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The Influence of Music on the Performance of Graduate Occupational Therapy Students during Practical Examinations

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Abstract

Test anxiety is alarmingly rising and has been shown to correlate with academic performance and affect occupations and well-being. Graduate occupational therapy (OT) students encounter a rigorous workload and pressure to become entry-level practitioners. Higher levels of baseline graduate student anxiety is correlated with increased test anxiety. Practical examinations are essential for assessing graduate OT students' higher learning and entry-level clinical skills. Educators are often challenged with identifying coping strategies to assist graduate OT students in reducing their test anxiety. Substantial research supports the use of music to reduce anxiety in adults. Seventy-five OT graduate students participated in this quasi-experimental study which explored the influence of background music on test anxiety during a lab practical examination. Participants completed pre- and post-outcome measures using the State-Trait Anxiety Inventory for Adults and the Test Anxiety Inventory and had their blood pressure and heart rate recorded. Results showed a significant main effect in the experimental group with music decreasing systolic blood pressure in participants with high state anxiety. Music had no significant interaction with mean arterial pressure, systolic blood pressure, diastolic blood pressure, heart rate, state anxiety, trait anxiety, test anxiety, or practical scores when comparing the experimental groups. Most participants indicated that background music assisted in decreasing anxiety experienced during practicals, and experimental group participants self-reported that background music was effective. Music intervention may be useful during practicals by reducing test anxiety. Additional studies would assist in further examining the efficacy of test anxiety reduction interventions with graduate OT students.

Keywords

Graduate student anxiety, music, allied health education, academic performance, test anxiety

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ABSTRACT

Test anxiety is alarmingly rising and has been shown to correlate with academic performance and affect occupations and well-being. Graduate occupational therapy (OT) students encounter a rigorous workload and pressure to become entry-level practitioners. Higher levels of baseline graduate student anxiety is correlated with increased test anxiety. Practical examinations are essential for assessing graduate OT students' higher learning and entry-level clinical skills. Educators are often challenged with identifying coping strategies to assist graduate OT students in reducing their test anxiety. Substantial research supports the use of music to reduce anxiety in adults. Seventy-five OT graduate students participated in this quasi-experimental study which explored the influence of background music on test anxiety during a lab practical examination. Participants completed pre- and post-outcome measures using the State-Trait Anxiety Inventory for Adults and the Test Anxiety Inventory and had their blood pressure and heart rate recorded. Results showed a significant main effect in the experimental group with music decreasing systolic blood pressure in participants with high state anxiety. Music had no significant interaction with mean arterial pressure, systolic blood pressure, diastolic blood pressure, heart rate, state anxiety, trait anxiety, test anxiety, or practical scores when comparing the experimental groups. Most participants indicated that background music assisted in decreasing anxiety experienced during practicals, and experimental group participants self-reported that background music was effective. Music intervention may be useful during practicals by reducing test anxiety. Additional studies would assist in further examining the efficacy of test anxiety reduction interventions with graduate OT students.

Introduction

The curricular requirements in occupational therapy (OT) programs are challenging and can be demanding for students (DaLomba et al., 2021). Students in healthcare professions must acquire vast amounts of knowledge while at the same time dealing with sleep deprivation, academic performance burden, and a disrupted work-life balance (Galal et al., 2021). There is a delicate balance between the descriptions of stress and anxiety in the literature, as both elicit similar physiological responses and can affect mental health. Mild symptoms respond well to coping mechanisms like music (American Psychological Association [APA], 2018a; 2018b). According to the APA, stress is defined as a "physiological or psychological response", whereas anxiety is "an emotion characterized by apprehension and somatic symptoms of tension in which an individual anticipates impending danger, catastrophe or misfortune" (APA, 2018a, para. 1; 2018b, para. 1). Stress, anxiety, and depression among graduate students are increasing and negatively impact mental health (Chi et al., 2023; Garcia-Williams et al., 2014). Anxiety from academic performance is the leading cause of mental health issues among college students (Barbayannis et al., 2022). In their systematic review and meta-analysis, Chi et al. (2023) indicated that graduate students have substantially higher levels of anxiety in contrast to undergraduate students, with a comparable prevalence in Masters and Doctoral students.

