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Intense Piano Training on Self-efficacy and Physiological Stress in Aging

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Intense piano training on self-efficacy and physiological stress in aging

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Abstract

The aim of this study was to evaluate the effects of an intense piano training program on general self-efficacy, musical self-efficacy, and physiological stress in older adults. Self-efficacy refers to perceived beliefs regarding the performance of domain-specific tasks or activities, which contribute to psychological and physical health. A key challenge is to identify activities that promote self-efficacy in the aging population. Seventeen healthy community-dwelling older adults (60–85 years) with little to no previous musical training participated in a within subjects experimental design. Measures of self-efficacy and cortisol levels were administered over three time points: an initial pre-testing session, a second pre-testing following a two-week no treatment control period, and a post-testing session upon the completion of piano training. Intense piano training consisted of 30 hours of training (3 hours per day) in which high levels of achievement were required. Results of a three-way Repeated Measures ANOVA over all time points with pairwise comparisons revealed significantly ($p < .05$) enhanced musical self-efficacy post-training, $F(2, 32) = 11.5$, $p < .001$, $d = .79$. No significant changes in general self-efficacy or cortisol levels were found. These results suggest that domain-specific self-efficacy may increase as a result of short-term intense music training; however, short-term music training may not be sufficient to transfer to general self-efficacy.

Keywords

aging; music training; musical self-efficacy; piano instruction; self-efficacy

Introduction

Self-efficacy, one's beliefs regarding capabilities to initiate and execute a course of action (Bandura, 1986; Bandura, 1997), is a variable that strongly contributes to cognitive performance in aging and is a crucial factor in predicting attrition in complex tasks such as musical training (Kavé et al., 2012; Seeman, Rodin, & Albert, 1993). Self-efficacy differs from self-esteem or confidence level as it references one's perception regarding the potential to reach a goal. In contrast, self-esteem refers to one's self worth. According to Bandura's social cognitive theory (1986), beliefs and actions are influenced by interactions between

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cognition, behavior, and environment. While many studies have found positive effects of long-term musical training on self-efficacy (Bugos, 2012; McCormick & McPherson, 2003, 2006), the purpose of this research was to examine the effects of a short-term intense piano training program, i.e., a piano program that progresses at a rapid pace during a short-time period, on domain-specific self-efficacy, general self-efficacy, and physiological stress in beginning adult musicians. We hypothesized that there would be an increase in all three variables due to the complex challenges associated with learning a new instrument.

There has also been considerable interest in the benefits of musical training in older adults. Research suggests that piano training for those with little to no previous musical training is associated with increased cognitive performance in areas of executive function such as verbal fluency and processing speed in older adults (Bugos, 2010; Bugos, Perlstein, Brophy, McCrae, & Bedenbaugh, 2007). In addition to training studies, correlational studies suggest that musical training may have protective effects in aging. For instance, research examining lifestyle variables in older adults found an association between adult musicians who began musical training at an early age and those who maintained performance through adulthood (Hanna-Pladdy & Gajewski, 2012); the authors suggested that such enhancements in cognitive performance may compensate for age-related cognitive deficits. Collectively, these studies suggest that musical training has the capacity to increase general cognitive performance. Yet, music participation may have additional psychosocial benefits that may potentially contribute to these outcomes but have yet to be fully explored. Preliminary data collected from older adults engaged in a 16-week music listening and mallet instruction intervention revealed increases in general self-efficacy (Bugos, 2012). Few studies examine self-efficacy stemming from a short-term intense training program for adult beginning musicians.

