neuroanatomical function of the cervical spine and Alexander's understanding of the role that kinesthesia plays in motor control (Batson, 1996). Moore and Woodman conducted a systematic review of the Alexander Technique in health-related conditions and reported "strong evidence" that the Technique was effective in relieving chronic back pain, and even moderate evidence of effectiveness in disability associated with Parkinson's disease (Moore & Woodman, 2012). In the same study by Moore and Woodman preliminary evidence suggested that the Alexander Technique helped improve balance in the elderly, posture, stuttering, chronic pain and respiratory function (Moore & Woodman, 2012). It should also be added that certain types of posture might be implicated as risk factors for PRNDs (Manchester, 2014a; Nyman, 2007). Given these findings and the substantial anecdotal evidence historically, it is not surprising that the incorporation of Alexander Technique principles into the Method, as well as concurrent study in the Technique, would receive an overwhelmingly positive response from participants in this study.

Research Question No. 2: Theme 5 – Interdisciplinary, Holistic Approach to Technique

Another result that emerged in the interviews and qualitative analysis was the helpfulness and relevance of interdisciplinary components (as displayed in the Conceptual Model) and the value of the holistic approach of the Method. The survey, on the other hand, did not explore the role of the holistic nature of the Method in preventing

future injuries except for several questions regarding the Method's emphasis on embodied cognition (Alexander Technique), biomechanics, anatomy, and neuroscience elements of modeling, and mental practice.

In the interviews, regarding the usefulness of interdisciplinary components, 17 interviewees (65%), without being prompted, specifically reported liking the interdisciplinary components. A smaller number of interviewees (nine or 35%) specifically reported that their studies in neuroscience and neuropedagogy were helpful. Again, without being prompted, 13 interviewees (26%) stated that they liked the holistic approach of the Method. One interviewee reported, "…but specifically neuropedagogy—understanding how the brain takes in information—completely changed my view of how to teach, how to present information in a compelling way." And as one survey respondent reported:

> I thought that the interdisciplinary nature of the program was very beneficial. So learning about physiology, learning about the brain, applying all that to the piano and music I thought really was very helpful. I have a Ph.D. in cognitive psychology, so there is overlap of a lot of common interests. (Survey respondent)

Literature and discussion. Since participants felt that knowledge from various disciplines was important in their ability to retrain and prevent injury, it was helpful to focus on certain underlying scientific components that inform the biomechanical model of the Method and that were corroborated in the literature on movement science (biomechanics, anatomy, and physiology). Twenty years ago when the Method and the biomechanical model it espoused were developed, there was considerable debate and little consensus in performing arts medicine research concerning risk factors for learning a complex motor skill such as piano playing (Aerts, Chesky, Paul & Yoshimura, 2006; Bruno, L'Abbate & Lorusso, 2007; Chesky & Pak, 2001; Dockrell & Shields, 1999).

Indeed, while considerable strides were made in research in that field, even as recently as 2013, Manchester, editor of *Medical Problems of Performing Artists*, wrote, "More than one of these chosen [piano technique] experts pointed out that applying quantitative methods to a complex activity whose purpose is to create art and evoke emotion is problematic from the start..." Manchester further added, "However, we are still not close to being able to scientifically define optimal technique for even one instrument or one dance genre" (Manchester, 2013a, p 63). Indeed, one obstacle to a scientific definition was that pianists, and others who used their technique to evoke art, were somehow exempt from using the principles of good biomechanics and physics. This assumption was questioned by various piano pedagogues in the 20th century who had attempted to look at piano technique from a more rational, biomechanically-informed perspective (Gat, 1965; Kochevitsky, 1967; Ortmann, 1929; Sandor, 1981). In the 1990s, pedagogues began to turn to other disciplines that addressed general principles of good biomechanics, as well as risk factors, associated with learning complex motor skills—namely, the movement sciences. (See Chapter II - Components of the Method Found in Other Disciplines). A study of biomechanics yielded certain commonly accepted principles of optimal body use based on physics, Newton's laws of motion, optimal skeletal alignment and efficient muscle use. These principles were already incorporated into the fundamentals of basic form in many sports. The goal was to determine what might stress the neuromusculoskeletal system and to create a model of piano technique that would reduce those stressors. The model that was created became the basic technical form taught by the Method. Coincidentally, Russell, a mechanical and aerospace engineer, called for a wide, multidisciplinary approach in the areas of biomechanics,

neuromuscular control, piano keyboard mechanics, and excessive muscle use, to be applied in the teaching of injury-preventive piano technique (Russell, 2006).

The success of the Method in communicating this biomechanical model that participants perceived as helping them recover from PRNDs might be partially attributed to the Method's pedagogical paradigm—one that was considered unusual for the piano pedagogy field but not as unusual in the sports or dance pedagogy fields, or in neuropedagogy (Gruhn & Rauscher, 2008). In these latter fields, the motor activity itself is taught in a sequential manner, beginning with the simplest coordinations and progressing step-wise to incrementally more complex coordinations or "skill progressions" (Hanton, Irwin & Kerwin, 2005; Millman, 1994; Rink, 1993). The underlying assumption, as in sports science, was that skill acquisition was based on the quality of the coordination each step of the way.

What seemed to be missing in the piano technique field was a clearer definition of quality of coordination, or basic form, that took into account not only optimal skeletal alignment, but awareness of efficient muscle use at all times. In the 21st century, thanks to the pioneering work in the field of technology-assisted piano pedagogy and multi-modal feedback, these two hallmarks of basic form could be quantified through motion analysis and surface electromyography (Chong & Riley, 2010; Coons, Marcarian & Riley, 2005; Manchester, 2014c; Riley, 2007; Riley, 2011). Therefore, the biomechanical model taught by the Method that participants reported helping them recover from PRNDs could now be tested to determine its claim of teaching biomechanical principles of optimal body use. Additionally, the Alexander Technique—an intrinsic component of the Method and a movement education discipline from the field of embodied cognition and somatic

education—might well have played an important part in participants' perceived relationship between the Method and their reduction of PRNDs. The Alexander Technique yielded high scores in both the qualitative and quantitative analyses. It rests on principles of optimal, dynamic skeletal alignment, and kinesthetic awareness of muscle state incorporated into the Method's technical model. As Batson stated it, its principles also include the idea of the integrity of whole-body organization, the central neuroanatomical function of the cervical spine, and Alexander's understanding of the role that kinesthesia plays in motor control (Batson, 1996). If the Method placed emphasis on cultivating awareness and control of the neuromusculoskeletal systems, then participants would likely have reaped the rewards of enhanced overall body awareness and control.

Research Question No. 2: Theme 6 – Effectiveness of Method in Preventing Recurrence of PRNDs and Theme 7 – Rational, Biomechanically-Informed Approach to Technique

These two themes emerged as a consequence of participants being asked whether the Method provided them with sufficient knowledge to prevent recurrence of injuries. Theme 7 resulted from the frequency of interviewees reporting how much they felt the Method was rational and biomechanically informed, and how much that helped clear up confusion and gave them greater knowledge to prevent future playing-related disorders.

Of the 26 interviewees, 65% felt that they had the knowledge to prevent further injuries. This number may have been higher had the question been asked of interviewees who had not experienced PRNDs. These interviewees perceived overwhelmingly that the Method succeeded in this aspect. Not surprisingly, 88% had difficulty changing old habits, but 88% were aware of reverting to old patterns and felt empowered to create new

patterns. The majority of interviewees (81%) felt they were now playing the piano with ease. For pianists who had suffered from pain and PRNDs, and had even lost their scholarships or jobs, this finding was highly noteworthy. As Abby declared, "I have gained a lot which I think will really help safeguard me...from injury." And Randall reported, "I don't even think about injury anymore, not playing-related.… I don't have pain when I play, ever."

In the survey, two questions relating to preventing future injuries, when combined, resulted in too low a Cronbach's alpha to produce a reliable subscale. The first question asked whether the Method provided sufficient training and knowledge to prevent injury while the second question inquired how much of the survey respondents' knowledge about preventing PRNDs was gained from the Method.

The first question concerning whether the Method provided enough help to avoid future injuries had a high mean score of .87, while the second, had a lower but still very positive mean score of .53. According to the inferential tests, both mean scores were significantly greater than zero. Since the first ("Provide help") question seemed to get to the heart of the matter of whether the Method provided the knowledge and training to prevent future injury, further inferential tests were performed on this question. Specifically, independent-samples *t*-tests were performed between four different groups (injured vs. non-injured, pianists vs. organists, males vs. females, younger vs. older). These inferential tests showed no statistically significant differences between any of the pairs of means.

Qualitative and quantitative comparison of those with and without PRNDs. Throughout the quantitative research, survey respondents who had PRNDs were

compared with those who did not. With few exceptions, the inferential tests carried out on the mean perceptions between the injured and non-injured were statistically the same. This was also true for the perception of whether the Method provided sufficient knowledge to prevent injury.

As part of the qualitative analysis, separate word clouds were created for injured and non-injured interviewees. These word clouds are shown in Figure 48 and Figure 49 below. It was interesting to observe how similar the words were in both of these word clouds. The injured and non-injured interviewees appeared to talk about the same subjects, using the same words.

Figure 48. Word Cloud, Injured Interviewees

Figure 49. Word Cloud, Non-Injured Interviewees.

The word clouds appeared to uphold the quantitative conclusions that both the injured and non-injured interviewees had similar perceptions on most topics, including the Method's success in helping prevent future PRNDs. The word clouds also illustrated how perceptions of the various topics discussed in the interviews and asked in the surveys were answered in very similar fashion by those with and without PRNDs. The obvious prominence of "think" most likely indicated the Method's emphasis on a science-based, rational approach that promoted biomechanical knowledge, deeper understanding and, as a consequence, more accurate replication of the biomechanical principles.

Literature and discussion. The discussion of the literature in Research Question No. 2, Theme 5 indicated the extent of interdisciplinary knowledge—embodied cognition, Alexander Technique, neuroscience and neuropedagogy, movement science, technology-based pedagogy, performing arts medicine, etc.—that informed the Method. Participants in both the qualitative and quantitative portions of this study seemed consistently to perceive that the biomechanical model they embodied allowed them ease and freedom in their playing. They also consistently stated that they felt empowered with sufficient knowledge to recognize a nascent injury and avoid it.

Inconsistencies, ambiguities, and alternative patterns. Regarding the value of principles of the Alexander Technique embedded in the Method, as well as concurrent study in the Technique with a certified instructor, there were no inconsistencies. All participants in the study appreciated its value. However, several interviewees mentioned that, while it was important, other somatic education disciplines might be equally helpful in recovering from and preventing recurrence of PRNDs. These included yoga, exercise programs, and the Feldenkrais Method. Also, although interviewees understood the rationale behind returning to the beginning stages of coordination to retrain their neuromuscular program, they found this very frustrating, as they did the unexpectedly slow pace of their learning.

Research Question No. 3

What effect, if any, do pianists perceive this interdisciplinary Method to have on various aspects of musicality and technique?

Theme 8 – Perceived results of Method on technical control of musical elements and sound production
Theme 9 - Perceived results of Method on experience of music-making at the piano

Above all else, the qualitative analysis emphasized that musicality and technique were intertwined, and that the Method emphasized that technical training eventually served musical goals. Each of the two themes that emerged was comprised of both technical and musical components. Interviewees pointed out how one of the most exciting aspects of the Method was its training in better technique which in turn led to better musicianship. As one interviewee described it, “I'm still amazed at how much more musical my playing is because of the technique and learning to listen…” Another stated,

"Musicality …goes so hand-in-hand with how your body is functioning. When your emotional state is channeled optimally…with what you're doing, you're not getting anxious, you're thinking about the task. And when that happens, the music just comes out."

This intertwining of technique and musicality carried over to the quantitative survey, as was shown by the "Overall music" subscale that included survey questions on both technique and musicality. Supporting the close relationship between these components shown by the interview portion of the study, this combined subscale turned out to be reliable with a Cronbach's alpha value of .959. The creation of the subscale itself corroborated the results from the interviews that the technical aspects of learning the Method were closely intertwined with the musicality aspects. The "Overall music" subscale had a high mean score of .74 that was tested as significantly greater than zero. Independent-samples *t*-tests carried out between the four groups—injury, keyboard type, gender, and age—all showed no differences in survey respondents' perceptions of overall musicality and technique. All had a positive perception.

Improved technique through the Method. In the qualitative portion, although the themes showed the technical and musicality aspects of the Method to be closely related, individual codes were used to separately examine the different technical and musical aspects of playing after (or while) learning the Method. A large majority of interviewees (92%) perceived that their technique was much better. Many spoke of this improvement in technique as enhancing their ability to make music. As Leah stated it, "I'm not concerned about the physical aspect of playing, so I feel like I am much more musical and also understand…what I need to do physically at the piano to be more

musical." Interviewees also perceived an overall improvement in tone quality. Tess commented, "My tone first of all changed very much. It's much, much deeper and richer."

Most interviewees reported that audiences responded to their playing with positive comments (92%). The "gained better technique" code was also highly correlated with the "positive comments from others" (.76) code. As Phoebe commented, "I'm often really amazed by some of the comments and compliments that I get. While I'm performing, I'm really focused on using my imagination to create…this sound that I want my audience to hear."

The survey questions were also divided into separate musicality and technique subscales. All of the music subscales ("Overall music," "Musicality," "Technique," "Listening," and "Others' comments on playing") were shown to be significantly greater than zero through inferential testing. However, a slightly concerning aspect did arise in the "technique" and "listening" subscales. In order to calculate and test the overall mean subscale values to determine whether they were significantly greater than zero, an individual subscale mean was calculated for each of the survey respondents. The highest and lowest of these individual subscales were represented by the "minimum" and "maximum" subscale values shown in Table 39. This table shows the minimum values for the "Technique" and "Listening" subscales to be negative. These results indicated that at least one survey respondent had a negative perception of the technical and listening skills taught through the Method. Therefore, at least one survey respondent appeared to perceive that those skills had worsened, rather than improved. As stated before, however,

the overall means of these two subscales were positive. Therefore, most respondents perceived these skills as having improved through study in the Method.

Another related subscale was "Others' comments on playing." The "Technique" subscale had a high mean score of .72 and the "Others' comments on playing" had a mean score of .78. Statistical analysis showed the "Technique" subscale, as well as the "Others' comments on playing" subscale to be significantly greater than zero. While both subscales were also tested for differences between groups by means of an independent-samples *t*-test, no pairs of scores were significant. For both of these subscales, no statistically significant differences existed by injury status, keyboard type, gender, or age.

Improvements in musicality. Improvements in interviewees' musicality were also addressed in the qualitative section. Interviewees discussed such topics as "enhanced fulfillment of artistic potential" and "much more musical now" which became codes. Again proving how interrelated technique and musicality were in interviewees' minds, the code "gained better technique" was very highly correlated with the "enhanced artistic potential" code. Tess reported, "I felt that the Method was the tool for me to express what my musicality or what the piece required." And one survey respondent summed it up, "It gave me tools for dealing with performance, technique and artistry."

The importance of listening was also discussed in detail. In fact, the correlation between "improved listening" and "enhanced artistic potential" was also very high. As Zoe expressed it, "It's much more about attuning your ear to what you're doing that's coming out of the piano. And it changes how you think about making music." And Ben reported simply that, "It enables me to express myself more freely and…dedicate more of your brain power to what counts in the music."

For the quantitative discussion of "Musicality" aspects in Chapter V, both a "Musicality" and a "Listening" subscale were created. The means for these two subscales were .73 and .78 respectively. Both subscales were reliable and significantly greater than zero. Independent samples *t*-tests on the "Musicality" subscale showed no statistically significant differences by injury status, keyboard type, gender, or age. The independent-samples *t*-test on the "Listening" subscale comparing pianists and organists, however, showed a statistically significant difference: organists indicated a significantly more positive perception of their improvement in listening skills than did pianists. A possible explanation was that, due to the nature of the organ, organists are trained to listen for what they can control—articulation and timing—rather than for what pianists have to control—volume, voicing, and tone quality. Therefore, the alteration in focus in the Method on continuous listening to the life cycle of each tone would be a new skill for many organists.