This study's focus is on test anxiety, which is a subcategory of the term "anxiety." Test anxiety inevitably affects various physiologic responses, such as increased heart rate (HR), blood pressure, and respiratory rate (APA, 2021; Gallego-Gómez et al., 2020). Test anxiety in students enrolled in healthcare professional programs can vary from low to severe, producing nausea, restlessness, fear of failing, and difficulty recalling information (Pincha et al., 2021; Wadi et al., 2022). The anxiety experienced during a test produces a complexity of biological and psychological responses directly associated with the students' burden of failure (Galal et al., 2021; Zeidner, 1998). Test anxiety can lead to persistent stress, which negatively affects academic performance (Wadi et al., 2022). Academic anxiety during testing is unavoidable and assists in preparing OT students for clinical fieldwork rotations by simulating their future entry-level jobs as practitioners. The academic preparation supports efficient work performance, which includes clinical in-the-moment problem-solving, behavior management, professional reasoning, emergency management, and effective communication with clients and their caregivers.

Literature Review

Anxiety is a standard response to worry or the anticipation of future events (APA, 2024). An individual's typical anxiety response is differentiated into a state or trait, which is either situational or personality anxiety (Saviola et al., 2020). Subjective feelings of anxiety in moments of various intensity or situational anxiety with emotional reactions, like worry and nervousness, are known as state anxiety (Spielberger, 1983). Test anxiety is a form of state anxiety and is high among graduate students in healthcare professional education, like OT, nursing, and physical therapy (Ergene, 2003; Ferreira et al., 2020; Pfeifer et al., 2008; Quinn & Peters, 2017). Pincha et al. (2021) showed a statistically significant correlation between high levels of test anxiety on OT students'

academic performance during assessments. In their study, fifty-one percent (*n* = 83) of OT students scored a high degree of anxiety on the Test Anxiety Scale Questionnaire, and participants reported stomach butterflies, nausea, negative emotions, and exam restlessness. Although anxiety can motivate OT students, test anxiety can also adversely impact academic preparation and performance (Pincha et al., 2021).

Trait Anxiety

Trait anxiety fluctuates among individuals during stressful situations. More substantial trait anxiety directly correlates with higher state anxiety (Spielberger, l983). An individual with elevated trait anxiety responds to stressful situations by focusing on threatening information and has difficulty adapting to the condition (Knowles & Olatunji, 2020). Overthinking, negative ruminating thoughts, avoidance, anxiety, and depression disorders are directly linked to trait anxiety (Knowles & Olatunji, 2020). A meta-analysis by Knowles and Olatunji (2020) concluded that individuals with high trait anxiety present with differences in specific areas of the brain, such as cortical thinning and diminished gyrification. High trait anxiety impacts the organization and function in the cortical areas, which hinders an individual's ability to control their response to an anxiety-provoking situation. Evidence supports using pharmacology and cognitive behavioral therapy for high-trait anxiety; however, the use of music is unclear (Knowles & Olatunji, 2020).

Transitioning to Graduate School

The transition to graduate school increases the anxiety of OT students in their first year, which continues throughout their educational program (Kumar & Jejurkar, 2005; Pfeifer et al., 2008). The Accreditation Council for Occupational Therapy Education (ACOTE) develops the graduate OT program curriculum standards, which shape the curriculum and course content by providing a conceptual framework with learning objectives to maintain each standard (ACOTE, 2018). Course content and practical examinations assist graduate OT students in skill acquisition, professional behaviors, and developing a therapeutic use of self. Demonstrating competency by passing a practical exam with a score of 80% or above in an accredited OT program is critical to preparing for the licensure exam through the National Board for Certification in Occupational Therapy (NBCOT). Occupational therapists (OTs) must pass the NBCOT exam and be licensed to deliver services. Higher education faculty acknowledge graduate OT students' immense pressure during tests and practical assessments, and they aspire to identify student-centered coping strategies for test anxiety reduction, such as effective study habits and mindfulness through academic advising and individual counseling (Dean et al., 2017; Everly et al., 1994). Occupational therapy students identify examinations as one of the leading causes of anxiety, along with the amount of studying and coursework (Kumar & Jejurkar, 2005). Robins et al. (2018) found that academic anxiety affects the well-being of healthcare professional students like OT. Academic anxiety leads to burnout and exhaustion before graduate OT students enter entry-level practice, known as academic burnout (Morales-Rodriguez et al., 2019; Robins et al., 2018). The risk of pre-occupation academic burnout is a growing problem for OT students in graduate school (Robins et al., 2018). Lewis-Kipkulei et al. (2021) provided insight into the prevalence of academic anxiety among OT students and the marginal effort to identify

