

Is It Possible To Enhance The Learning Experience Of Students In School By Incorporating Music To Aid Productivity While They Perform Various Tasks?

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Abstract

Learning significantly shapes the mind is a complex process that plays a crucial role in shaping students' cognitive abilities, problem-solving skills, and overall understanding of the world. However, in today's world, students face numerous distractions that can hinder their ability to concentrate and learn effectively. With the rise of electronic devices and social media, students' attention is often divided, leading to decreased focus and lower academic performance. One of the most prevalent distractions among students is the use of music while studying. Although the impact of music on learning has been debated for years, recent studies have suggested that learning while listening to music of various preferences among adolescents can be effective, leading to questions about its contribution to productive learning.

This study examines the variations in student productivity, particularly working memory, when exposed to classical music versus music of their choice. The study focuses on the different genre preferences of students and their impact on focused performance during learning activities. The study focuses on the different genre preferences of the students and their impact on focused performance during learning activities.

Previous research have established that classical music has a beneficial effect on learning, as it can regulate the heartbeat and decrease stress, leading to increased attention and concentration. However, continuous exposure to classical music may result in boredom, reducing the effectiveness of the learning experience. In contrast, students' preferences for genres such as hip hop, jazz, and pop have changed significantly, with these genres becoming tools for coping with emotions, socializing, and self-expression. Therefore, the study investigates whether students' preferred music genres impact their cognitive abilities and working memory during learning activities.

Utilising a mix of methodologies, the study analyses both quantitative and qualitative data involving 50 high school students between the ages of 13 and 15. While engaging in various educational activities, the kids will be exposed to both classical music and music of their own

choosing. They will be offered learning exercises to perform, where the measure of their cognitive abilities that lead to productivity will be recorded and examined. In addition to the quantitative data, the study gathers qualitative data through crowd interaction and surveys to understand the participants' music preferences, attitudes towards music during learning, and overall experience.

The study aims to provide valuable insights into the influence of music on students' cognitive abilities and working memory during learning tasks. The results will assist educators in comprehending the role of music in learning and how to utilize it efficiently to improve students' concentration and attention. The study's significance lies in its ability to suggest recommendations that could enhance the classroom environment and increase students' academic performance. By understanding the impact of music on cognitive abilities and working memory, educators can develop effective learning activities that integrate music to enrich students' learning experiences. Additionally, the findings of this study offers insights into the potential use of music therapy as an intervention technique for individuals with poor interest by enhancing attention and concentration levels during monotonous learning activities.

Design of Experiment

From Understanding the Current state of Art, it was necessary to delve deeper into the productivity of learning by testing the working memory for students during the learning activities. Although it is well known researches proving that classical music can help increase the spatial reasoning IQ, it remains unclear if classical music can help maintain concentration and increase the overall productivity. Hence, it is necessary to working memory tests under preferred music of an individual. The assumptions made from research, user surveys and were to be proved or disproved with the help of the probe.

Hypothesis:

1. There is no significant difference in Reading Comprehension Score between all three type of Audio/Music environment .
2. There is no significant difference in Reading Comprehension Score between/across all Gender.

3. There is no significant difference in Memory Test Score between all three types of Audio/Music environment .
4. There is no significant difference in Memory Test Score between/across all Gender.
5. Audio/Music Environment and Gender do not interact in any way

Speculations from Hypothesis (Possible Inferences) :

1. There is no significant difference in the average working memory index when exposed to classical music
2. There is no significant difference in the average working memory index when exposed to Preferred music
3. There is no significant difference in the average working memory index when exposed to no music

Working Memory Tests

Based on WMS guidelines, Daneman and Carpenter developed the *first complex working memory span task*, which arguably is best way to measure working memory because of its presentation of both a processing component and a storage component. This was also one of the latest WMS-III that were made with latest updates with respect to the usage failures of the other working memory tests. The WMS-III was chosen to gauge the working memory index for this probe testing.

Every task has two sets of operations that each user has to perform: storage and manipulation of the data displayed. The test officially consists of three sections; however, only the reading comprehension and operation span tasks were employed for the probe testing:

- I. **Reading Comprehension:** A reading task with questions suitable for high school students will be exposed to them. The students have to go through
- II. **Operation Span Task:** The student will be exposed to different operations (for example, “ $12 \times 8 = 96$, image of WINE”), he/she has to check if the calculation displayed here is accurate and repeat the image displayed post the mathematical operation.
- III. **Symmetry Span Tasks:** There will be boxes which are divided into smaller squares, which show patterns with coloured square boxes, the student is required to choose and colour the boxes on his sheet to mirror the box shown on the screen.