Self-efficacy and aging

Self-efficacy contributes to healthy aging, as it positively impacts cognitive performance resulting in fewer memory complaints. Previous aging research suggests that higher self-efficacy is associated with higher cognitive performance, particularly in the domains of memory self-efficacy and literacy self-efficacy (Kavé, et al., 2012; Seeman et al., 1993). Recently, self-efficacy has been associated with higher brain volume in aging women (Davis, Magamatsu, Hsu, Beattie, & Liu-Ambrose, 2012). Individuals with high self-efficacy often lead a more active lifestyle noting significantly fewer physical and psychological health problems (Comijs, Deeg, Dik, Twisk, & Jonker, 2002). Additionally, high self-efficacy is associated with behavioral characteristics necessary for continued engagement in tasks or activities. For instance, research suggests those with high self-efficacy may be more likely to set goals, persevere on tasks, and utilize strategies for goal attainment (Nielsen, 2004; Zimmerman, 2000). The development of self-efficacy may be especially important for continued engagement in complex sensorimotor activities such as learning to play a musical instrument.

Self-efficacy, a link between cognition and behavior in social cognitive theory, is a domain-specific malleable construct that can be influenced by four sources: masterful experiences, vicarious experiences, verbal/social persuasion, and physiological states (Bandura, 1986).

Learning a musical instrument has the capacity to engage all four sources of self-efficacy. While research suggests that these sources contribute to performance quality and self-efficacy in college students, little is known about the effects of musical training on self-efficacy in older adults (Ritchie & Williamon, 2012).

Masterful experiences

Masterful experiences have a strong influence over self-efficacy and refer to self-perceptions of prior successes or failures. Learning a musical instrument offers opportunities to experience masterful experiences through extensive practice. Research suggests that a minimum of 10,000 hours of practice are necessary to reach expert performance levels (Ericsson, Krampe, & Tesch-Römer, 1993; Ericsson & Lehmann, 1996). Although older adults enrolled in a short-term intense group piano training program may not reach 10,000 hours of practice, completion of an entire piano method in two weeks as part of an intense program provides opportunities to learn from failure and overcome bimanual challenges. Thus, the intense format of the program increases the likelihood of mastery experiences.

Learning a new skill in relation to masterful experiences is influenced by a learner's goal orientation. The achievement goal framework, a valid framework in the adult population (Hastings & West, 2009), suggests that learners initiate tasks with one of two goal orientations: learning goals or performance goals (Kaplan & Maehr, 2007). Learning goals foster the development of skill mastery and focus upon improving existing skills. Those with learning goals typically demonstrate an ability to accept failure as a necessary part of learning. Performance goals focus upon outcomes normally measured in test results, which for some individuals can have negative consequences in withdrawal from challenging tasks, poorer strategy usage, and negative affect (Smiley & Dweck, 1994). A learner's decision to adopt learning or performance goals is dependent upon implicit theories of ability. If the learner believes that ability can be modified through practice and perseverance, he or she will most likely establish learning goals. If ability is thought to be fixed and not malleable with practice, the learner may develop performance goals. Previous research suggests that older adults typically focus on process orientation or learning goals compared with young adults who focus on outcomes or performance goals (Freund, Hennecke, & Riediger, 2010). This is particularly evident in studies examining learning of new memory strategies or physical skills (Hastings & West, 2009; Mullen, McAuley, Satariano, Kealey, & Prohaska, 2012). Goal orientation may impact learning and self-efficacy as those with learning goals are likely to have had additional mastery experiences and persist in challenging activities despite opportunities for failure in the learning process. This research focused upon an intense training paradigm that requires learners to progress at a rapid pace; thus we predicted that this paradigm would allow adult learners with learning goals to witness mastery of such goals.

Vicarious experiences

Vicarious experiences refer to predictions of success or failure of future performance based upon interactions with or observations of others' performances. When an individual observes someone who is considered at an equal level of mastery successfully perform music, their perceived self-efficacy for musical performance may improve. In the musical

domain, it is quite common for studio instructors to include a weekly studio session in which all students receiving private music lessons have opportunities to perform for their peers. Within a situated learning framework, experiences such as these become an investment in peripheral participation contributing to vicarious experiences (Bandura, 1997).

