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Music to decrease anxiety in college students during the COVID-19 pandemic

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ABSTRACT

The COVID-19 pandemic impacted the world in a multiplicity of ways. For college students, considered emerging adults in a time of transition between adolescence and adulthood, the stressors were multiplied by severe disruptions in education, social activities, family distress, and job losses. Significant impact on mental health in college students has been reported during this period. We investigated the effect of a previously researched music experience on the anxiety levels of 36 performing arts college students. Results showed a high level of anxiety pre-intervention, but a significant decrease and normative levels at posttest. Although a small sample size warrants caution in generalization, these results show the feasibility of theoretically sound, brief music experiences to address significant distress in vulnerable populations.

Introduction

Emerging adulthood, considered the time between 18 and 29 years (Arnett et al., 2014), is an exciting time of growth, change and new responsibilities. It is also a time for the young person to find their vocational and social identity. This identity is mainly constructed through exploration of new relationships and interests (Arnett et al., 2014). Currently conceptualized as a transitional period between adolescence and young adulthood in high-income countries, emerging adulthood is characterized by its diversity of paths, instability in love relationship and vocational interests, and many times an absence of long-term commitments (Arnett et al., 2014). Although some of this instability is a part of healthy development, emerging adulthood is also an especially vulnerable time for the onset of mental health issues (Arnett, Žukauskienė, & Sugimura, 2014; Beiter et al., 2015; Lee & Jung, 2018). In the United States, up to 40% of emerging adults are diagnosed with mental health disorders (e.g., anxiety and depression), the highest for any age group (Kessler et al., 2005).

For emerging adults who attend college, these challenges may be especially salient. Previous literature has highlighted the number of stressors that college students experience (American College Health Association, 2020; Mahmoud et al., 2012; Unwin et al., 2013). From acquiring complete responsibility over their health and life in a short period of time, to juggling multiple work, family, school and social obligations, college students experience challenges for which, at times, they may not have enough cognitive and coping resources (Fiore, 2018;

Mahmoud et al., 2012). According to the transactional theory of stress and coping, when stressors exceed a person's ability to cope, anxiety and depression, among other mental health concerns, can appear (Lazarus & Folkman, 1984; Obbarius et al., 2021).

The COVID-19 pandemic affected social interactions, forced changes in academics and job losses, and generated multiple family stressors. It impacted emerging adults in higher education in a particularly pernicious way. New literature shows that anxiety and depression symptoms increased substantially for college students during the pandemic (Wang et al., 2020). Moderate to severe stress was reported by 72–88 % of college students (Lee, Jeong, & Kim, 2021; Wang et al., 2020). In fact, some studies show an alarming increase, up to 18% of 2031 respondents, in suicidal thoughts after the first few months of the pandemic (Wang et al., 2020). More alarming is the fact that the majority of students did not access mental health services, even when experiencing moderate to severe stress, anxiety or depression (Lee, Jeong, & Kim, 2021; Wang et al., 2020). According to a US nationwide survey (Kim et al., 2022), coping strategies that could be considered “maladaptive,” such as binge-eating and alcohol abuse, were more prevalent among 1st- and 2nd-year college students in the first few months of the pandemic (March – May 2020) compared to previous months (Nov. 2019 – Feb. 2020). Importantly, during those first months of the pandemic, the USA was under lockdown orders with its consequential effect on isolation and loneliness.

Several factors were associated with increased anxiety during the pandemic. These factors included being a female, spending quarantine

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alone, living in rural areas, experiencing financial difficulties, working full-time, facing reduced sleep quality, having limited physical activity, and transitioning to online learning (Haikalis et al., 2022; Jehi et al., 2022; Lee, Jeong, & Kim, 2021; Wang et al., 2020). On the other hand, protective factors limited the negative impact of those stressors. Those factors included experiencing positive changes during the pandemic (such as increased schedule flexibility, reduced schoolwork, and reduced external obligations), being able to find positive aspects of the crisis and being grateful for them (i.e., cognitive restructuring), and intentionally using extra-curricular activities for well-being (Finnerty et al., 2021; Haikalis et al., 2022; Wang et al., 2020).