Literature and discussion. For a potential understanding of the musical and technical results, it would be helpful to turn to another component of the Conceptual Model: Personal and Historical Pedagogy, and Personal and Historical Technique. The technical model that was taught in the Method was grounded in biomechanical principles of efficient body use. But this particular model had historical roots and was most closely aligned with a type of technique and body use that was prevalent in the late 19th and early 20th centuries in Russia, the United States, and Europe. As discussed in Chapter II, its roots were in what Gerig (2007) called "enlightened" piano technique—coordination of the whole arm, hand and fingers, as well as emphasis on muscular suppleness and flexibility as espoused by Liszt and Chopin, and later by Leschetitzky, Rubinstein,

Carreno, Godowsky; and in Russia, by Scriabin, Rachmaninoff, Gabrilowitsch, the Lhevinnes, and Safonov, teacher of the Lhevinnes and Scriabin. Others—including Matthay, Hess, Ortmann, and two of the researcher's own teachers (Lateiner-Grosz and Agosti)—used the same technical approach. While there were certain differences, the emphasis, as reflected in the Method, was consistently on building a solid technical foundation that included whole-arm muscular suppleness; non-accumulation of tension; using gravity to advantage; economy of motion; and a quiet, upright torso (Cooke, 1917). And in terms of the intertwining of technique and musicality, emphasis was placed on production of a warm, rich sound, and on all aspects of an organic musicality that flowed out of a free technique (Gerig, 2007). The Russian pianist Hoffmann summarized this approach, "One should acquire sovereignty over [the music]. And this sovereignty is technique. But—technique is not art. It is only a means to achieve art, a paver of the path toward it" (Hoffmann, 1909, p. viii).

Inconsistencies, ambiguities, and alternative patterns. As indicated from the "Technique" and "Listening" subscale minimum values shown in Table 39, not all survey respondents necessarily perceived the technique and listening skills taught by the Method in a positive light. At least one survey respondent had a negative perception of the technique and listening skills learned through the Method. Although this negative aspect did not show up in the interviews, it is important to note that such a response emerged from an anonymous survey in which the respondent felt secure in speaking the truth as he or she perceived it.

Additionally, whether any particular technical approach could affect the quality of tone production is a highly controversial topic in the piano and acoustical fields. There is

a long-standing and heated debate between, on the one hand, pianists and acousticians who claim that, because of the way the piano mechanism produces sound, a physiological approach to the key does not determine a particular quality of tone (Mark, 2003; Sandor, 1981), and, on the other hand, many pianists, audiences and some scientists who believe what their ears tell them: that they perceive, as did pianists and audiences of the Golden Age, a difference in tone quality, one pianist to another. And that difference in tone quality, they posit, is directly related to the physical approach or technique of the pianist (Birkett, McPhee & Vyasarayani, 2008; Tzotzkova, 2012).

Research Question No. 4

What do pianists consider, if any, the extra-musical effects of studying this interdisciplinary Method?

Theme 10 –Transformative, life-changing experience
Theme 11 – Enhanced professional and personal life
Theme 12 – Improved listening skills and lessened performance anxiety

Interview participants discussed numerous ways in which learning the Method enhanced their lives outside of music. As well as helping improve both their personal and professional lives, some interviewees discussed how learning the Method helped enhance concentration, awareness, positive outlook, and self-confidence. Lucy encapsulated her own extra-musical results as, "Positive, increased self confidence, increased self awareness, increased perception of how we may be perceived by other people because we're more aware of ourselves, and how we're carrying ourselves, and interacting with people." Interviewees also discussed how they were much happier in general now and felt

empowered in other areas of their lives. As one survey respondent reported, “I feel I have become a more confident player, teacher, and person.”

Many of those interviewed also felt that their personal life (92%) and their professional life (85%) were improved as a consequence of studying the Method. Angus commented that, ”The technique, it’s job security…in that I know I can deal with problems as they come up.” And a survey respondent reported that, “It has allowed me to continue as a professional, gainfully-employed musician.”

Another popular theme in the interviews was improved sense of well-being (77%) and even a shift in lifestyle after studying the Method. As Zoe expressed it, “…it’s whole lifestyle of how you use your body.” This particular facet of studying the Method was also emphasized in the quantitative section where survey respondents were asked to rate how the Method changed them in terms of a general sense of well-being. The mean for this particular survey question was .70, which was the highest mean of all of the extra-musical questions.

A particularly strong theme was that of self-transformation. This was perhaps the result of combining other codes such as increased confidence and happiness, self-empowerment, more awareness of self and others, and enhancement of professional and personal life. Paul commented in his interview, “…in general, it’s amazing what this [Method] has done, like for everything else in my life.” And one survey respondent summarized the views of a number of other survey respondents with, “The Method was a life changing experience.”

In order to more closely examine survey respondents’ extra-musical lives in the quantitative portion of the study, an “Extra-musical life” subscale was created with a

mean score of .57. Although the mean of this subscale was lower than the "Music-related" subscale scores (as well as the "Overall perception of the Method" scores), inferential testing determined it to be significantly higher than zero. Therefore, survey respondents overall did perceive that the Method improved their extra-musical lives.

The "Extra-musical" subscale was created as an average of nine survey questions. As with all subscales, a mean value of this subscale was also created for each survey respondent. The highest mean subscale for an individual survey respondent is shown as the "maximum" value in Table 40, while the lowest mean subscale for an individual is shown as the "minimum" in the same table. It is important to note that the minimum value for the overall subscale in Table 40 was negative. This indicated that at least one survey respondent perceived the Method as having worsened overall extra-musical life.

Interestingly, however, while interviewees reported, without prompting, that studying the Method had enhanced their extra-musical lives overall, at least a small portion of the survey respondents disagreed. One might conclude that such differences were possibly attributable to the confidential and private nature of the survey. One might also conclude that random differences between personalities of survey respondents and of interview participants contributed to the discrepancies. In particular, the survey questions that addressed interactions with people, as well as with personal lives, after studying the Method, had lower scores. The improvement in these areas was lower than, for example, improvement in a general sense of well-being and general movement, which had relatively high mean scores. Again, it might be speculated that anonymous survey respondents felt more comfortable in expressing negative perceptions in general. However, that the overall survey mean was positive does not necessarily indicate that the

negative value was anomalous. Whether the negative reaction was an anomaly or whether it might be indicative of a trend should be a subject for future research.

Influence of age. According to the statistical tests performed, the "Extra-musical life" subscale did not vary by injury status, keyboard type, gender, or age. In fact, for all independent-samples *t*-tests carried out, age was never a statistically significant influence. All perceptions subscales were statistically the same for both younger and older survey respondents. Word clouds were created from the interviews for both age groups, as shown in Figure 50 and Figure 51. It should be noted, however, that all participants were adults, and most had chosen to study the Method for personal and professional reasons. Even those students for which the course was required in the Professional Certificate Program at Salem College voluntarily elected to enroll in the Program. This might account for age not being statistically significant.

Figure 50. Word Cloud, Younger (Age 38 and Below) Interviewees.

Figure 51. Word Cloud, Older (Age 39 and Above) Interviewees.

The two word clouds appeared somewhat similar (again, with an emphasis on "think"), although "technique" appeared more important to younger interviewees, while "piano" was more important to older interviewees. One difference between the quantitative and qualitative sections with respect to age was the age distribution. The average age of survey respondents was older, at 45. Half of those survey respondents were 38 and below; the remaining half were 39 and above. The interviewees, on the other hand, were younger. While the average age of interviewees was 38, 18 of the 26 interviewees were 38 or below with only eight interviewees above 38 in age. This difference in distribution could help account for differences in the word clouds that did not appear when the survey respondents' perceptions, as indicated by the subscales, were compared by age. The average age of all participants—survey respondents and interviewees—was 42. However, age might have accounted for, at least in part, the differences between survey and interview results. Further research might determine whether age played a role in perception of the Method.

Literature and discussion. The high statistical scores and positive quotes from interviewees and survey respondents might be accounted for in part by the pedagogical underpinnings of the Method. Since its inception, the Method was an attempt at a new paradigm to replace traditional models that its developer perceived were not working. The Method was created not only for teaching injury-preventive, well-coordinated technique, but also for serving compelling musical-making, regardless of the level of repertory. Its emphasis on breaking down a complex skill into manageable components, mastered step-by-step, had resonance in sports pedagogy philosophy (Millman, 1994) that focused on building a solid foundation of skills, just as was the focus of historical piano teachers mentioned in Research Question 3 (Gerig, 2007). This emphasis on basic form, as well as on sound production, countered traditional piano pedagogy that attempted to teach a number of musical and theoretical skills, with less emphasis on teaching technique. That is not to say that such skills could not be taught simultaneously, but not at the expense of a solid, well-coordinated technical foundation in which technique was defined as *how* the body is coordinating, not *what* the pianist is playing.

These positive extra-musical results perceived by participants might also have resulted from of a transformative learning aspect of the Method's pedagogy, something the developer of the Method realized only after studying transformative learning in a doctoral program (Cranton, 2006). Transformative learning rests on the the premise that previous values, beliefs, and traditions are questioned, either as a result of a crisis or a strong desire to change (Mezirow, 2000). Many students of the Method in this research had experienced a serious crisis related to PRNDs and did not feel served by traditional venues and support systems for recovery or prevention. The temporary loss of control,

and the unsettling feeling of returning to a foundational level were similar to experiences in transformative learning. Arguably, the Method embodied at least portions of each of the five types of learning techniques listed by Hoggan, Simpson and Stuckey (2009) for creating an optimal learning environment: imagining new possibilities, deep learning of course content, self-awareness, purposeful change and social change, and increasing awareness of others. Such an environment had been shown to increase self-esteem, self-confidence, and positive image of oneself. It also could lead to self-empowerment, more hope, and an increased awareness of self and others—all results mentioned by the study's participants.

Additionally, elements from neuropedagogy (Gruhn, 2004), neuroscience (Pascual-Leone, 2003) and neurophysiology (Batson, 2009) research also were factored into the Method's pedagogy and might have accounted for the positive response to learning the Method in general. The Method incorporated elements from neuroplasticity (Bangert & Altenmüller, 2003; Doidge, 2007), modeling and observational learning (Bekkering, Hunnius, Lindemann, Paulus & Van Dam, 2011), mirror neurons (Molnar-Szakacs et al., 2006), mental practicing and implicit versus explicit learning (Gobel, Reber & Sanchez, 2010), the role of rest in off-line, consolidated learning (Allen, Cash, Duke, & Simmons, 2009; Manchester, 2012a), and the role of the brain's reward system in movement organization (Keitz, Leenders & Martin-Soelch, 2003), as well as findings confirming the importance of a positive, stimulating environment for improving synaptic function (Gruhn, 2007). Finally, elements embodied in the Method from the field of mindfulness (Herrigel, 1953; Kabat-Zinn, 1994) and Csikszentmihalyi's state of "flow"

(Custodero, 2005) could well have contributed to participants' perceptions of enhanced awareness and focus, as well as a sense of increased well-being and happiness.

Inconsistencies, ambiguities, and alternative patterns. There were no prominent inconsistencies or alternative patterns in this Research Question, either in the survey or the interviews. It was difficult to know why little negative response surfaced. The Method's underlying philosophy to think positively, however, might have predisposed participants through habituation to focus on more positive parts of the training. In Research Question No. 5, participants gave more specific reactions, some negative, regarding challenges in studying the Method and problems with instructors.

Research Question No. 5A

What do pianists perceive as the challenges of studying the Method?

Part A: Theme 13 – Progress feels slow in early stages of training
Part A: Theme 14 – Need for more structure in upper levels of training

Challenges to Learning the Method

In Themes 13 and 14, two categories of challenges emerged. The first category included the emotional, psychological, intellectual, and societal challenges specifically related to the Method. These included the difficulty of changing old habits; the demands on time; professional conflicts; and the need for cultivating character traits such as patience, perseverance, focus and mental discipline. Codes such as "learning Method demands patience," "learning Method is time-consuming," and "progress slowly in learning the Method" were created and discussed in depth by the interviewees. One interviewee remembered the very earliest stage of training. As Phoebe stated it, "It does

take a significant chunk of time to really train thoroughly in the Method…probably more than two years."

Even though they discussed the time it took and the accompanying frustration, many of the interviewees also talked about how they understood why the training took so much time, and that the Method was not a quick fix. As Randall stated it, "I think that…my expectations for, you know, how long that would take, or when I would be completely pain free, were maybe a little unreasonable."

Two other sub-themes emerged, worthy of mentioning. One was perceived expectation that students would be "spoonfed" information from the instructor rather than having to work hard themselves. The second sub-theme was the danger of losing one's drive as a musician while studying the Method. As Craig explained it, "…[it] can be a bit dangerous because you are waiting to be spoonfed information…and the student's going to lose their drive to be their own musician...you still have to work your ass off and really make it happen."

In the survey, only one series of survey questions addressed the actual process of studying the Method. Respondents were asked to rate various aspects of studying the Method, with answers ranging from extremely hard (-1) to extremely easy (+1). Therefore, a high score for this set of questions was not necessarily more positive; it only meant that a particular aspect of studying the Method was easier. A subscale "All aspects" was created with a mean of .09, indicating that learning the Method was neither easy nor difficult. Inferential testing showed this subscale to have no significant differences by injury status, keyboard type, gender, or age.

Challenges of pacing, sequence of steps, and gender differences. The second category of challenges concerned weaknesses that were perceived in the way the Method itself was structured, especially for the more advanced stages of training. Some interesting differences existed among groups of survey respondents, especially with regard to gender. In particular, women found four aspects of studying the Method more difficult than did men. These aspects were pacing, sequencing of steps, feeling in control of playing, and modeling. Interestingly, pacing and sequencing of steps were two aspects that arose often during the interviews as well. The women interviewees in particular addressed these issues. As Abby stated it:

> …the biggest thing is…knowing what repertoire will best help me achieve the next step and that's where sometimes in the Method it gets a little ambiguous….I think there is more of a gap where you learn the basic steps…and then you're almost kind of in limbo where it's hard to know what the next step is. (Abby)

However, the concern about pacing yielded contradictory results. Randall reported, "I got the product I wanted in the end, but I wish that I had gotten it faster." Yet Lucy offered the opposite observation: "The pacing was at times a bit too fast….At least in my case, I needed more time on some concepts and was kind of pushed to move ahead quicker than what I probably should have…"

Word clouds were used to add a different perspective to the qualitative findings. The word clouds in Figure 52 and Figure 53 were created based on the exact words of the females and males taking part in the interviews.

Figure 52. Word Cloud, Female Interviewees.

Figure 53. Word Cloud, Males Interviewees.

The word clouds are fairly similar in general, but none of the differences are related to pacing or sequencing. Again, although differences did arise concerning the challenges of certain aspects of learning the Method, including pacing and sequencing of steps, other inferential testing did not show significant differences between male and female survey respondents with regard to other perceptions of the Method.

Literature and discussion. The perceived concerns and ambiguities regarding pacing, sequencing, and structure could impact negatively motivation to learn. This, in turn, could reduce satisfaction, and increase confusion and frustration (Grühn, 2004; Grühn & Rauscher, 2008). From a neuropedagogical viewpoint, these mental states would not be conducive to optimal learning. Therefore, they need to be addressed.

Inconsistencies, ambiguities, and alternative patterns. There seemed to be some contradictory perceptions of pacing, sequencing and structure. It appears from the interview results that the Method needs clearer structure in the intermediate and advanced levels of training. Added to that—given the Method's emphasis on individualized training—more careful attention is needed to ensure that each individual student's needs in those areas are being met. However, concerns expressed by a few do not seem to have had statistical significance and, while it is important to honor the concerns of students about the Method, they should be viewed in context, relative to the total response.

A few interview participants expressed concern regarding the training they received from assistant instructors. They praised them but questioned their consistent pedagogical congruence with the Method's developer, as well as their ability to demonstrate technique and musicality in higher levels of repertory. Additionally, two survey respondents expressed respect for the Method, but had personal complaints about its developer. These complaints should be carefully scrutinized so that the developer can make appropriate adjustments. However, given that the negative comments were contained in an anonymous survey, it would make it difficult to know the relevant circumstances on both the student's and the instructor's side that generated the complaints.

Research Question No. 5B

What do pianists perceive as the positive aspects of studying the Method?

