Does Listening to Music Make You Smarter?

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INTRODUCTION:

Does Listening to Music Make You Smarter?

The Beatles. Led Zeppelin. Sonic Youth. Katy Perry. Music! These are a few artists who have definitely influenced my life for the better. I can honestly say that I would not be here today if it weren't for music— it has literally saved my life. Music is my knight and shining armor when I am a damsel in distress. It pulls me out of my cloud of darkness and brings me to the light. Music is everywhere and anywhere. It is the catchy jingle you find yourself singing because of a commercial, the instrumental you hear in an elevator, and all the sacred albums you listened to in your youth.

Music is powerful. It influences how you feel emotionally, spiritually, and physically and the ways in which you perceive the world. The lyrics of songs provide powerful messages and perspectives, melodies bless us with beautiful ambiance or pure Rock and Roll, and the combination of the two does wonders. Logically, music that sounds "happy" will make you happy— and "sad" music makes you sad. Despite music's obvious implications, there is definitely a realm of benefits that music provides that we should explore.

According to an EMedExpert article called "How Music Affects Us and Promotes Health" music reduces blood pressure, releases endorphins to counteract pain, and creates a harmonious emotional experience that releases immune-boosting hormones to reduce illness. In addition, music has been proven to enhance body coordination and athletic performance. When you are exercising, doesn't the perfect upbeat song motivate and lengthen your workout? Lastly, music relieves depression, reduces emotional distress, and increases self-esteem ("How Music," 2016).

Being around music, listening to music, music therapy, making music, or simply learning how to play a musical instrument has a plethora of positive benefits. All of these benefits are very promising to our mental, emotional, and spiritual health—but, if these simple acts can do wonders for us, it is crucial that we take every opportunity to explore every single possible effect of music. Therefore, I am curious to see how exactly music influences us cognitively in order to enhance our intelligence. Does listening to music or learning to play a musical instrument set-up an individual to learn better? Does it make us smarter? Does it improve our working memory and any of our skills to further improve our ability to process information and learn?

These simple questions may be the catalyst to make it a priority to implement music in all educational settings for student success. If music can cure my depression, make me run faster on the treadmill, and somehow improve my learning— music is medicine. Musicians want to heal with the world with music, so why can't scientists do the same?

ARTICLE REVIEWS:

Article One

Dawn C. Rose, Alice Jones-Bartoli, and Pamela H. Heaton conducted a study titled, "A Study of Cognitive and Behavioral Transfer Effects Associated with Children Learning Musical Instruments for the First Year Over One Academic Year" **(2015)**. My research questions whether or not listening to music or playing a musical instrument makes us smarter. This study investigates the transfer effects of musical education and the indirect effects that come with it. Learning music has been defined as a "superskill" that lends us "transfer" and "far transfer" effects. The scientists have defined transfer effects as direct skills from music education, and far

transfer effects for IQ, mathematics, and literature. **Rose, Jones-Bartoli, and Heaton** took action to test music education's effects specifically on behavioral visuo and psycho-motor skills, IQ, and memory.

The scientists of this study were aware of many concepts regarding intelligence, memory, and visuo/motor skills before the study. These same facts help answer my question. For example, musical training before the age of 7 has enhanced visuo/motor abilities. Musical learning has increased memory, attention span, and the mastering of skills because musical education is like school itself, therefore heightening IQ levels (Heaton, Jones-Bartoli, and Rose, 2015).

In order to investigate this, the study took a holistic approach of integrating musical lessons in 38 children between the ages of 7 to 9 years old over one academic school year. The study had 21 girls and 17 males who attended either a state or independent school with an average IQ of 106. The results of the study were split between Time 1, September 2013, and Time 2, June 2014. The students were split into two groups— the More Music Group (MMG) and the Less Music Group (LMG). 20 participants had an extra hour of musical lessons per week while the other 18 received less "…as part of their schools statutory curricular provision" **(56).**

