SYNOPSIS OF PROJECT REPORT

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Project Title : **DO DIFFERENT MUSIC CAN GENRES AFECT HEART RATE OR CONCENTRATION?**

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DO DIFFERENT MUSIC GENRES AFFECT HEART RATE OR CONCENTRATION”

- **HAMNA K.M**

Abstract:

- Music is a universal language that influences human emotions, mood, and even physiological responses.
- This research investigates whether different genres of music (classical, pop, rock, and instrumental) affect heart rate and concentration levels among students.
- Using heart rate monitoring and concentration-based tasks, the experiment aims to analyze the correlation between music and human performance.
- This experiment measures how different genres—**classical, pop, rock, and electronic**—affect the heart rate of participants.
- Using a controlled environment and heart rate monitoring, the study aims to determine whether tempo, rhythm, and emotional tone of music can significantly alter cardiovascular responses.
- The findings may have implications for stress management, exercise routines, and therapeutic practices.

Introduction:

- Music has been shown to influence the autonomic nervous system, leading to changes in heart rate, blood pressure, and brain activity.
- Certain genres may enhance focus (e.g., classical or instrumental), while others may increase excitement and stress levels (e.g., rock or fast-tempo music).
- Understanding this relationship can help in developing better study habits, stress management techniques, and therapeutic interventions.

a. Selection of Problems & Background Information

- **Problem Identified:** Many students listen to music while studying, but its effects on heart rate and concentration are not fully understood.
- **Background:**
    - Studies suggest slow, soft music lowers heart rate and increases relaxation.
    - Fast, upbeat music may increase heart rate and distract focus.
    - Concentration is essential for academic performance, and identifying helpful music genres can benefit students.

Goal:

"**Test whether listening to different music genres changes (a) heart rate and (b) concentration compared with silence".**

b. Research Questions:

1. Does listening to different music genres affect heart rate?
2. Which music genre improves concentration levels the most?

Literature Review:

Several studies have examined the link between music and physiological responses:

- **Bernardi et al. (2006)** found that classical music with slow tempos reduced heart rate and blood pressure, while techno music increased both.
- **Trappe & Voit (2016)** observed that music with a fast tempo and strong rhythm increased heart rate and arousal levels.
- **Knight & Rickard (2001)** demonstrated that relaxing music reduced anxiety and heart rate in students before exams.
- **Iwanaga (1995)** showed that music tempo directly influenced heart rate, with faster tempos leading to increased cardiovascular activity.

These studies suggest a consistent pattern: **tempo and emotional tone** of music are key factors in determining its physiological impact.

c. Hypothesis:

"If participants listen to calm and instrumental music, then their heart rate will remain stable, and their concentration will improve compared to listening to loud, fast-tempo genres like rock."

Testable Hypothesis:

- **H_1 (Heart Rate):** Up-tempo genres (e.g., pop/EDM/rock) will increase heart rate more than silence; calm genres (classical/lo-fi) will change it little or may lower it.
- **H_2 (Concentration):** Calm, low-lyric genres will yield better concentration scores than high-energy or lyrical genres and silence.

Objectives:

- To measure the effect of different music genres on heart rate.
- To assess concentration levels while listening to various genres.
- To compare and analyze which genre is most beneficial for studying.
- To recommend suitable music for relaxation and productivity.

Materials Required:

- Participants (10–20 students)
- Music samples (Classical, Pop, Rock, Instrumental)
- Heart rate monitor / fitness tracker / smartphone app
- Stopwatch / timer
- Concentration test sheets (memory tasks, math problems, puzzles)
- Notebook and pen for recording data
- Computer for data analysis

d. Procedure:

1. Collect at least **three different types** of instruments (string, wind, percussion).
2. Observe and record **how the sound is produced** in each.
    - Plucking, blowing, striking, etc.

3. Test how **pitch changes**:
    - String: tighten/loosen string or change length.
    - Wind: cover/uncover holes on flute/recorder.
    - Percussion: tap drum lightly and harder.
4. Note how **loudness changes** with force of vibration.