Verbal social persuasion

Feedback obtained regarding performances can influence prospective decisions, thus referred to as verbal/social persuasion. Verbal/social persuasion can be very influential especially if the feedback is perceived as reasonable and valid regarding an individual's performance capacity. Research examining the relationship between feedback and memory performance found that positive feedback strengthened the relationship between self-efficacy and memory performance in older adults compared to neutral or no feedback conditions (Jones, 2009).

Physiological states

Finally, physiological states, an important determinant of self-efficacy, refer to feelings experienced when actively engaged in or thinking about a specific activity or task. For instance, affective or emotional response may be tied to a specific task that could potentially decrease or increase stress levels. One question that we were interested in examining was whether intense piano training would increase stress levels in older adults. Is stress experienced during music training related to general and musical self-efficacy? To evaluate the hypothesis that such an intense training program may be stressful, we measured salivary cortisol as a physiological marker of stress.

Physiological measures such as cortisol levels are commonly used to examine physiological reactions to stressful situations. Research shows benefits in mood and quality of life for adults who participate in community choirs or drumming circles (Bittman, Bruhn, Stevens, Westengard, & Umbach, 2003; Bygren, Konlaan, & Johansson, 1996; Cohen et al., 2006; Johnson et al., 2013). Music listening has been utilized in clinical populations to reduce symptoms of depression, lower aggression levels, and for positive reminiscence (Cuddy & Duffin, 2005; Sung & Chang, 2005). Several studies examining the effects of music listening and music therapy suggest that music has the capacity to reduce or maintain cortisol levels. Research suggests that listening to relaxing music prior to the onset of a stressor can prompt a faster recovery than other forms of acoustic stimulation (Thoma et al., 2013). However, inconsistencies have been reported for cortisol levels stemming from musical performance. For instance, one study found reduced stress levels resulting from choral music participation (Beck, Cesari, Yousefi, Enamoto, 1999). In another study comparing mood, cortisol, and S-IgA levels in community chorus members compared to a music listening group results showed that singing did not affect cortisol levels and listening was associated with decreased cortisol levels (Kreutz, Bongard, Rohrmann, Hodapp, & Grebe, 2004). In our research, we sought to examine the effects of music learning in an intense music training program on physiological stress. Passive music listening may reduce stress; however, we hypothesized that active music training in a group setting (music performance) associated with learning a new instrument would increase cortisol levels due to complex demands placed upon sensorimotor systems.

Musical training is a domain that has the capacity to increase one's self-efficacy. Research suggests that children with instrumental or vocal instruction report higher levels of self-efficacy than children that are not enrolled in such programs (Ritchie & Williamon, 2011). In the musical domain, self-efficacy contributes to self-regulation, formal practice, and informal practice and affects cognitive strategy usage (McCormick & McPherson, 2003). To our knowledge, no previous literature examines the effects of musical training on self-efficacy in older adults. The purpose of this research is to examine the effects of intense piano training on musical and general self-efficacy in older adults. We hypothesized that a short intense program, while stressful, would accelerate learning, contributing to enhanced general and musical self-efficacy.

Methods

Participants

Twenty-four community dwelling adults (ages 60–85) were recruited from local senior groups, senior centers, and via digital media. Criteria for enrollment included those expressing no difficulty with hand movements, and no history of neurological deficits or significant hearing loss, and excluded those currently taking medications that could adversely affect cognitive performance. Potential participants were screened for neurological impairment using the Telephone Interview for Cognitive Status (TICS; Brandt, Spencer, & Folstein, 1988). Individuals with TICS scores < 30 were disqualified from research participation. Since this research examined the effects of newly-acquired musical skills in older adults on self-efficacy, additional criteria included those with less than three years of formal music training and not currently engaged in formal music instruction or music reading. Informed written consent was obtained from all participants in accordance with the policies of the University Institutional Review Board.

