MEMORABLE MUSIC AND COGNITIVE DEVELOPMENT IN EMERGING ADULTHOOD: A SCIENTIFIC PERSPECTIVE

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Abstract: Music has a remarkable ability to influence mood, improve concentration and stimulate human emotions. In the context of a learning simulation involving reading, listening, writing and eating snacks, memorable music was found to have a positive impact on adult learners' cognitive processes. From a study involving three adult learners aged between 18-29 years old, purposive non-random sampling was used to ensure inclusion criteria as adult learners without hearing loss. The research used a qualitative study with data collected through interviews and observations and thematic analysis. This research shows that memorable music has a positive impact on adult learners' cognitive processes. The integration of music in learning improved participants' attention, memory and thinking. Understanding the complex interactions between music and cognitive processes provides valuable insights for psychological and biological understanding, contributing to effective applications in rehabilitation, treatment and education.

Keywords: Memorable music, cognitive development, emerging adulthood, science perspective

INTRODUCTION

Music is an inherent necessity in human life. Research shows that music is considered one of the most enjoyable and fulfilling human activities (Dubé and Le Bel, 2003). Sometimes, music is considered a way of expression where freedom is a privilege (Ahmad & Rana, 2015). In addition, a study shows that listening to music becomes one of the most important parts at certain phases of life because it can define a person's identity, and express their social relationships (North et al., 2000; Schäfer et al., 2013).

In addition, music has become an essential need for individuals to go about their daily activities as it can provide a different experience. Just as music can affect cognitive functions, such as memory, attention, and problem solving (Levetin, 2006). In addition, music has the potential to influence mood, feelings, and thoughts and has the ability to change a person's emotional as well as physical status, whether

in a bad, good, or sad mood (Ahmad & Rana, 2015). Therefore, the effects of music can depend on a person's personality factors, preferences for the music they listen to, and their emotional state (Slobada & Jaslin, 2001). In addition, the effects of music also include affective changes identified from factors such as features such as the musical structure of the piece, interpretation by the performer, relevant conditions and characteristics of the listener's nature, and the respective context (Scherer & Zentner, 2001).

One type of musical stimulus that has received considerable attention in recent years is memorable music, defined as music that evokes personal memories and emotions (Janata, 2009). Memorable music can be associated with specific events, places, people or periods in one's life. Memorable music can evoke autobiographical and nostalgic memories (Barrett et al., 2010). Memorable music can also affect individuals' mood, arousal and motivation, and modulate their cognitive and emotional responses to other stimuli (Baumgartner et al., 2006). Studies have even suggested that there is a mood-inducing effect of music on the recall of childhood memories and found that music has an impact on the total number of memories recalled under happy conditions (Martin & Metha, 1997).

The effects of memorable music on cognition have been studied in several domains including language, memory and also creativity. Research shows that listening to memorable music can be used as a medium for language development (Palupi et al., 2019), improving verbal memory (Ferreri et al., 2013), and writing skills (Mulyono, 2022). Other research shows that memorable music can impair cognitive performance by distracting attention (El Boghdady & Ewalds, 2020), eliciting negative emotions such as affecting mental health (Amanda, 2022) or activating irrelevant memories (Schellenberg et al., 2008).

Music not only affects cognition, but also the anatomy of the human body. Several studies have shown that music has the transformative power to stimulate neuroplasticity and influence cognitive, emotional, physical and social well-being. Music can also help improve cognitive function and physical well-being, and is used as a non-pharmacological therapy in medicine (Zaatar, 2023). In addition, other studies also say that music can increase the pulse rate and have a physiological impact on the body, especially for those who play music (Sondakh, 2014). Music also has a positive influence on health and well-being through neurochemical systems that regulate reward, motivation, immunity, stress, arousal, and social affiliation (Chanda & Levitin, 2013). Even from a medical perspective, music can improve the quality of life of post-stroke patients (Luvita & Hidajat, 2017).

The emergence of various kinds of reactions produced by music, of course, cannot be separated from the entry of information data obtained that affects the cognitive performance process. The process of cognitive performance occurs, depending on how we receive information from the outside world and how to

understand the information and what to do with the information (Groome, 2013). Music thus has benefits that extend beyond personal and emotional development. Previous research has shown that listening to music can improve cognitive performance and learning ability, especially when listening to it before a task and when the music is familiar (Cansu et al., 2020; Cassidy, & MacDonald, 2009).