specific coping strategies, like relaxation and listening to music, sleeping, studying more, using humor, watching movies, and talking to peers to cope with the academic demands (Everly et al., 1994; Haughey et al., 2017; Soja et al., 2016).

The Influence of Music on Anxiety

Although music's specific neurochemical and biological effects on the human body are not well-known, research supports that listening to music stimulates the neural connections in our brains (Trimble & Hesdorffer, 2017). Music is therapeutic and can influence physiological and emotional reactions to stress, such as state anxiety (Chanda & Levitin, 2013; de Witte et al., 2020; Trimble & Hesdorffer, 2017). Music has been used for decades to reduce state anxiety, and music tempos vary and can correlate with responses to anxiety of the sympathetic nervous system, such as changes in HR and blood pressure (Bradt et al., 2013; Kulinski et al., 2022). Fernández-Sotos et al. (2016) described music tempo as 168-200 beats per minute (bmp) as very fast, 128-168 bmp fast, 108-120 bmp moderate, 76-108 bmp moderately slow, 66-76 bmp slow, 60-66 bmp at ease and rather slow, and 40-60 bmp as the slowest tempo. Uplifting or fast-tempo music affects the release of dopamine, a vasostimulant, which can elevate HR and blood pressure (Darki et al., 2022; Sonne et al., 2023). In this study, slow music was used, and a slow tempo of 60-80 bpm is correlated with lowering stress responses and HR, and lyrics can also have a calming or relaxing effect (de Witte et al., 2020; Koelsch et al., 2011).

Relaxing music prevented subjective anxiety and increased sympathetic nervous system responses such as systolic blood pressure (SBP) and HR in undergraduate students during oral presentations (Knight & Rickard, 2001). A systematic review (El Boghdady & Ewalds-Kvist, 2020) demonstrated that classical, low-volume music positively impacted surgeons' precision and task performance in an operating room. Bradt et al. (2013) demonstrated that music decreased patient anxiety pre-operatively. Galal et al. (2021) investigated the impact of music in preparation for an exam, which reduced test anxiety in pharmacy students. A randomized control trial by Gallego-Gómez et al. (2020) found that music combined with progressive muscle relaxation before exams lowered stress and positively impacted academic performance in nursing students.

Literature explores using music to reduce college student test anxiety, such as in pharmacy, engineering, and nursing (Brodersen, 2017; Claudio & Bakke, 2023; Galal et al., 2021; Goldenberg et al., 2013; Keptner et al., 2020) found the statistical significance of using four interventions: progressive muscle relaxation, a weighted object, controlled breathing, and an adapted reflex, which used a cold pack and breath holding for test anxiety with OT students before taking quizzes. Anyanwu (2015) discovered a significant correlation between the self-reported joy music provides and the positive impact of learning gross anatomy with medical and dental students. There is little in the existing literature describing the use of specific coping strategies for test anxiety in graduate OT students. What is not yet clear is the influence of music on test anxiety for graduate OT students during examinations like practicals. In this study, researchers addressed this need by controlling for an educational environment with graduate OT

students and investigating the effect of music on test anxiety. This study hypothesized that listening to background music during practical examinations reduces anxiety and positively impacts the academic performance of first and second-year graduate OT students.

Methods

Participants

Through convenience sampling, in December 2021, June 2023, and November 2023, the research team recruited 104 OT graduate students to participate at the beginning of their scheduled lab times three weeks before the practical examination. At the end of the lab, seventy-eight students signed consent forms to participate. They were enrolled in the quasi-experimental study conducted at a private college in upstate New York, with approval from the Institutional Review Board (1009-2021-2022). Inclusion criteria were male and female first- and second-year graduate OT students, ages 22-38, who were enrolled in the Functional Anatomy and Kinesiology or Physical Agent Modalities courses.

