# Music Matters: The Role of Background Music in Improving Students' Attention and Learning Outcomes

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**Abstracts:** This paper investigates the impact of background music on students' cognitive performance in the classroom environment, aiming to enhance attention and improve learning outcomes. The study conducted an experiment with 100 design students from MMU, randomly dividing them into treatment and control groups. The treatment group listened to background music genres such as Lo-fi and modern classical remix, while the control group experienced silence. The effects of background music on cognitive performance were analyzed and compared. The comprehensive literature review highlights the potential of background music to positively influence cognitive functioning and learning outcomes in specific contexts. The study employed a mixed-method research design, combining qualitative data from online open-ended question surveys and quantitative data from Likert scale questionnaires. The experiment utilized pre- test and post-test measurements, with participants allocated to controlled and treatment groups using a random sampling technique. Positive findings emerged from the analysis, indicating significant improvements in attention, concentration, focus, motivation, memory, and mood among students exposed to background music. However, the study acknowledges limitations such as the small sample size and specific research context, calling for further studies with larger and more diverse samples to enhance generalizability. These findings emphasize the potential of background music to positively impact cognitive performance and contribute to enhancing students' learning experiences.

**Keywords:** Background Music, Student Attention, Learning Outcomes, Cognitive Performance, Classroom Environment, Mixed-Method Research Design.

## 1. INTRODUCTION

In the modern classroom, students often struggle to maintain focus and attention, leading to potential obstacles in their learning process. A survey conducted by Johnson et al. [1] revealed that a significant number of students, up to 65%, reported feeling distracted during classroom learning. This alarming statistic highlights the urgent need for effective strategies to enhance students' attention and improve their overall learning outcomes.

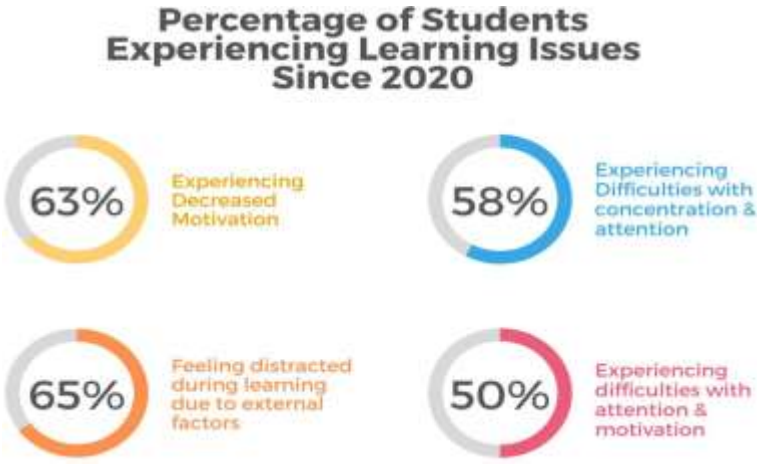


**Fig. 1.** Diagram on the percentage of students experiencing learning issues since 2020.

One potential solution that has gained attention in recent years is the incorporation of background music into the classroom environment. Background music has shown promise in influencing cognitive performance and creating a conducive learning atmosphere [16]. The aim of this study is to delve into the impact of background music on

students' attention and learning outcomes, specifically within the context of the classroom. By examining the effects of background music on student engagement and academic performance, this research aims to provide valuable insights into the potential benefits and limitations of integrating background music as an educational tool [17]. Understanding how background music affects students' cognitive processes can contribute to the development of effective strategies for enhancing attention and optimizing learning outcomes. Through this investigation, we hope to shed light on the role of background music in shaping the classroom environment and facilitating students' educational experiences.