T-tests and split plot profile techniques for simple RM ANOVA tests were used to evaluate the MMG and LMG groups for Time 1 and Time 2. The amount of hours per week each group practiced music was taken into consideration for these tests. In order to asses the student's level of music aptitude the study used Gordon's Primary Measure of Musical Audiation. **This is a test that calculates, diagnoses, and measures an individual's music potential. It was conducted during Time 1 and Time 2.** The resulting tests showed that their musical aptitudes increased overtime with a significant main effect. For individuals with no music training, their **composite t score, Time 1 and Time 2 had a t-test statistic of t(18)-4.561 with a p-value of**

<.001. For their tonal measure, Time 1 and Time 2 had a t-test statistic of t(17)-2.925 with a p-value of .009. For their rhythm score, Time 1 and Time 2 had a t-test statistic of t(18)-3.699 with a p-value of .002. For individuals who had music training, their composite t score, Time 1 and Time 2 had a t-test statistic of t(17)-2.925 with a p-value of .009. For their tonal measure, Time 1 and Time 2 had a t-test statistic of no score. For their rhythm score, Time 1 and Time 2 had a t-test statistic of t(17)-2.132 with a p-value of .048 (Heaton, Jones-Bartoli, and Rose, 2015). Don't need to report the stats—just interpret what these mean; what differences did they observe?

Memory was tested using The Children's Memory Scale (Cohen, 1997). The Children's Memory Scale tested their memory through word list learning, word list recall, reading numbers forward, and backwards, number totals, and sequences. In all realms of memory, using the split plot profile tests of the RM ANOVA showed that the scores of the music education group in fact increased over a significant amount of time.

The Movement ABC test was used to investigate the visuo/motor skills. The students were tested on their preferred hand placing pegs, non-preferred hand placing pegs, threading lace using both hands, the preferred hand of drawing a tail, catching a ball, throwing a bean bag to a target, preferred leg balance, and a non-preferred leg balance.

The Weschler Abbreviated Scale of Intelligence (WASI; Weschler, 1999) was conducted in order to asses "…data on vocabulary, matrix reasoning (non-verbal skills), block design (spatial ability) and similarities (semantic processing)" (Heaton, Jones-Bartoli, and Rose, **2015, p. 55).** The vocabulary and matrix reasoning of the MMG were more favorable than the LMG. The 4 factors of the WASI when tested showed that there was a significant overall effect of these measures over time with "F(3,35)=3.718, p=.014." The results of the WASI, Children's Memory

Scale, Movement ABC, and GPMMA tests coincides with my question of whether or not music improves our skills to learn/makes us smarter.

In conclusion, the effects of musical training/education on the 38 participants of this study show an increased ability to aim and catch, greater advantages for the MMG than the LMG, and an increased aptitude for non-verbal and spatial reasoning after just one year of musical training. The study has proven that music makes you smarter by showing the effects of an "…change over time associated with specialist musical training" **(~~Heaton, Jones-Bartoli, and Rose~~ Rose, Jones-Bartoli, & Heaton, 2015, p. 57).**

Article Two

Lidia Suarez, Shalini Elangovan, and Agnes Au are scientists from Singapore's James Cook University, and they conducted the study "Cross-sectional Study on the Relationship Between Music Training and Working Memory in Adults." Unlike the previous article, this article investigates musical training's transfer effects on adults, rather than children. As common sense goes, the better you are at memorizing, the smarter you become because of the information you can process and maintain. This study tests adult musicians and non-musicians for specific aspects of working memory (WM). As I have said, I wish to explore musical training/music's effects on our cognitive functioning. Similarly, the scientists of this study align with my research since they hypothesized that "…musicians [would] outperform non-musicians in WM tasks" **(Suarez, Elangovan, & Au, 2015)**.

Musical training studies have found that music allows for an enhanced attention span, IQ, auditory, motor, verbal, and visuospatial abilities. The study specifically peers into our working memory (WM) which is "…defined as a limited-capacity system for temporary storage and manipulation of information for complex tasks such as comprehension, learning, and

reasoning" **(Goldstein, 2008, p. 410**). In order to correctly asses our WM, the study conducted tests on the WM model by Baddeley **(2000)**. It focuses on the central executive, phonological loop, visuospatial sketchpad, and the episodic buffer as domains for assessment.

