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Citation

Pribble, C. (2023). The Effects of Sound-Based Intervention on the Daily Performance of College-Aged Students. *Rehabilitation, Human Resources and Communication Disorders Undergraduate Honors Theses*. Retrieved from <https://scholarworks.uark.edu/rhrcuht/83>

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The Effects of Sound-Based Intervention on the Daily Performance of College-Aged Students

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Abstract

Introduction

A mixed-methods summary examining the effects of The Listening Program (TLP) on the daily performance of a graduate student is presented. This is a pilot study that will observe the impacts of this program and the possible improvements in focus, visual perception, time management, behavior, and emotional and social regulation. Improvements in self-control/belief and overall stress management were noted.

Case Description

This case study focuses on one college-aged individual who is successfully and independently managing her graduate experience, receives no accommodations for disability, and has no previous experience with The Listening Program. Self-reports indicated high levels of intermittent stress and anxiety which affected her overall wellbeing.

Methodology

The participant for this study was recruited using an email template sent to current graduate level students at a large state university. The participant completed a pre-study evaluation in which productivity, self-care, focus, behavior, and emotional regulation were measured with the

Sensory Processing Measure (SPM-2), the Canadian Occupational Performance Measure (COPM), the Goal Attainment Scaling (GAS), and a behavioral observation checklist provided by The Listening Program. The participant completed The Listening Program Protocol for a ten-week period for thirty minutes per day, five days a week using AKG K361-BT headphones. A post-study evaluation was done to determine how the categories previously mentioned were affected. Post-study self-reports will be reviewed and summarized.

Background

Sound-Based Interventions (SBI) were introduced over 50 years ago by Dr. Alfred Tomatis and has since become a popular option among occupational therapists for its use in the improvement of attention disorders, learning rates, language development, emotional regulation, and motor skills (*History*, n.d.). This technique involves the playing of psychoacoustically modified music, usually through a form of circumaural headphones which will ensure that all outside noise is cancelled. Psychoacoustically modifying the music allows filters to be placed to target specific frequency ranges of sound that will stimulate the brain. The use of circumaural headphones is essential as headphones of low quality will not be able to replicate these frequencies. Dr. Tomatis's method of sound-based intervention was the first instance of this innovative treatment plan, it led to the development of several other SBIs including: "the Tomatis Method (TM), auditory integration training (AIT), Therapeutic Listening (TL), Integrated Listening Systems (iLs) and The Listening Program (TLP)" (Gee et al., 2013).

According to Abbott (2011) and Chiu, E., & Li, C. (2017), many types of SBI's have recently been used in combination with traditional occupational therapy intervention to treat children with

Autism Spectrum Disorder (ASD) and Sensory Processing Disorders (SPD), respectively. A study from the American Journal of Occupational Therapy (AJOT) showed improvements in behavior, verbal intelligence, and language as well as a reduction in behaviors such as tantrums, excessive amounts of energy, and nightmares after the implantation of therapeutic listening (Hall & Case-Smith, 2007). Another study has shown improvements in behavior, emotional control, mobility control, time management, and improvements in relationships between client and guardian (Chiu & Li, 2017). In addition to this, a study revolving around a child with ASD and auditory sensory over-responsivity showed that a reduction in negative behaviors can be an outcome of SBI's: "the results indicated that the participant exhibits a decrease in the number of negative (avoidant, verbal, and physical negative) and self-stimulatory behaviours..." (Gee et al., 2014).

Stimulation of the Brain Through Music

To begin to discuss how the brain is affected by music, one must first look at how music differs from language. At its basics, music has "...pitch changes, tonal relationships, melodic contour and harmony, changes in volume, and changes in stress/emphasis" (Harvey, 2018). The combination of these musical features in addition to the recognizable rhythmic pulse is what ultimately makes music differ from the language one uses on a daily basis. There is not one specific area of the brain that is stimulated by music, but instead the whole brain works to react to the sound that it hears (Harvey, 2018). The right temporal lobes process pitch, the prefrontal motor cortex and cerebellum process rhythmic cues, and the limbic areas process rhythm and tone (Galinska, 2015). According to Galinska (2015), this complex interaction within the brain is

what makes music differ from language in the way that it effects our brain. The Listening Program uses this science to make improvements in brain function through music.