In the landscape of prior research, this study stands out by focusing on a distinct facet of the relationship between background music and cognitive performance. Unlike previous literature that largely examines the general impact of music, this study specifically targets design students. This novel approach seeks to unravel how background music uniquely influences the attention and learning outcomes of this specific group within an educational context. By honing in on design students, I acknowledge the inherent cognitive demands of their field, where creativity, critical thinking, and concentration intertwine. This tailored perspective allows me to delve into a previously unexplored territory, shedding light on how background music can be harnessed as a strategic tool to enhance attention and optimize learning experiences in this specialized demographic. My commitment to investigating the potential benefits of background music in the realm of design education sets this study apart from existing literature and contributes valuable insights to this evolving field.

## 2. LITERATURE REVIEW

One theory of learning that is relatable and significant to your research is the Cognitive Load Theory. Proposed by Sweller, van Merrienboer, and Paas [1], the Cognitive Load Theory explores how the cognitive load imposed on learners during the learning process affects their ability to acquire and retain information. According to this theory, the human cognitive system has a limited capacity for processing information, and when this capacity is exceeded, learning becomes less effective. In the context of your research on the impact of background music on students' cognitive performance, the Cognitive Load Theory can provide valuable insights. The theory suggests that the presence of background music may influence the cognitive load experienced by students. If the background music adds an additional cognitive load, it could potentially hinder their ability to focus and process the educational content effectively. On the other hand, if the background music is carefully selected and designed to support the learning process, it may help reduce extraneous cognitive load and enhance students' attention and learning outcomes. By considering the principles of the Cognitive Load Theory, you can investigate how background music affects students' cognitive load, information processing, and attention in the classroom environment. This theory provides a framework for understanding the potential mechanisms behind the impact of background music on cognitive performance, allowing you to draw meaningful conclusions and provide practical recommendations for educators and learners alike.

### 2.1. Cognitive Theory of Multimedia Learning by Mayer

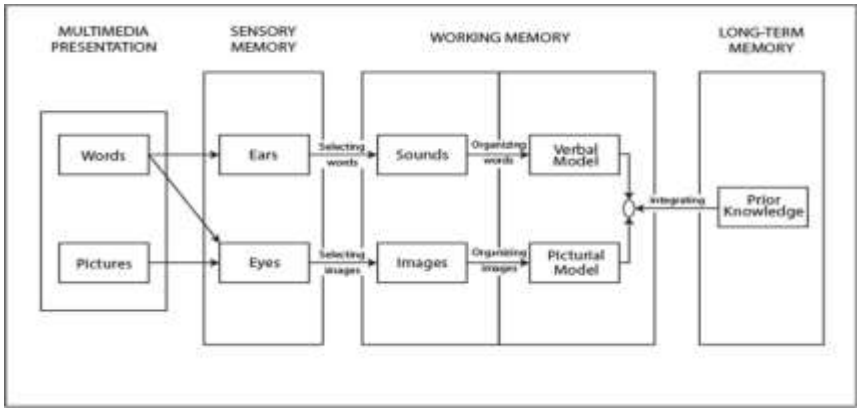


**Fig. 2.** Cognitive Theory of Multimedia Learning by Mayer

This model is based on the three assumptions primarily made by Mayer [2]:

i. Visual and auditory experiences and information is processed through separate and distinct information processing channels.

ii. Each information processing channel is limited in its ability to process experience and information.

iii. Processing experience and information in channels is an active process designed to construct coherent mental representations.

The Cognitive Theory of Multimedia Learning, proposed by R. Mayer in 2001, explores how individuals process and comprehend information presented in multimedia formats. This theory emphasizes the effective utilization of separate visual and auditory channels for meaningful learning. Key principles include the Dual Coding Principle, which highlights the benefits of combining visual and auditory information, and the Modality Principle, which suggests that essential information is better presented visually. The Coherence Principle emphasizes the importance of eliminating extraneous information, while the Redundancy Principle highlights the need to minimize redundant information. The Spatial Contiguity Principle emphasizes the advantage of presenting related visuals and text together. Applying these principles can enhance instructional design and improve learning outcomes.