Seven participants withdrew from the study prior to the second pre-training testing session. Attrition was due to unforeseen circumstances such as loss of employment, sudden illness, and loss of a family member. Data from the remaining 17 participants (4 males, 13 females) were examined with regard to musical and general self-efficacy across three time points (51 scores). The mean age was 71.24 (SD = 6.32) years and the average number of years of education was 17.27 (SD = 1.84) (see Table 1).

Participants completed a measure of musical aptitude at the first pre-training testing session and dependent measures of general and musical self-efficacy at three time points: pre-training 1; pre-training 2, following a two-week control period; and post-training following two-weeks of intense piano training. This design was selected in order to collect control data on all individuals thus alleviating the potential for demographic differences in experimental and control groups.

Description of measures

The General Measure of Self Efficacy (GSE; Sherer et al., 1982) is comprised of 23 positive and negative items on a 14-point Likert scale ranging from strongly disagree (1) to strongly agree (14). An example of a positive item on this scale is, "When I make plans, I am certain

I can make them work," whereas an example of a negative item is, "I avoid facing difficulties." Given the inclusion of both types of items on the scale, negative items were recoded prior to analysis. For example, a negative item rated 1 would be equivalent to 14 and so on. Higher scores correlate to a higher self-efficacy, thus a stronger belief in one's perceived abilities.

Two characteristic subscales of this questionnaire include general self-efficacy and social self-efficacy. The purpose of the general self-efficacy subscale is to examine beliefs regarding entrance into a new situation. Seventeen of the 23 items reflect components of general self-efficacy and consist of 85% of the variance. This measure was chosen for its reliability ($r = 0.86$) and extensive use in the literature (Chen, Gully, & Eden, 2001). In addition, the GSE was chosen as the basis for many additional self-efficacy measures employed in the Longitudinal Aging Studies Amsterdam (LASA; Jonker, Comijs, Knipscheer, & Deeg, 2009). LASA studies explore the effects of a variety of lifestyle factors in aging. Thus, we included the measure as it has been consistently used in a well-controlled and defined context and could be a good basis for future comparison studies.

An example item from the general self-efficacy subscale is, "I am self-reliant person." Six items at the end of the GSE measure account for the social subscale. The social subscale has a moderate reliability ($r = 0.71$) and variance of 26.5%. Social subscale statements such as, "I do not handle myself well in social gatherings," examine one's perceived efficacy when entering a social situation.

The GSE also demonstrates good construct validity. Elements of effort, initiation, and persistence, described in Bandura's social cognitive theory, map onto the items of the GSE. For instance, initiation, a person's willingness to commence a behavior, is measured through response to the statement, "If something looks too complicated, I will not even bother to try it." Persistence, operationalized as completion of behaviors or tasks despite obstacles, is measured by statements such as, "Failure makes me try harder" (Sherer et al., 1982).

The Musical Performance Self-Efficacy Scale (MPSES; Zelenak, 2010) is a reliable ($r = .87$) domain-specific questionnaire consisting of 24 items to which participants respond by selecting a number (0–100) to reflect strength of agreement to a specific statement regarding musical beliefs (0 = strongly disagree … 100 = strongly agree). Similarly to the GSE, the items included in the MPSES clearly map onto elements that contribute to self-efficacy in Bandura's sociocognitive theory: mastery experiences (eight items), vicarious experiences (five items), verbal/social persuasion (six items), and physiological state (five items). An example of an item from this measure is, "I have had positive experiences performing music in the past."

The Advanced Measures of Music Audiation (AMMA; Gordon, 1989) was used to measure music aptitude. We used this measure to ensure that music aptitude was within normal limits. The AMMA consists of 30 pairs of piano melodies in which participants distinguish whether melodic content is the same, tonally altered, or rhythmically altered. The AMMA was chosen for its reliability ($r = .81$) and content validity. The measure generates tonal and rhythmic scores and combinations of these scores serve as the composite score.