Groome (2013) states that there are main stages in cognitive processing consisting of input, perception, learning and memory stage, retrieval, and thinking.

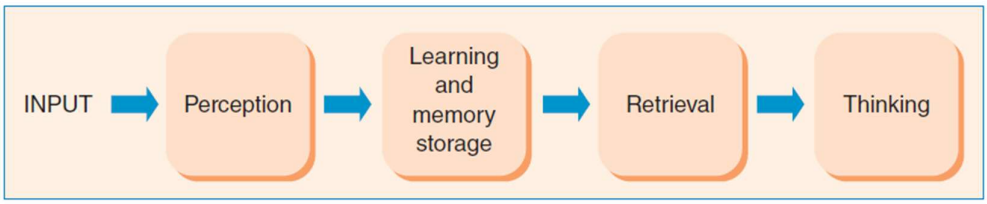

Figure 1. The main sequence in the cognitive process

The perception process begins with the initial stage, namely the initial perception stage. At this stage, the brain has begun to analyse the content of the information received. This process is done to understand the information contained in the input. This stage also involves making notes and storing the memory of the information received. Once the memory is created, the information can be retrieved and used at a later date. Retrieval of information can be done simply for access to information stored in the past, or to be used as a basis for mental activities such as thinking (Groome, 2013).

Therefore, there is a gap in the research on the effect of memorable music on cognition, particularly in adult learners.. Existing research tends to focus on young or middle-aged adults, with relatively simple cognitive tasks such as remembering words, making word associations, or completing simple language comprehension tasks. Therefore, there is a need for further research exploring the impact of memorable music on adult learners' cognitive development in the context of more complex and realistic tasks, such as reading, listening and writing. This research gap will open up further understanding of the applicative potential of music in supporting learning and cognitive development in this group in integrated simulation activities.

Integrated simulation is a learning activity that combines reading and listening tasks with specific objectives and feedback meaning that it is one of the most effective ways to facilitate the learning of complex skills in various fields (Chernikova et al., 2020). Integrated simulation has one of its objectives to develop higher order thinking skills such as analysis, synthesis, and evaluation and application of different concepts (Marcelina, 2023). Integrated simulation is also relevant for adult learners, who often face various challenges and opportunities in

their learning process, such as the importance of managing emotions, feelings, and cognition in influencing their risk perception and decision-making (Finucane, 2008). Because learning is essentially lifelong.

METHOD

This study utilised a qualitative research design (Creswell, 2014) to investigate the impact of memorable music on adult learners' thinking models in reading, listening, writing and snack eating simulations. Three adult learners studying for a Masters degree participated in the study, ranging in age from 18-29 years (Arnett, 2000). The participants were selected using purposive non-random sampling (Polit & Beck, 2012) to ensure that they met the inclusion criteria of being adult learners and not having hearing impairment. Data were collected through interviews and observations (Denzin & Lincoln, 2011). Thematic analysis (Braun & Clarke, 2006) was used to analyse the data and identify patterns and themes relating to the impact of memorable music on participants' thinking models.

In this study, the relevant samples will be the object of integrated simulation of cognitive development of adult learner thinking models that first collect data such as favourite reading books, memorable songs and snack foods according to personal needs and experiences, which can be seen more clearly in Table 1 below.

Table 1. Integration Simulation Data and Materials

Respondent Characteristics	Favourite Book	Memorable Music	Snack Food
I 26 years old (P)	Type of book : Novel Title : Dilan : Dia adalah Dilanku tahun 1990 Author : Pidi Baiq Established : 2014	Maidany – Kaca Yang Berdebu (2010) Smash – Senyum Semangat (2011) Ovhi Firsty – Saba dalam Penantian (2020)	Rengginang crackers
P 27 years old (P)	Type of book : Novel Title : A Gentle Reminder Author : Bianca Sparacino Established : 2020	Twice - One In A Million (2016) Twice - Fancy (2019) NCT – Beautiful (2021)	Arai pinang crackers
R 28 years old (P)	Type of book : Non Fiction dan Feminism Title : Cinta Untuk Perempuan Yang Tidak Sempurna Author : Najelaa Shihab Established : 2020	Nadin Amizah - Mendarah (2020) Naomi Scott - Speechless (2019) Ben - Because This Is My First Life (2017)	Dorokdok skin crackers

This integration simulation involved the tasks of reading a favourite book, listening to memorable music, and writing while listening to memorable music and eating a snack. The simulation lasted for 9 minutes which was broken down into 3 stages every 3 minutes. The first three minutes were reading a favourite book without distraction. The second three minutes is reading a favourite book while listening to memorable music and writing a summary of the reading. The third three minutes was reading a favourite book while listening to memorable music and eating chips, without writing a summary. After the simulation was over, the participants were asked to write down their thought process during the simulation in detail.