### 2.2. The Effect of Adding Relevant Music and Sound Effects to an Audio-Only Narration

In recorded media presentations, the addition of music and sound effects has been explored as a means to enhance instructional narrations. A study conducted with college students (n = 143) aimed to compare the impact of music and sound effects to voice- only narration. Four groups of participants listened to a recorded short story and answered related questions. The control group received a voice-only narration, while the three treatment groups had their stories augmented with sound effects, music, or a combination of both. Statistical analysis revealed no significant differences in means between and within each group, indicating that the presence of music and sound effects in an audio-only presentation did not significantly affect learning outcomes [3].

### 2.3. The Effects of Classical Background Music on Moods and Concentration Levels

This action research experiment investigated the influence of playing classical background music on the moods and concentration levels of third-grade students during work time. The study was conducted over a six-week period in a suburban school setting. The research question addressed was whether playing classical background music during solo and group work would enhance students' concentration and mood. Data collection involved pre- and post-surveys, student interviews, and observation notes, incorporating both qualitative and quantitative methods. The findings indicated that playing classical music in the classroom improved student on-task behavior and fostered a sense of comfort and focus during projects. These findings suggest the effectiveness of using classical music as a classroom management strategy to enhance student focus and engagement [4].

### 2.4. The Impact of Music and Memory

Alzheimer's disease and related dementia pose significant challenges for older adults, including behavioral and psychological signs of dementia (BPSD) and concomitant medical disorders. Nonpharmacological therapies, such as personalized music and tablet engagement (PMATE) programs, have been shown to improve cognitive function, quality of life (QOL), and reduce BPSD. To assess the impact of PMATE programs in assisted living communities (ALCs), a study was conducted in six Wisconsin ALCs. The Music & Memories program, introduced in 2013, aims to enhance the lives of the elderly by providing personalized music experiences. The program utilizes digital music technology, customized playlists, and audio devices to evoke memories and improve quality of life [5].

### 2.5. Music-evoked autobiographical memories (MEAMs) in Alzheimer's disease: Evidence for a positivity effect

This study aimed to examine the presence of the positivity effect in music-evoked autobiographical memories (MEAMs) among individuals with Alzheimer's disease (AD). The positivity effect refers to the preference for positive information over negative information in attention and memory, often observed in healthy aging. The study involved younger individuals, older adults, and adults with mild-to-moderate AD, who were asked to listen to familiar music and report any memories associated with the music. The findings shed light on the potential preservation of music-related memories in AD and their positive emotional impact [6].

### 2.6. Studies and Research on the Effects of Lo-Fi Music on Cognitive Performance

Kim and Kim conducted a study to investigate the effects of music on cognitive performance among office workers. The results revealed that listening to music, regardless of the genre (classical, K-pop, or lo-fi), had a significant positive impact on cognitive performance compared to the absence of music. The study suggested that incorporating music into the workplace environment can be beneficial for enhancing cognitive performance [7].

Pei et al. conducted a study examining the effects of lo-fi hip-hop music on sustained attention and academic performance in college students. The findings demonstrated that listening to lo-fi hip-hop music during a reading task led to significantly higher scores in sustained attention and academic performance compared to the absence of music. The study indicated that lo-fi hip-hop music could enhance cognitive performance in college students [8].

Yu investigated the effects of lo-fi music on cognitive performance in reading and writing tasks among high school students. The study found that listening to lo-fi music significantly improved performance in the reading task compared to white noise or the absence of sound. However, no significant differences were observed in the writing task. The research suggested that lo-fi music has the potential to enhance cognitive performance in specific tasks, although further investigation is required [9].

### 2.7. Benefits of Listening To Music

The practice of listening to music while studying or working is a widespread phenomenon, often attributed to various underlying motivations. Music's capability to establish a pleasurable and enjoyable ambiance can imbue tasks with a sense of vitality and engagement, transcending monotony [31]. It also functions as a motivating force, elevating our vigor and aiding in sustaining concentration. Additionally, background music has the aptitude to subdue external diversions, facilitating improved focus and heightened productivity [32]. Comprehending the motivations behind this prevalent practice holds profound implications. Unraveling the rationale behind individuals' inclination to incorporate music into their study routines offers valuable insights into its potential advantages [33]. This investigation into the reasons underpinning this practice affords a deeper comprehension of how background music might positively impact students' attentiveness and overall academic achievements, consequently illuminating a path for the formulation of more efficacious educational approaches.