In order to asses the 4 domains of the WM model, the study assesses 54 participants. Each participant has no disabilities and were split into a musician group of 24 and a non-musician group of 30. In order to be classified as a musician, the participant had to have had 5 years or more of musical training, with most of them starting around 8 years old. The musicians had 4 males, 20 females, and the non-musicians had 7 males and 23 females. The participants were similar in age, education, and IQ levels, but differed in family income.

The study was split into two parts. The first session was an experiment using the E-prime 2.0 to assign six WM tasks on the participants. 8 versions of the program were created for variance and practice tests were enabled to elicit a full understanding of the program.

The central executive tests for tasks on perceptual skills, speed, and attentional control. In order to asses the features of the central executive, the program allowed for two tasks. The first was a digit-symbol coding task in which they had to match numbers with symbols as quickly and correctly as they could in a booklet with 180 digits. After 2 minutes, the participants results were graded based on how many symbols they got correct. The second was a backward digit-spin task in which they had to write the reversed order of numbers called out. This assessment allows us to see if musical training affects our level of ability to memorize information, retain it, and also manipulate it for our own use.

The visuospatial sketchpad holds visuospatial information, such as musicians being able to translate musical notes as sequential finger movements. The visuospatial sketchpad was used for the static matrix span tasks and the dynamic matrix span task. The static matrix span task was

used to test memory capacity by making the participants draw a mark wherever they saw lines appear for 10,000ms on a gray matrix. The dynamic matrix span task was lighting up red lines on a matrix for 2,000ms one by one, and having the participants reiterate what lines turned red and the order in which they changed.

The phonological loop is used to asses the storage of information and re-reciting that same information, auditory memory capacity, articulatory rehearsal, and ability to memorize new string sounds. The study shows that music training enhances phonological memory through the memorization of words and non-words, vocabulary tests, and the forward digit span (Au, Elangovan, & Suarez, 2015) The phonological loop was tested by making the participants reiterate the same sequence of numbers they heard on paper on multiple successive trials through a forward digit span task. In addition, a non-word recognition tasks was assigned in which they assessed phonological memory and ability to learn new phonological forms. To do so, participants were played a list of "sounds"/non-words and then they replayed them again. As the repetition was going on, many non-words not previously played were inserted. The participants had to decide whether each non-word was previously played.

The episodic buffer is a combination of our long term memory (LTM), visuospatial sketchpad, and the phonological loop. In previous studies within the episode buffer, musical training has been "…associated with the capacity to rapidly scan visual information, [have] kinesthetic abilities, and mentally transform images of spatial patterns" and require "… psychomotor speed, hand-eye coordination, spatial processing, mental manipulation of information, and inhibitory control of irrelevant stimuli because these are processes practiced during music learning" **(Hayward & Gromko, 2009, p. 26-36)**.

The second session featured the The Advanced Measures of Music Audition (AMMA; Gordon, 1989) and was used to assess and measure each individual's music aptitude. The AMMA showed that the musicians scored significantly higher "(M-61.30, SD= 7.69)" compared to the "(M=51.10, SD=8.12)" non-musicians. The American National Adult Reading Test (AMNART) was used to measure verbal IQ. It was administered along with a demographic questionnaire to asses individual demographics because the study wanted to make sure that the musicians and non-musicians did not differ in age, IQ, and years of education.

Need reference

As a result, the study found that music training is positively correlated with improved benefits compared to the non-musicians. The musicians scored significantly better in the WM tasks of the digit-symbol coding task, backward digit span tasks, and dynamic matrix span task. The results show that musicians had an "…enhanced attention, visual-motor coordination, visual scanning ability, visual processing speed, spatial memory, and information manipulation skills" compared to the non-musicians which as a result, proves musicians to have better cognitive functioning, working memory, and skills to further enhance learning and the processing of information **(Au, Elangovan, & Suarez, 2015, p. 44)**.