RESULTS AND DISCUSSION

In this study, we wanted to explore the impact of memorable music on adult learners' thinking in an integration simulation activity. An integration simulation is an activity that consists of three aspects, namely reading a favourite book, listening to memorable music, and eating a light meal such as a snack. Three different samples of participants were used: I, P, and R. Their thinking models were viewed after the simulation in narrative form and analysed in detail in written form after the simulation.

The first sample illustrates how subjects respond to input stimuli, memory, and thought processes, as contained in the table below.

Table 2. Overview of the first sample's attentional and thinking processes

	Stimulus Input	Possibilities	Reaction
Sensation	Laptop machine sound The sound of people waking up for dawn Voice of recitation View the song button on the laptop View favorite novels Reading favorite novels Listen to *memorable* songs Feel the crunch of rengginang Straightening and bending the legs	Familiarize with reading Write a digest while reading and listening to a song	Reading while listening to songs and eating crackers
Memory	Remembering the old school days Remembering the idol Given the story in the novel Understand the content of the novel		
Thinking Process	Recall and write down the essence of the novel Understand the question command Understand the stages of simulation		

The results above illustrate that the subjects experienced various stimuli, including the sound of the laptop machine, the sound of the sahur call, the sound of the ngaji, looking at the song button on the laptop, looking at their favourite novel, reading their favourite novel, listening to a memorable song, feeling the texture of the rengginang, and doing straightening and bending movements of the legs. Subjects also recalled their school days, memories of their idols, and stories in novels. The subject's thought process involved understanding the content of the novel, remembering and writing the gist of the novel, understanding the question instructions, and understanding the stages of the simulation. In the interview, the subjects also revealed that the song "Senyum Semangat" from Smash took them back to their school days when the popularity of this boy band reached its peak in Indonesia. They also recalled how they idolised the group members and shared funny stories about that time. Despite being distracted by the music, the subjects remained focused on the book and continued reading it. While the second sample responded to stimulus input, memory, and thought process, which is contained in Table 3.

Table 3. Overview of the attention and thinking process of the second sample

	Stimulus Input	Possibilities	Reaction
Sensation	The atmosphere in the room was a little hot because it was about to rain	Aware of the ticking timer	Stop looking at the phone screen and refocus on the reading.
Memory	Recalling the first time you heard a song in 2018		
Thinking Process	Looking at the phone screen		

From the above results, this subject felt a little hot in the room due to the potentially rainy weather, and then realised the timer was running. The subject stopped the activity of looking at the mobile phone screen and refocused on reading. This table also notes that the subject recalled the experience of listening to a song in 2018, showing the impact of memory on the subject's thinking. In addition, from the interview, the subject also revealed that this song (One in a Million-Twice) has a special meaning to them because of the positive and uplifting lyrics. This song was first listened to when the subjects were writing their final thesis in 2018, when they felt discouraged and lacked confidence. This song gave encouragement and confidence to the subjects so that they managed to complete the final project successfully and within the specified time.

The results shown by the third sample regarding input stimuli, memory, and thought processes, which is contained in Table 4.

Table 4. Overview of the third sample's attention and thinking process

	Stimulus Input	Possibilities	Reaction
Sensation	The subject reads (looks at the writing while processing information from the message in the writing) in a book. Subjects tasted savoury and salty flavours in the snacks Feel happy because they listen to music with a low tone	The subject realised that the contents of the book were very similar to the subject's condition.	The subject continued reading the book. Subject continues to eat snacks
Memory	The subject listens to a memorable song while imagining themselves in the scene.	The subject thinksthe snacks he eats are delicious	
Thinking Process	recalled the information because they had read it before.		