Materials

State and trait anxiety was measured using the State-Trait Anxiety Inventory for Adults (STAI-AD) and the Test Anxiety Inventory (TAI) by Charles D. Spielberger. Both instruments were previously validated with high school, college, and navy recruits (Spielberger, 1980, 1983). The STAI-AD is cited in the literature over 30,000 times and is the primary assessment used most often for students susceptible to anxiety (Knowles & Olatunji, 2020; Mind Garden Transform System, 2023). The STAI-AD, a self-report questionnaire, uses a Likert scale and measures state and trait anxiety with 40 questions and a maximum score of 80 (Spielberger, l983). The STAI-State and the STAI-Trait have excellent reliability for college men and women with an alpha coefficient of .93 and .910 and internal consistency with a Cronbach's alpha of 0.90 (Franzoi et al., 2020). Higher correlations (.73-.86) were seen for college students with trait anxiety (T-Anxiety) compared to state anxiety (S-Anxiety;.16-.62; Spielberger, 1983). Spielberger (1983) reported that a lower coefficient is expected with S-Anxiety for a valid assessment that accurately reflects the present situation.

The TAI is one of the most frequently used self-reported measures of situational anxiety and symptom frequency throughout an exam, such as apprehension and nervousness (Chapell et al., 2005; Spielberger, 1980). The TAI contains 20 statements using a Likert scale with a maximum score of 80 points. The total score indicates an individual's emotions and worries throughout the process of taking an exam, such as preparation or studying, taking a test, and completing it (Chapell et al., 2005; Spielberger, 1980). Normative data of the TAI was established on undergraduate college students, with reliability for men being .94 and for females being .95 (Spielberger, 1980). The TAI was validated with a correlation coefficient for college undergraduate men (.82) and women (.83) with the Test Anxiety Scale (TAS; Spielberger, 1980). Normative data for the TAS was established on college students and test-retest reliability of .80 (Sarason, 1978).

Positive correlations of the TAI vary with other measures like the Worry and Emotionality Questionnaire (WEQ), Exam A-State, and STAI-AD, and the A-State. Therefore, the TAI does not distinguish trait from state anxiety (Spielberger, 1983).

Procedure

All data was collected once during three lab practicals in December 2021, June 2023, and November 2023. The Functional Anatomy practicals in December 2021 and November 2023 required participants to identify and palpate ten structures in the upper extremity. The Physical Agent Modalities Practical in June 2023 required students to complete one case-based card on electrical modalities. One week before the scheduled practicals, students signed up for 20-minute time slots with their lab partners for the exam. Each practical contained a grading rubric, and a score of 80 was required to pass. The research coordinator purchased remote online survey licenses for the Mind Garden Transform System to administer the STAI-AD and TAI on each student's laptop before and after the practicals. Participants were emailed the day before the practical with instructions about the study and information with hyperlinks for creating a new account and accessing the pre- and post-measures on the Mind Garden Transform System's website. The research coordinator selected the participants receiving the intervention based on their lab group, with three lab groups scheduled at various times on the same day. On the day of the practical, 30 minutes before the student's assigned time, one researcher collected pre- and post-outcome measures of HR, blood pressure, state, trait, and test anxiety in a separate, quiet laboratory room. Systolic blood pressure, diastolic blood pressure (DBP), and HR were recorded pre- and post-intervention on a data collection form with the digital Omron Blood Pressure Monitor model #BP5250 using an upper arm cuff while seated with the right or left arm supported both before and after the lab practical exams. Each participant completed the STAI-AD and TAI on their laptop or cell phone, and the Mind Garden Transform System collected raw and scaled scores. After completing the pre-assessments, students entered a private room for the practical.