From the previous list, extra-curricular activities are arguably one of the most amenable to intervention given that they are under the student's sole control. In fact, university students spontaneously engaged in a variety of extra-curricular activities for wellbeing during the beginning of the pandemic (Finnerty et al., 2021). The results of a survey of 786 university students in Australia showed their most common activities during lockdown: listening to music (92 % of the 786 participants), socializing with other via phone or social media (89 %) and watching movies with others in their household (65 %). Students also rated how much the activities contributed to their wellbeing. They indicated that outdoor exercise, socializing, and listening to music, in descending order, were the most useful (Finnerty et al., 2021). Consistent with previous research (Fiore, 2018; Krause et al., 2021), university students consistently rated music listening as one of the most popular and most useful activities for wellbeing.

Krause and collaborators (2021) assessed university students' use of media and its relationship to life satisfaction during the early stages of the pandemic. Researchers compared pre- and during-pandemic experiences and found that students' life satisfaction was positively related to music listening and negatively related to watching TV/videos/movies, when their media use increased. In other words, when students spent more time listening to music, an increase in life satisfaction was apparent. When students spent more time watching TV/videos/movies, their life satisfaction seemed to decrease. The authors theorized that level of control over what was heard and the level of engagement with music made this activity a proactive coping strategy and was linked to more positive outcomes (Krause et al., 2021).

The use of music for emotional regulation and stress management among adults seemed to have been a transcultural phenomenon during the pandemic (Cabedo-Mas et al., 2021; Finnerty et al., 2021; Ribeiro et al., 2021; Vidas et al., 2021; Ziv & Hollander-Shabtai, 2021). In a Brazilian descriptive study, 494 adult participants increased their daily music listening, and they used music to manage negative mood, to improve cognitive functioning, to improve positive mood, and for physical engagement (Ribeiro et al., 2021). Interestingly, participants with severe depression used music for negative mood management more than non-depressed participants, which highlights the function of music as a coping strategy (Ribeiro et al., 2021). In Israel, almost half of the participants surveyed ($N = 200$) believed that their music listening increased in frequency and amount and was more often used as an emotion regulation strategy during the pandemic compared to previous months. In other words, they believed that they used music more often to improve their mood, to increase energy levels, and to relax, which allowed them to deal with the negative effects of the crisis (Ziv & Hollander-Shabtai, 2021). Similar responses were obtained by 1868 Spanish citizens who reported using music (i.e., listening, playing a musical instrument, singing or dancing) to cope with lockdown. Specifically, they used music to relax, to escape [negative feelings], to improve their mood, or to avoid feelings of isolation (Cabedo-Mas et al., 2021).

Music interventions to address stress-related outcomes are well-documented. de Witte and collaborators (2020) summarized the growing evidence of music interventions to address stress through a systematic review and two meta-analyses of 104 RCTs, with 9617 participants. Stress reduction was observed in both physiological (d

$=0.380$) and psychological ($d =0.545$) outcomes. Specific physiological effects of music included reductions on heart rate, blood pressure and stress-related hormones. Specific psychological outcomes included reductions in state anxiety, nervousness, restlessness, and feelings of worry. Pleasurable or comforting traits of music (e.g., preferred or self-selected piece, preferred lyrics) as well as distraction from stressful events seem to explain the stress reduction effect. Interestingly, most music interventions in this review were short-term and applied in a variety of settings (e.g., medical settings, daily life, mental health, surgical procedures). In fact, moderation analysis indicated that only one session was needed for stress reduction, and that the positive effect of music through arousal regulation was independent of the setting (de Witte et al., 2020).

Consistent with previous reviews (e.g., Nilsson, 2008), tempo was the clearest moderator of the stress-reduction effect, with a moderate tempo (i.e., 60–80 bpm) showing larger effect sizes (de Witte et al., 2020). Although in de Witte et al.'s review specific music characteristics (other than tempo) did not moderate the effects of the music interventions, the authors warned that some studies did not explicitly report musical characteristics or their effect sizes, and thus moderation analyses lacked statistical power. de Witte and collaborators recommended that future research describe all aspects of the music intervention, and that moderators, such as music delivery (recorded vs. live), musical characteristics (e.g., timbre, melody, harmony), and frequency be tested.