Salivary cortisol measures

Analysis of salivary cortisol is a widely used non-invasive method of measuring physiological stress reaction (Chu et al., 2013). Cortisol, a stress hormone secreted by the adrenal glands, is found in its free form in human saliva. Research indicates that human saliva samples are an accurate indicator of cortisol hormone concentrations (r = .92; Kerlik et al., 2010).

Salivary cortisol samples were collected during a scheduled testing session at each of three time points: pre-training, following a two-week control time period, and post-training. Since cortisol levels typically peak during the course of the morning and decrease later in the day, testing sessions were scheduled during the same time of day for each time point. Samples were collected using an absorbent device, the Salumetrics Oral Swab (SOS). Participants were asked to refrain from eating 30 minutes prior to sample collection. Participants were instructed to position the swab under their tongue for a minimum of two minutes. All samples were immediately stored at −20° C prior to processing. All samples were sent to an independent laboratory for cortisol assay. Samples were assayed in duplicate using highly sensitive enzyme immunoassays (Salimetrics, PA) by a biochemist blind to testing time points and conditions. The test has a lower limit of sensitivity of .003 μg/dl, a range of sensitivity from .003 to 1.8 μg/dl, and average intra- and inter-assay coefficient of 4.8% and 8.8%. Average cortisol levels from each pair of results were used for analysis for each corresponding time point.

Statistical analysis

Scores from each measure were included in a Repeated Measures ANOVA with Time as a within-subjects variable having three levels. Original F-values are reported along with Greenhouse–Geisser (Greenhouse & Geisser, 1959) corrected p-values when the sphericity assumption was violated. Statistically significant ANOVAs were followed-up with Bonferroni-corrected pairwise comparisons.

Description of intense piano program

Group piano instruction included finger dexterity exercises, scales and technical pieces, music theory, and standard piano repertoire. The piano program was taught by an accomplished pianist with a Ph.D. in Music Education. At the beginning of each 3-hour session, the group performed hand/finger exercises and previously learned repertoire for 15 minutes, followed by the introduction of new music theory concepts for 30 minutes and accompanying piano repertoire for each new skill for 135 minutes. All participants were required to attend each piano training session held in an electronic piano lab equipped with Yamaha Clavinovas. Participants were encouraged and provided with opportunities to practice portions of new repertoire as a group during each session. The philosophy of the program was directed towards mastery using music education techniques to assist with musical challenges. For instance, half of the group performed the right hand part and the other half performed the left. Ultimately, participants were responsible for performing both hands simultaneously; however, isolating parts for independent hands assisted with manageability for beginning level pianists. Participants performed pieces with the class and were given opportunities to practice as they were independently required to demonstrate a

performance with less than three errors for each piece of the Alfred Adult All-in-One Course (Palmer, Manus, & Lethco, 1995). While music includes more than performance of notes and rhythmic figures, participants in their first 2 weeks of piano study were focused on correctly performing notes, rhythms, and dynamics. Other stylistic qualities were discussed in the piano course but were not emphasized. At the end of each class session, participants were given opportunities to perform for the class. Individual performances for the class were not required but presented as an option for those interested in showcasing newly acquired skills. All participants were provided verbal feedback from the course instructor and were measured on their ability to perform basic chord patterns and bimanual coordination in selected basic repertoire such as "Blow the Man Down." No practice outside of the program was required. In this accelerated program, most participants were able to complete level 1 in 2 weeks. Each session concluded with individual demonstrations of achievement for each participant based upon materials in the course text.

Results

Musical Performance Self-Efficacy Scale (MPSES)

Over the course of the program, musical self-efficacy increased (Figure 1). A Repeated Measures ANOVA (three time points: Pre-testing 1; Pretesting 2, Post-testing × GSE × MPSE) with Bonferroni post-hoc analysis shows significantly ($p > .05$) enhanced musical performance self-efficacy scores, $F(2, 32) = 11.5$, $p = .001$, $d = .80$ (Table 2). Pairwise comparisons reveal significant increases between pre-testing 1 and post-testing time points ($p = .01$) as well as between pre-testing 2 and post-testing ($p = .04$). No significant difference was found between pre-testing 1 and pre-testing 2 ($p > .05$).

