

Melodic Melodies: Is That All There is to Music?

Jessica Leung¹ and Carolina Daffre[#]

¹Los Alamitos High School

[#]Advisor

ABSTRACT

Music has great benefits; music can improve mood which in turn enhances cognitive performance in the brain. The objective of this literature review is to see how musical induction, the process of using mood induction through music, can change affect. Affect is the emotional reactive response to stimuli. With time, affect can influence mood, becoming an emotional state that stays stagnant for a prolonged period of time. Positive affect and mood benefit cognitive performance in 4 domains: attention and processing speed, working memory, declarative memory, and executive function. Results from scientific journals, blogs, and journal articles were reviewed to [paraphrased + shortened research question]. Studies suggest that musical induction can induce positive affect, enhancing cognitive performance in memory, processing speed, and attention. Since music is prevalent in daily lives, understanding how brain functions benefit positively from musical induction is extremely important; these tools and knowledge will be beneficial in solving mental health issues and other crises.

Introduction

It's minutes before my next tennis match against the number one player of our rival school. My palms feel sweaty, and I can hear my heart racing. As I sit on the bench, awaiting my turn, I put in my AirPods and turn up my favorite song. Instantly, my nervousness began to dissipate, and I was able to focus on the match ahead of me. Listening to music has a calming effect that can reduce anxiety before a big task. Are there any other benefits besides nerve calming that listening to music can bring? Based on these phenomena, is it possible that a positive affect caused by music can lead to improved performance?

Music is a combination of rhythm, melodies, and sound that harmonize to express an emotion. This review studies two specific types of music: positive and happy music, music with strong beats and uplifting melodies, and negative music, music with slower beats and sad lyrics. Music is able to increase the performance of different areas of memory, including episodic and semantic, as well as improve the processing speed of the brain (Bottiroli et al., 2014). Moreover, music uplifts mood, reducing anxiety and allowing for focus to improve in tasks (Bottiroli et al., 2014). Similar to music is musical induction, the process of using mood induction through music; mood induction is a method used to create either a positive or negative change in mood. This process relies on music to change the affective function in the mind. Musical induction is able to influence the affect both positively and negatively depending on the music played. Music with a slower tempo and sad lyrics often induce feelings of depression while fast beat songs with uplifting lyrics often elicit a mood of joy and excitement. Classical music can uplift mood, especially if it has an upbeat tone. Similarly, pop music also enhances a positive mood and can create strong feelings of happiness in the listener (Bottiroli et al., 2014). In the same way, these types of music can also cause a more positive affect response.

Affect is the emotional reactive response to an environment and with time, an affect can influence mood and become an emotional state that stays stagnant for a long period of time (Gottlieb, 2017). While affect is often used to express quick reactive responses to certain stimuli externally, mood is stable, persisting over time, and is often more internal than external (Gottlieb, 2017; Manley, 2003). Music often creates a positive affect for the listener, inducing feelings of joy and excitement when listening to the song. Over time, listening to this music repeatedly can cause a

gradual mood change, reducing overall anxiety and making the listener more calm in stressful situations (Bottiroli et al., 2014). Improvements in mood can also come with benefits in cognitive performance. It was found that a better mood was associated with higher processing speeds, a longer attention span, a higher reliance on heuristics, and a shorter reaction time compared to a more negative mood. However, negative moods did come with benefits as well, including higher processing accuracy, better focus, and improved analytical thinking (Awada, Debatinb & Ziegler, 2021). Based on this sensation, it is possible that music benefits general well-being and health across all life spans due to its positive consequences on emotional state and mood. If listening to music can improve performance and mood for all age groups, it would be beneficial for young children and even infants to be exposed to music early on in their lives.

Cognitive performance refers to mental abilities such as learning, reasoning, processing, and decision making. It is categorized into four different domains: attention and processing, working memory, declarative memory, and executive functions. Attention and process relates to the speed of processing information quickly and the ability to hold focus (Martin et al., 2019). Working memory includes short term memory and the ability to recall certain details from that inventory. Similarly to working memory is declarative memory. Declarative memory also includes the ability to recall all kinds of information and to recognize previously encountered information. Last, is executive function which includes skills in planning, sequencing, and making goals while also following through with them (Martin et al., 2019). These skills play an important role in daily life. For example, these functions are needed to plan trips, do school work, pay attention when communicating to other people, and tell stories.

