

Experiment on The Influence of Music on Memory Recall

ABSTRACT

Aims: This study aims to shed light on the circumstances in which music might either enhance or impair memory recall by examining the effects of music's emotional alignment with the task.

Place and Duration of Study: University of Mindanao-Digos College, Department of Teacher Education, from November to December 2024.

Methodology: University of Mindanao- Digos College second year students (N=45) from 3 different programs (BSED-English, BSED-FM, and BSED-Social Studies). The BSED-English was composed of 21 students, the BSED-FM was composed of 15 students, and the BSED-Social Studies was composed of 9 students. The majority of the participants were from the BSED-English program. Their age group ranges from 18-23. These participants were selected through random sampling.

Results: This study is conducted to find if there is a significant effect in terms of music and emotional congruence on memory retention. Kruskal-Wallis, a non-parametric alternative to one-way ANOVA, was utilized to determine the results. The chi-squared (χ^2) has a variance of 3.76, derived from the Kruskal-Wallis test, and serves to assess whether significant differences exist in memory retention across different conditions (Emotionally Congruent, Emotionally Incongruent, and No Music). The degrees of freedom (*df*) associated with this test are equivalent to 2. Whereas the effect size, measured by eta-squared (ϵ), was $\epsilon = 0.0854$. This indicates that approximately 8.54% of the variance in memory retention can be attributed to the emotional congruence of music. The small effect size ($\epsilon = 0.0854$) further suggests that any observed differences are likely to be of minimal practical significance. With a *p-value* of $0.153 > 0.05$, the findings suggest that there is no significant effect in "memory retention".

Conclusion: College students' memory retention is not considerably impacted by emotional congruence in music. The presence or absence of emotionally congruent, emotionally incongruent, or no music at all had no effect on participants' recollection of a story they had read.

Keywords: Memory Recall, Emotionally Congruent Music, Emotionally Incongruent Music

1. INTRODUCTION

Does the emotion evoked by music shape what we remember? Music has played a major role in many aspects of cognitive and emotional processes, including focus, association, and memory. The fact

that music can either be distracting or elevating remains an enigma in music psychology. It was hypothesized that if an individual feels emotion as a response to music, their cognitive processes are affected (Talamini, F., Eller, G., Vigl, J., & Zentner, M., 2022). In line with this, the study aims to explore how emotional congruence of music affects memory retention. In particular, the question lies on the effectiveness of mood-appropriate music on recalling specific details from the content of focus.

One of the core issues in the psychology of music was whether or not music can improve or otherwise hinder performance in various tasks (Naranjo, Beatriz & Rojo Lopez, Ana M., 2021). Several studies have been made with regard to music congruence. One study focused on the effects of music congruence (Indian, American, and Chinese music) on purchasing behavior, specifically on Indian, American, and Chinese food. Results have found that participants are more likely to choose food that matches the music playing in the background (North, A. C., Sheridan, L. P., & Areni, C. S., 2016). On the other hand, there has been a study conducted as well about the emotional congruence of music on memory retrieval. However, facial expressions were utilized. The study's results have found that cues encoded with emotionally incongruent stimuli (joyful music with images of sad facial expressions) trigger more memories than cues with emotionally congruent stimuli (joyful music with images of joyful facial expressions). Moreover, it has been revealed that memories triggered by music are dictated by this "incongruence effect" (Panteleeva, Y., Courvoisier, D. S., Glowinski, D., Grandjean, D. M., & Ceschi, G., 2022).

Previous research on the influence of music on memory recall presents mixed findings. While some studies suggest that music may enhance memory, others report negligible or even adverse effects. This research aims to address these gaps by investigating the specific conditions under which music can improve memory recall. This study will contribute to the field by providing clearer insights into the impact of music on memory recall under controlled conditions, including the influence of music congruence on memory recall. The findings could be valuable for educational and therapeutic settings, aiding in the development of better strategies for using music to support memory, learning, and cognitive rehabilitation.

This study is an attempt to elaborate on the effect of musical emotional congruence on memory. In this case, a story has been utilized as the source of the specific details that will be used on an assessment to be answered by the participants to answer the following questions:

1. How does emotionally congruent music influence memory retention compared to emotionally incongruent music and no music?
2. Is there a significant difference in memory retention between participants exposed to emotionally incongruent music and those who experience no music at all?

To fill the knowledge gap about how music influences cognitive processes, particularly memory recall, this study intends to investigate the impact of emotional congruence in music on memory retention. This study aims to shed light on the circumstances in which music might either enhance or impair memory recall by examining the effects of music's emotional alignment with the task (for example, pleasant music for cheerful content). The research will also investigate the impact of emotional incongruence, which suggests that mismatched music and content can improve memory recall (Panteleeva et al., 2022). The findings could provide valuable insights for practical applications in education, therapy, and environments that require enhanced memory and focus, offering evidence-based recommendations for using music to optimize cognitive performance.