We considered the hypothesis that, in this program, certain MSPE sub-scores contributed to the main effect, but others did not. MPSE questionnaire items were mapped to Bandura's four sources of self-efficacy, in the manner of Zelanak (2010). We tabulated scores for each item listed as contributing to each of four sources: mastery experiences, vicarious experiences, verbal/social persuasion, and physiological state (Table 3). Results of a Repeated Measures ANOVA (3 time points × 4 sources of musical self-efficacy) show that all four sources of self-efficacy significantly influence musical self-efficacy: mastery experiences, $F(2, 34) = 10.8$, $p = .001$, $d = 3.6$; vicarious experiences, $F(2,34) = 13.1$, $p = .002$, $d = 3.1$; physiological state, $F(2,34) = 12.2$, $p = .003$, $d = 4.0$; verbal/social persuasion, $F(2,34) = 6.9$, $p = .008$, $d = 2.3$. Pairwise comparisons show significant interactions between pre-training 1 and post-training time points as well as pre-training 2 and post-training for all four sources. No significant interaction was found between pre-training 1 and pre-training 2 time points.

General Measure of Self-Efficacy (GSE)

In contrast to musical self-efficacy, general self-efficacy did not change (Figure 2). A Repeated Measures ANOVA, conducted in conjunction with the analysis of musical self-efficacy described above, showed no significant effects of the program on general self-efficacy, $F(2, 32) = 1.44$, $p = .25$.

Salivary Cortisol

Analysis of salivary cortisol levels was conducted on 14 data sets as 3 did not contain sufficient saliva samples as reported by Salumetrics. Results of a Repeated Measures ANOVA (3 time points × mean cortisol levels based upon duplicate assay) showed no significant differences between pre- and post-testing time points, $F(2,26) = .04$, $p = .94$. The pattern of results suggests that cortisol levels decreased slightly between pre-training 1 and pre-training 2 (Table 2). While cortisol levels increased slightly between pre-training 2 and post-testing, this increase was not significant.

Discussion

Results suggest that learning a musical instrument in a short-term intense program could potentially influence the perception of musical self-efficacy, but may not be sufficient to increase general self-efficacy. While domain-specific enhancements in self-efficacy have been found for memory self-efficacy resulting from a six week program (Hastings & West, 2009), few training studies examine self-efficacy resulting from short-term intense programs in older adults.

Data obtained from younger and older adults suggest that long-term training may be necessary to enhance general self-efficacy. Previous data collected from older adults engaged in a 16-week music listening and mallet instruction intervention reveal increases in general self-efficacy post-training (Bugos, 2012). These data are consistent with research from long-term sports programs that suggest increases in self-efficacy in adult swimmers and injured athletes who receive coping strategies and training adaption (Zagórska & Guszkowska, 2013). While research suggests a relationship between time spent in formal and informal music training and self-efficacy scores in young children (McCormick & McPherson, 2003, 2006), data from this research serve as a first step into the effects of short-term musical training on self-efficacy outcomes in older adults.

Our results suggest that music learning opportunities structured with an initial intense-training period may promote increased musical self-efficacy. The notion of providing an intense period prior to a long-term training program is not novel. For instance, the military use a similar paradigm for bootcamp or basic training. Military personnel are provided with short-term rigorous training designed to prepare them for their posts. When individuals complete basic training, they often go for additional training, perhaps less intense, for skill maintenance. In addition, many colleges and universities offer band camps targeted for advanced high school musicians and young children. New application of this approach for adult learners at the beginning level of skill acquisition in music learning may yield potentially beneficial effects in self-efficacy and overall cognitive performance. Enhanced musical self-efficacy through an intense program early in musical studies also could lead to less attrition contributing to lifelong musical learning.

