PalArch's Journal of Archaeology of Egypt / Egyptology

INFLUENCE OF MUSIC THERAPY ON LEARNING AND MEMORY – A REVIEW

Dr.G.Sridevi[1]
[1]Associate Professor,Department of Physiology,Saveetha Dental College and Hospital,162, Vellapanchavadi, Poonamalle high road,CHENNAI- 600077

Dr. G. Sridevi. INFLUENCE OF MUSIC THERAPY ON LEARNING AND MEMORY – A REVIEW-- Palarch's Journal Of Archaeology Of Egypt/Egyptology 17(7), 1935-1943. ISSN 1567-214x

Keywords: music therapy, therapeutic tool, memory, learning, dementia

ABSTRACT

Music therapy is a therapeutic science thatexpresses emotions of a person through rhythmic, melodic, harmonic elements. This expressive therapy uses musical notes to increase and maintain physical, social, psychological well-being. It is a therapeutic tool that influences many areas of the brain that involve cognitive, emotional, sensational and motor processing. Music therapy often helps recover from various mental disorders like anxiety, depression, autism, schizophrenia, dementia, insomnia and personality problems. Different concepts of music have different influence on the brain. Loud fast music and slow soft or slow loud music hindered the process of learning, but soft fast type of music enhanced learning. Instrumental music interferes with learning to a lower level compared to music with lyrics. The areas possibly affected by music are the cerebrum, auditory cortex and the cerebellum. The auditory cortex and cerebellum are generally associated with sound and movement and cerebrum associates with hippocampus which is considered as a large memory center of brain. This explanation possible associates how music is related to memory. Thus, music produces a stimulating effect on mood and enhance learning process and this form of therapy is therapeutically beneficial for treating Alzheimer's disease and senile dementia.

INTRODUCTION

Music is a tone or sound that occurs in a melody or a harmonic tune and can be sounded by one or more instruments and human voices. This is a science of art of sounds or tones that occurs in succession and that expresses emotions of a person through rhythmic, melodic, harmonic elements

Music therapy is a form of expressive arts therapy that uses musical notes to increase and maintain physical, social, psychological well-being. This therapy uses music to listen to music, sing it and play a musical instrument along with it. (*Website*, no date a) This therapy is done by trained musical therapists and this is engaged in hospitals, schools, nursing homes and rehabilitation centres.

This musical therapy is a therapeutic tool that influences many areas of the brain that involve cognitive, emotional, sensational and motor processing. Music therapy often helps recover from various mental disorders like anxiety, depression, autism, schizophrenia, dementia, insomnia and personality problems (GoodTherapy Editor Team, 2009)

Many researches have strongly evidenced the association between music on performance tasks on individuals and groups of people. Music therapy is reported to improve the learning phase of memory, increased mood changes and alertness, improvement of sports performance

Music is a play consisting of tones of clearly and good defined and fixed tones. If the sound vibrations are clearly quantified, it is music and other sounds like cry, glissandos are not considered as music ,but are noise. Music gives pleasure and helps to influence memorizing task performance and the effect produced depends on the individual factors and group effects (Musliu, Berisha and Latifi, 2017)

Many therapeutic musical interventions can be roughly categorized into active techniques and receptive techniques. Active technique involves singing or chanting a music, playing, composing or improvising a musical note in an instrument. Receptive technique involves listening to a musical note and responding to this note by dancing or analyzing lyrics of the sound. These two techniques are often used in a combination for therapeutic benefits.(*Website*, no date b)

A study investigated the effect of background music on learning outcomes pertaining to cognitive abilities, mood and arousal mediation effects, learning and memory. They involved a demographic questionnaire and two pre tests for analysis of arousal and mood. Results revealed that background music mediated cognitive abilities and skills and did not affect mood and arousal. (*Website*, no date b, *Website*, no date c)