Part B: Theme 15 – Individualized training, video-recorded lessons and somatics
Part B: Theme 16 – Happier learning in a supportive community
Part B: Theme 17 – Uniquely defining components of the Method

In the interviews, three themes emerged that seemed to be perceived as defining characteristics of the Method, as well as positive aspects of it. While individualized training and somatic education were highly valued by interviewees, several more striking findings emerged from RQ5B regarding positive aspects of training. Over 60% found learning the Method a great experience, felt they learned a lot, and were happy during training; and 65% enjoyed the interdisciplinary components. Ironically, compared to complaints from several interviewees regarding pacing in RQ5A, 73% of interviewees found the pacing of learning satisfactory. They were especially positive about the week-long intensive training workshop. As Zoe commented, "I thought it was incredibly positive. It gave me a glimpse of what was possible and it was intriguing enough to want to continue it." Rosalie, who did not have a PRND, commented on the training in general, "I have been pretty much nothing but pleased with the results of taking the time out of my life to retrain myself this way." And a survey respondent summed up her perception of studying the Method in the narrative section, "I really couldn't be happier with my experience during my training." A large contributing factor to that was interviewees' appreciation of a safe, supportive, compassionate community in which they learned from each other. As one participant expressed it, "Suddenly, I was like, 'Well, I'm not alone.'"

As mentioned before, 100% of interviewees, when asked specifically, perceived concurrent training in the Alexander Technique, as well as Alexander Technique

principles embedded in the Method, to be a valuable component of the Method. But there was another unique component of the Method that was perceived favorably by all interviewees—Professional Tactile Guidance (PTG). PTG is guided, hands-on touch used to help students become aware of muscle tension so they can learn to control it at the piano. It is a skill that must be trained and, above all, applied professionally. Participants unanimously agreed that PTG was invaluable to successful training. Jacob stated, "I think that's [PTG] a very fundamental, almost indispensable piece [of the Method]." And Phoebe echoed that opinion, "I think it was very helpful and probably really essential. I don't know how I would have learned without it."

Survey respondents were also asked how important Professional Tactile Guidance (PTG) was to learning the Method's biomechanical model. The answers to this question were on a sliding scale ranging from extremely detrimental (-1) to made no difference (0) to extremely beneficial (+1). This survey question was answered by 67 participants out of 74. The mean score of the question was a high and positive .91 and was significantly different from zero. As expected, the mean score of the perceived effectiveness of Professional Tactile Guidance was significantly greater than zero, thus indicating that survey respondents found this aspect of the Method to be highly beneficial.

Literature and discussion. While a review of the literature did not include the topic of therapeutic touch, the use of professional touch is an essential component of the Alexander Technique. Indeed, while some Alexander Technique instructors are said to prefer verbal directions, most use a highly trained form of light touch to stimulate the nervous system and the body's kinesthetic awareness and proprioceptive, both vitally important for neuromuscular reprogramming (Batson, 1996).

Inconsistencies, ambiguities, and alternative patterns. While the Method is highly structured in a step-by-step manner, its developer must also take into consideration the unique needs and perspectives of its students. A few contradictory opinions expressed about pacing being too fast or too slow, and the need for even more structure, were telling examples of the potential challenge of any method or curriculum that values and requires individualized attention. Nonetheless, flexibility and adaptability to students' needs are the only means of ensuring that the Method continues to help pianists, to improve, and to remain relevant.

Chapter VII

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

Advanced piano playing has been said to be one of the most demanding and multifaceted activities known to humankind. Technical performance alone at an advanced level of musical repertory requires sustained repetitive motion and subtle, complex interaction of musculoskeletal, neuromuscular, and sensorimotor systems. Added to that are stringent artistic demands requiring highly developed musical, intellectual, emotional, and communicative skills. Such technical and artistic demands require discipline, focus, and dedication, similar to athlete-artists such as dancers, figure skaters, and gymnasts. And even the presence of pain and risk of playing-related injury do not diminish pianists' motivation to practice and perform. It is not surprising that pianists are highly susceptible to playing-related neuromusculoskeletal disorders.

In spite of advances in the field of performing arts medicine over the past 35 years, the rate of playing-related neuromusculoskeletal disorders (PRNDs) remains consistently high worldwide. Pain, disorders, and injury have grave personal, professional, financial, and emotional consequences: studies may be halted and careers even ended. However, unlike in the sports medicine field where, for example, the National Collegiate Athletic Association (NCAA) has been building a research database of injuries of thousands of athletes since 1982, relatively few musicians have been the subject of research in PRNDs. As Manchester, editor of *Medical Problems of Performing*

Arts, recently wrote, "We now have published research data on a few hundred musicians with mixed results compared with data on tens of thousands of athletes with fairly consistent results…" (Manchester, 2014e, p. 180). Much more research is needed. However, the problem, Manchester believes, is compounded by the complexity of the activity of playing the piano: scientists and researchers find it challenging to apply the scientific gold standard of randomized controlled trials to compare one alleged injury-preventive method or intervention to another. Manchester also stated that we were not close to scientifically defining optimal technique in even one instrument (Manchester, 2013a). Meanwhile, pianists worldwide continue to suffer from PRNDs.

A slightly different route was taken in the early 21st century when researchers in ancillary fields, including movement sciences (biomechanics, kinematics), neuroscience, and embodied cognition, among others, contributed their findings in research related to the performing arts, and specifically to piano playing. Their results, however, were largely isolated and, as yet, were not integrated or applied in a systematic or pragmatic way to the ongoing problem of PRNDs. A few researchers have expressed a need for expedited development of biomechanical models and strategies for teaching injury-preventive piano technique (Allsop & Auckland, 2010; Wristen, 2000). Russell, a mechanical and aerospace engineer at Carleton University in Ottawa, Ontario, notwithstanding the biomechanical complexity of playing the piano or the mechanical complexity of the piano itself, called for a wide, multidisciplinary approach to piano technique and pedagogy in the areas of biomechanics, neuromuscular control, piano keyboard mechanics, and excessive muscle use. He believed that such an interdisciplinary approach could expedite the development of models and strategies for

teaching injury-preventive piano technique (2006). Russell stressed optimal skeletal alignment, minimizing muscle use, avoiding joint stiffness, and the critical role of the brain and spinal cord in playing the piano. His findings also corroborated studies in embodied cognition and somatic education that emphasized the importance of proprioception in teaching psychomotor skills (Batson, 2009).

Aside from the complex physical activity of playing the piano, one further complication seemed to make scientists hesitant to study piano technique—the necessity for pianists to evoke art while playing. However, it is the author's opinion that pianists should be no more exempt from motion analysis, surface electromyography, or other means of quantifying physical use than dancers or figure skaters who also create artistic products. Ironically, a number of anecdotally successful piano pedagogues in the 20th century held the same opinion, and had attempted to look at piano technique from a more rational, biomechanically-informed perspective (Gat, 1965; Kochevitsky, 1967; Ortmann, 1929; Sandor, 1981). Their goal was the same as Russell's (2006) and the author's—to create a biomechanical model that exemplified core principles of efficient biomechanics, a kind of "basic form" of piano playing. The goal of these pedagogues—all interested in science but themselves not scientists—was first to determine what might stress the neuromusculoskeletal system, and second to create a model of piano technique that would reduce those stressors. Such a so-called injury-preventive model had been taught in various ways since the late 19th century, and had been exemplified in, among others, many of the great virtuoso players of the 20th century—Rubinstein, Rachmaninoff, the Lhevinnes, Hoffmann, etc. Furthermore, the Method under investigation based its own alleged injury-preventive technical model on similar biomechanical principles. Similarly,

a number of other pedagogues of the late 20th and 21st centuries, such as Taubman, Golandsky, Grindea, Frazier, Karpoff, and the developer of the Method, purported to teach biomechanically informed, injury-preventive technique.

Meanwhile, due to continuing challenges to understanding and eliminating playing-related disorders, pianists who had either experienced PRNDs, or who wished to avoid them, were often desperate for answers and treatments that would work. Their frustration, as this study demonstrated, was sometimes exacerbated by inaccurate diagnoses and insufficient medical interventions to help pianists return to playing and to resume their studies or their careers. Naturally, in their desperation, pianists frequently turned to these various pedagogues who had become known throughout the professional piano world for teaching injury-preventive technique, and for which anecdotal evidence existed that their biomechanical model and approach worked, and even enhanced musical artistry.

The problem, however, was that very few of these injury-preventive techniques and methods had ever been systematically investigated, and certainly not with the gold standard of randomized controlled trials. Therefore, research was absent regarding the trustworthiness and efficacy of these techniques and methods. The author's own Method and technical model (as explicated on the DVD *Freeing the Caged Bird – Developing Well-Coordinated, Injury-Preventive Piano Technique;* Lister-Sink, 1996) had received considerable attention and anecdotal support since 1995. However, it had never been investigated systematically to determine its short or long-term efficacy or whether it, indeed, helped both to recover from and prevent further recurrence of PRNDs.

Therefore, the purpose of this study was to investigate systematically this particular interdisciplinary Method that purported to teach injury-preventive piano technique. The gold standard of research design could not be used due to challenges of length of study as well as diplomatic concerns regarding the comparison of the researcher's own Method to that of respected colleagues. Therefore, a study of students' perceptions of the effectiveness of the Method seemed the most viable option. A convergent, mixed-methods, qualitative-quantitative design paradigm was chosen combining a quantitative survey designed to yield both descriptive and inferential statistics, and lengthy interviews for yielding rich data. Consequently, interpretation was possible across two databases, thus generating a more complete picture. Students had to have studied the Method for at least two semesters, or the equivalent, between 1990 and 2014. Since the researcher had actually developed the Method under investigation, it was imperative to reduce researcher bias as much as possible. Four Research Assistants who had received CITI Human Subjects' Rights training were hired to conduct all correspondence, as well as signing of IRB-approved consent forms, conducting interviews, administering the survey, transcribing and encoding interviews with NVivo, and eliminating identifying markers in the NVivo quotes that would ultimately be used by the researcher. Furthermore, the researcher was not aware of who was being interviewed, and all surveys were anonymous. A database maintained by the researcher since 1990 was used by an RA to contact students and to inquire as to their willingness to take the Qualtrics survey and to be interviewed. All participation was voluntary. Out of a final list of 103 pianists, 74 (*N=74*) took the survey (71.8% return) and 26 were interviewed, either face-to-face or via Skype. No coercion was used, and participants

were assured that every step had been taken to ensure confidentiality and to minimize risk to them, personally or professionally. One of the Research Assistants was a professional statistician who helped develop survey questions that would yield inferential statistical data, and who transcribed interviews and helped analyze data with SPSS software. The interviews were coded for meaning, with a total of 132 codes. Using NVivo software, a Pearson Correlation Coefficient determined which codes were most closely related. From the codes, 17 themes emerged directly related to the five Research Questions.

Conclusions

Research Question No. 1

How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in recovering from those disorders?

Theme 1 – Perceived consequences of experiencing PRNDs
Theme 2 – Perceived effectiveness of medical treatments vs. the Method for PRNDs
Theme 3 – Conflicting perceptions of Method – skepticism vs. hope

Perceived consequences of PRNDs. The first major finding in this study, revealed in both the survey and the interviews, was that participants with playing-related disorders experienced profoundly negative consequences of PRNDs—professionally, emotionally, academically, psychologically, physically and sometimes financially. Of the 26 interviewees, 18 had experienced PRNDs and over half had been unable to play at all prior to retraining. Many hid their pain and injury for fear of losing their scholarships or jobs. Some continued to play through pain, either because their teachers or schools required it, or because they did not want to admit they had a PRND. Participants were

acutely aware of the stigma attached to having a PRNDs and spoke of feeling worthless, hopeless, a failure, and isolated from other musicians. Several even mentioned they knew others who had contemplated suicide because they had lost their musical voice and their purpose in life.

A conclusion to be drawn from this is that the negative impact of PRNDs has not been sufficiently acknowledged or addressed by the music profession, including piano teachers, music administrators, colleagues, family, and friends. In spite of the growth of awareness of health and wellness issues in the music field, and institutional mandates for enfolding health and injury-prevention content into music curricula, playing-related disorders remain largely unacknowledged and unaddressed, resulting in a world-wide crisis in the piano world.

Perceived effectiveness of treatments. A second finding was that treatments and interventions were only somewhat successful and largely addressed only symptoms rather than causes or origins of the PRND. Over half of the interviewees with PRNDs reported that medical and complementary healthcare treatments were only mildly beneficial, and did not prevent the problem from recurring. Many expressed frustration with confusing diagnoses or treatments that did not work. They frequently did their own research and self-diagnosed, and in some cases, sought other complementary, alternative or even untested treatments. While some interviewees were happy with the treatments they received, some felt they were not respected nor understood by healthcare professionals. A few expressed concern that they were not taken seriously, or that healthcare professionals implied that injury was a necessary part of being a pianist. Some reported being considered to be hypochondriacs. For that reason, they elected not to seek further

medical help. Additionally, study participants frequently felt unsupported by their teachers who either sympathized but could not offer advice, or required them to continue practicing and fulfilling academic requirements in spite of pain. However, many participants were grateful for the support they received from family and friends.

A conclusion to be drawn from this finding is that, in spite of considerable growth in performing arts medicine research over the past thirty years, as well as some success in treatments, many pianists with playing-related pain and disorders are not being served adequately. It is difficult for them to find healthcare professionals who view them more holistically, including their history of PRND, their technique, their non-playing-related medical conditions, their practice habits, etc. The frequent complexity of their PRND is not sufficiently understood (Pascarelli, 2004). Additionally, some participants receive confusing and sometimes contradictory diagnoses and, therefore, potentially inappropriate tests and treatments. Finally, even pianists who receive successful diagnoses and subsequent treatments that lessen or eliminate symptoms, sometimes experience a recurrence of the PRND. This could be attributed to their not being fully educated to the original causes of the PRND, including deficiencies in their muscle coordination and skeletal alignment (technique). An alternative conclusion, however, might be that ongoing pain, dysfunction, and frustration have negative emotional, and mental consequences, rendering pianists less able to communicate their problems clearly and adequately to healthcare professionals, teachers, and administrators. This might also account in part for their sensitivity to criticism and perception of not being supported.

Conflicting perceptions of the Method. A third major finding from Research Question No. 1 was that a majority of study participants viewed the Method, in general,

as positive in helping them recover from their PRNDs and return to practicing, playing, their studies, and their jobs. At the same time, skepticism about the Method was very high from teachers, colleagues, family, and friends, even as the Method was working for the participants. Statistically the effectiveness of the Method on PRNDs was highly significant (.69 on a scale of -1 to +1) and almost 75% of interviewees reported that the Method worked in helping them recover from their PRNDs. Moreover, the overall effectiveness of the Method was also significantly greater than zero (.78). While some pianists did not find the Method to have much impact on their lives, some spoke of the experience of studying the Method as being transformative in many other aspects of their lives, as well.

One conclusion that can be drawn from why most participants felt the Method worked is that the Method's underlying interdisciplinary basis and mission were to address pianists' physical, emotional, and artistic needs from a holistic viewpoint. Furthermore, one primary goal of the Method was to help each individual pianist with a PRND to obtain an accurate diagnosis from physicians sympathetic to and understanding of musicians' requirements. Thereafter, effective and often tailor-made treatments from a variety of both mainstream and complementary healthcare professionals were applied. Pianists were then more empowered with biomechanical and anatomical knowledge to understand the origins of their PRNDs. Additionally, while studying the Method, they were allowed sufficient time to acquire new habits in a safe, positive environment through a carefully constructed, stepwise progression tailored to their individual needs. Concurrently, they built awareness and control of their body use through Alexander Technique principles, as well as through certified instruction.

A second conclusion regarding their perceived success was that while training, participants were embedded in a community of supportive, compassionate students, teachers, and administrators whose mission was to help students recover physically, emotionally, and professionally. Such purposeful support was part of the transformative learning component of the Method.

Ironically, however, another important finding was that considerable skepticism of the Method was expressed, both from the participants in the beginning stages, and frequently from teachers, colleagues, and family. This presented psychological and emotional challenges for pianists, even as the Method was helping them physically and professionally regain their playing, jobs, and academic status. Also, frustration at the slow pace of learning and, for some, the humbling experience of having to return to fundamentals further complicated participants' reactions.