At the start of the practical, two students randomly selected confidential assessment cards and took turns independently completing their assignments. The private room for the Functional Anatomy practicals had one pair of students and a practical instructor in one room. The Physical Agent Modalities practicals had two pairs of students and two practical instructors in one private room. A music playlist was developed by one of the researchers using Spotify, with a selection of 47 familiar songs from 1965- present, all of which were 60 bpm. The private laboratory room was quiet or had 60 bpm low music in the background, using a portable Bose SoundDock®XT speaker with an iPhone playing around 35-40 decibels (dB), which were measured with the Abavivi FY826 decibel meter. Typical noises are a conversation (60 dB), a large office (50 dB), and a library (40 dB; Center for Disease Control and Prevention, 2022; Center for Hearing and Communication, 2021). The background music played for the entire duration of their scheduled time, which was at least 20 minutes. After completing the practical, students were immediately directed back to the data collection room for post-assessment outcome measures.

Results

The participant characteristics are shown in Table 1. Of the 104 recruited, 78 graduate OT students were enrolled in the study and were identified as eight percent male (*n* = 6) and 92% female (*n* = 72). Non-randomization resulted in 38 participants in the experimental group with music in the background and 40 in the group without music. Two participants did not complete the outcome measures, one participant was absent the day of the practical, resulting in a total of 75 participants. Missing data from incomplete pre and post-tests were excluded from the analysis. The means can be seen in Table 2 for MAP, DBP, heart rate, STAI-S, STAI-T, TAI, and the practical scores.

Table 1

Study Sample Characteristics

Characteristics	*n*	%	*M*
Age in years			22
Gender			
Male	6	8	
Female	69	92	
Total	75	100	
Ethnicity			
Non-Hispanic/Latino	75	100	
OT students			
Entry-level Doctoral Program	16	22	
Master's Program	59	78	
Total	75	100	
First-year graduate	53	72	
Second-year graduate	22	28	
Total	75	100	
Pre-test State Trait Anxiety Inventory			
State Trait Anxiety Inventory-State anxiety [a]			
20-37 low	7	9	
38-44 moderate	5	7	
45-80 high	61	84	
Total	73	100	
State Trait Anxiety Inventory- Trait anxiety [b]			
20-37 low	18	25	
38-44 moderate	22	30	
45-80 high	33	45	
Total	73	100	

Note. Total participants = 75

[a] Two female participants did not complete the STAI-S and are not included in the table

[b] Two female participants did not complete the STAI-T and are not included in the table

Total scores on the STAI-S and STAI-T range from low, moderate, to high anxiety, which is 45-80 (Spielberger, 1983). For the pre-test STAI-S music and non-music groups, seven participants (9%) scored in the low anxiety range, five (7%) for the moderate anxiety range, and 61 (84%) in the high anxiety range (see Table 1). In the music and non-music groups pre-test STAI-T, 18 (25%) scored in the low anxiety, 22 (30%) for the moderate anxiety range, and 33 (45%) in the high anxiety range (see Table 1).

Table 2

Descriptive Statistics for Dependent Variables

Variable	Pre-test		Post-test		
	M	*SD*	*M*	*SD*	*MD*
Mean arterial pressure					
No Music	98.78	8.51	92.99	17.30	5.79
Music	95.53	9.96	93.25	9.99	2.28
Systolic Blood Pressure					
No Music	126.97	13.55	121.97	12.65	5.00
Music	122.08	13.73	115.97	12.59	6.11
Diastolic Blood Pressure					
No Music	84.56	8.65	83.08	9.93	1.48
Music	81.81	10.15	82.75	10.22	.94
Heart rate					
No Music	87.56	15.90	82.56	11.80	5.00
Music	89.08	13.81	85.56	12.99	3.52
State Trait Anxiety Inventory - State anxiety					
No Music	56.35	13.99	44.00	13.38	12.35
Music	57.76	8.95	45.11	11.43	12.65
State Trait Anxiety Inventory - Trait anxiety					
No Music	49.81	12.03	47.73	11.46	2.08
Music	49.25	8.36	46.96	8.16	2.29
Test Anxiety Inventory					
No Music	55.78	11.03	51.68	12.07	4.10
Music	52.94	11.36	50.99	11.75	1.95
Practical grades					
No Music			94.26	6.80	
Music			94.43	5.03	

The mean pre-test scores in Table 2 for the STAI-S of the music (*M* = 58) and no music (*M* = 56) and STAI-T of the music and no music (*M* = 49) correlate with high anxiety. A series of two-way ANOVAs compared the differences of music on SBP, DBP, HR, mean arterial pressure (MAP), STAI-S, STAI-T, TAI, and practical examination scores compared to no music (see Table 3). All tests for sphericity were non-significant ($p < .001$). All analyses were held to a .05 level of significance.