Recent research has in fact attempted to find the most effective music elements to address mental health needs in the college population. Specifically, Fiore (2018) developed a receptive music experience to address music therapy students' stress and anxiety, with careful consideration of the musical elements. The author's musical piece was based on the Therapeutic Function of Music framework (TFM; Hansson-Abromeit, 2015), where an exhaustive literature review of each musical element indicated how each element should be designed for stress and anxiety management. The results of her pilot study indicated that participants had a significant decrease in stress and anxiety levels, as measured by the STAI (Spielberger, 1983). Personal vulnerability (i.e., person's ability to cope with stressors), as measured by the Stress Overload Scale - Revised (SOS-R; Amirkhan, 2015), also showed significant improvement after the intervention. The second subscale of the SOS-R, the Event Load (i.e., the extent of a person's responsibilities), showed an overall decrease, but the difference was not statistically significant. Regarding perception of musical elements, participants indicated that *melody* was the most effective to reduce stress and anxiety, whereas *instrumentation* was the least useful (Fiore, 2018).

Given the need to investigate effective, yet brief, interventions for stress and anxiety management for college students in unprecedented times, we opted to replicate Fiore's study with the understanding that we were dealing with circumstances that may imply greater duress than the original study. In that regard, we considered this study a conceptual replication. A conceptual replication is a study that tests "the same theory with variable experimental designs," (Kunert, 2016, p. 1632). In contrast, a direct replication is a study that "attempts to recreate an experimental design as closely as possible." (Kunert, 2016, p. 1632). Different from Fiore (2018), we hypothesized that stress overload due to the pandemic would have greater impact on participants' pre-intervention anxiety levels. Therefore, we considered that stress overload, measured through the Stress Overload Scale-Revised (SOS-R; Amirkhan et al., 2015), should be considered a predictor (and not an outcome measure), along with Trait anxiety levels, as measured by the Trait version of the State Trait Anxiety Inventory (T-STAI; Spielberger, 1983). Our research questions included:

1. Can a 5-min music piece, specifically created to address anxiety and stress management, reduce performing arts college students' state anxiety under circumstances conducive to extended stress overload?

2. Are pretest anxiety, trait anxiety, stress overload during the previous week, or other demographic characteristics, predictors of state anxiety after the music experience?
3. How do college students' state anxiety levels during the third semester of the COVID-19 pandemic compare to previously investigated samples of males with neuropsychiatric disorders and normative data for female college students (Spielberger, 1983)?

We intended to compare our data with normative data for female college students as these are frequently higher than data for males, and may more accurately represent students' experience during the pandemic. The comparison with neuropsychiatric populations was meant to investigate the degree of anxiety, which seemed to reach clinical levels, that we observed and was reported in college students during this period.

Method

Study design

This study was a conceptual replication of Fiore (2018) but with important differences in utilization of measures and aims. Similar to Fiore (2018), this study had a one group, pretest-posttest design, with a self-selected sample of students. From Fiore (2018), we preserved the State version of the STAI (Spielberger, 1983) as the outcome measure (pretest-posttest), but we conceptualized the SOS-R as a predictor of the intervention effect and added the Trait version of the STAI, age, and gender, as other predictors.

Participants

Different from Fiore (2018), who only invited music therapy majors, we invited all students in a School of Music, Dance and Theater. A staff member sent schoolwide emails to all undergraduate and graduate students enrolled in at least one class. The recruitment email included a link to the online survey platform where the questionnaires and music stimuli could be accessed. Reminder emails were sent on days 5, 9, and 13 after initial email. The survey was open from April 16th to April 30th, 2021, which corresponded to the last week of the semester and the week of final exams in this university. It also corresponded with the last week of a school year where most classes were provided completely online at this university. At this point, the pandemic had lasted more than a year.

Measures

Demographic survey

Using Fiore (2018) demographic survey, participants responded to an online survey that included questions about (a) their age, (b) year in school, (c) current level of practicum/student teaching (if applicable), (d) use of anti-anxiety meds (type and frequency), (e) hours worked outside of school, number of times healthcare was accessed in the last month, and (f) activities for wellbeing.

Outcome measure

S-STAI. The State version of the State Trait Anxiety Inventory (STAI Form Y-1; Spielberger, 1983) is a 20-item scale that assesses anxiety as a transitory emotional state of tension, apprehension, and worry, with associated arousal of the autonomous nervous system (Spielberger, 1983). The S-STAI measures a person's emotional state in a given moment (e.g., *I feel upset*) and has a 4-point Likert-type scale with anchors from *not at all* to *very much so*. Items 1, 3, 8, and 10 are reverse-coded. Higher scores indicate more anxiety. The S-STAI has shown 1-hour test-retest reliability of $r = 0.33$ in males and $r = 0.16$ in females, with alpha coefficients (KR-20 formula, Cronbach, 1951) above .90. This measure has been used profusely and normative data are available for military personnel, working adults, high school and college

students, and psychiatric patients. In the current study, this scale was provided before and after the music experience.