Introduction of a short-term intense training period into a cognitive training program may be the key to fostering more permanent lifestyle changes in older adults. Unlike young children, adult learners have the capacity to think abstractly and employ concepts and skills in a musical framework at a more rapid pace. The primary challenge for adults engaged in

sensorimotor skill learning such as musical training lies in the temporal complexity and motor skill requirements such as bimanual coordination. Bimanual coordination in aging is linked to decreases in white matter tracts and processing speed which may contribute to the challenges faced in motor skill acquisition. Despite these challenges, there was still a significant increase in musical self-efficacy potentially attributable to the underlying need of perceived progress. According to self-determination theory, an individual's perceived progress is a need in a social learning environment (Gagné & Deci, 2005). Our data suggest that process orientation or learning goals motivate adult beginning pianists more than performance goals. Older adults discussed a need to demonstrate progress between piano classes in the form of completing pieces or exercises that would assist in facilitating future learning. In contrast, competition motivates children enrolled in intense piano training, as they focus on performance goals for specific piano pieces (Bugos, Rauschfuss, & Maxfield, 2013).

Our results suggest that an intense musical training program may challenge participants without inducing physiological stress. Sufficient challenge is a necessary part of a cognitive intervention to promote successful aging. Previous research suggests that piano training can serve as an effective cognitive intervention, enhancing working memory and processing speed in older adults (Bugos, 2010; Bugos et al., 2007). It is possible that older adults experienced challenges throughout the program; however, cortisol levels show no significant difference in generated stress. One potential explanation for this result may be the lack of focused individual performance. Participants were required to engage in group-based performance activities and were individually assessed during classes. However, students were not required to perform individually for the entire class or during any formal concert. Research comparing stress levels of choral singers who experienced a rehearsal and performance environment found significantly increased cortisol levels for participants in a performance environment compared to rehearsals (Beck, Cesario, Yousefi, & Enamoto, 2000). While participants perceived our program as very challenging, class sessions may have been viewed as rehearsals in which individuals felt comfortable to perform, thus stress levels were unaffected.

Limitations and alternative interpretations

This research contains a relatively small sample size in which participants served as their own control. Future research with a larger population is necessary to achieve more generalizable statistical results. In addition, participants did not receive an attentional component during the control time period. Individual and group attention was provided during group piano training. As the program was very intensive, no additional practice component was required. While many participants did not have access to a piano or keyboard outside class, we did not independently monitor practice beyond self-report. Further research is necessary to assess the effects of piano practice in adult learners on self-efficacy performance.

This research did not evaluate the role of sensorimotor ability on self-efficacy or stress levels. If adults have higher self-efficacy for motor-specific activities or have higher sensorimotor performance ability, these factors could contribute to research results. Future

research that standardizes measures of sensorimotor performance will greatly contribute to our knowledge of how sensorimotor levels contribute to adult learning and transfer to self-efficacy, cognitive performance, and stress associated with new skill acquisition.

Conclusions

As the aging population increases, there is considerable interest in activities that could potentially elevate mood, produce strong positive emotions, and enhance self-efficacy. Musical training may be one such activity that could foster increases in cognitive performance and self-efficacy contributing to successful aging. Further research is necessary to evaluate the effects of long-term music training on self-efficacy, the role of development on self-efficacy, and the role of goal maintenance on cognitive performance in music learning.