Based on the evidence found, it is possible that improvements in both mood and affect caused by music can be beneficial to cognitive performance. Moreover, these improvements may differ between different age groups. Overall, listening to music and certain melodies can come with many benefits: it creates a positive mood, impacting both cognitive processes and the affect of the listener. These improvements from music in both mood and affect can not only reduce overall anxiety but can also improve cognitive performance. Based on the data found, is it possible that music influencing mood can improve cognitive performance? We will aim to answer this question across development looking at studies done in infancy, adolescence, adulthood, and late life stages.

Methods

Evidence used to support the hypothesis were found in blogs, scientific journals, and journal articles. They included a mix of analysis, review, and report readings. Some of the key search terms used to find evidence for the literature review were “musical induction”, “music”, “melodies”, “mood”, “affect”, “cognitive performance”, “4 domains”, “induction”, “infants”, “adolescents”, “young adults”, “adults”, “older adults”, “temperament”. 4 age groups were assessed to explore whether different stages of life have different benefits from music.

Results

I. Infants (0-5 years old)

Studies have shown that during hospitalization, infants who listen to music have their stress reduced significantly than infants without music. During this phase, babies were exposed to different types of music while their heart and respiratory rate were recorded by a machine. Since music positively benefited vital signs in these infants, it was concluded that music could reduce stress in them during hospitalization (Amini et al., 2013). In infants and young children, listening to music can release helpful chemicals such as dopamine and oxytocin that can induce positive emotions and encourage them to be more empathizing and kinder. These children feel more inclined to be caring to others and share their toys. Furthermore, listening to music in this age group can build confidence and character, making them more likely to help others in a time of need (Nelson, n.d.).

Along with benefits to the mood in infants, listening to music, even in the womb, can increase a baby's creativity, sharpen both their auditory and working memory, enhance emotional intelligence, and strengthen cognitive development. A study was conducted in Hungary showing that small children ages 3-4 who have experience playing music scored higher on a creativity test than those who did not listen to any music or receive any training in music (TinyLove, 2020). Higher creativity is so significant since it can lead to better problem solving skills and a more open mindset (Carson, n.d.) Also, emotional intelligence was also found to increase since music often portrays an emotion to its listener, and it was found that children who were exposed to classical music were not only able to detect emotions of the people around them but also inside of themselves more easily (TinyLove, 2020). Since infants who listen to music are exposed to many different sounds, both their auditory and prefrontal cortex developed faster, leading to better attention and problem-solving skills (McElroy, 2016).

Along with listening to music, an infant's mood can also have an impact on their cognitive abilities as a child and also later on in life as they mature. Very young children often display temperament, both positive and negative, especially as newborns. Temperament is the way children react to certain stimuli and environments they experience in their life; it influences their emotions and behavior when interacting with others (Allard & Hunter, 2010). It was found that temperament affected verbal and nonverbal abilities, literacy, numeracy, and higher reactivity. Moreover, low levels of negative mood led to more compliance from the children, higher social conscience in group situations, and a more overall developed conscience (Rothbart, 2012). In contrast to the positive benefits, increased negative affect can lead to depression, anxiety, and behavioral problems as they grow into their adolescent and teen years (Rothbart, 2012).

For infants, music is often used as a stress reliever since it can reduce the anxiety they feel in hospitalization (Amini et al., 2013). Along with being a stress reliever, music can also induce happy emotions in children, encouraging them to be kind to others (Nelson, n.d.). Music can not only improve mood but also their cognitive performance. It was found that music enhances creativity, memory, emotional intelligence, and cognitive development in babies, even when they are in the womb. Children who listen to music at an early age were shown to be more creative than their peers (TinyLove, 2020). Music not only directly affects cognitive performance but also indirectly impacts cognitive performance in children based on increasing or decreasing mood and temperament. A more positive mood in children improves their verbal skills, literacy skills, and reactivity (Rothbart, 2012). Based on the evidence given, if listening to music can benefit infants greatly, then perhaps everyone should start listening to music at a young age to improve both their mood and cognitive performance.