Learners with good high working memory could positively affect background music which will help to compensate an additional burden on cognitive functions A study by Husain et al, worked on the hypothesis based on arousal and mood. This hypothesis explains that background music does not directly affect cognitive abilities, but indirectly influences through mediators of arousal and mood. This mediation affects cognitive performances in addition to spatial abilities and learning outcomes. (Klix and Hagendorf, 1986)

Studies revealed that the characteristics of music namely the intensity and tempo have a significant effect on the learning process in the brain. (Thompson, Glenn Schellenberg and Letnic, 2012) Loud fast music and slow soft or slow loud music hindered the process of learning, but soft fast type of music enhanced learning. Instrumental music interferes with learning to a lower level compared to music with lyrics. (Perham and Currie, 2014)

The benefits of musical learning had stretched its potential to verbal recall of a foreign language too. In a study by Ludke et al, the participants were made to listen to paired phrases in two unfamiliar languages, English and Hungarian. These phrases were presented vocally, sung by a rhythm and the participants were made to repeat the Hungarian words loudly and made to reproduce, recall, recognize the Hungarian words by vocabulary tests. The participants were made to effectively recall the unfamiliar words in the task. (Ludke, Ferreira and Overy, 2014; Perham and Currie, 2014)

Another study evaluated the recall of 16 new sentences in a random manner shown on a computer screen. The task was presenting the 16 sentences for a seconds time by two ways of expression, spoken as well as sung conditions. These sentences were averaged to 30 seconds. The responses were recorded in the way that sung phrases were recorded first followed by spoken sentences. Results revealed that there was an enhanced recall of the new words in the musical set compared to the spoken set of presentation.(Kilgour, Jakobson and Cuddy, 2000)

A study investigated the effect of music therapy on short term memory. The participants were categorized into lyrical music groups exposed to rhyming lines of poems, relaxed music groups and non- music groups exposed to nonsense syllables. The results found significant differences among these groups and also the study observed relaxing music increases short term memory and non music groups did not significantly affect the memory. On the other hand, there were no significant differences between relaxed music groups and lyrical music groups.(Musliu, Berisha and Latifi, 2017)

MUSIC THERAPY AND MEMORY ENHANCEMENT

A study was conducted comparing the structural and functional changes of the brain in two different groups of people, a life-long musician group and a third age non musician group. Their findings measured the quantitative and qualitative changes in the brain and the results revealed that there was a significant difference in the functional abilities of the brain in the two age groups and then they later also reported that there were no structural and functional changes in the brain among the two groups of participants..(*Website*, no date d)

Music that involves a text of songs are consolidated and stored in separate regions of the brain along areas that govern with production of speech and recall of language. These areas of the brain recall only musical memory but not other vocalization. Thus, music activates multiple areas of the brain apart from verbal centres. Thus, connecting these areas of the brain, strengthens the memory related to those centres. Since memory storage areas of the brain exist, a person is capable of musical stimulation even if he becomes non-verbal. (*Website*, no date e)

Previous research studies by Bolles et al observed that music is so strong to activate more parts of the brain. The areas possibly affected by music are the cerebrum, auditory cortex and the cerebellum. The auditory cortex and cerebellum are generally associated with sound and movement and cerebrum associated with the hippocampus which is considered as a large memory center of the brain. This explanation possibly associates how music is related to memory. (‘Remembering and Forgetting: An Inquiry into the Nature of Memory, Edmund Blair Bolles. Walker and Co., New York. 313 pages. ISBN: 0-8027-1004-2. $22.95’, 1988)

Music acts as an emotional stimulus, in a fact that different types of music can induce different emotions in the listeners. Happy music is nostalgic and sad music can evoke sadness. This type of music can recall autobiographical memories and even change their mindset as per the situation of the song. (*Website*, no date f)