Potential moderators

T-STAI. The Trait version of the State Trait Anxiety Inventory (T-STAI Form Y-2) assesses enduring and relatively stable differences in the tendency to "perceive stressful situation as dangerous or threatening" which creates anxiety states (Spielberger, 1983, p. 7). Trait anxiety also refers to the frequency and intensity in which such states have manifested and the probability of experiencing them in the future. According to Spielberger (1983), such dispositions or tendencies are acquired in childhood and persist throughout the individual's life. The T-STAI is a 20-item scale that assess how people *generally* feel with items such as "I feel nervous and restless," and anchors from 1 (*almost never*) to 4 (*almost always*). Higher scores represent higher trait anxiety. The T-STAI showed a 1-hour test-retest reliability of .84 in males and .76 in females. Institute for Personality & Anxiety Testing (IPAT) *Anxiety Scale* (Cattell & Scheier, 1963), the Taylor *Manifest Anxiety Scale* (TMAS; Taylor, 1953) and the *Affect Adjective Checklist* (AACL; Zuckerman, 1960) ranged from .51 to .79 for males and from .52 to .85 for females.

SOS-R. The Stress Overload Scale-Revised (SOS-R) assesses stress overload, defined as "a state where life demands overwhelm one's resources to meet those demands" in the previous week (Amirkhan et al., 2015, p. 987). The version used in this study has 10 Likert-type questions assessing perceived demands in everyday life (i.e., Event Load items) and perceived inability to deal with those demands (i.e., Personal Vulnerability). The 5-point Likert-type scale has anchors between *not at all* and *a lot*. The final score is the sum of both subscales and provides a continuous score (i.e., an *interval* instead of a *categorical* variable). By combining Event Load (EL) and Personal Vulnerability (PV) scores, a diagnostic grid with 4 categorical risk scores can be determined: low EL + low PV = low stress (lowest risk); high EL + low PV = challenged (low risk); low EL + high PV = fragile (low risk); and high EL + high PV = high stress (high risk). The scale has shown excellent sensitivity of 96.15% (95% Confidence Interval [89.15; 99.16]) and specificity of 100% (95% Confidence Interval [95.94, 100]). Both the PV and EL subscales appeared to be strong predictors of health scores (i.e., illness, sick days, missed days and self-health ratings), with all correlations above .80, $p < .001$ (Amirkhan et al., 2015).

Music experience

The music was intended as a receptive experience and was developed by Fiore (2018) and graciously shared with the current author. The original music piece was composed based on a Therapeutic Function of Music analysis (TFM; Hanson-Abromeit, 2015) for stress and anxiety management. After posing a therapeutic goal, examining relevant literature on musical elements conducive to address the goal, and consolidating the musical element descriptions, Fiore (2018) chose the following compositional features: (1) tempo starting at 72 bpm and decreasing 1 bpm at transitional points, ending at 68 bpm; (2) instrumentation of piano, alto flute, and guitar; (3) repetitive four-measure phrases, gradually expanding to 8-measure phrases; (4) ABA form in C major (A and A' section), and A minor (B section). The melody had mainly a stepwise motion, with occasional small intervals, and chord progressions were mainly in root position, with occasional inversions. Instrumentation complexity and rhythmic structure were decreased throughout the experience. The music was recorded and delivered via the Qualtrics™ online survey platform. Further details can be found in the original study (Fiore, 2018). A recording can be found here: <https://soundcloud.com/user604701773/music-for-trio>.

Procedures

The study received approval from the university Institutional Review Board (#00013757) prior to participant enrollment. Participants

received the recruitment email that contained the link to the online platform. If willing to participate, participants clicked on the link and accessed the informed consent form on the online platform. If they agreed to participate by selecting the statement “I agree”, they were directed to the rest of the survey that included the demographic questionnaire, T-STAI, SOS-R, and S-STAI-pretest. After completing these questionnaires, the online survey asked participants to get in a comfortable position, in a quiet setting, and presented the music experience. After the music was played, participants completed the posttest S-STAI. The full procedure lasted about 20 min.

Data analysis

We analyzed changes in participants’ state anxiety levels under circumstances conducive to extended stress overload with paired-sample *t* tests of participants’ S-STAI pre- and posttest scores. We analyzed potential predictors of state anxiety after the intervention (i.e., posttest S-STAI scores) using a stepwise multiple regression model with the posttest S-STAI as the dependent variable and stress overload during the previous week (SOS-R), pretest anxiety (pretest S-STAI), trait anxiety (T-STAI), age, and gender as predictors.