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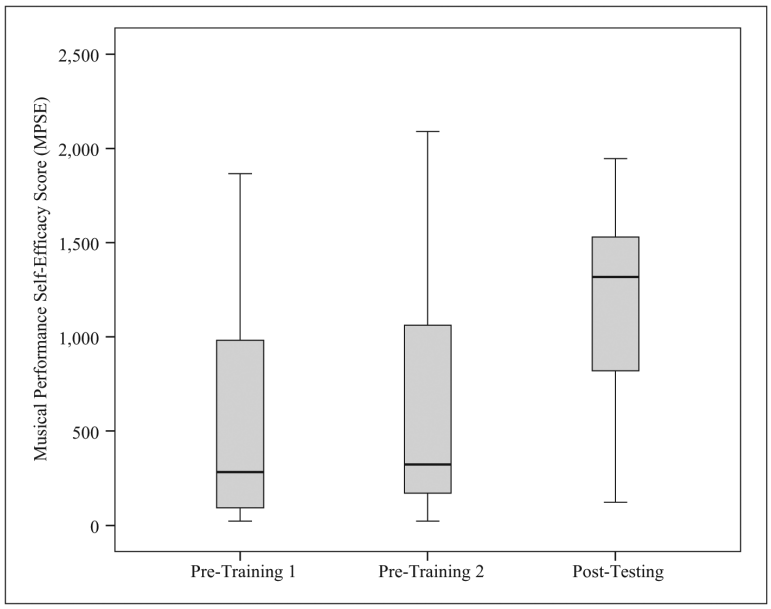

Figure 1.
Musical self-efficacy scores.

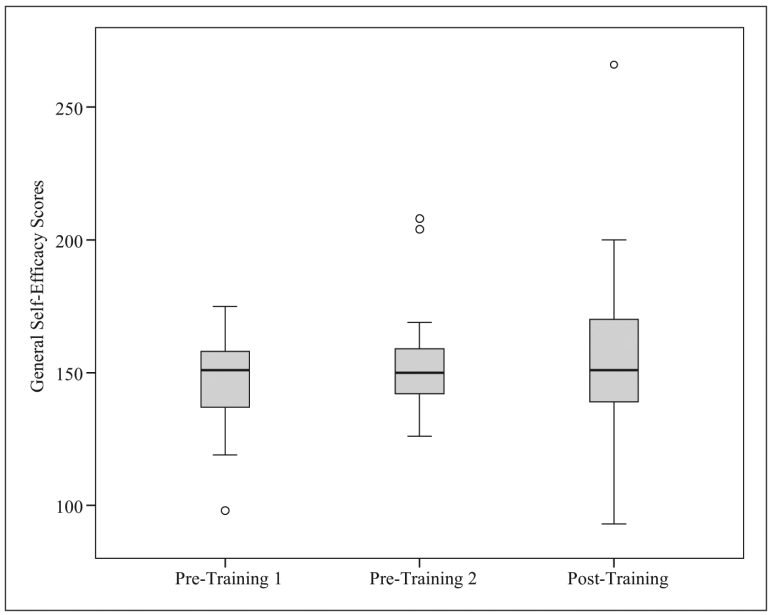

Figure 2.
General self-efficacy scores.

Table 1

Demographic Table (SD).

	Participants (*N* = 17)
Age	71.24 (6.32)
Gender (Male/Female)	4/13
Education in years	17.27 (1.84)
AMMA Rhythm	24.82 (4.43)
AMMA Tonal	26.71 (3.79)

Note: AMMA = Advanced Measures of Music Audiation.

Table 2

Mean self-efficacy scores and cortisol levels (SD).

	Pre-training 1	Pre-training 2	Post-training
MPSE	573.53 (646.68)	648.47 (644.68)	1132.94 (579.84)
GSE	145.65 (20.86)	155.12 (22.04)	156.53 (36.79)
Cortisol in ug/dl	.30 (.58)	.27 (.23)	.31 (.44)

Note: MPSE = Musical Performance Self Efficacy; GSE = General Self-Efficacy; ug/dl= microgram per deciliter.

Table 3

Mean sources of musical self-efficacy (SD).

	Pre-training 1	Pre-training 2	Post-training
Mastery experiences	143.6 (33.9)	165.2 (34.7)	271.9 (25.1)
Vicarious experiences	118.2 (29.4)	128.6 (33.4)	229.6 (30.7)
Verbal/social persuasion	214.3 (52.4)	241.3 (48.2)	348.9 (45.0)
Physiological state	131.6 (42.5)	144.1 (41.1)	304.6 (39.0)