A conclusion to be drawn, corroborated by the literature, is that methods for teaching technique, in general, are suspect by many pianists. As revealed in Chapter II, piano technique methods have had historically negative connotations of rigidity and narrow-mindedness (Gerig, 2007; Godowsky, 1933), allegedly forcing all students into the same technical mold and sometimes even leading to stiffness and injury. An alternate conclusion is that the Method itself is so different from traditional pedagogical paradigms that it is understandably suspect by teachers and colleagues, although the paradigm would not be as unusual in sports training. The Method's interdisciplinary, individualized, holistic nature—requiring hands-on tactile guidance and more than one lesson per week to effectively train—is not part of current mainstream pedagogical practices. Therefore, pianists felt uncomfortable and somewhat isolated from their colleagues and teachers

until the Method began to work for them. Even then, many found it difficult to adequately explain to people outside the Method what they are doing. One might conclude that the Method's developer has not found adequate means of communicating effectively its principles, goals, and strategies. Consequently, students might be negatively impacted in a number of ways.

Research Question No. 2

How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the role of this interdisciplinary Method in preventing recurrence of those disorders?

Theme 4 – Role of the Alexander Technique in the Method
Theme 5 – Interdisciplinary, holistic approach to technique
Theme 6 – Effectiveness of Method in preventing recurrence of PRNDs
Theme 7 – Rational, biomechanically-informed approach to technique

The importance of the Alexander Technique. A major finding was that most participants, in both interviews and the survey, considered the Alexander Technique to be a valuable component of the Method and believed it contributed to recovering from PRNDs. All interviewees viewed it positively and almost three-quarters of survey respondents affirmed its importance in the Method. Pianists felt better physically, emotionally, and mentally as a result of their concurrent work in Alexander Technique.

The primary conclusion to be drawn is that the Alexander Technique is an important component for teaching the Method and several of the Method's objectives—optimal, dynamic skeletal alignment; efficient muscle use; and kinesthetic awareness. Most participants found it to be supportive of healing and good holistic health in general. As students optimize their neuromusculoskeletal use through the Alexander Technique,

and release long-accumulated muscle tension through realigning their head, neck, spine and upper and lower extremities, they increase self-awareness, heighten proprioception, and are more able to identify and prevent harmful body use patterns.

Effectiveness of the Method in preventing recurrence of PRNDs. Another major finding was that many interviewees (65%) perceived the Method to be effective in preventing recurrence of injury, and a majority of survey respondents viewed the Method even more favorably (.87) in preventing recurrence of PRNDs. Interviewees voluntarily reported that the interdisciplinary, holistic components (especially neuroscience and neuropedagogy); the rational, biomechanically informed approach; and training in mindful awareness were helpful in understanding and preventing recurrence of PRNDs. Additionally, even when PRNDs reoccurred, many participants believed they had sufficient knowledge to recover from the PRNDs.

A major conclusion that can be drawn is that the Method empowers students with cognitive knowledge and analytical skills, as well as an actual biomechanical model, that help them understand risk factors and prevent recurrence of injury. Additionally, should a PRND reoccur, they are knowledgeable enough to understand its origins and recover from it. Such tools include anatomical and biomechanical knowledge, kinesthetic awareness and control of their bodies, fundamental knowledge of how the brain works and of neuroplasticity, and self-knowledge through ongoing, deliberate reflection and observation. The somatic education component in the Alexander Technique training helps them embody that knowledge, as well. The unmistakable prominence in all the NVivo word clouds of the word “think” is an indicator of the Method’s considerable

emphasis on empowerment through knowledge in many forms; and on a rational, science-based approach that promotes more accurate replication of core principles.

Research Question No. 3

What effect, if any, do pianists perceive this interdisciplinary Method to have on various aspects of musicality and technique?

Theme 8 – Perceived results of Method on technical control of musical elements and sound production
Theme 9 – Perceived results of Method on experience of music-making at the piano

Technique, musicality and sound intertwined. The major finding was that participants felt more musical as a result of studying the Method and perceived that music, technique, and sound production were eventually interwoven, even though they were taught separately in the beginning stages of training. Interviewees reported that the most exciting aspect of training in the Method was to discover that a more efficient technique led to better musicianship and to being more emotionally available and connected to the music. The majority felt that physical impediments no longer got in the way of music-making, and that they felt a sense of release and freedom while playing—and even unity with the piano, as well as an enhanced fulfillment of their artistic potential. Many felt they could play more advanced repertory and were in control of their playing. Three-quarters of survey respondents felt overall more musical. A large majority of interviewees perceived that their technique was much better (92%) and that the audience's response was equally improved (92%), while survey respondents felt very positive (.78) about their technique, and equally positive about audience response. One survey respondent did not perceive that the Method had helped his or her technique

improve (-.37). However, no negative responses to the biomechanical model or technique learned in the Method were reported in the interviews.

Another finding was the perceived correlation between the type of technique participants acquired and the improvement in sound production. Participants felt their sound was warmer, more beautiful and that they could control voicing and phrasing much better. They also felt more rhythmic flow, and much more facility, suppleness, and power.

The primary conclusion that can be drawn is that while technique is merely a tool for the pianist to communicate musical content, when it is working well, it becomes inseparable from the musical product. Music cannot be mastered by a pianist without the highly physical skill of technique, as teacher Boulanger was noted as saying (Gerig, 2007). Another conclusion is that the more physically free the pianist feels, the better able she or he is to listen, feel at ease at the instrument, and communicate with the audience.

A final conclusion to be drawn is that the Method's non-traditional insistence on separating foundational technique and sound production from actual music-making in the initial stages of training might be a more expeditious way of acquiring an efficient, injury-preventive technique. Further study is clearly needed. The only pitfall, however, is that, as participants repeatedly reported, the Method requires a great deal of mental discipline, patience, and perseverance to delay the gratification of experiencing music while they are retraining their coordination and physical habits at the piano. For that reason, one might also conclude that the Method will not work for everyone, given the role of the rewards system in the brain for sustaining motivation to stay the course. However, a conclusion could also be drawn that pianists with PRNDs are more motivated

to discipline themselves to forfeit music-making temporarily because of their intense desire to eventually return to playing free of pain.

Research Question No. 4

What do pianists consider, if any, the extra-musical effects of studying this interdisciplinary Method?

Theme 10 – Transformative, life-changing experience
Theme 11 – Enhanced professional and personal life
Theme 12 – Improved listening skills and lessened performance anxiety

The primary finding of Research Question No. 4 was that the large majority of participants felt that their lives were enhanced in multifactorial ways by studying the Method. Interviewees felt overwhelmingly that both their personal (92%) and their professional (85%) lives were greatly improved. Many viewed the Method as a catalyst for transformation. They were happier, more self-confident, more mindful, more focused, less stressed out, and enjoyed a much-enhanced sense of well-being (77% in the interviews and .70 mean for the survey). Another finding was a high correlation between reduced performance anxiety and both feeling more focused and listening better. One participant perceived that the Method fostered the ability to remain calm and to eliminate the fear response.

The primary conclusion to be drawn is that a holistic approach to retraining piano technique that deliberately incorporates cognition with embodiment, that promotes holistic health, that trains the Alexander Technique's "primary control," that establishes efficient breathing habits, that attempts to establish optimal skeletal alignment and efficient muscle use, that emphasizes kinesthetic awareness, that promotes a positive outlook, and that builds self-esteem is, by definition, going to engender a sense of well-

being, and help participants feel good about themselves and others. An alternative conclusion is that while retraining, pianists are allowed the space and time in a safe, non-critical, supportive environment to establish a more healthful life-style, to self-reflect and to rid themselves of negative patterns of behavior, thus promoting greater happiness and a healthier body. Another conclusion regarding the lessening of performance anxiety is that the combination of Alexander Technique tenets (habituating pianists to release unnecessary tension, to breathe efficiently, to align their spines well, to establish their primary control) with learning specifically how to control and coordinate with ease the playing apparatus of the arms, hands and fingers alters brain activity. These practices calm down the anxiety center and heighten activity in both the pre-frontal cortex where executive function occurs, and in the sensory areas for hearing and touch.

Research Question No. 5A

What do pianists perceive as challenges of studying this interdisciplinary Method?

Theme 13 – Progress feels slow in early stages of training
Theme 14 – Need for more structure in upper levels of training

A primary finding from Research Question No. 5A, was that the Method, for all its perceived effectiveness, is nonetheless extremely challenging to learn from a psychological, emotional, societal, and intellectual viewpoint. Participants in the study repeatedly commented on difficulties with changing old habits; the time required to retrain; professional conflicts; and the need for cultivating character traits such as patience, perseverance, focus and mental discipline. Some participants also noted how

difficult it was to temporarily suspend making music and playing repertory, although they understood the neuropedagogical rationale behind that requirement.

The primary conclusion to be drawn from these findings is that, again, studying the Method is not suitable for every pianist, at least as it now stands. This is congruent with another finding that, for many piano teachers, the Method is difficult to explain or to "sell" to parents and new students, even as they believe in its rationale. The Method's many challenging aspects make mental, psychological, emotional, and professional demands on adult students, even though studying it helps them recover from and prevent injury, and even transforms the lives of some. The conflicting reactions to the non-traditional aspects of the Method—including some pianists with PRNDs—point to the conclusion that the Method cannot necessarily be applied universally to all pianists. This includes beginning children and adult piano students, or young pianists. This is especially so of those who have not yet experienced playing-related difficulties, which seems to be the highest motivator for studying the Method. Although as part of the Certificate Program, the pedagogy of injury-preventive piano technique is taught, the challenges to teaching the core biomechanical principles in the carefully sequenced manner of the Method remain considerable. Until other positive findings in this study—such as enhanced musicality and technique—are more widely associated with the Method, most piano students will not seek it out. Additionally, until better means are established of conveying the Method's core biomechanical, pedagogical, and artistic principles to the general population of piano students, it will remain on the fringes of the piano pedagogy world. Finally, the developer of the Method would do well to scrutinize all aspects of the

Method, and modify some, so that the Method might better serve more pianists and their learning styles.

Another major and most helpful finding from Research Question No. 5A came from a few female interviewees and related to structural flaws in the Method itself. They thoughtfully articulated perceived weaknesses in the structure and organization of the Method past the intermediate stages of training, specifically in how repertory and exercises were graduated from one level of coordination to the next. Female interviewees also found difficulties with pacing of learning—either too slow or too fast—and feeling out of control of playing during the beginning stages of training. These findings, however, were equally correlated with perceptions that the Method required considerable discipline, faith, and perseverance because it was so difficult to change old, entrenched habits. Survey respondents, however, did not perceive these aspects as needing modification.

A finding that was not significant statistically, but that is critical to the survival of the Method was the question of whether the Method's perceived success was teacher- or personality-dependent. Many interviewees expressed respect and considerable support for the developer and primary instructor of the Method. However, several others expressed highly negative reactions to the developer and primary instructor; they perceived that they either did not learn enough because of personality problems, or that they learned a great deal from the Method but questioned the pedagogical approach of its developer.

Such reactions, albeit statistically insignificant, are nonetheless troublesome and perhaps point to the Method's dependence on its developer for success or failure. It also raises the question of whether the Method itself can be replicated in a curricular form not

dependent upon its developer. Coincidentally, some interviewees expressed the need for vigilance in selecting assistant instructors who completely understood and supported the Method's underlying holistic principles and who were on the highest levels of teaching and performing. Otherwise, some felt, the effectiveness of, and even respect for, the Method could be undermined. From this finding could be concluded that teacher training should be much more thorough and include quality control through ongoing observation of assistant instructors' teaching and performance, and even establishment of recertification processes as the Method itself evolves. Another conclusion is that the developer should direct considerably more effort toward the replication of the Method, regardless of who is teaching it.

Research Question No. 5B

What do pianists perceive as positive aspects of studying the Method?

Theme 15 – Individualized training, video-recorded lessons and somatics
Theme 16 – Happier learning in a supportive community
Theme 17 – Uniquely defining components of the Method

While the majority of participants reacted favorably to the interdisciplinary, holistic components of the Method—to the individualized training, to the somatic education (Alexander Technique), and to the importance of a supportive, compassionate, positive community of kindred spirits—one major finding emerged: All interviewees believed that Professional Tactile Guidance was essential to learning the technique taught by the Method, and an overwhelming majority of survey respondents (mean score of .91) ranked it "extremely beneficial." The use of this hands-on tool was viewed as vitally important for enabling the student to develop the kinesthetic awareness and control of the neuromusculoskeletal system needed for both recovery from and prevention of PRNDs.

The primary conclusion to be drawn from this finding is that the technique of hands-on tactile guidance (PTG) developed for the Method was perceived as essential to successful training. However, a cautionary note must be added: The use of any form of touch by anyone other than trained and certified healthcare professionals, including somatic education instructors, must be subjected to the most rigorous scrutiny. Furthermore, PTG should be used only by certified Method instructors, and in the presence of parents with younger students, or with adult piano students in a safe environment in which all lessons are video-recorded.

Recommendations for Best Practices

The findings of this study suggest the following implications for best practices in the Method, as well as in the piano pedagogy and performing arts medicine fields:

Recommendations for the Music and Healthcare Professions

1. Leaders in the performing arts medicine field should increase efforts to establish risk factors for injury, and to promote core principles of efficient biomechanics for injury-preventive piano technique. Moreover, increased attention should be directed in this field toward disseminating information in a clear language, understandable by the piano profession.
2. A strong component of injury-preventive technique should be included in all graduate piano pedagogy curricula. Recent studies have shown that this component is absent in most graduate degree programs in piano pedagogy across the United States. This component should address the teaching of injury- preventive piano technique to both children and adults.

3. National, state, and local organizations of independent piano teachers should educate their members to the prevalence and negative impact of PRNDs and to the importance of teaching injury-preventive piano technique in their studios.
4. Music administrators and teachers in higher education must learn to identify signs of playing-related neuromusculoskeletal disorders in pianists, and assist them in obtaining accurate diagnoses and appropriate treatments from healthcare professionals skilled in working with PRNDs.
5. Music administrators and faculty in higher education should work to create an informed, supportive environment for pianists that experience PRNDs. Such an initiative should include educating music faculty, staff, students, and parents to the negative impact of PRNDs on pianists' academic, emotional, psychological, financial, and, eventually, professional lives.
6. The Alexander Technique or another form of somatic education should be considered as a curricular requirement in both undergraduate and graduate music degree programs across the United States.

Recommendations for the Method Under Investigation

1. Structural weaknesses in the Method need to be addressed and corrected. Specifically, a clearer graduated sequence of exercises and repertory from one level of coordination to another should be created, especially in the intermediate to advanced levels.
2. More assiduous attention needs to be focused on ensuring that each

student's individual pacing is perceived by the student as appropriate, and that the student's motivation and engagement are more diligently monitored.

3. The Method needs to incorporate better ways of teaching injury-preventive technique to younger generations that have challenges associated with living in today's technological, distracted, fast-paced world.
4. Future teachers of the Method need to be more carefully and rigorously trained, ensuring that the Method's underlying biomechanical principles are transmitted accurately to students, and that instructors understand and can demonstrate the intrinsic connection between technique and musicality. Teachers of the Method must always remember that the ultimate goal of the technique is compelling music-making.
5. More emphasis needs to be placed on teaching Professional Tactile Guidance (PTG) to future instructors in the Method. Both the perceived value of PTG as a pedagogical tool, and the potential risks of its use in a highly litigious society must be underscored.
6. Various creative, age- and level-appropriate curricula need to be created to teach the Method effectively to beginners—both children and adults—and to pianists who have never experienced PRNDs.
7. The Method needs to be scrutinized for replicability, as well as for how it might be redesigned for insertion in a piano pedagogy curriculum in higher education. The question would be whether such a non-traditional,

interdisciplinary, holistic pedagogical paradigm could fit into a more traditional piano pedagogy program, or, conversely, whether adapting the Method to a more traditional setting would even be possible or desirable.

8. The Method's developer needs to review and revise all steps of the Method, as needed, for accurate biomechanical information, for more efficient teaching of each step, and to better adapt the Method to a wider audience of pianists.