Table 3

ANOVA Summary Table

Source	*F*	*Df*	*MS*	*p*	partial η^2
Music Yes or No	1.57	1, 73	235.12	.21	.02
Testing	7.25	1, 73	292.54	0.009*	.01
Interaction	.51	1, 73	20. 48	0.48	.01
Mean arterial pressure					
Music Yes or No	3.86	1, 73	1110.67	.053*	.05
Testing	20.143	1, 73	1155.55	<.001*	.22
Interaction	.201	1, 73	11.56	.655	.00
Systolic blood pressure					
Music Yes or No	.59	1, 73	89.11	.44	.01
Testing	.072	1, 73	2.76	.79	.00
Interaction	1.44	1, 73	55.34	.23	.02
Diastolic blood pressure					
Music Yes or No	.48	1, 73	.58	.45	.01
Testing	15.01	1, 73	680.69	<.001*	.17
Interaction	.48	1, 73	20.29	0.51	.01
Heart rate					
Music Yes or No	.18	1, 69	31.62	.67	.00
Testing	40. 69	1, 69	5739.48	<.001*	.37
Interaction	.04	1, 69	5.78	.84	.00
State Trait Anxiety Inventory-State anxiety					
Music Yes or No	.11	1, 69	23.25	.74	.00
Testing	10.46	1, 69	189.12	.002*	.13
Interaction	.11	1, 69	2.07	.74	.00
State Trait Anxiety Inventory -Trait anxiety					
Music Yes or No	.29	1, 69	73.11	.59	.00
Testing	9.88	1, 69	221.20	.002*	.12
Interaction	2.30	1, 69	51.39	.13	.03
Test anxiety inventory					
Music Yes or No	.02	1, 75	.59	.90	.00
Practical					

Note. MS = Mean squares, effect size = η^2 or partial η^2. *Significance at the 0.05 level. STAI = State Trait Anxiety Inventory

Post-test mean scores (see Table 2) trended toward reducing MAP, SBP, HR, STAI-S, and TAI in both groups. A series of two-way ANOVAs compared the differences between the music and testing variables. No significant interactions were found between the music and non-music groups for MAP, SBP, HR, DBP, HR, STAI-S, STAI-T, TAI, or practical scores (see Table 2). There were significant main testing effects for the pre and post-measures for MAP (p = 0.009), SBP (p <.001), HR (p <.001), STAI-S (p <.001), STAI-T (p = .002), and the TAI (p = .002). A significant main effect was discovered in the music variable (i.e., music vs. non-music group) for SBP (p = .053). A series of two-way ANOVAs compared the differences between both experimental groups of the participants with high anxiety scores (n = 61) on the STAI-S and STAI-T (n = 34). There was no statistically significant interaction of the STAI-S scores between 45 and 80 $F(1, 59) = .99$, $p = .32$, $\eta^2 = 0.02$. Music trended toward a small effect on the students identifying with high anxiety ($\eta^2 = 0.02$) compared to all participants (see Table 3). There was a statistically significant main effect of the STAI-S for participants in the high anxiety range $F(1, 59) = 70.40$, p <.001, $\eta^2 = 0.54$. All participants' mean pre-test scores for the TAI (see Table 3) are higher than the normative data for undergraduate college students, males (M = 38.48 SD = 12.43), and females (M = 42.79, SD = 13.70) (Spielberger, 1980). Szafranski et al. (2012) suggested that the normative data for the TAI, established in 1980, may need to be updated due to changes in the academic environment. Therefore, the researchers of this study cannot draw conclusions from the mean scores of the TAI.