The semantic associative network model of memory of Bower (1981) has a possible explanation behind these mood-congruency effects. According to the model, memory is seen as a network of connections and each emotion has its specific “node” where other nodes reside that contain events, verbal labels, and any type of information associated with that specific emotion. Once the emotional node is triggered, the other nodes connected to it will make it easier to access memory or attention.

2. MATERIAL AND METHODS

This section describes the methodology used in the study, allowing others to replicate the experiment.

2.1 Participants

The participants of the study were 2nd-year students of UMDC (N=45) from 3 different programs (BSED-English, BSED-FM, and BSED-Social Studies). The BSED-English was composed of 21 students, the BSED-FM was composed of 15 students, and the BSED-Social Studies was composed of 9 students. The majority of the participants were from the BSED-English program. Their age group ranges from 18-23. These participants were selected through random sampling.

2.2 Instruments

The study utilized an in-between subjects research design to effectively differentiate the results of memory retention across the three conditions wherein 15 participants were randomly assigned in each group. In addition, the researchers used a normality test, specifically the Shapiro-Wilk test, to determine whether the sample data had been drawn from a normally distributed population. It is generally performed to verify whether the data involved in the research have a normal distribution. Next, the researchers used descriptive statistics, a method used to summarize and describe the main features of a dataset. This includes measures of central tendency, such as mean, median, and mode, which provide information about the typical value in the dataset. Lastly, the researchers used Kruskal-Wallis, a non-parametric alternative to one-way ANOVA, to find if there is a significant effect in terms of music and emotional congruence on memory retention. This was used to figure out if there was a significant effect in terms of music and emotional congruence on memory retention.

2.3 Procedure

The environment was calm, quiet, and free from distractions. Comfortable seating was provided. Participants were informed beforehand about the study’s purpose and given instructions on what to expect. Upon arrival, participants were randomly assigned to one of the two groups (emotionally congruent music and emotionally incongruent music, with no music) by drawing numbers. This randomization ensures that each participant has an equal chance of being assigned to any of the two conditions, reducing selection bias and ensuring the groups are comparable. A total of 45 participants were assigned to three groups (15 per group).

For the first condition (Emotionally Congruent Music), the facilitator briefly explained the basics of the experiment and participants were then given instructions. Afterward, the participants were instructed to settle down comfortably as the facilitator handed them a story to read with music that matched the mood of the story (happy story + happy music). The same procedure is done in the second condition (Emotionally Incongruent Music) except participants read the story with sad music accompaniment. Lastly, the Control Group (No Music) only involved reading the story without the use of music). Then, in all conditions, the participants answered an assessment given to them by the facilitators after reading to test how much they could remember from the story.

After the study, participants were debriefed about the nature of the study, the purpose of the accompaniment of emotionally congruent music and emotionally incongruent music, and the significance of the findings.

2.4 Ethical Considerations

Participants were provided with a consent form explaining the purpose of the study, the procedure, and any risks. They were then told to sign the form before participation. For confidentiality, all data were kept confidential and anonymous. Identifying information was not shared. Participation was made voluntary, and participants may withdraw from the study at any time without penalty. After the study, participants were debriefed following the study and given a chance to ask questions. As a form of justice for their participation, the participants were provided with tokens as a form of appreciation.

3. RESULTS AND DISCUSSION

A Shapiro-Wilk test was conducted to test the normality of data. For the emotional congruence of music on memory retention, the results show a significant deviation from normality, $W= 0.874$, $P<.001$. These results suggest that the assumption of normality was violated.

Table 1 Normality Test

	W	p
emotional congruence of music on memory retention	0.874	< .001

Note. A low p-value suggests a violation of the assumption of normality

Descriptive statistics revealed that the mean quantity of scores in emotionally congruent music was $M= 8.47$, ($SD= 0.516$, , $SE= 0.133$.), while the mean quantity of scores in emotionally incongruent music was $M= 8.47$, ($SD= 1.506$, , $SE= 0.385$.), and the mean quantity of scores in no music was $M= 7.53$ ($SD= 1.807$, , $SE= 0.467$). Each condition included $N= 15$ participants.