The Listening Program

According to Lucker and Dowman (2019), The Listening Program is a form of listening therapy in which acoustically modified music and sounds are played through a headset. This can lead to improvements in listening, auditory processing, educational abilities, and emotional competence. Various programs are available based on the need of the user. TLP Spectrum™ can be used in children or adults with sensory sensitives and can be effective in those seeking to alleviate stress. TLP Achieve™ can be used in older children or adults that want to seek changes in learning, communication, and performance. TLP Level One™ can be used with all ages and focuses on improving brain function and mental abilities. TLP™ can be used in all ages to help stimulate rhythm awareness, focus, timing precision, and response to stress (TLP Programs).

The Listening Program focuses on the use of classical music, including Mozart, Haydn, Vivaldi, and Danzi; these pieces are used in combination with audio filters which place them at a frequency ranging from 20Hz to 20kHz. This article also states that there are a variety of schedule types for listening that are based on age, attention, and behavior style of the individual: extended, which is once a day for 15 minutes; base, which is twice a day for 15 minutes; and condensed, which is once a day for 30 minutes. In the previously mentioned study, the individual would participate in the 30-minute listening sessions while engaging in play or art activities for approximately 5 days a week, for a minimum of 50 hours over a 20–40-week period. Any cognitively demanding tasks were discouraged while listening. Often, there is another 20–40-

week period after the initial session to build upon the improvements that were made in the first segment (Lucker & Doman, 2019).

Another study done with children who have sensory integration and auditory processing concerns suggests similar results and shows improvements in categories such as motor coordination, visual perception, and visual-motor control. These children were placed on a base schedule (two 15-minute sessions a day) and completed a total of 20 weeks on the program. This study showed significant changes on Berry VMI scores in... “motor coordination with an increase in age equivalence of 3 years and an increase of 6 months in the area of visual perception section and 5 months in visual motor integration.” Significant improvements were also noted in Bruininks-Osteretsky Test of Motor Proficiency (BOT) in response speed, bilateral coordination, attention to task, participation, ability to follow directions, and improved sensory regulation and processing. (Esteves et al., 2009). These results support the claims that The Listening Program promote improvement in emotional and cognitive categories.

Sensory Processing Measure-2 (SPM-2)

The SPM-2 is a norm-referenced measure that assesses, via a parent or self-completed questionnaire, these areas: “visual, auditory, tactile, olfactory, gustatory, proprioceptive (body awareness), and vestibular (balance and motion) sensory systems, as well as praxis and social participation” (SPM, 2022). Results from this measure reflect responses to questions rated on a four-point scale and are dependent on the reporter; this is not a behavioral assessment.

Canadian Occupational Performance Measure (COPM)

The COPM is a client-centered assessment focused on establishing clear goals based on the client's prioritization of need. The main areas of focus are self-care, productivity, and leisure. This assessment considers the client's performance on an action as well as their satisfaction with this level of performance, which encourages the client's involvement in purposeful tasks and activities. Self-care includes personal care, functional mobility, and community management; productivity includes paid/unpaid work, household management, play/school; leisure includes quiet recreation, active recreation, and socialization. (Law, et al., 1990).

Goal Attainment Scaling (GAS)

The GAS is a client-centered, structured approach to goal setting and progress monitoring. It allows for each goal to be set with a set of possible outcomes on a 5-point scale, ranging from "worse than expected" to "better than expected;" each is associated with a numerical value (Clair, et al., 2022). This allows for the researcher to compare progress over time.

Purpose

The purpose of the case study is to describe the use of TLP as an intervention in addressing focus, visual perception, time management, behavior, and emotional and social regulation. The results of this study will be beneficial in identifying potential uses of TLP for any post-secondary students who are not formally diagnosed with a disorder or disability. As previous studies often limit participants to children or those with specific diagnoses, this study will broaden the applicability of this modality to include college students who are seeking strategies for improvements in study and learning experience. The results from this study will show if TLP is a feasible resource for student success.