II. Adolescence and Young Adulthood (6-20 years old)

For many adolescents and young adults, music is soothing and often sought out when dealing with anxiety, depression, or stress (Bogt et al., 2016). Music is often used as a release for any negative emotions that may come from peer pressure, schoolwork, pressures from family, the loss of someone special, and stress from relationships with friends and family (Bryant, 2014). By listening to music, these children and teens can both release and control these negative emotions as music is used as a coping mechanism (Bryant, 2014). However, music can also be a form of enjoyment during free time when relaxing to explore their own identity and increase happiness (AACAP, 2017). It helps them feel comfortable in situations where they feel stressed and gives them a feeling of belonging when they are able to connect with others through common music interests (Bryant, 2014).

Listening to music can have huge benefits on adolescents and teens. Tapping to a beat when listening to music can enhance processing and reading skills since it improves both linguistic and perceptual skills (Bryant, 2014). Moreover, it was found that there was a positive correlation to reading speed and the tempo of the background music; the faster the tempo, the more the reading speed would increase. Along with reading speed, listening to music while doing work was discovered to enhance attention span in young adults. It was found that calmer music caused young adults to focus more on the accuracy of a test rather than the speed to complete it (Cloutier et al., 2020).

Music can influence cognitive performance in adolescents and young adults, but so can affect and mood. A study conducted with children years 8-12, found that a more negative affect influenced the students' performance in math, worsened both their working and short-term memory, and reduced attention span compared to children who experienced a more positive affect (Vriend et al., 2016). The negative affect in these children caused them to perform worse in tests and skill checks that tested their cognitive abilities in memory, processing, and attention (Vriend et al., 2016). Moreover, another study showed how a negative affect due to an unfortunate event could cause poor performance in school, especially on hard tests. On the other hand, it was found that a more positive mood during school allowed children to perform better academically since they had better concentration, attention, and could process things quicker (Science News, 2009).

For adolescents, teens, and young adults, music is used to reduce their anxiety when they feel overwhelmed and reduce their sadness when they lose someone special to them. Not only does music help adolescents when they feel negative emotions, but it also improves their mood and helps them feel a sense of belonging (Bogt et al., 2016; Bryant, 2014; AACAP, 2017). However, along with these great benefits in mood, music can improve cognitive performance, extend attention span and also increase processing speed and reading speed depending on the tempo of the song (Bryant, 2014; Cloutier et al., 2020). Music can affect cognitive performance but so can mood. A child who experiences positive affect will have a higher attention span and is able to memorize facts quickly and also recall them faster. Moreover, processing and concentration also benefited from positive mood/affect (Vriend et al., 2016; Science News, 2009). As the research suggests, listening to music as a child could increase both their mood and cognitive performance. If music comes with these benefits for adolescents, then perhaps it could be an effective method to boost their mood and performance.

III. Adults (21-64 years old)

In many adults, listening to music has been found to reduce stress and improve mood. Music improves blood flow, lowers hormones related to stress, as well as eases pain. Also, it activates neurochemical systems and structures in the brain that help regulate emotions and enhance positive mood (Heid, 2018). Moreover, in adults experiencing loss, it was found that they often listened to sad music which was often comforting since it provided them with a substitute friend who they felt truly understood the pain they were going through. In contrast to sad music, it was found in a study in 2013 that adults who listened to upbeat songs could experience happiness for up to two weeks (Boothby, 2017).

Along with benefits in mood, music can improve parts of cognitive performance in adults such as stimulating neural connections, improving attention, and helping regain lost memories (Boothby, 2017). It was also found that listening to classical music benefitted spatial reasoning and autobiographical memories in adults (Mammarella, Fairfield & Cornoldi, 2007). A study conducted on adults using background music found that adults who listened to music, regardless of the length, performed better on cognitive tests than the control group who was not exposed to any music during the testing period. Those who listened to music had faster reaction times and also had their reaction time improve within the three weeks of testing; this might be due to the fact that familiar music gave them faster reaction times rather than music the adults had never heard before (Kirk, Ngnoumen, Clausel & Purvis, 2021). They also had an increase in sustained attention when given a response task right after listening to music compared to the adults who were tested while listening to music. In this study, it was suggested that listening to music while doing a demanding cognitive task was beneficial; however, listening to music could be more beneficial in cognitive tasks when engaging in the task after listening to a piece of familiar music. This was caused by the fact that familiarity to the piece of music contributed a lot to the participant's engagement in a task (Kirk, Ngnoumen, Clausel & Purvis, 2021).