To understand how the levels of state anxiety in college students during the third semester of the COVID-19 pandemic compared to previously investigated samples of males with neuropsychiatric disorders and normative data for female college students (Spielberger, 1983), we used independent-sample *t* tests to compare Spielberger’s data (1983) with our participants’ pretest and posttest scores of the S-STAI.

Results

Only 36 students out of 1132 (3.18%) who received the invitation participated, indicating a low response rate. Participants included students from several majors (e.g., music education, music therapy, dance, theater); specific information about their major was not requested to avoid identification, given that some programs are small. However, some students shared this information voluntarily. Students from disciplines other than music therapy were not personally acquainted with the researcher. Participants self-identified as female (*n* = 24, 66.7%), male (*n* = 7, 19.4%), queer male (*n* = 1, 2.8%), non-binary (*n* = 2, 5.6%), or gave no response (*n* = 2, 5.6%). Participants were freshman¹ (*n* = 2, 5.6%), sophomore (*n* = 5, 13.9%), junior (*n* = 8, 22.2%), senior (*n* = 13, 36.1%), master (*n* = 4, 11.1%), doctoral students (*n* = 4, 11.1%), or provided no response (*n* = 1, 2.8%). Information regarding participants’ use of anti-anxiety medication, number of healthcare visits in the past month, number of class/work hours missed, and outside activities are reported in Table 1.

For our first research question, results of the paired-sample *t* test indicated a significant difference in scores on the S-STAI ($t(35) = 4.32, p < 0.001, 95\% \text{ CI}(3.181, 8.819)$) after intervention, with a higher mean score in the pretest ($M = 42.28, SD = 12.153$) than the posttest ($M = 39.28, SD = 10.801$) (see Fig. 1). Shapiro-Wilk tests and Q-Q plots and examination of extreme values indicated normal samples with no outliers.

Results for our second research question indicate a significant multiple regression model ($F = 23.84, p < .001$). P-P plot, VIF and scatterplot analysis indicated that normality, multicollinearity and homoscedasticity assumptions were met. Pretest anxiety explained

¹ These labels are based on US university programs and are reported as shared by students. Freshman is typically a first-year university student; sophomore, a second-year student; junior, a third-year student; and senior, a fourth-year student. However, these labels correspond more closely to progress in a program and not specific year in it. A student may be a senior, based on years in the program, but take junior classes, and thus consider themselves a junior

Table 1

Demographic information (participants’ use of anti-anxiety medication, number of healthcare visits in the past month, number of class/work hours missed, and activities for wellbeing).

Research Identification Number	Use of anti-anxiety medication	Number of healthcare visits in the last month (any reason)	Number of class/work hours missed	Activities for wellbeing
1	N/A	0	0	biking, walking
2	N/A	0	0	dance
3	Medical marijuana	2	0	walking, hiking, gym, piano, research, cross-stitching
4	Sertraline	0	2	n/a
5	none	2	0	women’s music fraternity
6	None	0	0	theater, hiking, reading, movies, writing
7	no	1	0	walking, yoga.
8	No	4	0	music, running, soccer, going to museums, hiking, reading, looking at trees, language learning
9	n/a	2	1	Korean television
10	None	1	16	walking, journal, writing and drawing
11	Clonazepam and Zoloft	6	~40	fraternity, dance, journaling/ blogging
12	Relax Now	0	4	dance, running, skating
13	N/A	2	3	snowboarding
14	N/A	0	0	n/a
15	N/A	1	1	badminton and walking late at night
16	NA	1	0	crafts, baking, running, reading, community band
17	n/a	12	7	art
18	Prozac	1	2	volunteering, vocal lessons
19	Prestiq	1	0	gardening, parenting
20	None	0	10	leader of a student advocacy club, participating in musicals
21	N/A	0	0	outdoor walking
22	N/A	N/A	10	n/a
23	N/A	N/A	N/A	drumming, exercising
24	N/A	N/A	2	reading, video games, hiking
25	N/A	0	5	clubs
26	NA	2	16	music performance
27	N/A	0	5	church jobs, festival committees, music student organization leadership, private

(continued on next page)

Table 1 (continued)