Table 4

Post-Study Survey Results

Questions	Respondents	Yes	No
Do you listen to music to relieve stress or anxiety?	35	88.6%	11.4%
Do you feel a quiet room during a lab practical increases stress or anxiety?	35	66%	34%
Do you feel playing music in the background could help reduce any stress or anxiety experienced during a practical?	35	88%	12%
Do you feel that the music playing in the background during the practical effectively reduced any stress or anxiety you experienced?	24	88%	12%

The day after the study, participants (*n* = 75) were emailed an anonymous, non-standardized, four-question follow-up survey using Google Forms with dichotomous and categorical data (see Table 4). Thirty-five participants completed the post-intervention follow-up survey, and item four focused on the experimental group only (*n* = 24). Students were asked which type of music they listened to for relieving stress and anxiety, which contained categorical data and students (*n* = 35) reported listening to more than one type of music for stress and anxiety reduction. OT students ranked pop music first (27%), followed by country (23%), R&B/rap (21%), Rock (11%), Acoustic (8%), Classical (6%), Christmas/Holiday (1%), Afrobeat/Spanish (1%), and Alternative (1%).

Discussion

The results of this study draw attention to the question of whether the use of background music influences test anxiety and, ultimately, academic performance in graduate OT students. Music was shown to have a significant main effect on SBP; however, there were no statistically significant differences between the two experimental groups regarding MAP, HR, SBP, DBP, STAI-S, STAI-T, and practical scores (see Table 3). The post-intervention surveys indicate that OT students' music genre preferences vary from pop and country to Afrobeat and alternative. In addition, our participants identified using music as a coping mechanism for anxiety, similar to the findings of Haughey et al. (2017) and Soja et al. (2016). Despite the lack of significance in comparing the differences between the intervention and control groups with respect to most of the outcome measures, participants (88%) in the experimental group found the intervention subjectively effective.

The research team recognizes that some OT students may have preferred quiet test environments; however, most participants in our study indicated an association between a quiet room and increased test anxiety. El Boghdady and Ewalds-Kvist (2020) found that a quiet room does not inhibit the body’s normal, elevated cardiovascular and cortisol responses to stressful situations compared to a room with soft music with surgeon’s, preoperative patients and staff in the operating room (Khalfa et al., 2003; Trappe, 2010; VanderArk & Ely, 1993). Participants in the control group who use background music while studying could be disadvantaged in a quiet examination room, as emphasized by Claudio and Bakke (2023). According to Kumar et al. (2016), medical students who use music to study performed poorly on exams when not listening to music during the exam. In contrast to Claudio and Bakke (2023), in which participants were engineering students, the researchers in this study preselected the background music without considering individual OT student selection. A small percentage of participants (12%) in this study did not find the music intervention effective, and by not accounting for their preferences, participants may not have found the music calming but rather anxiety-provoking. The work by Lilley et al. (2014), who investigated music's effect on students enrolled in an introductory psychology class before a test, found that undergraduate students prefer their own music choices. Goldenberg et al. (2013) described that music can affect mood, and a positive shift can influence test anxiety and they concluded that music preference is directly related to the effectiveness of an intervention. Therefore, allowing students to choose music during a practical may influence an intervention through motivation and autonomy, reducing test anxiety.

Interestingly, several study participants inquired about the music genres and their contribution to the selection of songs before the intervention. Through post-intervention discussions, participants in the control group asked for background music for future practicals, and participants in both groups who study regularly with music suggested creating playlists for practicals. This study revealed a more remarkable change in both groups' pre- and post-measures of SBP than in DBP, consistent with Lilley et al. (2014). The instructors administering the practicals in this study were part of the research team and were well-known to the participants, which may have led to a response bias on the STAI-AD and TAI. Like Lilley et al. (2014), who did not find significance in SBP or STAI, they indicated that the lack of significance with the STAI may also be related to their participants responding favorably. While researchers acknowledge these limitations, a further investigation where the research coordinator is different from the practical instructor would strengthen the rigor of the procedure.