Similar to other studies, it was found that adults that experienced more positive affect had a much quicker reaction time to questions asked and when speaking. Moreover, these adults were able to remember a lot more things and held their attention longer than adults who did not listen to music (Watolla et al., 2020). A study in 2019 found

that mood along with emotional load, had a significant effect on cognitive performance, specifically memory. Undergraduates who had a more positive mood scored much higher on a working memory test than those who were either neutral or negative in mood. Notably, participants who experienced a positive mood tended to focus on the big picture, while those who felt negatively focused more on the details. Lastly, the study also suggested that too much negative stimuli caused working memory to become overloaded and result in poorer performance (Raczy & Orzechowski, 2019).

In adults, music was shown to reduce stress, improve mood, and give comfort when experiencing negative emotions (Heid, 2018; Boothby, 2017). Moreover, music was seen to also improve adults' cognitive performance regarding their attention span, working memory, reaction time, and reasoning abilities while doing difficult cognitive tasks (Kirk et al., 2021; Mammarella, Fairfield & Cornoldi, 2007). However, one study noted that working on a cognitive task after listening to music was more beneficial than listening to music while doing the task. Familiarity further increased music's benefits to adults' cognitive performance (Kirk et al., 2021). Along with music, affect and mood played an important role in adults' cognitive performance. Similar to music, positive affect/mood was found to improve reaction time, attention span, and memory while a more negative affect/mood resulted in worse performance in these categories (Watolla et al., 2020; Raczy & Orzechowski, 2019). Since music is seen as both a mood and cognitive performance booster for adults, it would be beneficial to them to listen to music. With these benefits, music could be an effective tool when working or in need of a better mood.

IV. Older Adults (65+ years old)

Like many others, older adults relieve stress when listening to music. A study conducted in 2016 found that older adults suffering from cognitive decline would listen to music and then feel an improvement in their mood. Music therapy is a form of therapy that can be performed on older adults which helps to make them feel more optimistic about life and improve the mood of the people in this practice (Heid, 2018). Moreover, it was found that older adults who listened to music conceived a more positive outlook on life and felt more positive emotions. These benefits led them to interact better with others, become interested in more things, and experience more positive emotions (Enlivant, 2022). Along with these results, music was also seen to increase relaxation levels and reduce tension when agitated (Enlivant, 2022).

A study conducted in older adults found that listening to music increased autobiographical memory and fluency (Mammarella, Fairfield & Cornoldi, 2007). Also, music was able to trigger memories in older adults who experienced dementia and/or Alzheimers, causing them to communicate more with others after listening to a piece of music. In these older adults experiencing dementia and Alzheimers, music that held an important memory stimulated the medial prefrontal cortex, giving them the ability to very vaguely remember the memory (Enlivant, 2022). Listening to music was also seen to make patients with these conditions hum even when they could no longer speak. Along with communication and memory improvements, listening to music improved recovery time, mobility, and coordination for older adults (Enlivant, 2022). A Finnish researcher found that music enhanced neuron connections in the brain's frontal lobe, the part of the brain in charge of communication, helping patients who experienced strokes regain the ability to talk and recover faster (Study Finds, 2021).

Unlike other age groups, both a positive and negative affect seemed to benefit the cognitive performances in older adults. A study conducted in the Netherlands found that positive and negative affect led to a better working memory when trying to memorize events and facts and also led to more benefits when learning visually (Tieks et al., 2022). Although this may be true, not all older adults experiencing negative affect benefited from it. Some of them experienced the exact opposite effect; the negative mood they experienced slowly decreased their brain size, leading to problems with memory and a harder time concentrating on specific tasks for a long period of time (Cleveland Clinic, 2019). Although it can be reversible, depressed mood can lead to shrinking in brain areas such as the hippocampus, thalamus, amygdala, and prefrontal cortex (Wilson & Burford, 2021). These structures help maintain and regulate functions in the brain needed on a daily basis including memory, learning, emotional control, and attention span. With

the shrinking of these structures, it becomes harder for the brain to maintain these functions, lowering cognitive performance (Wilson & Burford, 2021). Thus, music can be beneficial through inducing positive emotions that can also help preserve cognitive performance. Based on the data, it is possible that listening to more music that improves mood can maintain better cognitive performance not just in older adults but all age groups.