Recommendations for Future Research

Based on the findings in this study, the researcher recommends consideration of the following research in areas relevant to injury-preventive piano technique:

. 1. Building upon research in sports pedagogy and several interdisciplinary studies in piano technique, research needs to be conducted that would attempt to establish a baseline of core principles of efficient biomechanics and optimal body use at the piano.

2. Research should be directed toward creating a curriculum for training injury-preventive piano technique in graduate piano pedagogy degree programs.

3. Until the gold standard of randomized control trials is designed to compare one injury-preventive technique to another, researchers in performing arts medicine should study the practices of piano teachers who are widely acknowledged in the music profession as successful in teaching principles of well-coordinated, injury-preventive technique. In this way,

commonalities in the biomechanical forms taught, and the strategies used to teach these forms, might be revealed.

. 4. More research is needed to ascertain whether different biomechanical and physiological approaches to technique have any effect, either perceived or quantifiable, on tone production and tone quality.

5. A study addressing the potential value of studying the Alexander Technique concurrently with piano in preventing PRNDs needs to be undertaken.

. 6. More studies should be conducted to determine whether hands-on tactile guidance is more effective in teaching principles of good coordination at the piano than no hands-on guidance.

. 7. A case study should be undertaken to determine whether the Method is effective as an intervention for pianists with focal dystonia and hypermobility.

. 8. More in-depth research into the perceived effects of studying this Method and other methods on performance anxiety, self-perception, and ability to sustain focus might be useful to pianists.

9. A comparison of this Method and other contemporary approaches with historical methods such as those by Leschetitzky, the early 20th century Russian school, and Matthay might be helpful in identifying commonalities regarding technique, musicality and methodology.

Researcher's Reflection

This study was driven by three personal needs: First, I wanted to reveal the poignant, even heartbreaking stories of my students who have suffered—largely in isolation—from playing-related injuries. Second, I wanted to investigate whether the Method and its technical model were grounded in sound scientific and pedagogical principles. Finally, I wanted to uncover any weaknesses or strengths in the Method so that I could better set my students on a path of life-long joy in music-making. My work with pianists, and organists, over the last quarter century has been deeply fulfilling. But it has also led to a close acquaintance with what I call the shadow side of the piano world. Playing-related injury stops hopes, dreams, studies and careers in their tracks. And as this research demonstrated, injuries also leave pianists devastated. They frequently lose all purpose in life. The very thing that gave them the most joy now gives them pain. They often say that they have lost their voice and cannot speak. I have a personal acquaintance with this hopelessness. But I was one of the lucky ones, thanks to a naturally gifted teacher who helped me acquire a healthful technique. That fortunate but serendipitous experience set me on a life-long path to understand how we can prevent playing-related injury in the first place. Some of these stories, like mine, have a happy ending. But many do not. No one knows how many pianists have been fortunate enough to resolve their injury themselves. But I do believe that the rate of unresolved playing-related injury is unacceptably high. Our profession can and should do much better. We owe it to our piano students and to our art to help them realize their full musical potential through a healthful, injury-preventive technique.

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Appendix A

Salem College
Certificate Program in Injury-Preventive Keyboard Technique

CURRICULAR OUTLINE & COURSE DESCRIPTIONS - 2014

MUSI 304. Injury-Preventive Keyboard Technique **One course**
This course is designed to give the keyboard major practical and theoretical knowledge of the fundamentals of a holistic, healthful technique. It addresses biomechanics, keyboard mechanics, wellness and instructions in the fundamentals of healthful sound production through the Lister-Sink Method. Students apply principles of injury-preventive technique to basic keyboard exercises, studies and graduated repertoire. Instruction includes a beginning week of intensive daily workshops, followed by a weekly group and private lessons, as well as guest lectures. It is recommended that this course be taken concurrently with MUSI 223 (Alexander Technique).

MUSI 223. Alexander Technique **One-quarter course**
(One semester required. Recommended to be taken at least twice.)
The Alexander Technique teaches instrumentalists and singers to identify and prevent unnecessary patterns of tension during practice and performance. Study of the technique improves coordination, promotes ease and freedom of movement, and helps the musician avoid strain and injury. Pass/no credit grading. May be repeated for credit.

MUSI 216. Pedagogy of Injury-Preventive, Well-Coordinated Keyboard Technique **One course**
This course examines the components of sound pedagogy while emphasizing the most effective means of teaching injury-preventive on the elementary and intermediate levels through the Lister-Sink Method. Instruction includes lectures on methodology, educational psychology, learning styles, lesson planning, studio set-up, and video analysis. Students complete 10 weeks of student teaching. Prerequisite: MUSI 116.

MUSI 226. Keyboardists' Injuries: Causes and Cures **One course**
The objectives of this course are to identify and study in depth the injuries that afflict keyboardists; to study history and present state of the field of music medicine; to study current mainstream medical and complementary approaches to healing; and to develop a common language to bridge the music and medical worlds. This course will equip more fully the future teacher not only to teach injury-preventive technique but also to be able to help guide the injured keyboardist to the appropriate health-care professionals, and then to be a partner in the rehabilitation and retraining process.

MUSI 023. Applied Piano instruction (intensive) **Two semesters, at three-quarter course each**
Individual piano instruction, plus a one-hour studio class. Applied lessons each semester emphasize the application of injury-preventive technique to compelling music-making. Weekly lessons and studio class demonstrate how technique and artistry are ultimately joined.

COURSE OFFERING SCHEDULE OPTIONS

OPTION 1 **(3 semesters, including optional additional training)**

FALL
MUSI 116 – Injury-Preventive Keyboard Technique
MUSI 223 – Alexander Technique
MUSI 023 – Applied Piano Instruction

SPRING
MUSI 216 – Pedagogy of Injury-Preventive Keyboard Technique
MUSI 023 – Applied Piano Instruction
MUSI 223 – Alexander Technique (recommended)

FALL
MUSI 226 – Keyboardists' Injuries: Causes and Cures
MUSI 023 – Applied Piano Instruction
MUSI 223 – Alexander Technique (recommended)

OPTION 2 **(2 semesters)**

FALL
MUSI 116 – Injury-Preventive Keyboard Technique
MUSI 226 – Keyboardists' Injuries: Causes and Cures
MUSI 223 – Alexander Technique
MUSI 023 – Applied Piano Instruction

SPRING
MUSI 216 – Pedagogy of Injury-Preventive Keyboard Technique
MUSI 023 – Applied Piano Instruction
MUSI 223 – Alexander Technique (recommended)

Instructional delivery methods:
On-site instruction will be used for all residential students. Students who do not live within commuting distance will take a hybrid form of the courses. They will be required to be on campus for at least 51% of the course delivery time. The remainder of instructional time will be in the Distance-Learning format, with participation in courses and applied lessons via webcam. Students may fulfill written assignments and exam requirements online. Performance and jury requirements may be completed via webcam or pre-recorded DVD performances.

Appendix B

Movement Analysis of Method's Basic Stroke

MOVEMENT ANALYSIS: WHOLE-ARM PRODUCTION OF ONE DEPRESSION OF A PIANO KEY WHILE SEATED

COMPONENT 1 - Starting Position I – Determining Height of Bench, Alignment of 5 Fingers on Separate, Adjacent Keys

Name of Joint	Starting Position	Observed Joint Action	Segment Being Moved	Force for Movement	Agonists	Type of Contract-ion
Spine and shoulder complex, including sternoclavicular, acromioclavicular, coracoclavicular and glenohumeral joints	The pianist sits on the front half of a supportive bench balanced evening on the sitting bones, facing the piano.The spine is aligned in the 4 natural curves and the pianist is tilting approximately 10 degrees forward The humerus is hanging with gravity, inferior to the shoulder and the forearm is flexed at a 90º angle from the elbow joints. Each finger tip of the right hand rests on a separate key.	Neutral position of the spine. Neutral position of the 4 joints of the shoulder complex, serving to support the right arm as the forearm is flexed while the finger tips rest on the piano keys.	The torso, head, legs, shoulder and arm complex are immobile at the beginning of the movement.	No movement as yet	Spinal support while sitting from rectus abdominis, internal and external obliquest, and deep spinal muscles. Rotator cuff muscles including the supraspinatus, teres major, and subscapularis to stabilize the glenohumeral joint as the forearm is supported. Also muscles of the scapula, including the levator scapula, serratus anterior, rhomboids, subclavius, trapezius and pectoralis minor stablize the scapula against the weight of the forearm.	Isometric

MOVEMENT ANALYSIS: WHOLE-ARM DEPRESSION OF A PIANO KEY
COMPONENT 1 – Alignment - Starting Position II

Name of Joint	Starting Position	Observed Joint Action	Segment Being Moved	Force for Movement	Agonists	Type of Contraction
Elbow joints, including humeroulnar, humeroradial and proximal radioulnar joints	Forearm (ulnar and radius bones) is flexed from the elbow at a 90º angle	**Humeroulnar joint**, a hinge joint, has allowed the forearm (ulnar and radiusbones) to be flexed at a 90º angle to the humerus. The **proximal radioulnar joint** pronates the forearm, allowing the radius to pivot around the ulna**.** The **humeroradial joint, a** gliding joint, prevents movement of the forearm in any but the sagittal plane.	There is no movement at this point. However, movement of the ulnar, radius, carpal, metacarpal and phalangeal bones have been placed in pre-movement position.	Translation (to place forearm, hand and fingers in starting alignment) via tension.	Brachialis, brachioradialis, pronator teres, pronator quadratus	In preparation for the actual movement, concentric contraction occurred to place the forearm, hand and fingers in starting alignment

MOVEMENT ANALYSIS: WHOLE-ARM DEPRESSION OF A PIANO KEY
COMPONENT 1 – Alignment - Starting Position III

Name of Joint	Starting Position	Observed Joint Action	Segment Being Moved	Force for Movement	Agonists	Type of Contraction
Wrist/carpal joints (gliding), carpometacar-pal, metacarpalpha-langeal, interphalangeal joints	Pianist is seated on the bench at a height which allows the forearm to be pronated and flexed at the elbow 90º, and the ulnar, radius, carpal bones and metacarpal bones of the right forearm and hand to form a straight line from the elbow to the MCP joints, parallel to the floor. All 5 finger tips are resting on separate, adjacent white keys of the piano.	No joint action in preparatory alignment	There is no movement at this point. However, movement of the ulnar, radius, carpal, metacarpal and phalangeal bones have been placed in pre-movement position.	Translation (to place forearm, hand and fingers in starting alignment) via tension.	Brachialis, brachioradialis, pronator teres, pronator quadratus. Since the CMC, MCP, PIP and DIP joints are not called upon to stabilize bones, nor is it necessary to abduct or adduct the fingers while simply placing and then resting the naturally aligned hand and fingers over 5 white keys, no muscular activity is needed from the extensors, flexors, lumbricals or interossei.	None in the forearm or hand muscles. The muscles of the elbow as listed above continue to allow the forearm to be flexed at a 90º angle and the forearm, hand and fingers to be pronated and the finger tips to be resting on the keys.

MOVEMENT ANALYSIS: WHOLE-ARM DEPRESSION OF A PIANO KEY COMPONENT 2 – Movement - Lifting Upward (Positive Linear Movement) of Right Forearm

Name of Joint	Starting Position	Observed Joint Action	Segment Being Moved	Force for Movement	Agonists	Type of Contraction
Humeroulnar joint	The pianist lifts the forearm in pronation to a height sufficient to allow the carpal, metacarpal and phalangeal bones to release into gravity. Humerus is hanging vertically in the beginning of the lift of the forearm but then, by "default" to keep the wrist joint rising vertically to the piano key, it flexes forward 15-20 º	Humeroulnar joint functions as a hinge as the forearm is raised (usually approximately 2-3 inches vertical distance from the tip of the 3rd digit to the piano key. All other joints of the wrist, hand and fingers are destabilized. Glenohumeral joint flexes humerus 15-20º as the wrist rises vertically over the piano key.	The ulnar, radius, carpal, metacarpal and phalangeal bones are lifted vertically. Humerus	Translation via tension. Translation via tension	Brachialis, assisted by the biceps brachii. Anterior deltoid, rotator cuff muscles	Concentric Concentric
Glenohumeral joint						

MOVEMENT ANALYSIS: WHOLE-ARM DEPRESSION OF A PIANO KEY
COMPONENT 3 – Movement - Releasing Right Forearm Vertically Into Gravity (Negative Linear Movement)

Name of Joint	Starting Position	Observed Joint Action	Segment Being Moved	Force for Movement	Agonists	Type of Contraction
Humeroulnar joint	This segment of the movement smoothly and immediately follows the vertical lift of the forearm, hand and fingers	Humeroulnar joint functions as a hinge as the forearm is released into gravity of falls freely in natural acceleration. All other joints of the wrist, hand and fingers remain destabilized while the arm, hand and fingers are above the keys and not touching the keys.	The ulnar, radius, carpal, metacarpal and phalangeal bones are released into gravity vertically (linear motion)	Translation in the negative direction, due to gravitational force.	No muscles are used due to the release of the brachialis (and biceps brachii) as the forearm, hand and fingers are allowed to free-fall vertically straight down into gravity.	None

MOVEMENT ANALYSIS: WHOLE-ARM DEPRESSION OF A PIANO KEY
COMPONENT 4 – Movement - Landing & Depression of Piano Key by 3rd Finger Followed by Instantaneous Release of All Force

Name of Joint	Finishing Position	Observed Joint Action	Segment Being Moved	Force for Movement	Agonists & Antagonists	Type of Contraction
Sternoclavicular, acromioclavicular, coracoclavicular, glenohumeral, humeroulnar, humeroradial and proximal radioulnar, radiocarpal, carpometacarpal, metacarpalpha-langeal, interphalangeal joints.	The pianist lands the 3rd fingertip at the bottom of the piano keyframe.	Sternoclavicular, acromioclavicular, coracoclavicular, glenohumeral, humeroulnar, humeroradial and proximal radioulnar, radiocarpal, carpometacarpal, metacarpalpha-langeal, interphalangeal joints stabilize for an instant as the pianist's fingertip contacts the bottom of the keyframe of the piano in order to transmit the force (mass of forearm plus natural acceleration) into the key, thus activating the piano action.	In a split second, the ulnar, radius, carpal, metacarpal and phalangeal bones move the distance from the top of the key surface to the bottom of the keyframe, thus deforming the piano key lever.	Compression directed axially into the piano key.	Agonist and antagonist muscles surrounding the shoulder joints, elbow joints (brachialis and triceps), wrist joints (extensors and flexors), and CMC, MCP, PIP and DIP joints **of the 3rd finger only** (lumbricales and interossei) co-contract for an instant to stabilize joints as force is directed into the keyframe.	Isometric

MOVEMENT ANALYSIS: WHOLE-ARM DEPRESSION OF A PIANO KEY
COMPONENT 5 – Movement - Instantaneous Re- Depression of Piano Key by 3rd Finger
Initial Release of All Force Into Key

Name of Joint	Finishing Position	Observed Joint Action	Segment Being Moved	Force for Movement	Agonists & Antagonists	Type of Contraction
Sternoclavicular, acromioclavicular, coracoclavicular, glenohumeral, humeroulnar, humeroradial and proximal radioulnar, radiocarpal, carpometacarpal, metacarpalpha-langeal, interphalangeal joints.	In order to prevent the piano key from rebounding to its original position after all force is released , the pianist must instantaneously re-direct sufficient force through the forearm, hand and 3rd finger into the key frame (approximately 40 to 60 grams). Otherwise, the key will rebound due to the escapement/spring mechanism in the piano action.	Continued stabilization of sternoclavicular, acromioclavicular, coracoclavicular, glenohumeral, humeroulnar, humeroradial and proximal radioulnar to maintain the alignment of the forearm. Minimal stabilization of radiocarpal, carpometacarpal, metacarpalpha-langeal, and interphalangeal joints of 3rd finger	In a split second, the ulnar, radius, carpal, metacarpal and phalangeal bones move a fraction of a centimeter from the bottom of the key frame to to a fraction of a centimeter, and then back to the bottom of the keyframe.	Rebound from the split-second impact of the finger tip on the keyframe to a slight compression directed axially into the piano key to keep the key lever depressed.	Continuing spinal support while sitting from rectus abdominis, internal and external obliquest, and deep spinal muscles. Rotator cuff muscles including the supraspinatus, teres major, and subscapularis to stabilize the glenohumeral joint as the forearm is hgeld in place by the brachialis muscles. Minimal extensor, flexor, lumbrical or interosseus of 3rd finger.	Slight isometric contraction to support 40 grams of mass, and tension in brachialis to maintain "concert" alignment of forearm at 90º angle to humerus.