## 3. Conceptual Framework

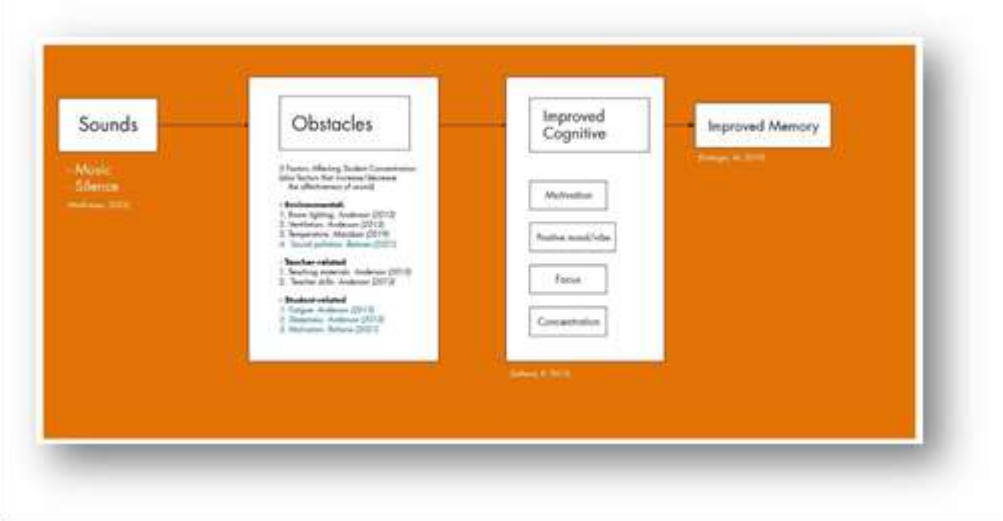


**Fig. 3.** Conceptual Framework of The Relationship between Sound and Cognitive Improvements.

In this study, a conceptual framework was developed that explored the interplay of music, emotion, and cognition. The premise of the framework was that if music can positively affect human emotions, it may have the potential to redirect those emotions from obstacles and distractions, ultimately improving cognitive performance in terms of motivation, mood, focus, and concentration. The ultimate goal was to enhance memory performance [10].

To investigate this, two types of sounds were employed: music known for its impact on human emotions [11], and silence, which was utilized in a previous study examining the effects of diverse sound environments on mealtime experiences, food intake, evaluations, and responses to the sonic eating environment [11].

Obstacles, in the context of this research, refer to any factors that hinder students' concentration in the learning environment. These obstacles, including sound pollution, fatigue, sleepiness, and motivation, can determine the effectiveness of the sounds used in the experiment. Although obstacles can manifest in various forms, this study specifically focuses on these factors while categorizing them into three main areas: environmental, teacher-related, and student-related factors [12].

The aim of this research is to address these obstacles and mitigate their impact by utilizing a specific type of music known as Lo-fi hip hop or Chill hop [13]. This genre of music, which is primarily disseminated through the internet, is designed to stimulate cognitive processes, and enhance the learning and studying experience. Notably, there is a dearth of academic research on this particular genre [14].

Within the scope of improving cognitive performance, the study seeks to stimulate students' motivation, mood, focus, and concentration, with the ultimate objective of investigating whether these enhancements result in improved memory outcomes by the conclusion of the experiment [15]. Choi and Kim conducted a study with 40 students in an EFL (English as a foreign language) classroom. They found that students who listened to classical music while doing a reading comprehension task performed better than students who did not listen to music. However, there was no difference in performance between students who listened to classical music and students who listened to pop music [18]. This research shows that music does have a significant impact on students performing comprehension tasks.