From the integration simulation conducted by the subject, it can be seen that the subject experienced cognitive development related to memory, imagination, and concentration. The subject was able to recall the information he had read and felt that the sentences written by Najeela Shihab were very positive, causing a feeling of pleasure. In addition, the subject is also motivated to behave well towards fellow women. Then when the music played, the subject imagined that he was in a scene of a Korean film/drama scene that matched the music he was listening to, which had imagined like that for only a few moments, approximately only 20 seconds. Then the subject returned to concentrating on reading the book while listening to music and eating snacks. In addition, the subject also demonstrated critical thinking skills by writing a reading summary based on the contents of the book he read. The subject is able to identify problems, gather information, evaluate arguments, draw conclusions, and provide reasons related to reading. The subject did not experience any interference or obstacles in performing integration simulations because he was used to these activities. The selection of books, music, and snacks used in the integration simulation made the subject feel comfortable and happy. The reading material chosen also made the subject feel motivated and inspired.

From the results of integration simulations conducted on three subject samples, it was seen that memorable music influenced various stages in the cognitive process of adult learners. The main stages in the cognitive process, including input, perception, learning and memory storage, retrieval, and thinking, are affected by the musical stimulus encountered by the subject. As can be seen in table 5 below.

Table 5. Thematic Analysis Results

Cognitive Process Stage	Theme	Subtheme	Excerpt
Input	Attention	Increased	The music listened to also had an emotional impact that affected the subject's motivation and interest in the reading task
	Concentration	Increased	Basically, the subject did feel more focused when reading a book while listening to slow music
	Mood	Positive	When reading, the subject felt that the sentences written by Najeela Shihab were very positive, which caused a feeling of pleasure
Perception	Comprehension	Strengthen	Music influences the subject's perception of the content of the book, which can strengthen their understanding and analysis of the reading material
	Comprehension	Distracting	The subject imagined like that for only a few moments, approximately only 20 seconds, after which the focus returned to reading
Learning and memory storage	Memory	Association	Subjects used music as an association to recall information obtained from books read
	Memory	Effect	Music provides a strong memory effect, connecting the subject with certain experiences and emotions associated with the song listened to
Retrival	Retrival	Context	Music assisted the subject in initiating the information retrieval process by providing back the associated context
	Retrival	Emotion	Music helps the subject in initiating the information retrieval process by giving back the associated emotions
Thinking	Thinking	Evaluation	Subjects were able to use information obtained from books and music to evaluate arguments related to the reading
	Thinking	Analysis	Subjects were able to use information obtained from books and music to analyse their thinking
	Thinking	Synthesis	Subjects were able to use information obtained from books and music to synthesise their thinking
	Thinking	Stimulation	Music influenced the subject's cognitive process by providing additional stimulation that could enrich and deepen their thinking

From the data obtained through thematic analysis listed above produced by the subjects, it can be described as follows.

1. Input

Subjects respond to various sensory stimuli, including sounds, sights, and tastes, which affect attention, concentration, and mood. In fact, recent research suggests that music can have positive effects on attention, concentration, mood, motivation and learning (Nadon et al., 2021; Vigl et al., 2023; Mendes et al., 2021). Specifically, music can increase attention to a task, leading to improved concentration, and create a positive mood that affects motivation and interest in the task (Nadon et al., 2021). However, the type of music and its characteristics can also affect cognitive performance. For example, fast and loud music can impair reading comprehension, while baroque instrumental music is excellent for improving attention and reasoning (Ahmad & Rana, 2015; Nadon et al., 2021). Moreover, familiar music is also associated with increased enjoyment and performance on cognitive tasks (Ahmad & Rana, 2015). Overall, music can be used as a useful tool to improve cognitive performance, but the type of music and its characteristics should be carefully considered.

2. Perception

Subjects interpret the information they receive from the environment, including the content of the books they read but there are also situations where music may interfere with the subject's understanding of the book, depending on the type of music, its characteristics and differences in individual experience. For example, fast and loud music can interfere with reading comprehension, while baroque instrumental music is great for enhancing attention and reasoning. In addition, familiar music has been associated with increased enjoyment and performance on cognitive tasks (Du et al., 2020; Su et al., 2023). However, music can also interfere with reading comprehension, especially when the music has lyrics or when readers encounter difficult vocabulary (Vasilev et al., 2023) Overall, although music can improve cognitive performance in various ways, the effects may vary based on factors such as the type of music and individual differences in musical knowledge and training (Du et al., 2020; Su et al., 2023).