Article Three

Zekerya Batur of Usak University in Turkey conducted the study, "The Contribution of Music to the Fluent Writing Skills: Mayaz Technique" **(2016)** in order to asses how listening to music in a classroom environment influences writing skills. Does playing music in a classroom environment inspire students to write more, therefore, excel more in the classroom? These results

coincide with my research by giving proof that listening to music does enhance our skills to further enhance our learning, ability to process information, and IQ levels.

The study makes a point to say that is crucial that we explore the tools we have to "… encourage pupils to develop their writing skills and contribute to their improvement in an efficient manner" and that one of these tools is music **(Batur, 2016, p. 83)**. The study's purpose is to differentiate writing skills with music by counting the number of words produced. The MAYAZ Technique uses music as an educational tool to inspire emotional intensity in students to further their fluent writing skills. In order to administer the MAYAZ technique, the study investigated 80 pupils from the 5th and 6th grade with an average IQ of 70-80. Respectively, each grade had a control group of 20 and an experimental group of 20.

The control and experimental groups were placed in separate classrooms where they were asked to write about anything they wanted. The experimental group's classroom had background music playing while the control group's did not. After twenty minutes, each groups papers were collected and the number of words "…in accordance with the frequency of their use in the written material" were counted (Batur, 2016). After the procedure was administered, the results were tested on a variety of socio-economic variables in consideration of each pupil's varying writing skills.

The Mann Whitney U Test tested the 80 pupils in accordance to the variables of gender, grade, reading daily newspapers, listening to music while studying or not, and preference of music listening while studying. The test resulted to show that girls "(X=47,38)" tested higher than boys "(X=32,89)", 5th grade students "(X=47,70)" wrote more than the 6th "(X=33,70)" graders, students who listened to music while studying had a higher word count "(X=46,89)",

and that there was no significant difference in terms of desire of listening to music or reading daily newspapers.

The Krushal Wallis test was administered to consider variables of parent's professions. The profession of the mother had so statistical significant difference, but the father's profession did. Student writing skills were highest in pupils "whose fathers [were] shopkeepers, followed by workers, academicians, and civil servants respectively" **(Batur, 2016, p. 88).**

In conclusion, the findings of this study shows that music enhances fluent writing skills. For, "…the pupils who wrote their essays in the accompaniment of the background music used more words in their essays than those in the control group" therefore showing that "…the background music contributed to the pupil's fluent writing skills" (Batur, 2016, p. 82). Classroom settings where music is being played proves that pupils will produce a higher word count based on music, considering the variables of age, gender, grade, parent's profession, and music listening during studying/in a classroom. Therefore, music's implementation in educational settings proves to be successful for a student's success.

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LIMITATIONS:

Article One

Don't need titles

In "~~A Study of Cognitive and Behavioral Transfer Effects Associated with Children Learning Musical Instruments for the First Year Over One Academic Year" by~~ Dawn C. Rose, Alice Jones-Bartoli, and Pamela H. Heaton **(2015)** I have identified a few limitations to their study. First of all, the statistical validity is at jeopardy here. As the study only conducts research on a total of 38 participants. The n score is so small that the statistical powers of this study is not as clear and representative as it could be. Second, the external validity as well. The participants

of this study were of ages 7-9 and from states schools and independent schools. The schools the researches chose could easily affect the results. For example, some schools may have a higher budget in their music education, therefore skewing the musical abilities of the participants.

Good point

Across *conditions*? That could be an issue, but not that imbalanced here.

Also, there was an unequal ratio of participants for each variable. For females, there was 21 while males only had 17. For those exposed to extra music lessons, 20 had them, while 18 of them had less music lessons. These variables should be controlled throughout the study and ultimately could skew the results presented here. In addition, the researches should have also accounted for the children's parents and the variables that come with them. For example, the socioeconomic status of the parents, if the parents are supportive or unsupportive of their musical training, and etc. These variables can greatly affect the musical abilities of the participants.