IV. **Scoring and Data identifiers:** The general measure of WMS scale cannot be used as they mainly involve adults of age over 19. Through all these, the data identifiers would be the total units of data, speed and accuracy of the task performed.

To find the index score, the test were initially measured without exposing them to any audio stimuli, the average of score of the working memory score will be taken as the normal indicative. If under the influence of classical or preferred music, the participants scored more than the generated index score, he/she will be said to have performed better.

READING PASSAGE 1

EXTRACTIONANDPURIFICATIONOFDRINKINGWATER

Some consumers choose to purchase bottled drinking water, rather than relying on city tap water supplies. Bottled water has typically been extracted from underground sources. If water exists underground, but has no natural exit points, bottling companies may construct a water table well by drilling down to extract water from an unconfined aquifer. This is done when the Earth's natural water level – known as a water table – is much lower than the Earth's surface. In some cases, as with a valley or gully on a mountain, the level of the water table may be higher than the Earth's surface, and a natural spring can emerge. Bottling companies are permitted to extract this water from a hole drilled into the underground spring, but the composition of the water must be identical to that of the naturally surfacing variety nearby.



$$(12 + 5) - 6 = 11$$

Is this True or False ?



Sample of the span tasks that were used during the testing:

Choice of Music to be played during the Probe

During the experiment, the students were presented with spatial and linguistic tasks while two different audio stimuli, classical music and preferred music, were played in the background. The classical music chosen was a series of compositions that have been utilized in various studies involving brain function and learning performance. The preferred music was generated from Spotify's top playlist among students, which was chosen based on prior crowd interaction conducted before the probe testing. The Spotify playlist was then played during the probe testing.

Medium / Procedure

The students will be asked for their basic demographic details, learning habits, and general music preferences before the testing process. Following this, the testing group will be given instructions on the overall procedure, and the process of each task will be explained to them before each task. A general round without any audio stimuli will be conducted to measure the baseline indices, with each round averaging 30 minutes. The entire experiment will last for a total of three hours. During the second round, classical music stimuli will be played in the background while the participants are exposed to the tests. In the third round, the participants will be exposed to the tests with their preferred music stimuli played in the background.

The reading comprehension was printed and given out to each individual for different rounds. And each reading comprehension round of 30 minutes was followed by an Operation Span round where, the display of the information on a presentation was used. Each symbol was displayed for 2 seconds, further to which calculation was displayed for about 10 mins. At the

end of all calculations, the students were asked to write the symbols on the given sheet of paper.

The tests results were analysed individually, each correctly attempted question was a given a specific points which contributed to the assessment of their efficiency in working memory. The reading comprehension tested their linguistic and logical capabilities, while the operation span task tested their visuospatial abilities, both constituted to the working memory index equally.

The Results From Probe & Observation



A total of 50 high school students aged between 13 and 15 years participated were subjected in a closed controlled environment where the probe was conducted. The students mentioned that they usually listened to music during their study time, and used it as source of motivation to keep studying for prolonged period of time. Their song of choice were from the genre ‘Rock’ and ‘Pop’ by famous musician ‘XXXTentacion’ and by band named ‘Imagine Dragons’.

Observations:

- (1) During the ‘no background music’ round, they appeared to concentrate more when each round of stimuli was introduced. However, as the probe testing period continued, and they proceeded to lose interest and grew progressively bored. They began to feel the urge to take

frequent breaks, possibly due to a lack of stimulation. Additionally, they were tempted to interact with their peers to discuss the correct answers, which could have been a way to break the monotony of the activity. The students started to find the task tiring and repetitive as time progressed, and they may have experienced a drop in motivation as a result.