Appendix C

Music Teachers National Association 2008 Conference, Denver, CO
Panel Handout

ENLIGHTENED KEYBOARD TECHNIQUE
A DEFINITIVE MODEL FOR THE 21ST CENTURY

PANELISTS

Barbara Lister-Sink - Producer, *Freeing the Caged Bird – Developing Well-Coordinated, Injury-Preventive Piano Technique* DVD; Artist-in-Residence, Salem College
Heidi Brende – DMA (piano) Certified Alexander Technique Instructor, Denver, CO
John Chong - MD, Director, Musicians Clinics of Canada, Toronto, Ontario
Reginald Gerig - Author, *Great Pianists & Their Technique*
Kathleen Riley - Ph.D., Adjunct Professor in Music & Research, New York University
Teresa Schuemann - PT, DPT, SCS, ATC, CSCS Board Certified Sports Physical Therapy Specialist, Fort Collins, CO

I. DEFINITION OF HEALTHFUL, INJURY-PREVENTIVE KEYBOARD TECHNIQUE

Healthful, "enlightened" keyboard technique is defined as the optimal coordination of the whole body, directed by the brain, with the instrument.

Two hallmarks of such a technique are

Optimal skeletal alignment
Efficient muscle use

II. ESTABLISHING A COMMON LANGUAGE & TERMINOLOGY BETWEEN SCIENCE & MUSIC

A. Remember and refer to the hallmarks of well-coordinated technique

Optimal skeletal alignment
Efficient muscle use

B. <u>Language to Emphasize</u>	**<u>Potentially Confusing Language</u>**
tension (as necessary muscle) contraction	tension-free
healthful technique	healthy technique
released (muscles)	relaxed (muscles)
alignment	posture (connoting rigidity)
efficient playing	effortless playing
smooth coordination	graceful (connoting excessive motion)
supple	loose, limp
stabilize	fix, hold
well-coordinated playing	relaxed playing

C. The Importance of Clear, Plain English

to build a common language, understandable by all, it is important to emphasize plain English wording and clear, specific and concise terminology. Avoid highly technical terminology or confusing, contradictory language in general.

III. EFFICIENT, WELL-COORDINATED BODY USE THAT HELPS PREVENT PLAYING-RELATED INJURY & MAXIMIZES ARTISTIC POTENTIAL

A. Optimal alignment and balance on sitting bones of the "central axis" (spine/spinal cord and brain) as center of command and control of the periphery

1) Begin with reference point— "neutral" balance and alignment of spine/neck/head over sitting bones, with released legs
2) Allow spine to lengthen naturally (not stretch or straighten)
3) Allow shoulders to remain released
4) Allow neck to be free of unnecessary tension
5) Allow head to be well-balanced on top of torso
6) When leaning forward on bench, rock forward on sitting bones with entire torso, instead of leaning forward from upper back and shoulders only

B. Optimal alignment of arms/hands/fingers for sound production
NOTE: The whole arm is usually in subtle but constant motion while playing. The optimal alignment defined herein is usually for the first note of multiple notes in any whole-arm cycle.

1) Support arms efficiently—allowing upper arms to be pendulous and shoulder joint released when not stabilized for sound production
2) Release medial deltoid whenever possible for maximum mobility and ease of movement from the shoulder socket
3) Align bones of forearm (carpal) and hand (metacarpal) to form a natural arch for bearing weight at moment of tone production, usually forming a straight line on the top of forearm from crook of elbow to knuckle bridge (MCP joints).

IMPORTANT NOTE: There are historically slight variations on this alignment from one well-coordinated technique to another. Some approaches advocate a slight downward or upward slope of the top of the forearm from the elbow to the knuckles, rather than a line parallel with the ground. Such a variations are still within the realm of healthful alignment and range of motion.

4) In conjunction with the forearm bone alignment in 3, use the natural arch formed by the hand and finger bones for bearing weight at moment of sound.

C. Efficient muscle use

1) Continually allow muscles to release, refresh and recover while playing
2) Support whole arm efficiently with torso muscles by maintaining optimal spinal alignment
3) Support forearm efficiently, when pronated, with brachialis/biceps
4) Allow upper arms to be pendulous and shoulder joint released when not stabilized for sound production
5) Release medial deltoid whenever possible for power, maximum mobility, and ease of movement from the shoulder socket
6) Stabilize joints (shoulder, elbow, wrist, and fingers) only for weight bearing
7) Maintain relatively released joints for ease of movement (up and down, lateral and curvilinear) whenever possible
8) In general, use only the necessary amount of tension for the time needed
9) Use kinesthetic awareness to monitor and control muscle state at all time

IV. INEFFICIENT BODY USE PATTERNS THAT MAY LEAD TO TENSION, FATIGUE, PAIN OR INJURY AT THE INSTRUMENT

A. Torso/Upper Body

1) general imbalanced spinal alignment resulting in loss of torso support and compromise of neuromuscular system
2) failure to find optimal balance and mobility of torso on sitting bones
3) compressing torso, resulting in inadequate breathing, spinal misalignment, and inefficient support of the arms which limits free movement
4) unnecessary raising of shoulders and tightening of trapezius muscle
5) pulling neck forward and down and pulling head back in relation to neck
6) tightening jaw, tongue and facial muscles
7) unnecessary tightening of neck muscles
8) tightening legs, including pulling up or pushing down of feet
9) unnecessary tightening of buttock muscles

B. Arms/Hands/Fingers

1) continuously holding upper arms away from torso, or pressing arms in towards ribs, instead of allowing upper arms to be pendulous and release into gravity from the shoulder sockets
2) unnecessary and continuous contraction of triceps in opposition to biceps (co-contraction), thereby overstabilizing elbow joint and preventing ease of movement
3) excess or sustained tension and co-contraction of extrinsic hand muscles (extensors and flexors) in lower arm
4) hyperextension of hand/wrist, pressing on median nerve
5) overstabilizing wrist joints, inhibiting mobility
6) curling in (flexing) fingers while lifting (extending) them and attempting to move (= co-contracting)
7) failure to release instantaneously forearm muscles at moment of sound production and continuing unnecessary pressure on key
8) continuous fixation of any joint, resulting in muscle fatigue and loss of joint mobility, flexibility, suppleness and ease of movement
9) static contraction (continuous, nonfunctional, invisible muscular tension)

C. Legs (especially for organists)

1) misalignment of spine, failure to balance on sitting bones, resulting in overstabilizing the legs in the hip sockets
2) holding or squeezing together (overstabilizing) of knees, instead of allowing legs to follow the natural alignment from hip joints
3) unnecessary tightening of ankles and lower legs instead of allowing them to hang with gravity and move as freely as possible
4) pressing on or moving from the back of the heel bone, rather than from the ankle joint at the front of the heel bone

D. Poor ergonomics in general

1) non-adjustable bench height
2) inappropriate bench height
3) lack of cushioned support of sitting bones (leading to slumping back and creating pressure on tail bone, or hyperextending lumbar spine and balancing on upper legs)

4) overly elevated music rack (creating tension in cervical spine)
5) bifocals or poorly adjusted glasses (causing tightening of neck and pulling back of head)
6) inadequate lighting (creating neck and facial tension)
7) piano or organ action unnecessarily heavy
8) practice room too cramped for proper distance from instrument
9) overly resonant acoustics (leading to hearing loss)
10) overly muffled acoustics (leading to forcing tone)

V. The Connection Between Well-coordinated Technique & Artistry

A. Healthful technique does not create musicality. Rather, it allows the player to listen better, and to be free of distracting physical impediments that block access to musicality.

1) Technical/Musical Benefits

a. enhances suppleness, speed and facility
b. broadens dynamic range and tonal palette
c. increases tonal power
d. facilitates smoother phrase shaping
e. enhances ability to play diverse and subtle articulations
f. facilitates ease and beauty of voicing
g. promotes natural sense of timing and rhythm

2) Physical/Mental/Psychological Benefits

a. helps prevent discomfort, fatigue, strain and injury
b. promotes a sense of physical well-being while playing
c. helps reduce performance anxiety
d. promotes greater focus and concentration
e. enhances the ability to listen continually and more acutely

Appendix D

Institutional Review Board Official Documents

Teachers College, Columbia University
525 West 120 Street
New York NY 10027
212 678 3000
www.tc.edu

INFORMED CONSENT

Principal Investigator: Barbara Lister-Sink

Research Title: A Purposeful Case Study in Students' Perceptions of an Interdisciplinary Method for Teaching Injury-Preventive Piano Technique

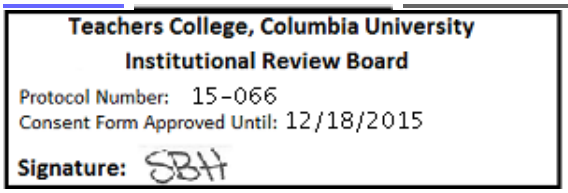
DESCRIPTION OF THE RESEARCH: The purpose of this study is to ascertain subjects' perceptions of the short and long-term effects and results, if any, of studying the Lister-Sink Method during the past 25 years. Since the Method claims to be injury-preventive, subjects will also be asked, if applicable, questions about the Method itself, their current health, and about their history of playing-related neuromusculoskeletal disorders (PRND). Particular emphasis will be placed on subjects' perceptions of any effects of studying this Method on their PRND—either during or after training. The study is a mixed methods design including both quantitative and qualitative research and will consist of two phases.

In Phase I, subjects will be sent an online survey consisting of general questions regarding their perceptions of their health; their history of PRND; their recurrence of injury (if applicable); their motivation to study the Lister-Sink Method; the Method's effects on their technique, musicianship, and extra-musical activities; and challenges in training in the Lister-Sink Method.

Phase II will consist of interviews of a cross-section of subjects who have indicated from the survey a willingness to be interviewed. From those volunteers, a selection of subjects will be made to achieve a balance between subjects who experienced playing-related neuromusculoskeletal disorders prior to training, and those who never experienced PRND prior to training. Interview questions will explore in greater depth the perceptions revealed in Phase I.

The Researcher for this study will be Barbara Lister-Sink, a student in the Doctoral program in Music and Music Education at Teachers College, Columbia University, New York. Since the Researcher is also the creator of the Method under investigation, it is critical that subjects not feel coerced to respond in a particular way and that the data collected from subjects be as accurate and honest as possible. Therefore, both Phase I and Phase II of the research will be managed by a Research Assistant who will conduct all

recruitment, consenting procedures, interviewing and transcribing processes. These will include handling all correspondence, receiving consent forms, administering the survey, as well as scheduling, conducting and transcribing audio recordings of interviews, and secure storing of all audiotapes. Furthermore, the survey in Phase I is designed so that the Researcher Barbara Lister-Sink will have no knowledge of a participant's specific identity. These protocols reflect an assiduous effort to minimize identifying markers and the possibility of Barbara Lister-Sink discovering any link between content and author.



For subjects who do not live within commuting distance, interviews will be conducted via Skype but will be only audio-recorded. Interviews, including those conducted via Skype, will be held in the Church Parlor of St. Paul's Episcopal Church in Winston-Salem, North Carolina. After the interviews, audio recordings will be transcribed by the Research Assistant, and then crosschecked to ensure accuracy. Data will then be encoded and analyzed for results. To ensure confidentiality of subjects' responses, all audio-recordings will be stored by a Research Assistant in a locked filing cabinet, and the online survey will be stored in a secured, password protected location, after being administered by a Research Assistant. All survey responses and interview recordings will be accessible only to the Research Assistant. Moreover, at no time will the Researcher Barbara Lister-Sink hear any audio-recordings.

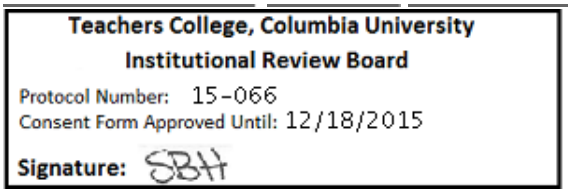
RISKS AND BENEFITS: The risk of harm or discomfort anticipated in this study is as follows: Both the survey and the interview may require both time and considerable effort, thus resulting in mental and physical fatigue. You may also feel pressure to participate in the study because of your relationship with Researcher. Additionally, you may have concern that a breach in confidentiality might have an adverse impact on you personally or professionally, as well as on your relationship with the Researcher. However, as stated above, to diminish this particular risk, a Research Assistant will conduct all correspondence regarding recruitment, consent forms, follow-ups, as well as survey, interview, transcribing processes and secure storage of audiotapes, transcripts and surveys. At the conclusion of the study, all data will be destroyed by the Research Assistant. Furthermore, during the survey should you become distressed in recalling reactions to playing-related injury or other related stressors, you may terminate the survey at any time. Likewise, during the interviews should you experience distress or discomfort while reflecting on playing-related injury or other related stressors, you may end the interview at any time. You will also not be required to answer all questions, but only those that you desire to answer. It is also hoped that the presence of a capable interviewer (Research Assistant) in a pleasant, neutral environment will help you feel more relaxed and comfortable.

For the research, subjects will not be in contact with the Researcher. Your participation is strictly voluntary and you may discontinue participation at any time during the survey or, if applicable, the interview, with no penalty or fear of recourse or negative repercussions.

Regarding benefits, there are no direct benefits for participation in this study. Indirect benefits might include knowledge that your participation in this study could eventually benefit other researchers and pianists in search of pedagogical methods in injury-preventive piano technique.

PAYMENTS: There will be no payment for your participation. However, all participants will receive a summary of the research findings.

DATA STORAGE TO PROTECT CONFIDENTIALITY: To ensure subjects' confidentiality in Phase I of data collection, no identifying information will be collected. Survey data from Phase I will be stored in an online encrypted database, accessed exclusively by the Research Assistant. In the Phase II interview stage, all audiotapes of interviews will be stored in a locked filing cabinet accessible only to the Research Assistant. Printed copies of interview transcripts from Phase II will be stored in a locked filing cabinet accessible only to the Researcher and the Research Assistant. Electronic copies of the interview transcripts will be held in an encrypted database, as



well. Interview participants will be identified only by pseudonyms. At the conclusion of the study, all data will be destroyed by the Research Assistant.

TIME INVOLVEMENT: Completing the survey will require approximately 25 to 40 minutes, depending on the detail of your responses in the narrative sections. The face-to-face interview time will take approximately 1 to 1 1⁄2 hours, depending upon how much information you wish to convey and on whether additional questions will be asked of you if you experienced a playing- related disorder prior to studying the Method.

HOW WILL RESULTS BE USED: Results of this research will be published in a dissertation in partial fulfillment of degree requirements for the Doctor of Education, College Teaching of an Academic Subject (Ed.D.C.T.A.S.) at Teachers College, Columbia University, New York. It is hoped that findings from this study will be used to design methods and curricular for preventing playing-related neuromusculoskeletal disorders in pianists. Additionally, findings may be publicized in music trade journals and/or presented at music educational or performing arts medicine conferenc

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PARTICIPANT'S RIGHTS

Principal Investigator: Barbara Lister-Sink

Research Title: A Purposeful Case Study of Students' Perceptions of an Interdisciplinary Method for Teaching Injury-Preventive Piano Technique

I have read and discussed the Research Description with the researcher. I have had the opportunity to ask questions about the purposes and procedures regarding this study.

- My participation in research is voluntary. I may refuse to participate or withdraw from participation at any time without jeopardy to future medical care, employment, student status or other entitlements.
- The researcher may withdraw me from the research at his/her professional discretion.
- If, during the course of the study, significant new information that has been developed becomes available which may relate to my willingness to continue to participate, the investigator will provide this information to me.
- Any information derived from the research project that personally identifies me will not be voluntarily released or disclosed without my separate consent, except as specifically required by law.
- If at any time I have any questions regarding the research or my participation, I can contact the investigator, who will answer my questions. The investigator's phone number is 336-749-5715.
- If at any time I have comments, or concerns regarding the conduct of the research or questions about my rights as a research subject, I should contact the Teachers College, Columbia University Institutional Review Board /IRB. The phone number for the IRB is (212) 678-4105. Or, I can write to the IRB at Teachers College, Columbia University, 525 W. 120th Street, New York, NY, 10027, Box 151.