Table 2 Group Descriptives

	N	Mean	SD	SE
emotional congruence of music	15	8.47	0.516	0.133
emotionally congruent				
on memory retention	15	8.47	1.506	0.389
emotionally incongruent				
no music	15	7.53	1.807	0.467

This study is conducted to find if there is a significant effect in terms of music and emotional congruence on memory retention. Kruskal-Wallis, a non-parametric alternative to one-way ANOVA, was utilized to determine the results. The chi-squared (χ^2) has a variance of 3.76, derived from the Kruskal-Wallis test, and serves to assess whether significant differences exist in memory retention across different conditions (Emotionally Congruent, Emotionally Incongruent, and No Music). The degrees of freedom (df) associated with this test are equivalent to 2. Whereas the effect size, measured by eta-squared (ϵ), was $\epsilon = 0.0854$. This indicates that approximately 8.54% of the variance in memory retention can be attributed to the emotional congruence of music. The small effect size ($\epsilon = 0.0854$) further suggests that any observed differences are likely to be of minimal practical significance. With a p -value of $0.153 > 0.05$, the findings suggest that there is no significant effect in “memory retention”. Thus, we accept the null hypothesis.

Table 3 Kruskal-Wallis Analysis Between Emotional Congruence of Music on Memory Retention

	χ^2	df	p	ϵ^2
Emotional Congruence of Music on Memory Retention	3.76	2	0.153	0.0854

One of the aims of the study is to identify how emotionally congruent music influences memory if we compare it to emotionally incongruent music and with no music. The findings suggest that emotionally congruent music is on par with the mean scores of emotionally incongruent music and slightly better compared to the no music condition. Music and memory are closely connected in the sense that music therapy became a valuable tool to trigger recall among individuals (Levine, R., 2023). Music, especially when tied to a specific emotion and context, is a useful tool in learning. In other words, when information is set to certain music, it becomes easier for individuals to recall concepts and facts (Roberts, C., 2023).

In addition, with regards to the results between emotionally incongruent music condition and no music condition, no significant difference was found. Participants in the emotionally incongruent music performed slightly better in comparison to those exposed to no music. However, once again, the Kruskal-Wallis Analysis results imply that the differences between the groups are not statistically significant. One study focusing on emotionally congruent pictures stated that in terms of individual differences, the study's individual variable was not connected to the emotion-congruency effect. In other words, this fact suggests that mood, gender, music experience, liking and familiarity have no influence on superior memory for emotionally congruent over the incongruent condition. Moreover, they added that music is not often utilized for mood congruency testing on cognitive functions and, instead, is used more often for music-evoked emotions (Talamini, F., Eller, G., Vigl, J., & Zentner, M., 2022). Music can aid in the recall of memories, even if the music is not aligned to the theme of the material (Matziorinis, A. M., & Koelsch, S., 2022).

The presence of music in the study does not significantly influence memory retention, regardless of its emotional congruence. Several factors, such as the environment of the experiment, and possible exposure of the participant to music prior to the conduct of the study, how complicated the music-reading task is given to the participants, played a role in its significance (Chitalkina, N., Puurtinen, M., Gruber, H., & Bednarik, R., 2021). Furthermore, while music can be beneficial in boosting memory, there are also disadvantages. The findings of another similar study conducted by Jakubowski, K. & Eerola, T. (2021)

found that music is not optimal for retrieval cues of memory. Participants who read a story while listening to music, regardless of its theme, become distracted and therefore, are less likely to remember detailed information (Prabhu, P. S., Nair, R. P., Lau, L. Y., Chong, J. Y., Sia, Z. F., & Aithal, P. A., 2022). This variability of results is explained by multiple factors such as the mood state of an individual, type of task, and style of music as accompaniment in their task. Another study revealed that the effects of music on memorization may vary due to it causing competition in a limited cognitive capacity system (Echaidea, C., del Río, D., & Pacios, J., 2019).

4. CONCLUSION

According to the study's findings, college students' memory retention is not considerably impacted by emotional congruence in music. The presence or absence of emotionally congruent, emotionally incongruent, or no music at all had no effect on participants' recollection of a story they had read. A p -value > 0.05 was found in the data analysis, suggesting that the emotional tone of the music had no appreciable impact on memory performance. This implies that music's emotional tone did not improve or worsen memory retention in this study.

Nevertheless, a number of limitations in the study limit how broadly the results may be applied. The study only looked at narrative recall, which might not be relevant to other kinds of educational resources. Furthermore, the study solely examined emotional congruence in music, neglecting other elements like tempo, volume, and individual variances in musical tastes or mood, and the sample size might have been too small to identify subtle impacts. Future studies should employ larger, more varied samples, examine a broader range of musical qualities, and account for potentially confounding factors like mood and personal musical preferences in order to build on these findings. Although there isn't a direct link between emotional congruence and memory retention, these results imply that music's impact on memory might be more nuanced and influenced by various other factors.

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APPENDIX

STORY AND QUESTIONNAIRE

In the Emerald City of Oz, Princess Ozma's guardians, the Cowardly Lion and the Hungry Tiger, sit beside her throne. Though they are powerful creatures, no one ever needs their protection, and they grow bored and frustrated with their roles.

One day, the Lion says to the Tiger:

"I'm getting tired of this job. No one is afraid of us and no one pays any attention to us."

The Tiger replies, purring:

"That is true. And I'm dreadfully hungry all the time. What I long for is fat babies."