Working memory is information that includes the learning material, learning task and contextual factors. These actors need to be processed for execution of learning tasks. Music therapy (MT) is one of the non-pharmacological interventions in the treatment of dementia and Alzheimer's disease (AD) ((Irish *et al.*, 2006; Satoh *et al.*, 2015). Many Studies have also reported that music therapy significantly prevented cognitive decline in relation to episodic memories, autobiographies, global cognitive tasks, psychomotor tasks and executive functional domains as observed as four seasons on a cassette recorder as a background. Thus, MT is considered as a promising therapeutic approach in treating dementia and AD as shown by significant reduction on the scores in the State Trait Anxiety Inventory.(Irish *et al.*, 2006)

Another study investigated the effect of playing music and listening to it on recalling memories of childhood and generalized past life. Megan Metzler et al found that people who were engaged in music during their childhood days had better recalled experiences of the past and general life practices of the past.(*Website*, no date g). The study explained that musical training in early life significantly decreased age related cognitive and neural networking decline and also preserves memory and bodily movements compared to a person who was not related to music at any time.

Another study by Ozdemir L et al., investigated the effect of music therapy that included multisensory stimulation effects like Music therapy, painting pictures and orientation tasks in 4 sessions/week for 3 weeks among 27 mild AD patients. The scores of Mini Mental State Examination increased and Geriatric Depression Scale and Beck Anxiety Scale scores considerably decreased. This anxiety reducing effect continued even after three weeks after completion. (Ozdemir and Akdemir, 2009)

A study by Johnson et al, observed that AD twins had a significant improvement in spatial- temporal tasks reported that the AD twin had a significant improvement on listening to a piece of Mozart on the spatial-temporal task. A study by Arroyo-Anlló et al observed that listening to Spanish songs provided a stabilization or enhancement in self consciousness in AD and improved memory from mild to moderate stages as shown by good scores in MMSE and FAS (frontal Assessment short tests).(Arroyo-Anlló, Díaz and Gil, 2013; Sakamoto, Ando and Tsutou, 2013)

A study evaluated the effect of favourite songs in Karaoke music on 10 AD patients as a therapeutic intervention to dementia for 6 months and observed significant improvement in memory related tasks. Karaoke is an automated music with vocal songs played together and this form of music is used universally for enjoyment and entertainment. Japanese Raven's Colored Progressive Matrices was the completion task after a 6 months music course was analyzed in AD. They found increased brain activity in the left lingual gyrus and right angular gyrus as observed by functional Magnetic Resonance Imaging changes and better after -minus-before analysis tasks in music treated groups. ((Irish *et al.*, 2006; Satoh *et al.*, 2015). There are more researches that concentrate on observation that MT can alleviate anxiety, depression, agitation, decrease mood changes and behavior in dementia. (Sakamoto, Ando and Tsutou, 2013)

The influence of MT towards neural changes in the brain is attributed to the fact that neurons recover after music listening and preserve cognitive functions.(Särkämö *et al.*, 2008) . Also the fact that music induces

steroidogenesis that in turn promotes neurogenesis, neuroprotection and conserves cognitive ability. (Fukui and Toyoshima, 2008)

Another study made a comparative analysis of sung lyrics and spoken lyrics using rhythmic or melodic elements to recall verbal elements. The sung music enhances brain encoding of verbal information better than spoken lyrics. (Simmons-Stern, Budson and Ally, 2010). Another novel study was conducted to compare the verbal mnemonic effects on verbal contents along with three different music- song by Ode to Joy, movie sequence by Charlie Chaplin and another spoken alone. The results revealed that the songs sung with texts were better recalled compared to other groups. (Palisson, 2015)

MOOD CHANGES AND MEMORY

Many theoretical studies and strategies have been worked out to influence the effect of mood on memory consolidation. Positive and enhanced mood is generally related to good learning outcomes and negative and diminished moods and even boredom decreases the learning process. Studies by Rauscher et al, explored that music seems to enhance positive moods which is explained as the Mozart effect. Music produces a stimulating effect on mood and enhances the learning process which is explained by arousal mood hypothesis. (Rauscher, Shaw and Ky, 1993)

The arousal mood hypothesis states that listening to background type of music does not directly impact its effect on cognitive capacity of a person , but mediates it through inducing arousal and mood improvements and thus has an impact on learning outcomes, spatial abilities and cognitive functions of the brain. (Husain, Thompson and Glenn Schellenberg, 2002).Thus the hypothesis concluded that mood and arousal are also important potential mediators of learning strategies.