· I should receive a copy of the Research Description and this Participant's Rights document.
· Audiotaping is part of this research. I ( ) consent to be audiotaped. I ( ) do NOT consent to being audiotaped.
· Written and audio taped materials ( ) may be viewed in an educational setting outside the research. ( ) may NOT be viewed in an educational setting outside the research.
· My signature means that I agree to participate in this study. Participant's signature: _____ Date: ____/____/____
Name: _____

_____ ___ ___

Teachers College, Columbia University
Institutional Review Board
Protocol Number: 15-066
Consent Form Approved Until: 12/18/2015
Signature: SBH

INVESTIGATOR'S VERIFICATION OF EXPLANATION

I, _____, certify that I have carefully explained the purpose and nature of this research to _____ (participant's name) in age-appropriate language. He/She has had the opportunity to discuss it with me in detail. I have answered all his/her questions and he/she provided the affirmative agreement (i.e. assent) to participate in this research.

Investigator's Signature: _____

Date: _____

_____

Teachers College, Columbia University
Institutional Review Board
Protocol Number: 15-066
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Signature: SBH

Appendix E

Interview Questions Script

Hi. My name is_____ and I am a research assistant for [the developer of the Method]. I want to thank you very much for taking the time to be here today. As you know, [the developer's] dissertation research is on students' perceptions of the Method. She is studying your perceptions to determine the Method's negative or positive effects on students. In this way she can know what is working and what is not, and make necessary changes. [The developer] will never hear these audiotapes, and each person interviewed will be assigned a pseudonym to protect confidentiality.

Today I want you to feel as comfortable as possible, and to feel you can speak openly about your experiences with this Method. Please let me know at any time if you would rather not answer a specific question, or if you would like to stop the interview. Also, please always feel free to expand on a particular question if you like, or even to take a different direction. Also feel free to add any thoughts or reflections you might wish to be recorded. These questions are just guidelines for this open-ended interview.

Questions for All Subjects

1. Please state your age (unless you'd prefer not to) and gender, as well as the time frame and your age when you studied the Method.

2. How long have you played the piano? If you are an organist, how long have you played the organ?

3. How would you describe the type of music you play primarily—classical, jazz, popular, sacred music?

4. Please tell me about your musical training background—where you studied, your degree(s) or anything else you'd like to add.

5. If you consider yourself to be a professional musician, please tell me a little bit about your professional activities.

6. Before you began the Method, how would you describe your ability to play the piano and your general experience as a pianist?

7. Why did you decide to study the Method?

8. Prior to training in the Method, did you experience a playing-related neuromusculoskeletal disorder (PRND) of any sort? How did you know it was playing-related?

NOTE TO INTERVIEWER: If the subject answered NO to Question 8, please skip Questions 9 through 16.

Questions Only for Subjects with History of PRNDs

9. Please describe the nature of the injury or disorder and how long you experienced it.

10. If you were injured from playing, did you receive a diagnosis and treatment for the injury prior to studying the Method?

11. What treatments did you receive prior to studying the Method, if any, and were they helpful?

12. Did you continue playing with the injury or disorder? And how did that go?

13. If you did experience a PRND, how did your teachers, colleagues, family, friends, etc. respond along the way?

14. What were the most helpful aspects of the Method in recovering from your injury problems? Please describe them to me in your own words.

15. What were the least helpful aspects of the Method in recovering from injury? Why do you think they were not helpful and in what way?

16. Please tell me whether you feel you have sufficient or insufficient technical training and knowledge as a result of studying this Method to prevent further injury, or to handle any future disorder or injury.

Questions for All Subjects

17. Have you experienced any non-playing disorder or condition that interfered with your ability to play your best? If so, please describe—when, how long, and what the nature of the problem was.

18a. If you studied the Method as part of the Wingsound Intensive Technique Training Program, please feel free to comment on the impact of that week—negative or positive—on your later training.

18b. If you studied the Method as part of the Certificate Program in Injury-Preventive Keyboard Technique at Salem College, please feel free to comment on the impact—negative or positive—on your training of principles of the Alexander Technique and somatic education, neuroscience or neuropedagogy, movement science and sports

pedagogy, performing arts medicine, technology-assisted pedagogy and transformative learning—or any other aspects that were particularly important to you.

19. Please describe what effect, if any, studying this Method has had on your musicality—in terms of phrasing, rhythmic flow, structural cohesion, emotional content, communication with audience, performance anxiety, fulfillment of artistic potential, etc.?

Did studying the Method have any effect on how you perceived the music or the actual experience of playing the piano?

20. Please describe what effect, if any, studying the Method has had on your technique in terms of tone control and quality, dynamic control, ability to voice, facility, muscular suppleness, speed, power, etc. Did studying the Method change how you feel physically at the piano?

21. Has your musical or technical training from the Method resulted in any positive or negative changes in your studies or career?

22. How do you feel about your communication with the audience after training?

23. Would you please describe positive or negative comments, if any, from others about your musicality and technique after the training.

24. What level of repertory—technically and musically—relative to your previous, pre-Method level, are you now playing? Please describe any changes in your repertory choices, if any, because of your training in the Method, and whether you feel you can or cannot play certain passages, repertory, etc.

25. Has studying the Method had any effect, positive or negative, on your overall health and well-being? Or other aspects of your life?

26. Please describe what effect if any, negative or positive, the Alexander Technique has had on your technical and musical training while you were studying the Method.

27. Have you noticed any changes, positive or negative, in your ability to concentrate, move, hear, interact with others, accomplish goals, or maintain balance and self-confidence?

28. Has studying the Method had any effect, negative or positive, on your professional or personal life? Please feel free to add anything else that you feel might help us understand the effects of the Method on pianists so that we might improve it.

29. Please describe any negative or positive challenges to training in this particular pedagogical paradigm. Please be as specific as you like about the pacing, sequencing of steps, length of time in each stage, and any other strategies you found challenging.

30. What were the responses, if any, from teachers, colleagues, family, friends, etc., to your training in this particular Method?

31. Do you teach the Method, or incorporate any of the various interdisciplinary aspects or components of it in your teaching? If so, why and to what effect? If not, please explain why you have not.

32. Do you still review the two "Cue Sheets," and, if so, are they helpful or not?

How effective was hands-on, professional tactile guidance to learning the Lister-Sink Method technical model?

33. What, if anything, would you change about the Method to improve it?

34. How much of what you learned while training in the Method have you been able to retain, if so desired? What have the challenges been to retention of the technique? Are you aware when you are reverting to previous habits? Have the new habits become automatic or must you remain fully conscious of your habits?

35. Please feel free to share anything else related to your study of the Method.

Thank you so much for your participation in this research study. I've really enjoyed speaking with you.

Appendix F

Research Questions Matched with Interview & Survey Questions

1. How do pianists with a history of playing–related neuromusculoskeletal disorders (PRNDs) perceive the effectiveness of this interdisciplinary Method in recovering from those disorders?

2. How do pianists with a history of playing-related neuromusculoskeletal disorders (PRNDs) perceive the effectiveness of this interdisciplinary Method in preventing recurrence of those disorders?

3. What effect, if any, do pianists perceive this Method to have on various aspects of musicianship (such as phrasing, rhythm, structural cohesion, emotional content, communication with audience, performance anxiety, fulfillment of artistic potential, etc.) and technique (such as tone control, tone quality, dynamic control, voicing, facility, muscular suppleness, speed, power, etc.)?

4. What do pianists consider, if any, the extra-musical effects of this Method (such as mental focus, sense of well-being, increased kinesthetic and auditory awareness, enhanced flexibility and suppleness of movement, etc.)?

5. What do pianists perceive as challenges and positive aspects of studying the Method?

Research Questions Matched with Interview Questions

Research Question	Interview Questions	Survey Questions
RQ1: How do pianists with a history of playing–related neuromusculoskeletal disorder (PRND) perceive the effectiveness of this interdisciplinary Method in recovering from the disorder? Subscales to be used: 1. Effects of PRND on life subscale 2. Effectiveness of other help in dealing with PRNDs subscale 3. Perceived	Prior to training in the Method, did you experience a playing-related neuromusculoskeletal disorder (PRND)? How did you know it was playing-related? Please describe the nature of the injury or disorder and how long you experienced it. If you were injured from playing, did you receive a diagnosis and treatment for the injury prior to studying the Method? What treatments did you receive prior to studying the Method, if any, and were they helpful? Did you continue playing with the injury or disorder? And how did	**Have you ever experienced a playing-related neuromusculoskeletal disorder (PRND)?** **How did you feel about the level at which you were able to play while you were injured?** **Please select as many as apply to describe your PRND.** (Muscle fatigue or strain, Extensor tendonitis, Medial epicondylitis, Radial epicondylitis, Thoracic outlet syndrome, de Quervain's syndrome, Carpal tunnel syndrome, cubital tunnel syndrome, Spinal disorder, General repetitive syndrome disorder (RSI), Joint hyperlaxity, Other:) **What effect has PRND had on your life?** (Studies, Professional life, Personal life, Sense of well-being, Mental focus, Kinesthetic awareness, Auditory awareness, Flexibility, Suppleness of movement during every day activities, Overall health and well-being, Other: please explain, Other: please

Research Questions Matched with Interview Questions

Research Question	Interview Questions	Survey Questions
effectiveness of Method on PRNDs subscale 4. Overall perception of the Method subscale	that go? If you did experience a PRND, how did your teachers, colleagues, family, friends, etc. respond along the way? What were the most helpful aspects of the Method in recovering from your injury problems? What were the responses, if any, from teachers, colleagues, family, friends, etc., to your training in this particular Method?	explain, Other: please explain) **How was your playing while you were injured?** **How effective was the treatment?** **To what extent did the following people help you deal with your PRND?** (Teachers, Family, Partner, Colleagues, Friends, Health care professionals: Please note area(s) of speciality, Mental health professionals: Please note area(s) of speciality) **To what extent did studying the Lister-Sink Method help you recover from your PRND?** **What effect, if any, did studying the Lister-Sink Method have on your PRND?** **How did the following aspects of studying the Lister-Sink Method affect your PRND?** (Alexander Technique, Incorporating knowledge from other disciplines, Training environment, Instructors' attitudes, Individualized attention, Individualized pacing, Fellow students' support, Time away from life stressors, cost of training, Other: please explain, Other: please explain, Other: please explain) **How committed are you to the Lister-Sink Method?** **What are your overall feelings about the Lister-Sink Method?** **Compared to how you used to feel while playing, how do you feel while playing since studying the Lister-Sink Method?** (Physically, Emotionally)
RQ2: How do pianists with a history of playing-related neuromusculoskeletal disorder (PRND) perceive the	Please tell me whether you feel you have sufficient or insufficient technical training and knowledge as a result of studying this Method to prevent further injury, or to handle any future disorder or injury.	**Have you ever experienced a playing-related neuromusculoskeletal disorder (PRND)? Please check all that apply.** (Yes, prior to studying the Lister-Sink Method, Yes, while studying the Lister-Sink Method, Yes, since completing my study of the Lister-Sink Method, No)

Research Questions Matched with Interview Questions

Research Question	Interview Questions	Survey Questions
effectiveness of this interdisciplinary Method in preventing recurrence of the disorder? Subscale to be used: Method Aspect Helpful for PRND subscale	If you studied the Method as part of the Certificate Program in Injury-Preventive Keyboard Technique at Salem College, please feel free to comment on the impact—negative or positive—on your training of principles of the Alexander Technique and somatic education, neuroscience or neuropedagogy, movement science and sports pedagogy, performing arts medicine, technology-assisted pedagogy and transformative learning—or any other aspects that were particularly important to you. Please describe what effect if any, negative or positive, the Alexander Technique has had on your technical and musical training while you were studying the Method. How much of what you learned while training in the Method have you been able to retain, if so desired? What have the challenges been to retention of the technique? Are you aware when you are reverting to previous habits? Have the new habits become automatic or must you remain fully conscious of your habits?	**How did the following aspects of studying the Lister-Sink Method affect your PRND?** (Alexander Technique, Incorporating knowledge from other disciplines, Training environment, Instructors' attitudes, Individualized attention, Individualized pacing, Fellow students' support, Time away from life stressors, cost of training, Other: please explain, Other: please explain, Other: please explain) **To what extent has the Lister-Sink method provided you with the technical training and knowledge to help you prevent PRND?** **To what extent did you gain your knowledge of preventing PRND through your study of the Lister-Sink Method?**
RQ3: What effect, if any, do pianists perceive this interdisciplinary Method to have on various aspects of musicianship and technique? Subscales to be used: 1. Overall music subscale 2. Musicality	Please describe what effect, if any, studying this Method has had on your musicality—in terms of phrasing, rhythmic flow, structural cohesion, emotional content, communication with audience, performance anxiety, fulfillment of artistic potential, etc.? Did studying the Method have any effect on how you perceived the music or the actual experience of playing the piano?	**How have your teachers, colleagues, friends, physicians, or family responded to you and your playing since you studied the Lister-Sink Method?** (Teachers, Colleagues, Friends, Physicians, Family, Audience, Other: please explain) **How has studying the Lister-Sink Method affected your musicality?** (Phrasing, Rhythmic flow, Structural cohesion, Emotional content, Communication with audience, Performance anxiety, fulfillment of artistic potential, Other: please explain, Other: please explain, Other: please explain)

Research Questions Matched with Interview Questions

Research Question	Interview Questions	Survey Questions
subscale 3. Technique subscale 4. Listening subscale 5. Others' comments on playing subscale	Please describe what effect, if any, studying the Method has had on your technique—in terms of tone control and quality, dynamic control, ability to voice, facility, muscular suppleness, speed, power, etc. Did studying the Method change how you feel physically at the piano?	**How has studying the Lister-Sink Method affected your ability to listen and hear yourself while playing?** **To what extent has your training in the Lister-Sink Method affected your ability to play difficult passages or repertory?**
	How do you feel about your communication with the audience after training?	**At what skill level are you playing now relative to how you played before studying the Lister-Sink Method?**
	Would you please describe positive or negative comments, if any, from others about your musicality and technique after the training.	**How has studying the Method affected your perception of music-making while playing?** (Overall perception, Ability to listen and hear myself at the piano or organ)
	What level of repertory—technically and musically—relative to your previous, pre-Method level, are you now playing? Please describe any changes in your repertory choices, if any, because of your training in the Method, and whether you feel you can or cannot play certain passages, repertory, etc.	**What effect, if any, did studying the Method have on your technique?** (Tone control, Tone quality, Dynamic control, Ability to voice, Facility, Muscular suppleness, Speed, Power, Other: Please explain)
RQ4: What do pianists consider, if any, the extra-musical effects of studying this interdisciplinary Method? Subscale to be used: Extra-musical life subscale	Has your musical or technical training from the Method resulted in any positive or negative changes in your studies or career?	**How has the Lister-Sink Method changed you in other ways <u>outside of playing the piano or organ</u>?** (Ability to concentrate, General movement, Hearing, Interactions with other people, Accomplishing goals, Self confidence, Personal life, Professional life, General sense of well-being, Other: Please explain)
	Has studying the Method had any effect, positive or negative, on your overall health and well-being? Or other aspects of your life?	**To what extent has the Lister-Sink Method resulted in life changes?**
	Have you noticed any changes, positive or negative, in your ability to concentrate, move, hear, interact with others, accomplish goals, or maintain balance and self-confidence?	**What kind of life changes resulted from your study of the Lister-Sink Method? Please check all that apply.** (Positive. Please explain if you wish:, Negative. Please explain if you wish:, Neutral. Please explain if you wish)
	Has studying the Method had any effect, negative or positive, on your	**What effect, if any, has studying the Method had on your <u>professional</u> life?**