3. Learning and memory storage

Subjects responded that in learning and memory storage they had certain experiences and emotions associated with the song, so memorable music has a strong memory effect. Because of the emotions that arise, it enhances the

memory process and music helps evoke strong emotions in forming certain information (Jäncke, 2008). In addition, music has been shown to improve learning and memory retention in various contexts, such as language acquisition and academic performance (Lehmann & Seufert, 2017; Vigl et al., 2023). However, the effectiveness of music in memory retention may vary depending on the individual's musical knowledge and training, the type of music, and its characteristics (Jäncke, 2008; Lehmann & Seufert, 2017). Overall, using music as a tool to create associations and enhance emotional connections can improve memory retention and learning outcomes.

4. Retrieval

The result raised by the subject is that memorable music can help the subject to start the information search process by providing context and related emotions. Research shows that music can assist individuals in searching for information by providing context and evoking related emotions (Jäncke, 2008). Music can also improve memory, emotional engagement such as mental health, and overall learning outcomes (Wang et al., 2022). The emotional experience of music is influenced by musical features such as tonal, rhythmic, and loudness (Salakka et al., 2021). Utilising music to create meaningful connections can enrich the learning experience and improve information processing and retention.

5. Thinking

In this final phase, the music listened to by the subjects was able to influence their cognitive processes by providing additional stimulation that could enrich and deepen their thinking. Research shows that music can influence cognitive processes and improve thinking (Vigl et al., 2023). Music can also improve memory, emotional engagement, and learning outcomes, but the impact of music on cognitive performance can vary based on individual differences in personality type, working memory capacity, and the type and volume of music played (Dolegui, A. S., 2013; Lehmann & Seufert, 2017; Bottiroli et al., 2014) Overall, utilising memorable music as a tool to create meaningful associations can optimise information processing and retention, thus enriching the learning journey for individuals.

Based on the results of the description above, it can be seen that in the end music has a significant impact on various stages of cognitive processes in each subject, especially on memorable music. Starting from the input stage, where music affects attention, concentration, and mood, to the thinking stage, where music also provides additional stimulation that enriches and deepens the subjects' thinking.

However, it is important to understand that the interaction between music and cognitive processes not only involves psychological aspects, but also has a complex biological basis (Peretz, 2006).

Biopsychology is the study of human biological mechanisms in psychology, with a focus on the sensory system or sensation, which is the process of detecting the presence of stimuli from the external environment through the senses (Hapsari, 2014). For example, that music can influence sensory neural activity in healing the sick, specifically in altering autonomic responses to musical stimuli, in order to more effectively treat those suffering from Disorders of Consciousness (DoC) (Riganello et al., 2015). In addition, music can also alter neural activity through emotionality. Emotions evoked by music can alter activity in various brain structures and have important therapeutic implications (Koelsch, 2018). Even in learning, music has a significant impact, stating that music can improve concentration and learning by using alpha brain waves (Prima, 2018).

The influence of music on cognitive processes is becoming increasingly important to understand in a psychological and biological context. Music not only affects attention, concentration and mood, but also provides an additional stimulus that enriches thinking. Biopsychological studies emphasise the role of the sensory system in autonomic responses to music, particularly in treating patients with disorders of consciousness. The integration of psychological and biological aspects in understanding the effects of music may lead to a more comprehensive understanding and more effective applications in the fields of rehabilitation, treatment and education. Therefore, understanding how music affects cognitive processes not only provides valuable psychological insights, but also contributes to our understanding of the complex biological relationship between music, the brain and human behaviour.

CONCLUSION

A study conducted on adult learners explored the impact of memorable music on their cognitive processes. The findings indicate that music plays a significant role in influencing various stages of cognitive processes, including attention, perception, learning, memory storage, information retrieval, and critical thinking. During the input stage, music improved the subjects' attention, concentration, and mood. At the learning and retention stage, music establishes a strong association between the information in the book and the music, enhancing memory and aiding information retrieval by providing context and associated emotions. Finally, at the thinking stage, music stimulates and enriches subjects' thinking, enabling them to evaluate, analyse, and synthesise thoughts more effectively. This research contributes to our understanding of how music interacts with cognitive processes,

helping adult learners to learn and think critically. It also sheds light on the complex biological relationship between music, the brain, and human behaviour.

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