Research Identification Number	Use of anti-anxiety medication	Number of healthcare visits in the last month (any reason)	Number of class/work hours missed	Activities for wellbeing
28	N/A	3	1	teaching, cooking
29	no	0	0	dance
30	N/A	0	16	running, tennis and batting cages
31	N/A	0	0	occasionally hiking, racquetball, singing, jamming
32	N/A	2	4	walking, gardening, swimming
33	Lexapro	0	0	photography, journaling
34	N/A	2	0	writing
35	N/A	3	0	hiking

53.7% of the variance (adjusted R squared = 0.537, $p = <0.001$). Age explained an additional 7% of the variance (R square change = 0.07, $p = .028$). Stress overload, trait anxiety, and gender were excluded from the model as none of these additions was significant.

Results to our third research question indicated no significant difference ($t(35) = -1.85, p = .073, 95\% \text{ CI}(-7.85, 0.37)$) between scores from the male neuropsychiatric population ($M = 47.74, SD = 13.24$) and the pretest S-STAI scores in our sample ($M = 45.28, SD = 12.153$). However, we found a significant difference ($t(35) = -5.41, p < .001, 95\% \text{ CI}(-13.4, -6.09)$) between the posttest S-STAI scores from our sample ($M = 39.28, SD = 10.801$) and the male neuropsychiatric population. Contrastingly, pretest S-STAI scores in our sample ($M = 45.28, SD = 12.153$) were significantly higher ($t(35) = 3.22, p = .003, 95\% \text{ CI}(2.41, 10.63)$) than female college students' scores ($M = 38.76; SD = 11.95$). Our participants' posttest S-STAI scores ($M = 39.28, SD = 10.801$) were not significantly different ($t(35) = 0.288, p = .775, 95\% \text{ CI}(-3.14, 4.17)$) to female college students' scores. In other words, at

pretest, our sample showed similar anxiety levels than male neuropsychiatric populations and significantly higher levels than female college students; however, at posttest, our sample showed significantly lower anxiety levels than neuropsychiatric populations and similar levels than female college students.

Discussion

The purpose of this study was to investigate the effect of a brief music experience on performing arts college students' anxiety levels during the COVID-19 pandemic. It is important to note that for performing arts students, the effects of the pandemic may have been more salient than for other college students, given that almost all performing arts venues, including school ensembles, were canceled during this period. Not only was their college experience limited, but their future seemed uncertain given the economic effects on concert halls and other arts spaces. We considered that addressing this need was imperative, and that a replication of a previous study (Fiore, 2018) may allow us to understand the effect of a brief music experience under extreme duress as opposed to "typical" circumstances. Thus, we theorized our study as a conceptual replication of Fiore (2018).

Our results indicate that a brief (5-min) online music experience was sufficient to significantly decrease anxiety levels. Most notably, students were experiencing similar anxiety before the intervention as neuropsychiatric populations, but after the intervention they showed similar levels to those of female college students. The pre-intervention high levels of anxiety are consistent with previous literature that revealed the effect of the COVID-19 pandemic on college students' mental health (Kim et al., 2022; Lee, Jeong, & Kim, 2021; Wang et al., 2020). Post-intervention scores are consistent with previous literature that shows an immediate and beneficial effect of music experiences on college students and other adults (Cabedo-Mas et al., 2021; de Witte et al., 2020; Finnerty et al., 2021; Fiore, 2018; Krause et al., 2021; Ribeiro et al., 2021; Vidas et al., 2021; Ziv & Hollander-Shabtai, 2021). In this case, the positive results provide more evidence that the purposeful selection of musical elements is needed to make a very brief intervention effective (Fiore, 2018).

Contrary to our hypothesis, trait anxiety, stress overload, and gender were not significant predictors of state anxiety post-intervention. On the