Research Questions Matched with Interview Questions

Research Question	Interview Questions	Survey Questions
	professional or personal life?	**What effect, if any, has studying the Method had on your <u>personal</u> life?**
RQ5: What do pianists perceive as challenges and positive aspects of studying this interdisciplinary Method? Part A: What do pianists perceive as the challenges and difficulties of studying the Method? Part B: What do pianists perceive as the positive aspects of studying the Method? Subscale to be used: Learning the Method subscale	If you studied the Method as part of the Wingsound Intensive Technique Training Program, please feel free to comment on the impact of that week—negative or positive—on your later training. Please describe any negative or positive challenges to training in this particular pedagogical paradigm. Please be as specific as you like about the pacing, sequencing of steps, length of time in each stage, and any other strategies you found challenging. How effective was hands-on, professional tactile guidance to learning the Lister-Sink Method technical model? What, if anything, would you change about the Method to improve it? Please feel free to share anything else related to your study of the Method.	**Please rate your response to the various aspects of studying Lister-Sink Method.** (The pace at which new material was introduced; Sequencing of steps; Length of time spent at each stage of learning; Time spent away from playing music; Changing old habits; Mental discipline required; Patience required; Perseverance required; Feeling in control of playing; Having to acquire some biomechanical and anatomical knowledge; Writing self-reflections; Writing synopses of video-recorded lessons; Accepting an alternative technical model; Encountering reactions of outside teachers, colleagues, students, family and friends; Video-taping all lessons; Modeling; Mental practice) **Were there any other pedagogical issues or aspects of training that you would like to mention?** **How would you rate the level of challenge you experience while teaching the Lister-Sink Method?** **How effective was hands-on, professional tactile guidance to learning the Lister-Sink technical model?** **Please feel free to write any other comments about your experiences or the effects of training in the Lister-Sink Method.**
Demographic information	Please state your age (unless you'd prefer not to) and gender, as well as the time frame and your age when you studied the Method. How long have you played the piano? If you are an organist, how long have you played the organ? Please tell me about your musical training background—where you studied, your degree(s) or anything	**How old are you?** **Are you a man or a woman?** **How old were you when you started playing the piano or organ?** **How old were you when you started studying the Lister-Sink Method?** **What is your background level of collegiate training in piano or organ?**

Research Questions Matched with Interview Questions

Research Question	Interview Questions	Survey Questions
	else you'd like to add. If you consider yourself to be a professional musician, please tell me a little bit about your professional activities. Prior to training in the Method, did you experience a playing-related neuromusculoskeletal disorder (PRND) of any sort? How did you know it was playing-related? Please describe the nature of the injury or disorder and how long you experienced it.	**I am predominately a** (Pianist, Organist) **Do you teach piano or organ?** **Are you a professional musician?** **Have you ever experienced a playing-related neuromusculoskeletal disorder (PRND)?** **Please select as many as apply to describe your PRND.** (Muscle fatigue or strain, Extensor tendonitis, Medial epicondylitis, Radial epicondylitis, Thoracic outlet syndrome, de Quervain's syndrome, Carpal tunnel syndrome, cubital tunnel syndrome, Spinal disorder, General repetitive syndrome disorder (RSI), Joint hyperlaxity, Other:)

Appendix G

Survey Questions

NOTE: The following questions will be presented in random order to each participant, except where display logic requires a specific order, to prevent iatrogenic narrative intrusion. The completed survey is available at https://qtrial2014az1.az1.qualtrics.com/SE/?SID=SV_blJtpxGhWVaY1zD.

How old are you?

Are you still formally studying the Lister-Sink Method?
(Yes, No)

When did you stop formally studying the Lister-Sink Method?
(1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014)

How helpful were the following areas of study incorporated into the Lister-Sink Method?
(History of piano technique, History of piano teaching methodology, History of pianist's injuries, risk factors, and treatments, History of the field of performing arts medicine, Pedagogy of the Lister-Sink Method)

Answers to these are a slider between: (Hindered my learning (-1) , Had no effect on my learning (0), Helped my learning considerably (+1))

How helpful did you find the study of the following in the Lister-Sink Method? Please add any comments if you wish.
(Neuroscience, Neuropedagogy, Movement science, Sports pedagogy, Embodied cognition, Alexander Technique, Transformative Learning Theory, Mindfulness training)

Answers to these are a slider between: (Extremely unhelpful (-1), Extremely helpful (+1))

Are you a man or a woman?
(Man, Woman)

What size is your hand?
(Small: have difficulty reaching an octave, Medium: comfortably reach an octave, Large: comfortably reaching a 10^{th}, Extra large: comfortably reach beyond a 10th)

What was your level of repertory playing before beginning to study the Lister-Sink Method?
(Beginner, Intermediate, Advanced)

How old were you when you started playing the piano or organ?
(Check answer: choices are 0 - 100)

How old were you when you started studying the Lister-Sink Method?
(Check answer: choices are 0 - 100)

What type of music do you primarily play?
(Classical, Jazz, Popular, Sacred, Other; please describe:)

What is your background level of collegiate training in piano or organ?
(Undergraduate major piano, Undergraduate minor piano, Undergraduate major organ, Undergraduate minor organ, Masters level piano, Masters level organ, Doctoral level piano, Doctoral level organ, Artist diploma organ, Artist diploma piano, No formal collegiate training)

I am predominately a
(Pianist, Organist)

Do you teach piano or organ?
(Yes, No)

For how many years have you taught?

To what extent do you incorporate the Lister-Sink Method in your teaching?

Answer is a slider between: (Not at all (-1), I incorporate a few elements in my teaching, I incorporate many elements in my teaching, I teach the Lister-Sink Method as precisely as I can (+1))

Are you a professional musician?
(Yes, No)

How long (in years) have you been a professional musician?

Prior to studying the Method, how many hours per day did you practice or play?

Answer is a slider between: (None, 24)

Since studying the Method, how many hours per day did you practice or play?

Answer is a slider between: (None, 24)

Why did you study the Lister-Sink Method? Please select as many as apply to you.
(I studied the Method as part of a curricular requirement, I wanted help with a playing-related neuromusculoskeletal disorder (PRND), I thought it would help me become a better musician, Other:)

Where did you study the Lister-Sink Method? Please select as many as apply to you.
(Salem College Certificate Program in Injury-Preventive Keyboard Technique, Salem College as an undergraduate music major, Private study with Barbara Lister-Sink, Wingsound Intensive Piano Technique Training Workshop, Other:)

How committed are you to the Lister-Sink Method?
Answer is a slider between: (Extremely uncommitted (-1), Extremely committed (+1))

What are your overall feelings about the Lister-Sink Method?

Answer is a slider between: (I have extremely negative feelings (-1), I have extremely positive feelings (+1))

Did you study the Lister-Sink Method because of a PRND?
(Yes, No)

Did you study the Lister-Sink Method because of a colleague's recommendation?

(Yes, No)

Did you study the Lister-Sink Method because it was part of your studies?

(Yes, No)

Have you ever experienced a playing-related neuromusculoskeletal disorder (PRND)? Please check all that apply.
(Yes, prior to studying the Lister-Sink Method, Yes, while studying the Lister-Sink Method, Yes, since completing my study of the Lister-Sink Method, No)

Please select as many as apply to describe your PRND.
(Muscle fatigue or strain, Extensor tendonitis, Medial epicondylitis, Radial epicondylitis, Thoracic outlet syndrome, de Quervain's syndrome, Carpal tunnel syndrome, cubital tunnel syndrome, Spinal disorder, General repetitive syndrome disorder (RSI), Joint hyperlaxity, Other:)

Has your PRND recurred since you began studying the Lister-Sink Method? Check all that apply
(I have experienced no recurrence, Symptoms recur from time to time, Symptoms are always present, It is bothering me now)

Did you receive a diagnosis from a medical professional for your PRND?
(Yes, No)

Did you receive treatment for your PRND?
(Yes, No)

Did treatment end before you began to study the Lister-Sink Method?
(Yes, No)

How effective was the treatment?

Answer is a slider between: (Extremely harmful (-1), Extremely effective (+1))

To what extent did studying the Lister-Sink Method help you recover from your PRND?

Answer is a slider between: (Made it much worse (-1), Helped me recover completely (+1))

For how many years did you have a PRND?

To what extent did the following people help you deal with your PRND?
(Teachers, Family, Partner, Colleagues, Friends, Health care professionals: Please note area(s) of specialty, Mental health professionals: Please note area(s) of specialty)

Answers to these are a slider between: (Extremely harmful (-1), Extremely helpful (+1))

Did you continue to play despite your PRND?
(Yes, No)

Did continuing to play worsen the problem?
(No, Yes, and this is how:)

How did you feel about the level at which you were able to play while you were injured?

Answer is a slider between: (Extremely unhappy (-1), Extremely happy (+1))

If you wish, please explain more about how you felt (or feel) while dealing with PRND.

What effect has PRND had on your life?
(Studies, Professional life, Personal life, Sense of well-being, Mental focus, Kinesthetic awareness, Auditory awareness, Flexibility, Suppleness of movement during every day activities, Overall health and well-being, Other: please explain, Other: please explain, Other: please explain)

Answers to these are a slider between: (Much worse (-1), Much better (+1))

What effect, if any, did studying the Lister-Sink Method have on your PRND?
(Please explain if you wish to:)

Answer is a slider between: (Made it much worse (-1), Had no effect (0), Helped me recover completely (+1))

How did the following aspects of studying the Lister-Sink Method affect your PRND?

(Alexander Technique, Incorporating knowledge from other disciplines, Training environment, Instructors' attitudes, Individualized attention, Individualized pacing, Fellow students' support, Time away from life stressors, cost of training, Other: please explain, Other: please explain, Other: please explain)

Answers to these are a slider between: (Made it much worse (-1), Had no effect (0), Helped me recover completely (+1))

Has your PRND, or any other problem with playing, recurred since you studied the Lister-Sink Method?
(Yes; please explain if you wish:, No)

How was your playing while you were injured?
(Please explain if you wish:)

Answer is a slider between: (Much worse than before the injury (-1), Much Better than before the injury (+1))

How is your PRND now?

Answer is a slider between: (Worse than ever (-1), Better than ever (+1))

What is your level of repertory playing now?
(I no longer play the piano or organ, Beginner, Intermediate, Advanced)

How do you feel about playing now?

Answer is a slider between: (Extremely dissatisfied (-1), Extremely Satisfied (+1))

Please explain why you feel as you do about playing now, if you wish.

How have your teachers, colleagues, friends, physicians, or family responded to you and your playing since you studied the Lister-Sink Method?
(Teachers, Colleagues, Friends, Physicians, Family, Audience, Other: please explain)

Answers to these are a slider between: (Extremely negative (-1), Extremely positive (+1))

To what extent has the Lister-Sink method provided you with the technical training and knowledge to help you prevent PRND?

Answer is a slider between: (Extremely unhelpful (-1), Extremely helpful (+1))

To what extent have other resources provided you with the technical training and knowledge to help you prevent PRND?
(Colleagues, Other teachers of the Lister-Sink Method, Teachers besides those teaching the Lister-Sink Method, Health care professionals: Please note area(s) of speciality Internet: Please explain, Other: please explain, Other: please explain)

Answers to these are a slider between: (Extremely unhelpful (-1), Extremely helpful (+1))

How has studying the Lister-Sink Method affected your musicality?
(Phrasing, Rhythmic flow, Structural cohesion, Emotional content, Communication with audience, Performance anxiety, fulfillment of artistic potential, Other: please explain, Other: please explain, Other: please explain)

Answers to these are a slider between: (Made it much worse (-1), Had no effect (0), Greatly improved it (+1))

How has studying the Lister-Sink Method affected your ability to listen and hear yourself while playing?

Answer is a slider between: (Made it much worse (-1), Had no effect (0), Greatly improved it (+1))

Do you make different repertory choices because of your training in the Lister-Sink Method?
(Yes: I play more challenging pieces, Yes: I play less challenging pieces, Yes: I have modified my choices in the following way: , No)

To what extent has your training in the Lister-Sink Method affected your ability to play difficult passages or repertory?

Answer is a slider between: (It is now impossible (-1), It is the same (0), It is now greatly improved (+1))

At what skill level are you playing now relative to how you played before studying the Lister-Sink Method?

Answer is a slider between : (Much lower (-1), Much higher (+1))

How has studying the Method affected your perception of music-making while playing?
(Overall perception, Ability to listen and hear myself at the piano or organ)

Answers to these are a slider between: (Extremely unsatisfying (-1), Extremely satisfying (+1))

What effect, if any, did studying the Method have on your technique?

(Tone control, Tone quality, Dynamic control, Ability to voice, Facility, Muscular suppleness, Speed, Power, Other: Please explain)

Answers to these are a slider between: (Made it much worse (-1), Greatly improved it (+1))

Compared to how you used to feel while playing, how do you feel while playing since studying the Lister-Sink Method?
(Physically, Emotionally)

Answers to these are a slider between: (Much worse (-1), Much better (+1))

Has your study with the Lister-Sink Method resulted in any changes in your studies or career? Please select as many as apply and add explanations if you wish.
(Yes: positive changes. Please explain if you wish:, Yes: negative changes Please explain if you wish; No: Please explain if you wish)

To what extent has the Lister-Sink Method resulted in life changes?
(Please explain if you wish:)

Answer is a slider between: (No life changes (-1), Important life changes (+1))

What kind of life changes resulted from your study of the Lister-Sink Method? Please check all that apply.
(Positive. Please explain if you wish:, Negative. Please explain if you wish:, Neutral. Please explain if you wish)

To what extent did you gain your knowledge of preventing PRND through your study of the Lister-Sink Method?

Answer is a slider between: (I learned everything that I know about preventing PRND through studying the Lister-Sink Method (-1), I gained no knowledge about preventing PRND through my study of the Lister-Sink Method (+1))

What effect has the Alexander Technique had on your life in general? Please add any comments.
(Comments:)

Answer is a slider between: (Made it much worse (-1), Made it much better (+1))

How has the Lister-Sink Method changed you in other ways <u>outside of playing the piano or organ</u>?
(Ability to concentrate, General movement, Hearing, Interactions with other people, Accomplishing goals, Self confidence, Personal life, Professional life, General sense of well-being, Other: Please explain)

Answers to these are a slider between: (Much worse (-1), Much better (+1))

What effect, if any, has studying the Method had on your <u>professional</u> life?

What effect, if any, has studying the Method had on your <u>personal</u> life?

Please rate your response to the various aspects of studying Lister-Sink Method.
(The pace at which new material was introduced; Sequencing of steps; Length of time spent at each stage of learning; Time spent away from playing music; Changing old habits; Mental discipline required; Patience required; Perseverance required; Feeling in control of playing; Having to acquire some biomechanical and anatomical knowledge; Writing self-reflections; Writing synopses of video-recorded lessons; Accepting an alternative technical model; Encountering reactions of outside teachers, colleagues, students, family and friends; Video-taping all lessons; Modeling; Mental practice)

Answers to these are a slider between: (Extremely hard (-1), Extremely easy (+1))

Were there any other pedagogical issues or aspects of training that you would like to mention?

How often do you revert to previous habits?

Answer is a slider between: (I always play the same way I did before learning the Lister-Sink Method (-1), I always use the Lister-Sink Technical Model (+1))

How would you rate the level of challenge you experience while teaching the Lister-Sink Method?

Answer is a slider between: (Extremely difficult (-1), Extremely easy (+1))

How often do you refer to Cue Sheet No. 1?

Answer is a slider between: (Never (-1), Every time I play (+1))

How often do you refer to Cue Sheet No. 2?

Answer is a slider between: (Never (-1), Every time I play (+1))

How much of the neuromuscular program you learned in the Lister-Sink Method is now automatic?

Answer is a slider between: (None of it (-1), It's completely automatic (+1))

How effective was hands-on, professional tactile guidance to learning the Lister-Sink technical model?

Answer is a slider between: (Extremely detrimental (-1), Made no difference (0), Extremely beneficial (+1)

How natural is the neuromuscular program you learned in the Lister-Sink Method to you now?

Answer is a slider between: (I must maintain conscious control of my coordinations (-1), My coordinations feel completely natural (+1))

How much have you retained the principles and neuromuscular program embedded in the Lister-Sink Method?

Answer is a slider between: (Nothing (-1), Every nuance (+1))

Please feel free to write any other comments about your experiences or the effects of training in the Lister-Sink Method.