"Fat babies?" the Lion asks.

"Yes," says the Tiger. "If I ate one, the people would fear me."

The Lion agrees:

"It would stir up quite a scene if you ate a fat baby. As for me, my claws are sharp enough to tear a person to pieces. Then I would roar and become important."

The Tiger asks:

"After you tear the person to pieces, what would you do next?"

The Lion replies:

"I would roar and run to the jungle to hide before anyone could stop me."

"I see," says the Tiger. "You are really cowardly."

"To be sure," the Lion admits. "That's why I'm called the Cowardly Lion."

Both beasts grow tired of being peaceable, and decide to create a disturbance. They agree to attack the first baby and person they meet, then run away to the jungle.

They leave the palace, walking through the city. The Lion wonders aloud:

"I wonder how many pieces I should tear a person into?"

The Tiger suggests:

"Sixty would be about right."

As they walk, they finally hear a child crying. The Tiger rushes around the corner and finds a fat baby crying in the street. The Tiger says to the baby:

"What's the matter?"

"I lost my mamma!" the baby wails.

The Tiger, instead of eating the baby, says softly:

"Don't cry, little one. I'll help you find your mamma."

The Lion, disappointed, urges:

"Go on, eat your fat baby."

The Tiger looks at him, shocked:

"Would you want me to eat a poor little lost baby?"

Just then, the baby's mother runs toward them, trips, and falls. The Lion immediately helps her up:

"Poor thing! Are you hurt?"

The woman, struggling, says:

"My baby!"

The Lion reassures her:

"The baby is fine. Don't worry. I'll carry you back home, and the Hungry Tiger will carry your baby."

The woman, now safe, thanks them:

"I've heard what good beasts you are. Now I know the stories are true. You have never had an evil thought."

Ashamed, the Lion and Tiger leave and return to the palace. The Tiger reflects:

"I don't believe fat babies taste like gumdrops. I think they taste like raspberry tarts."

The Lion grumbles:

"You're a humbug."

The Tiger then asks:

"Tell me, how many pieces do you usually tear your victims into?"

The Lion replies:

"To tear anyone into pieces would soil my claws and blunt my teeth. I'm glad I didn't hurt that poor woman."

The Tiger yawns:

"You're a coward."

The Lion responds:

"It's better to be a coward than to do wrong."

"It's better to stay hungry than to harm a child."

The Tiger agrees:

They both fall asleep, content with their decision to be kind.

Name: _____ *(optional)*

Year and Program: _____

Age: _____

Score: _____

Instructions: *Encircle the letter of the correct answer.*

1. Where do the Cowardly Lion and the Hungry Tiger serve as guardians?

- A) The Palace of the Wizard of Oz
- B) The Throne Room of Princess Ozma
- C) The Emerald City Gates
- D) The Land of the Winkies

2. Why is the Cowardly Lion frustrated with his job?

- A) He is tired of guarding the palace.
- B) No one is afraid of him, and he feels ignored.
- C) He doesn't want to work with the Tiger.
- D) He wishes to leave Oz and go to another land.

3. What is the Hungry Tiger constantly hungry for?

- A) Meat
- B) Fruit
- C) Fat babies
- D) Fish

4. What does the Lion imagine he could do to become more important?

- A) Sing loudly in the streets
- B) Build a bigger throne
- C) Tear someone into pieces and roar
- D) Become the ruler of Oz

5. How do the Lion and Tiger decide to prove their power?

- A) By scaring everyone in the Emerald City
- B) By attacking the first baby and person they meet
- C) By stealing from the people of Oz
- D) By challenging the Wizard of Oz

6. What happens when the Tiger finds a lost baby in the street?

- A) He eats the baby.
- B) He comforts the baby and tries to help find its mother.
- C) He roars loudly to scare the baby.
- D) He runs away scared of the baby.

7. How does the Lion react when the baby's mother falls?

- A) He ignores her.
- B) He helps her up and carries her home.
- C) He roars at her.
- D) He calls for the Wizard of Oz.

8. What does the woman say after the Lion and Tiger help her?

- A) "You've ruined my baby!"
- B) "I've heard of your cruelty, but now I know the stories are false."
- C) "Thank you very much for your kindness, I know the stories about you are true."
- D) "You should have eaten the baby, I wanted to see it happen!"

9. What does the Hungry Tiger say at the end of the story?

- A) "I'm still hungry for fat babies."

B) "I think fat babies taste like raspberry tarts."

C) "I never want to eat again."

D) "I'm going to leave Oz forever."

10. What lesson do the Lion and Tiger learn by the end of the story?

- A) It's better to be feared than to be kind.
- B) It's better to go hungry than to harm a child.
- C) It's better to run away from your responsibilities.
- D) It's better to fight everyone in Oz.