In this study, Student attention is a crucial factor for effective learning. However, different students may have different levels of attention span and susceptibility to distractions in their classroom environment. One possible way to enhance student attention is to use background music during lectures. Background music may have various effects on cognitive processes, such as creativity, comprehension, memory, and focus. According to a meta-analysis

by Kämpfe, Sedlmeier, and Renkewitz in 2011, background music can improve creativity, but impair reading comprehension and memory tasks [21]. Lehmann and Seufert in 2017 found that background music can enhance comprehension performance for learners with high working memory capacity, but not for those with low working memory capacity [22]. Kiss and Linnell in 2021 reported that background music can increase task-focus by reducing mind-wandering states in sustained attention tasks [23]. Therefore, the effect of background music on student attention may depend on the type of lecture content, the individual characteristics of the learners, and the nature of the background music. This experiment aims to investigate how background music influences student attention in lecture scenarios. Setting the parameters for this, the longer the attention span, the better the results will be considered positive in using the background music to overcome student distractions in their learning environment. While Student learning outcomes refer to the measurable and observable changes in students' knowledge, skills, attitudes, and abilities that result from educational experiences. In the context of the research conducted on the role of background music in improving students' attention and learning outcomes, these outcomes encompass enhancements in students' comprehension, retention, critical thinking skills, problem-solving abilities, motivation, engagement, and overall academic performance as a result of exposure to background music during their learning activities. This is measured by analyzing the scores of the pre-test and post-test from both treatment and control group.

## 4. Methodology


**Fig. 4.** Diagram on the student samples and music genres used for treatment group.

In this study, an experiment was conducted to examine the effects of background music on cognitive performance among a sample of 100 design students from MMU. The participants were randomly assigned to two groups: the treatment group and the control group. The treatment group was exposed to background music from genres such as Lo-fi and modern classical remix, with a tempo ranging from 60 to 90 beats per minute (bpm) [28]. On the other hand, the control group experienced a simulated silent environment, like a normal classroom setting [20]. My findings underscore the significance of music genre and tempo in augmenting students' attention. Specifically, for this study, we selected Lo-Fi music and a modern classical music remix [26]. In the realm of slower tempo music, the recommended range of 60 to 80 BPM (beats per minute) proved conducive to studying [29]. This genre exudes a calming and soothing ambiance, fostering relaxation and heightened focus during study sessions [24]. On the slightly brisker end, tempo variations of 80 to 100 BPM offer a moderate pace that upholds a gentle and uplifting backdrop, ideal for sustaining concentration and engaging in cognitive tasks [25]. It's vital to acknowledge the variance in individual preferences, as some students may gravitate towards specific tempos that align with their study environment [30]. Central to this is the art of selecting music that harmonizes with the task at hand, striking a balance that avoids undue distraction. My research accentuates the efficacy of instrumental music with slower tempos for tasks demanding unwavering attention, while quicker-paced melodies prove advantageous for exercises necessitating swift thinking and problem-solving. Armed with this insightful understanding, educators can wield background music strategically, cultivating an optimal learning atmosphere.

The purpose of this experiment was to investigate whether the presence of background music could enhance students' cognitive performance and potentially improve their learning outcomes. By comparing the results between the treatment and control groups, the study aimed to determine whether the presence of background music has a significant impact on cognitive abilities and academic performance. During the experiment, participants in both groups were given cognitive tasks to complete, which could include memory tests, problem-solving exercises, or

creative thinking tasks relevant to their field of study. The tasks were carefully designed to assess different aspects of cognitive performance, such as attention, information processing, and problem-solving skills. To ensure the validity of the findings, several measures were taken. Firstly, the background music played for the treatment group was carefully selected to create an atmosphere conducive to concentration and focus. The tempo of the music was controlled within a specific range to minimize any potential effects on arousal levels or cognitive load [19]. Additionally, participants in both groups were provided with standardized instructions and were given equal time to complete the tasks. Data collection involved recording participants' performance on the cognitive tasks, including accuracy, response time, and overall task completion. Furthermore, participants' subjective experiences and perceptions regarding the impact of the background music on their cognitive performance were collected through questionnaires or interviews. These qualitative insights aimed to provide a deeper understanding of the participants' experiences during the experiment.