Participants with higher pre-test BP elevations also demonstrated higher pre-test scores on the STAI and TAI. Zhang et al. (2011) reported a significant correlation between elevated BP and high anxiety in college students. Data collection revealed variations in BP with four participants' BPs elevated after the exam, and several participants had minimal (*n* =14) to no (*n* = 3) variations in BP pre-and post-intervention. Conflicting findings in BP responses during exams, as Hughes (2004) and Lovallo et al. (1986) described, were also present. Previous studies established that listening to music around others provides a positive distraction by decreasing anxiety (de Witte et al., 2020). Our research team hypothesized that background music during practical exams might assist in reducing academic anxiety that is typically heightened by a quiet examination room. By not finding a statistically significant interaction, our results differed from those of Gallego-Gómez et al. (2020). Their randomized control trial combined music with progressive muscle relaxation and investigated coping mechanisms for test anxiety before exams (Gallego-Gómez et al., 2020). Given the increased anxiety before exams and practicals across the board for all students, future studies would benefit by identifying students who use music to study, report high anxiety during exams, and then compare their academic performance with and without music (Galal et al., 2021). Furthermore, our results highlight the need for further research to explore the potential effect of different music genres and personal music preferences on OT students during practicals due to the variations of physiological responses based on one’s choice of music (Kulinski et al., 2022).

Limitations

There were several limitations to this study. The small sample size challenges generalizability and finding statistically significant interactions. Collecting data during finals week naturally heightens all students' acute academic stress and HR. Even though the research coordinator selected the 60 bpm songs, the specific type of music could increase HR due to students’ emotional excitability. The practical instructors were familiar to the participants, and there was no randomization or blinding. Acute stress triggers from a practical examination incite the release of norepinephrine, which increases HR and stimulates cortisol, a stress hormone (Merz & Wolf, 2015). Cortisol has a peak response from 21-40 minutes after a stressful event and was found in

elevated concentration on the day of practical examinations (Dickerson & Kemeny, 2004; Merz & Wolf, 2015). The experimental group's intervention was only 20 minutes, and as a result, cortisol levels could have been elevated during the post-testing due to acute stress from taking the practical. Compared to written exams, oral exams threaten social assessment because an instructor actively listens and provides direct feedback (Preuss et al., 2010). The current literature has no clear correlation between cortisol levels and state anxiety (Merz & Wolf, 2015). Physiological and psychological responses like BP, HR, state, and test anxiety naturally decrease when a perceived stressful situation has ended, affecting both the experimental and control groups after completing a practical. Although the research coordinator sent participants emails, posted visual signs, and provided verbal reminders, the students needed clarification of the study's setup. There were variations in the testing room; some participants did not take the post-test immediately after the practical, and the arm used for the blood pressure cuff needed to be specified. The blood pressures were taken at different times of day depending on whether the student's lab time was either morning or afternoon. The automatic blood pressure cuff should have been consistently used on the same arm for all students, and the post-tests should have been completed directly after the practical.

Implications for Occupational Therapy Education

Occupational therapy educators should encourage students to identify coping strategies for reducing test taking anxiety, such as listening to music, progressive muscle relaxation, and deep breathing (Gallego-Gómez et al., 2020; Haughey et al., 2017; Keptner et al., 2020; Soja et al., 2016). Graduate OT students would benefit from a self-assessment tool developed by OT educators, which identifies their levels of test anxiety and the coping strategies they use for academic stress. Encouraging graduate OT students to identify their coping strategies for test anxiety will allow educators to investigate the influence of using specific coping strategies, like music, during lab practicals. In addition, OT educators can survey students who use music to alleviate test anxiety for their personal choice of music or music genre preferences. During a practical examination, OT educators may also provide the option of background music based on the student’s preferences. Supporting strategies, like listening to music, may assist in reducing test anxiety, positively impact an OT student’s academic performance, and circumvent academic burnout during graduate school and professional burnout in the early years of clinical practice (Morales-Rodriguez et al., 2019; Robins et al., 2018; Shin et al., 2022).

Conclusion

Literature supports the benefits of music for anxiety in healthcare environments, and one could argue that music could be favorable for test anxiety in academic environments for healthcare students. Clinical settings are often busy, fast-paced, and boisterous, with varying noise. The intervention in our study exposed students to practice settings by simulating real-life contexts with music during practical examinations in preparation for becoming entry-level OT practitioners in various

settings. Our results suggest there are opportunities for student-centered interventions for test anxiety in an academic environment. Educators must appreciate that OT students' needs are individual and assist in facilitating supportive educational contexts while maintaining a rigorous program.

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