Client History

The participant of this study is a female student-athlete in the first year of graduate school at The University of Arkansas. She receives no accommodations for disability and is successfully managing her graduate experience. She was 21 years old at the start of her participation and turned 22 during the study; she had no concerns in any of the areas measured by the SPM-2. She has good physical health but reported a great amount of psychological stressors due to balancing school, athletics, and financial stability. She reported some of her behavior strengths as being focused, driven, time efficient, organized, empathetic, and a good listener. Self-reported behavior weaknesses were stress and being easily triggered. She is currently seeing a psychologist 1-2 times each week. Her goals for the program include seeing improvements in organization and a reduction in anxiety and stress.

Assessment

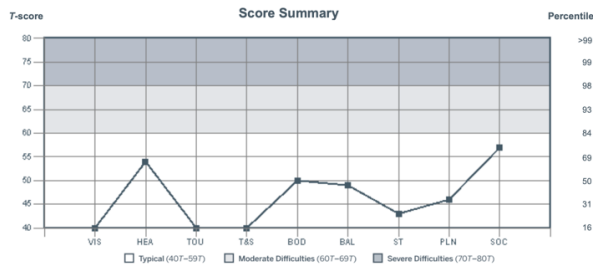
The Sensory Processing Measure (SPM-2) was administered pre- and post-study. The SPM-2 gives T-scores that allow for norm-referenced indexes of the functions of the following categories: vision, hearing, touch, taste and smell, body awareness, balance and motion, sensory total, planning and ideas, and social participation (Mind Resources, n.d.). The Goal Attainment Scaling (GAS) was administered to observe progress or decline over time. The GAS allows for goals to be set with possible outcomes on a 5-point scale, ranging from “worse than expected” to “better than expected;” each is associated with a numerical value (Clair, et al., 2022). The scale was personalized to be representative of her sense of self-control/belief as well as stress. Self-control/belief was measured with the analogy of a storm with “severe storm” or little to no self-control being the lowest rating at -2 and “sunny day” or full self-control being the highest rating

of +2. Stress self-talk was also rated on a scale of -2 to +2. The Canadian Occupational Performance Measure (COPM) showed high performance and satisfaction within all areas of ADLs, participation, and leisure therefore it was administered only pre-study and no comparison of results are included.

SPM-2 Pre-Study:

	VIS	HEA	TOU	T&S	BOD	BAL	ST	PLN	SOC	
Raw score	12	20	13	10	13	15	83	14	21	Raw score
T-score	40	54	40	40	50	49	43	46	57	T-score
%ile	16	66	16	16	50	46	24	34	76	%ile
Interpretive range	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Interpretive range

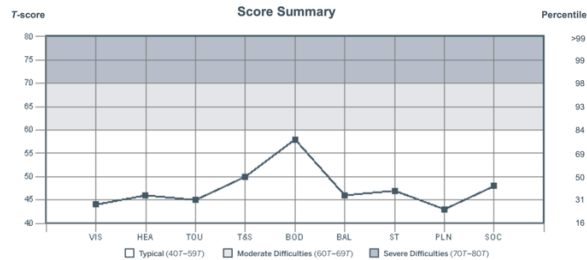
VIS = Vision; HEA = Hearing; TOU = Touch; T&S = Taste and Smell; BOD = Body Awareness; BAL = Balance and Motion; ST = Sensory Total; PLN = Planning and Ideas; SOC = Social Participation



SPM-2 Post-Study:

	VIS	HEA	TOU	T&S	BOD	BAL	ST	PLN	SOC	
Raw score	13	16	15	17	16	14	91	13	17	Raw score
T-score	44	46	45	50	58	46	47	43	48	T-score
%ile	27	34	31	50	79	34	38	24	42	%ile
Interpretive range	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Typical	Interpretive range

VIS = Vision; HEA = Hearing; TOU = Touch; T&S = Taste and Smell; BOD = Body Awareness; BAL = Balance and Motion; ST = Sensory Total; PLN = Planning and Ideas; SOC = Social Participation