- (2) When classical music was played, the children appeared very relaxed and uninterested in the music, unlike when there was no music playing, where they tended to talk among themselves. Towards the end of the session, they also became easily bored and desired to finish the session. However, they seemed to be able to concentrate more on the activities than during the no-stimuli round.
- (3) When the preferred music was played, the students appeared to enjoy the atmosphere more. They would hum along to the tunes and become less focused on the activity they were performing. Even though they were not completely concentrating, they were enthusiastically investing more time and delving deeper into the tasks. When they recognized the lyrics of the songs, they would sing along and become more distracted, and they would also lose focus during beat drops and choruses.
- (4) It appeared that every individual involved in the activity regarded it as an exam, with the inclination to engage in a contest with their peers, striving to do better than the others. The participants seemed to have a competitive spirit and a motivation to excel, possibly driven by a desire for recognition or a sense of personal accomplishment.
- (5) Participants in the operation span task were asked to remember a series of equations and symbols. After understanding the pattern of the task, they tried to memorize as many symbols as possible to demonstrate their ability to recall information accurately. After comprehending the pattern for the operation span task, they attempted to memorize as many symbols as possible.
- (6) A group of children demonstrated a preference for social interaction and communication by repeatedly asking for activities that allowed for discussion. They preferred group activities, which may have provided a sense of belonging and connectedness to the group.
- (7) The reason for the participants' possible fatigue and boredom with the audio task may be due to the insufficient intervals between the each rounds of audio stimuli. Taking breaks between tasks is important to prevent mental fatigue and maintain focus and motivation. In the context of an audio task, it can be especially important to allow participants time to rest and recharge between rounds, as listening can be a mentally taxing activity. Without sufficient breaks, participants may experience a decline in attention and become bored or disengaged with the

task. This can lead to reduced accuracy and motivation, which can negatively affect performance.

Results

The data collected, which included attempted and accurate answers on the reading comprehension task, underwent a one-way ANOVA to either validate or reject the hypotheses that were developed prior to the study.

1. There is no significant difference in Reading Comprehension Score between all three type of Audio/Music Environment .

Music and RC					
	Df	Sum Sq	Mean Sq	F Value	Pr(>F)
RC	1	41.24	41.24	103.9	<2e-16
Residuals	148	58.76	0.40		

Outcome: Since the p-value from F-test is lesser than 0.05, the null hypothesis is rejected. Hence, there is a significant difference in Reading Comprehension Score between all three types of Audio/Music Environment

2. There is no significant difference in Reading Comprehension Score between/across all Gender.

Gender and RC					
	Df	Sum Sq	Mean Sq	F Value	Pr(>F)
RC	1	0.09	0.09118	0.402	0.527
Residuals	148	33.7	0.22682		

Outcome: Since the p-value from F-test is greater than 0.05, the null hypothesis is accepted. Hence, there is no significant difference in Reading Comprehension Score across different genders.

3. There is no significant difference in Operation Span Task Score between all three types of Audio/Music environment .

Music and MT					
	Df	Sum Sq	Mean Sq	F Value	Pr(>F)
RC	1	1.87	1.8666	2.815	0.0955
Residuals	148	98.13	0.6631		

Outcome: Since the p-value from F-test is greater than 0.05, the null hypothesis is accepted. Hence, there is no significant difference in Operation Span Task between all three types of Audio/Music Environment.

4. There is no significant difference in Operation Span Task Score between/across all Gender.

Gender and MT					
	Df	Sum Sq	Mean Sq	F Value	Pr(>F)
RC	1	0.26	0.2602	1.153	0.285
Residuals	148	33.40	0.2257		

Outcome: Since the p-value from F-test is greater than 0.05, the null hypothesis is accepted. Hence, there is no significant difference in Operation Span Task between genders.

5. There is no interaction between Audio/Music Environment and Gender. A TWO-WAY ANOVA was performed on the dataset to find any relation between music and gender.

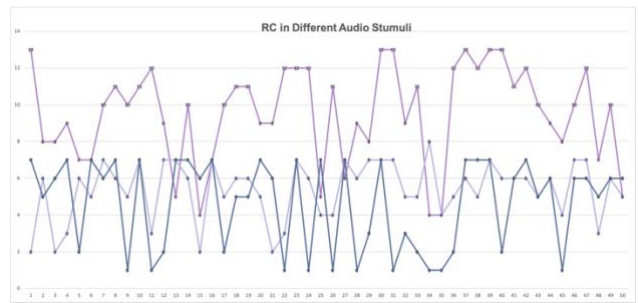
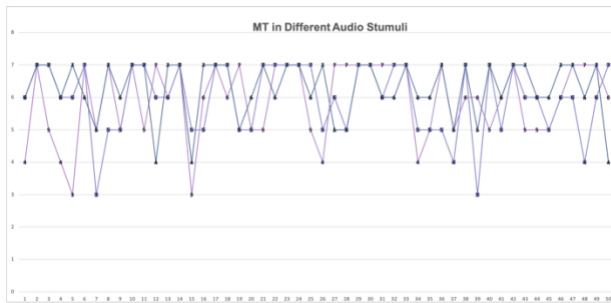
Gender*Music and MT					
	Df	Sum Sq	Mean Sq	F Value	Pr(>F)
Gender	1	3.9	3.9	0.677	0.412
Music	1	600.2	600.2	103.025	<2e-16
Gender.Music	1	0.6	0.6	0.105	0.747
Residuals	146	850.6	5.8		