FORMS OF THERAPY

There are different music therapy techniques that have been used therapeutically. Soundscape Music Therapy consists of Drumming , music assisted relaxation, Listening to recorded or live music, singing singing familiar songs, playing instruments with piano or guitar, Lyrical music , preparing music for new songs, dancing for new music and writing choreography for a music. There are many other forms of music therapy namely Dalcroze Eurytmics, Kodaly philosophy of music therapy and Neurologic music therapy. In Dalcroze Eurythmics , the students are taught music in the form of therapy. This therapy focused on the rhythmic expression of movement in their learning expression. Kodaly philosophy of music therapy uses rhythm, sequence, notation and music literacy. This type of music therapy has a good impact on learning performance, conceptual formation and perception. Neurologic music therapy is a form of neuroscience that uses perception of music on functional behaviours. Orff-Schulwerk is another form of music therapy that helps children to improve the learning ability and cognition. This method also enlightens the efficacy of humanistic psychology and improves interaction among people. (*Website*, no date h; Husain, Thompson and Glenn Schellenberg, 2002)

The American Music therapy association uses music therapy as a clinical and evidenced based medicine for clinical practice. This association helps to achieve therapeutic goals by the following strategies – Music interventions, Clinical and evidenced based music therapy, individual goal oriented therapy and credential professional therapy. (ROIA RAFIEYAN, 2007)

MUSIC THERAPY IN ALZHEIMER'S DISEASE

Music therapy is an essential therapy that helps in the retention of memory and prevents loss of mental function in Dementia with Lewy bodies and Alzheimer's disease . Certain musical therapy techniques are adopted like writing a song , guided imagery with music, lyric music analysis, counselling with music, singing a song, instrumental playing and relaxation with music are useful in memory dysfunction which helps in physical and psychological improvements, increased communication and improvising memory retention and retrieval of memory (Hilliard, 2005)

Music therapy involves the utilization of both cerebral hemispheres for the complete life and improves cognitive functioning in older adults (King, 2013) Corpus callosum is strengthened by music therapy with musical interaction. The functions of amgydala is also provoked by emotional music. Hippocampus is also activated with musical context and is impacted by incorporation of melody line, lyrical and harmonical music. (Lammers and Kruger, 2008).

AGE ASSOCIATED MEMORY LOSS

There are two forms of age related changes that researchers identified in the brain. Age-Associated Memory Impairment (AAMI) and Age Related Cognitive Decline (ARCD) are pathological dysfunctions of the brain when one individual advances with age.

With progression of chronological age, the brain also follows an Age Associated Memory Impairment (AAMI) . In such type of memory loss, an old person is unable to recall memories and experiences of the past and has lapses in their memory pattern due to impaired functioning of medial parietal lobe (MPL) of the brain. There is also a shift in memory related functions from MPL to the hippocampus, which is an important area of the brain involved in consolidation of memory. This shifting occurs as a result of shutting down of sensory identification in MPL occurs as age progresses.((*Website*, no date i; Hilliard, 2005)

Another dysfunction caused by age is Age related Cognitive Dysfunction (ARCD) which consists of decreased cognitive function, forgetting attitudes, impaired problem solving capacity. Hippocampus plays very hardly to keep the brain in a functional state in ARCD. (Ferris and Kluger, 1996).(Website)

CONCLUSION

Music therapy is considered as an evidence based therapeutic medicine that has been used in different forms of cognitive dysfunction. Music activates multiple areas of the brain apart from verbal centres and strengthens the memory and also acts as an emotional stimulus that can induce different

emotions in the listeners, recall autobiographical memories and even change their mindset. Music produces a stimulating effect on mood and enhance learning process and this form of therapy is therapeutically beneficial for treating Alzheimer's disease and senile dementia.

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