Lastly, we can also find a limitation in the construct validity of this study. The researches decided to investigate the "transfer effects" of music specifically on visuo/motor skills and IQ and memory. However, "transfer" effects tend to be problematic because of evidence that can be provided from outside variables not measured in this study. Logically, when listening to music, many factors may contribute to why an individual is better at memorizing or their visuo/motor skills because of factors unrelated to music. An example of outside variables may be that some students are inclined to play video games or read more books than others, making their visuo/motor skills or memorization better. These "transfer effects" that they are trying to investigate are at the jeopardy of variables that can manipulate these results. Perhaps the reason why they test better in certain areas than others is simply because of "transfer effects" that are not defined by the study, since most of the tests they conducted showed that there were barely any correlations.

More relevant to internal validity. Were participants randomly assigned? If so, this isn't as much of a concern (though with 38 participants, there's still a fair amount of uncertainty that these factors really balanced out). If no random assignment, this is a much larger issue.

Article Two

Lidia Suarez, Shalini Elangovan, and Agnes Au are scientists from Singapore's James Cook University, and they conducted the study "Cross-sectional Study on the Relationship Between Music Training and Working Memory in Adults" (2015) but, there a few limitations to this study. In the procedure of this study, there were two sessions that took up two hours. The participants had to perform six working memory tasks and then they had to take the AMMA and AMNART. It is noted that the first session was given to all the participants and that the second task was administered either on the same day or for later in the week. The limitation I can find here is that perhaps the AMMA and AMNART scores of the participants who took them right after their working memory tasks would be better than those who would take the second session later in the week. As the working memory tasks that were asked of the participants could easily affect how well they scored on the AMMA and AMNART as opposed to those who would do them later in the week. Good point

A second limitation is that since their study was a quasi-experimental study, the participants accounted for several variables that could ultimately affect their musical ability. Though the study "…ensured that both groups contained a similar number of males and females, and were closely matched in ages education, and verbal IQ…[along with]…statistically controlled…effects of family income" (Au, Elangovan, & Suarez, 2015, p. 44) these controlled similarities are not necessarily generalizable. And, with non-random assignment, there still may be confounding variables that were not taken into account.

Their method of participants hurts the external validity, because if they were closely matched in age, education, and IQ, that is not a representative sample of the general population. Some adults may be younger or older, and have better musical abilities. Some adults may have varying educations. For example, a person could have never gone to college, as compared to the

participant who completed college. Perhaps the individual who did not go to college is infinitely better than the participant who did complete college because of the time they had to improve themselves. In addition, we can also find that the musicians are advantageous in intelligence compared to the non-musicians. The difference of intelligence they tested were only verbal IQ, but they did not test reasoning, memory, or comprehension. Therefore, I find that the external validity of this study to be at jeopardy here.

Article Three

Zekerya Batur of Usak University in Turkey conducted the study, "The Contribution of Music to the Fluent Writing Skills: Mayaz Technique" (2016) but I find that there is a construct validity to his study. He is testing the effect background music has on his participant's fluent writing skills. He operationalizes fluent writing skills as the participants number of words. The more words you write, the more fluent your writing skills are. However, my quibble here is that does the number of words you really write dictate your fluency of writing? Perhaps individuals in the writing room with background music had more words to write down because they were writing gibberish. Or perhaps, some individuals in the room without background music wrote less because their fluency writing skills are so high, that they can explain their points being made in a more concise and straight forward manner. I find that word count does not really denote how well you write as a student. Therefore, I find that there is a construct validity in Zekerya Batur's study. In effect, the whole study is measuring the number of words rather than the actual fluency of thoughts to paper that is being tested here. However, I understand that perhaps writing more words just means that the participant will work better in educational environments. This finding is still relevant to the research I'm conducting.

an issue with?

Good point

In addition, the external validity of the study. The students in this study were controlled for similar IQs and test scores from Turkish language exams. Since the students were selected based on Turkish language exams, this study is not generalizable to outside sources since this exam is only based in Turkey. Perhaps if the participants were chosen based on a generalizable test, the external validity would not have been harmed.