GAS: Self-Control/Belief

<i>Rating</i>	<i>Week 1</i>	<i>Week 2</i>	<i>Week 3</i>	<i>Week 4</i>	<i>Week 5</i>	<i>Week 6</i>	<i>Week 7</i>	<i>Week 8</i>	<i>Week 9</i>	<i>Week 10</i>
-2 "Severe Storm"	0	0	0	0	0	0	0	0	0	0
-1 "Thunderstorm"	2	2	2	1	0	3	0	0	1	1
0 "Fair Weather"	4	1	1	4	1	1	4	0	3	1
1 "Breezy"	1	4	4	1	5	1	2	4	1	4
2 "Sunny Day"	0	0	0	0	0	0	0	2	0	0

GAS: Stress Self-Talk

<i>Rating</i>	<i>Week 1</i>	<i>Week 2</i>	<i>Week 3</i>	<i>Week 4</i>	<i>Week 5</i>	<i>Week 6</i>	<i>Week 7</i>	<i>Week 8</i>	<i>Week 9</i>	<i>Week 10</i>
-2	0	0	0	0	0	0	0	0	0	0
-1	1	3	2	1	0	3	0	0	1	1
0	4	1	1	3	1	1	2	0	4	1
1	2	3	4	2	5	1	4	6	0	4
2	0	0	0	0	0	0	0	0	0	0

Program

The Listening Program Spectrum™ was implemented for this study. This program is primarily used for people with sensory sensitivities and focuses on calming low frequency sounds.

Spectrum™ consists of four zones and 4 cycles of listening; each zone is a different level of frequency filtration. It is recommended that this protocol be followed for at least two cycles (50 hours) and up to four cycles (100 hours) (Advanced Brain Technologies, 2012-2018). The participant chose to use the condensed schedule which consists of listening for 30 minutes once a day. Participant engaged in some form of creative activity or rested while listening; some of the activities done were calligraphy, sketching, painting, coloring, dancing, puzzles, and resting. The survey created from GAS goals was completed after listening each day. It should be

acknowledged that the participant also received treatment from a psychologist 1-2 times a week during the program; this may have influenced results.

Results

Results from the SPM-2 were typical both pre- and post-study; the program did not seem to have an influence on sensory functioning. Ratings on the GAS goals seemed to generally increase each week until week 8 in which participant expressed a feeling of increased stress due to an increase in schoolwork. The scores trended more positive in later weeks than in early weeks, indicating a positive change in overall self-control/belief and stress self-talk. A verbal post-study interview was conducted in which participant expressed opinions on the program. She noticed that stressful events were not as damaging to her mental state as before the program and had overall better self-talk/belief. Since finishing the program, she noticed that she was able to prioritize her schedule better and felt more control/less stress over being able to complete tasks successfully.

Discussion

Results from the SPM-2 do not support use for college students who do not receive accommodations for a disability or impairment. For future studies, this program would be better fit for users who have sensory processing scores outside of the “typical range” on the SPM to show improvement with regulatory ability. Self-regulatory strategies are often seen in high-achieving students; they are able to develop and modify strategies as well as employ more effective strategies for self-regulation than low-achieving students (Ruban & Reis, 2006). This is evident in results from the SPM-2; it is important to note that the participant scored in the

“typical range” pre-study. This left little room for change in measured categories. Future studies should consider using a self-efficacy scale such as the General Self-Efficacy Scale (GSES), an anxiety scale such as the Hamilton Anxiety Rating Scale (HAM-A), or a stress scale such as the Perceived Stress Scale (PSS). Using scales such as these will allow for a better picture of any changes in high-achieving students who may perform well on assessments such as the COPM and SPM-2 but have underlying concerns.

Self-reports indicated improvements in overall self-talk/belief and stress-management, but participant believed this was due to the reflection time during listening instead of the program itself. A future study comparing 30 minutes of listening each day to 30 minutes of reflection time may be beneficial in exploring this more.

Some of the participant’s recommendations for future student listeners are using the base schedule (15 minutes, twice a day) if they have a busy schedule, set up a creative space with no distractions to complete listening in, and complete listening during the middle of the day rather than at the end of the day.

Acknowledgements

I would like to express my gratitude for my mentor Dr. Jeanne Eichler, Ed.D., MOT, OTR/L, MT, as well as committee members and supervisors Dr. Rachel Glade, Ph.D, CCC-SLP, LSLS Cert AVT and Amanda Troillett, OTD, OTR/L for their help in guiding me throughout this project and their continued support.

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