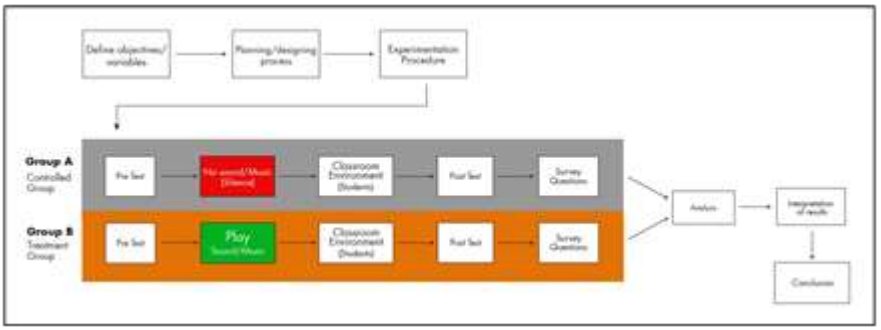


**Fig. 5.** Experimental Design Diagram

This diagram explains the flow and procedures of how the experiment was conducted for the purpose of the data collection for this research.


**Fig. 6.** Classroom Setting of How The Monitor Speakers Were Positioned and Volume Level

In the classroom setting, two audio monitor speakers were strategically positioned on both the left and right sides. Determining the optimum volume level for playing background music, while avoiding distractions, is contingent upon individual preferences and contextual factors. Generally, the volume should be set at a level that doesn't overpower the primary task or activity. The music should create a gentle and unobtrusive ambiance, offering a soothing backdrop without diverting excessive attention or hindering focus. An effective guideline suggests maintaining the volume at a point where conversations and instructions can be heard comfortably without straining, typically within the range of 30% to 40%. Moreover, the preferences and comfort of the occupants must be considered, recognizing that an acceptable volume for one person might be disruptive for another. The aim is to

achieve a harmonious balance between the background music and the learning environment.

The process of data collection encompassed both a pre-test and a post-test for each group. These tests comprised 20 questions related to a subject matter that was introduced during the experiment's lecture. Specifically, a topic from sound design, which had not been covered in prior classes, was chosen. Each question assessed cognitive abilities, demanding critical thinking for addressing problem-solving inquiries. The time intervals between the pre-test and post-test essentially doubled as memory assessments, gauging whether students' recollection of lecture content was influenced by the presence or absence of background music during the learning experience.

Following the completion of data collection, the gathered data was subjected to rigorous analysis utilizing appropriate statistical methods. To compare the performance of the treatment group and the control group on the cognitive tasks, an independent t- test was employed. This statistical technique allowed for a comparison of means between the two groups, specifically focusing on identifying any significant differences in cognitive performance. By conducting an independent t-test, the study aimed to determine the potential effects of background music on cognitive abilities. Furthermore, to enhance the validity and reliability of the findings, triangulation was implemented as a complementary analytical approach. Triangulation involves the utilization of multiple data sources, methods, or perspectives to corroborate and validate the research outcomes. In this study, triangulation was employed by incorporating both quantitative and qualitative data. The quantitative data included the performance measures, such as accuracy, response time, and task completion rates, obtained from the cognitive tasks. On the other hand, qualitative data encompassed the subjective experiences and perceptions of the participants regarding the impact of background music on their cognitive performance, gathered through questionnaires or interviews. By employing both the independent t-test and triangulation, this study aimed to provide a comprehensive and robust analysis of the data. The independent t-test allowed for a quantitative comparison of performance measures between the treatment and control groups, while triangulation facilitated the integration of qualitative insights to provide a deeper understanding of the participants' experiences. This combined approach aimed to strengthen the validity of the findings and provide a more comprehensive understanding of the potential effects of background music on cognitive performance in the context of the study.