SYNTHESIS:

In the three articles that I reviewed, the bigger picture to be made is that music, does in fact, affect an individual's cognition and intellectual abilities. In the study of "A Study of Cognitive and Behavioral Transfer Effects Associated with Children Learning Musical Instruments for the First Year Over One Academic Year" (2015) and "Cross-sectional Study on the Relationship Between Music Training and Working Memory in Adults" (2015) we can see that music training affects physical abilities along with cognitive abilities.

Need authors' names for citation, not title

In ~~"A Study of Cognitive and Behavioral Transfer Effects Associated with Children Learning Musical Instruments for the First Year Over One Academic Year"~~ we find that for physical abilities we see an improvement of hand/eye coordination in the students with more music lessons. In "Cross-sectional Study on the Relationship Between Music Training and Working Memory in Adults" (2015) we find that there are improvements in visual-motor coordination, visual scanning ability, and visual processing speed. Though these physical attributes do not necessarily affect intelligence, they may help in improving intelligence.

For example, an individual's visual processing speed will help them learn materials better than those who lower processing speeds. Since these studies both measure individuals with

music lessons, we can see that music lessons give individuals an advantage over those who are not exposed to the music lessons.

In relation to the cognitive abilities that are tested, both studies found an increased ability for reasoning and memory. In "A Study of Cognitive and Behavioral Transfer Effects Associated with Children Learning Musical Instruments for the First Year Over One Academic Year" we find that the children who had music lessons had better non-verbal reasoning. In "Cross-sectional Study on the Relationship Between Music Training and Working Memory in Adults" (2015) we find that the adults who had music training had a better spatial memory. We can conclude that both these studies support the idea that music improves our intellectual abilities, as non-verbal reasoning and spatial memory increases an IQ.

The third study I investigated, "The Contribution of Music to the Fluent Writing Skills: Mayaz Technique" (2016) found that listening to music improves fluent writing skills. In all three of these studies, the participants were exposed to music in some shape or form. The two studies I mentioned above dealt with individuals who dealt with music hands on, since they were learning how to play musical instruments. The Mayaz Technique study had the participants listening to music. In conclusion, we can see that exposure to music has many advantages in the realms of reasoning, memory, and fluent writing skills. After reading this research, I can clearly conclude that music does in fact improve cognitive thinking through intellectual abilities.

HYPOTHESIS:

Hypothesis: Variations of music genre listening in the work environment will affect (either increasing or decreasing) worker productivity.

Needs to be more specific—what genres, and which ones will improve vs. decrease productivity?

Taking into consideration the three studies I evaluated, we can conclude that listening to music improves cognition through intellectual abilities. I asked, "Does listening to music make you smarter?" and we found that many physical and intellectual abilities were improved by listening to music. In accordance to the physical abilities that were found, I pose another research question. Does listening to music make you work harder?

How does listening to music affect an individual in their work environment? The research I investigated was in the school environment or for just adults in general, but we could see how music affects adults in their work environments. I would like to see how the implementation of music affects a person's ability to complete tasks required of their occupation.

For example, in the fast food industry. Will the workers perform faster and create more food if specific music is being played for them? Will they meet the required time limits they must meet for each customer, (i.e 5 minute limits for customers waiting for their food in the drive-thru)? Or, in manufacturing companies where workers must create things. For example, sewing factories. Will the implementation of listening to music in these factories make the workers produce larger amounts of clothing? In order to really drive this experiment out, I could even figure out what different types of music produce more productivity. Does rock, metal, classic, pop, pop punk, reggae, indie or disco make people work faster/harder?

Hold off on operationalizations—need to flesh your ideas out; what's your theory behind this?

I feel like different types of music will produce different types of productivity and I understand that through my research, the implementation of music improves intellectual and physical abilities. So why wouldn't they work in the work environment as well?

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Limitations: 10/10
Clear discussion of relevant limitations.

Synthesis: 10/10
Relevant comparisons of studies were made.

Hypothesis: 9/12
Novel hypothesis is proposed and supported, but it needs to be more clear

Quality: 5/5
Clear and readable throughout.

PP2 Total: 34/37

PP1 Revision: 58/63