Gender*Music and RC					
	Df	Sum Sq	Mean Sq	F Value	Pr(>F)
Gender	1	1.34	1.342	1.164	0.2824
Music	1	3.24	3.240	2.812	0.0957
Gender.Music	1	0.76	0.756	0.656	0.4191
Residuals	146	168.24	1.152		

Outcome: Since the p-value from F-test is greater than 0.05, the null hypothesis is accepted. Hence, the two individual variable in the probe, gender and music has no relation to each other.

Inferences

The ANOVA analysis of the dataset revealed significant differences in the impact of music on reading comprehension. A line graph was used to determine which audio stimulus produced the highest results.



Speculations from Hypothesis (Possible Inferences)

- 1. There is no significant difference in the average working memory index when exposed to no music**

Based on the findings, a clear conclusion can be drawn that reading comprehension materials are comprehended and processed more effectively in a music-free environment. The absence of music enhances the absorption of the reading material and facilitates the establishment of logical connections between ideas. However, it is noteworthy that the results obtained from the operation span task (also referred to as the Memory Test - MT) highlight notable challenges in memorizing different objects while simultaneously performing calculations. Additionally, it is worth considering that these difficulties may arise when the activities are approached with minimal interest and when distractions and discussions are at their highest levels. It is possible that the absence of music made it challenging for the students to maintain their focus on the activity, and they might have experienced cognitive fatigue as a result.

- 2. There is no significant difference in the average working memory index when exposed to classical music.**

During the period when classical music was played, the students encountered a certain level of irritation and lacked motivation to study. Surprisingly, despite these factors, the presence

of music did not disturb them. On the contrary, it created a quieter classroom atmosphere, effectively restricting additional discussions. This conducive environment allowed the students to concentrate and sustain their focus on the activities presented to them.

Analysing the graph provided, it can be deduced that reading comprehension performance reached its peak when classical music was played, surpassing the performance observed when preferred music was present. This indicates that classical music had a more positive impact on the students' comprehension abilities.

Regarding the operation span task, the results indicated that the students' ability to memorize during calculations was nearly identical to the conditions where no music stimuli were present. This suggests that the presence or absence of music had minimal influence on their memorization capabilities during the task.

In summary, despite experiencing some initial irritation and lacking motivation, the students remained undisturbed by the classical music during the study period. The resulting quieter classroom environment facilitated concentration and focus. Classical music proved beneficial for reading comprehension, while the impact on memorization during calculations was relatively negligible compared to the absence of music.

3. There is no significant difference in the average working memory index when exposed to Preferred music.

The students displayed highly positive reactions when exposed to preferred music, indicating their strong interest and willingness to engage in activities within that particular environment, regardless of the duration of each task. However, occasional distractions emerged when they enthusiastically sang along to their favourite parts of the songs they were familiar with. Upon analysing the line graph, it becomes apparent that preferred music had a notable impact on their overall performance.

Despite the positive aspects, challenges were observed during the reading comprehension section. It became evident that the students struggled with limited encoding and forming connections in their working memory while engaging in this particular task. This difficulty could potentially explain the relatively lower number of attempted questions. It is plausible

that as the probing testing neared its end, the students gradually became bored, leading to a decline in their participation and enthusiasm.

Nonetheless, the incorporation of preferred music as an audio stimulus holds promise for enhancing student engagement and prolonging their involvement in learning activities. The positive reactions and sustained interest generated by preferred music suggest its potential to positively influence student motivation and focus. By carefully selecting and utilizing preferred music, educators can create a conducive learning environment that captivates students' attention and encourages their active participation for extended periods of time.

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