For older adults, music was seen to reduce stress, produce a more positive outlook on life, increase interest and relaxation levels, and reduce agitation (Heid, 2018; Enlivant, 2022). One effective method on older adults is music therapy which can help enhance their mood. Along with mood, music was seen to greatly improve performance in older adults, especially ones suffering from either dementia or Alzheimers. Music encouraged adults with Alzheimers to interact with others and hum even when they were unable to speak. Improvements in recovery, mobility, and coordination were also seen after listening to music (Enlivant, 2022). Similarly to music, affect benefitted cognitive performance in memory and concentration; however, both positive and negative affect were beneficial to cognitive performance in certain ways unlike other age groups (Tieks et al., 2022). Through this research, it was shown that music benefits the mood and cognitive performance of older adults. With the given information, music could be a fruitful way to improve their mood and performance when it is needed.

Discussion

In summary, there appears to be enough evidence to support that music can improve mood which in turn improves cognitive performance in memory, processing skills, reaction speed, and much more. Previous research documents, journals, and studies, suggest that music can enhance mood in people while both positive and negative moods could bring about benefits to cognitive performance depending on the person and age group, they are in.

Across different age groups, it has been noted that music can bring positive benefits in the mood and affect. For infants and young children, music induced positive moods and affect such as happiness and confidence while many adolescents and teens used music as a release from negative emotions and a way to explore their own identity and find happiness (Nelson, n.d.; Bryant, 2014; AACAP, 2017). Similarly, many adults use music to reduce stress and improve their mood (Heid, 2018). Older adults were also seen to use music as a stress reliever, a positive emotion inducer, and a method to help them view life more positively (Heid, 2018).

Along with the benefits music can have on mood, research has shown that positive mood and affect can positively affect a person's cognitive skills. In young children, it was seen that children who displayed lower levels of negative emotion were often more compliant and had a more developed conscience compared to those who had higher levels of negative emotion and displayed both behavioral problems and anxiety (Rothbart, 2012). Moreover, in both teens and young adults, it could be seen that more positive affects caused them to perform better in academics since they were more concentrated, had more attention, and could process things quicker than those who were feeling down (Science Daily, 2009). Likewise, improved memory, attention span, and a better working memory were all benefits that came to adults who experienced more positive emotions (Watolla et al., 2020; Raczy, Orzechowski, 2019). Older adults too had a better working memory when they experienced positive affect than when they experienced negative ones (Tieks et al., 2022). Based on the current knowledge provided, it could be possible that music induces positive emotions which in turn improves cognitive performance.

However, it is important to keep in mind some limitations of this literature review. Most of the evidence pulled for the literature review comes from literature reviews and blogs that studied mainly people in North America and Europe, so it is uncertain whether music can benefit people from all over the world and with different backgrounds. Moreover, due to this limitation, it is unknown if people living in continents like Asia, Africa, Australia, and South America will experience the same benefits or will not even benefit at all from music due to their different lifestyles and living environments. Another limitation was that many studies on musical benefits such as improvements on mood and cognitive performance, etc. were not able to be accessed due to financial reasons.

Nonetheless, listening to music is an activity that all age groups can participate in to connect with one another, even if the genre preferences are different. As seen in the reviews done on children, adults, and older adults alike, music can bring benefits to both mood and cognitive performances, short-term and long-term. Music can induce positive emotions, relieve stress, and uplift the mood, being beneficial to both cognitive performance and mental health. An improved mood caused by music can improve functions in the brain such as processing speed, memory, and reaction speed.

Music is a beneficial way to uplift mood and improve mental performances at the same time. Moreover, there are already some ways to help people through the use of music such as musical therapy. Music therapy includes but is not limited to listening to music, writing songs, singing, and discussing songs. All these methods are used to improve both mental health and the physical health of people who might be struggling with health problems. By doing some of the methods mentioned, it can help people reduce anxiety, improve self-esteem, and help those experiencing Alzheimer's, autism, chronic pains, or any traumatic events (Wong, 2021).

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