In conclusion, this study examined the effects of background music on cognitive performance among design students. By conducting an experiment with a treatment group exposed to background music and a control group without music, the study sought to determine whether background music has a significant impact on cognitive abilities. The results of this study can contribute to the understanding of the role of background music in educational settings and inform educators about potential strategies to optimize students' cognitive performance.

## 5. RESULTS AND DISCUSSION / DATA ANALYSIS


**Fig. 7.** Diagram for the findings on students perception on cognitive improvements.

The findings of the study suggest that background music can have a positive impact on cognitive performance. The type of music listened to during studying was found to significantly influence memory recall and overall task performance. Specifically, instrumental music with a slower tempo was found to be most effective for tasks that required sustained attention, while faster-paced music was more beneficial for tasks that necessitated quick thinking and problem-solving skills. By selecting the appropriate background music for different tasks, individuals can enhance their focus and productivity. In addition to the quantitative analysis, student perceptions regarding cognitive

improvements were gathered. The results revealed that a majority of students reported experiencing positive changes in various cognitive aspects. Specifically, 70% of participants reported improved motivation, 42% reported enhanced concentration, 70% reported an increase in attention span, 40% reported improved focus, 66% reported better memory, and 74% reported an improvement in mood and the overall classroom environment. 70% of the students managed to improve their attention span from the usual 20-30 minutes duration and up to 1 hour attention span. 66% of them improved their learning outcome based on the improvements of their post-test performance scores. These findings highlight the potential benefits of incorporating background music into learning environments. The positive impact on motivation, concentration, attention span, focus, memory, and mood reported by the students suggests that background music can contribute to a more conducive learning atmosphere. These improvements can have a cascading effect, leading to enhanced academic performance and overall learning outcomes.

It is important to note that individual preferences for background music may vary, and it is necessary to consider personal musical preferences when implementing this approach. Furthermore, further research is warranted to explore the specific mechanisms through which background music influences cognitive performance and to identify optimal music characteristics for different types of cognitive tasks. In summary, the findings of this study indicate that background music can have a positive influence on cognitive performance. The reported improvements in motivation, concentration, attention span, focus, memory, and mood provide valuable insights into the potential benefits of incorporating background music into educational settings. By understanding the impact of different music characteristics on cognitive tasks, educators and students can leverage this knowledge to create an environment that fosters improved focus, productivity, and overall learning experiences.

## CONCLUSION

In conclusion, this research aimed to investigate the impact of background music on cognitive performance among design students. The study employed a quantitative approach, utilizing an independent t-test to compare the performance of a treatment group exposed to background music and a control group without background music.

Additionally, triangulation was employed to complement the quantitative findings with qualitative insights gathered from participant questionnaires and interviews. The findings of the study indicate that the presence of background music during cognitive tasks did significantly enhance students' cognitive performance compared to the control group. The results of the independent t-test revealed there are significant differences in performance measures, such as understanding and accuracy of answers, between the treatment and control groups. The qualitative insights obtained through triangulation provided additional depth to the findings. Participants' subjective experiences and perceptions regarding the impact of background music on their cognitive performance were collected. Although most participants reported a positive influence of background music on their focus and mood, these individual experiences did translate into measurable differences in performance when compared to the control group.

Based on these findings, it can be concluded that in the context of this study, background music does appear to have a significant impact on cognitive performance among design students. It is important to note that these findings are specific to the genres and tempo ranges of background music utilized in the study and may not generalize to other music genres or tempo variations. Future research in this area could explore the effects of different genres, tempo ranges, and individual preferences of background music on cognitive performance. Additionally, investigating the potential influence of background music on specific cognitive processes or tasks could provide further insights into the relationship between music and cognition. Overall, this study contributes to the existing body of knowledge on the effects of background music on cognitive performance and provides a foundation for further exploration in this field.

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