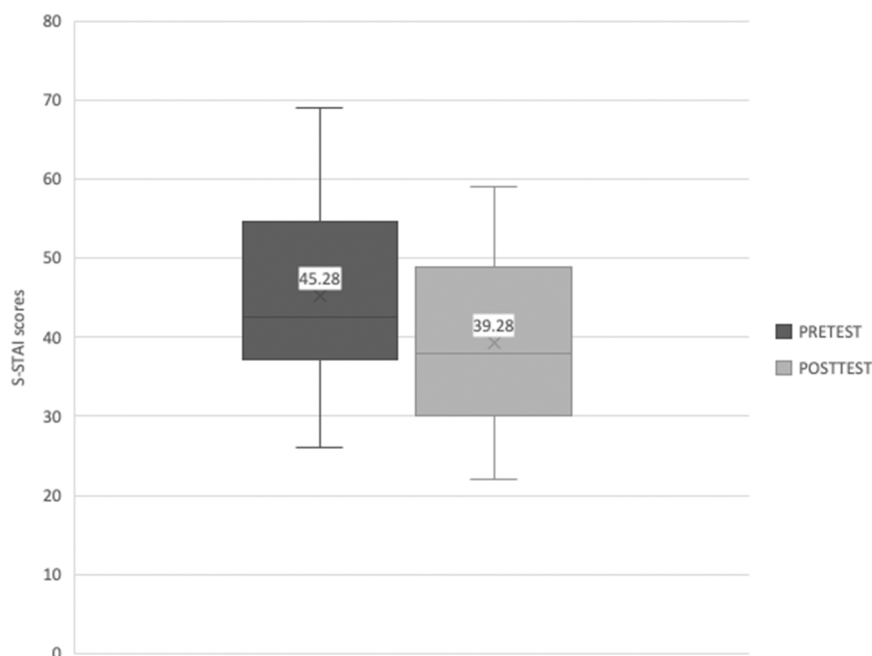


Fig. 1. Mean state anxiety of college students before and after the music experience.

other hand, pretest state anxiety did explain 54% of the variance in posttest state anxiety, and age also explained a significant amount (7%). In other words, the students' emotional state immediately before they approached the music experience (and to a certain extent, their age) was more impactful than the amount of stress the previous week and other variables on the music's ability to decrease their anxiety. This finding is consistent with previous literature (Hernandez-Ruiz et al., 2020) where participants who had the ability to relax during baseline had a better response to a music intervention for relaxation than those who did not relax or grew more anxious during baseline. This finding indicates that pre-existing emotion regulation skills may mediate the effect of music interventions for stress and anxiety reduction. Further research should consider and measure these skills.

Limitations

The most important limitation of this study is the low response rate (3.2%) which curtails the external validity of our study. Arguably, the students who volunteered to respond were highly aware of their mental health, and thus motivated to act; they could also have been more stressed than the average student and were seeking support; or they could have been less stressed and had time to spare to complete the survey. On the other hand, the results are consistent with other literature, regarding the high levels of anxiety, the positive results, and the explanatory variables, which lends support to our findings.

Other limitations include the fact that, as an online survey, we did not have control over the music experience nor over the integrity of the responses. Although we used software constraints to avoid students from cutting off the music experience, being in their own space, students had the ability to not listen to all the recording, skip ahead, or not listen at all. However, we consider that our results are valid since we did not detect any anomalous response patterns, and students received no incentive to participate. The students were motivated by their own interest in the topic, which gives credence to their responses.

Coping skills are essential for meaningful changes in anxiety levels and to limit its effects on everyday life and health (Lazarus & Folkman, 1984; Obbarius et al., 2021). Arguably, using a brief and effective strategy to ameliorate short-term anxiety is an effective coping strategy, made available to students through an online platform. However, the long-term effects of this music intervention cannot be gleaned through this study. Future studies with a longer intervention period are needed. Further, as a quasi-experimental study with no control group, we cannot assert a cause-effect relationship between the music experience and the results. Future research should compare the music experience to equivalent interventions or no intervention to specifically identify the therapeutic effect of music.

Conclusions

The COVID-19 pandemic created stress within all group ages, but emerging adults were especially vulnerable given the instability of their own developmental stage, coupled with extreme impact on their immediate activities and social relations, and the uncertainty of their future careers. Performing arts students in our study experienced an enormous amount of stress and anxiety, similar to clinical levels, during this period. This conceptual replication of Fiore (2018) indicates that the music experience helped students regulate their anxiety to normative levels (i.e., female college students) even during times of extreme duress. This result seemed possible because the music was specifically created with theoretical understanding of the elements that would make it relaxing (Fiore, 2018). Further research on the mediation effect of pre-existing emotion regulation skills on music interventions for relaxation/stress reduction is warranted (Hernandez-Ruiz et al., 2020). Art educators in tertiary education, who support emerging adults that may be experiencing high levels of anxiety and stress with limited resources, are encouraged to consider the effect of short music experiences as an

effective coping strategy. Importantly, attention to the evidence base of the most effective musical elements should be applied.

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Conflict of interest

None declared.

Data availability

Data will be made available on request.

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