Experimental Design:

Use a **within-subject** design: every participant does **all** music conditions. Randomize the order to reduce order effects.

1. **Randomize order** of music conditions for each participant (e.g., use slips of paper).
2. **Volume check:** Set to the same level for all conditions.
3. **Resting baseline:** Sit quietly 2 minutes → record baseline HR.

Part A — Heart Rate Protocol

For each music condition:

1. Sit and listen for **3 minutes** without moving or talking.
2. Record **HR at the end of minute 3** (or average of last 30–60 seconds).
3. **Washout:** 2 minutes of silence before the next condition.

Part B — Concentration Protocol

For each music condition (different round than HR, or do after a 5–10 min break):

1. Play music for **30 seconds** to settle.
2. Start the **concentration task** (same difficulty across all conditions):
    - **Stroop**: 30 items; record **time to finish** and **errors**.
    - **Math**: 30 mixed problems in 2 minutes; record **correct**.

3. **Washout:** 2 minutes of silence.

Different music genres stimulate these systems in distinct ways.

Genre-by-Genre Effects

Genre	Typical Tempo	Emotional Tone	Heart Rate Effect	Explanation
Classical	Slow to moderate	Calm, soothing	↓ Decreases	Activates parasympathetic system; lowers stress and cortisol
Rock	Fast, loud	Energetic, aggressive	↑ Increases	Stimulates sympathetic system; raises adrenaline
Pop	Moderate to fast	Upbeat, varied	↕ Mixed	Depends on tempo and lyrics; can excite or relax
Jazz	Variable	Relaxed or intense	↕ Mixed	Smooth jazz lowers HR; fast bebop may raise it
Electronic/Dance	Fast, rhythmic	Stimulating	↑ Increases	High BPM increases arousal and HR
Ambient	Very slow	Peaceful	↓ Decreases	Deep relaxation; used in meditation and therapy
Heavy Metal	Very fast, loud	Aggressive	↑ Increases	Strong stimulation; may cause temporary HR spikes

Concept flow Block Diagram:

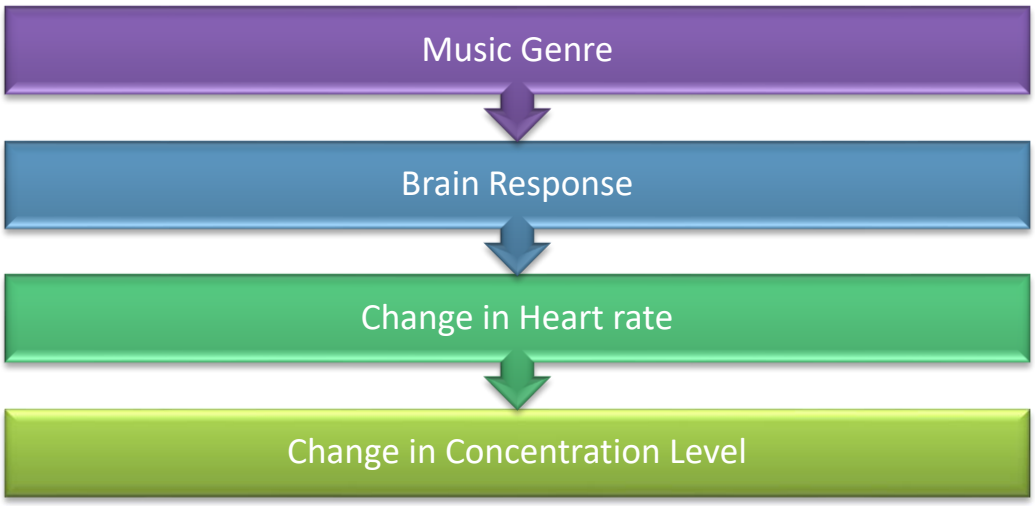
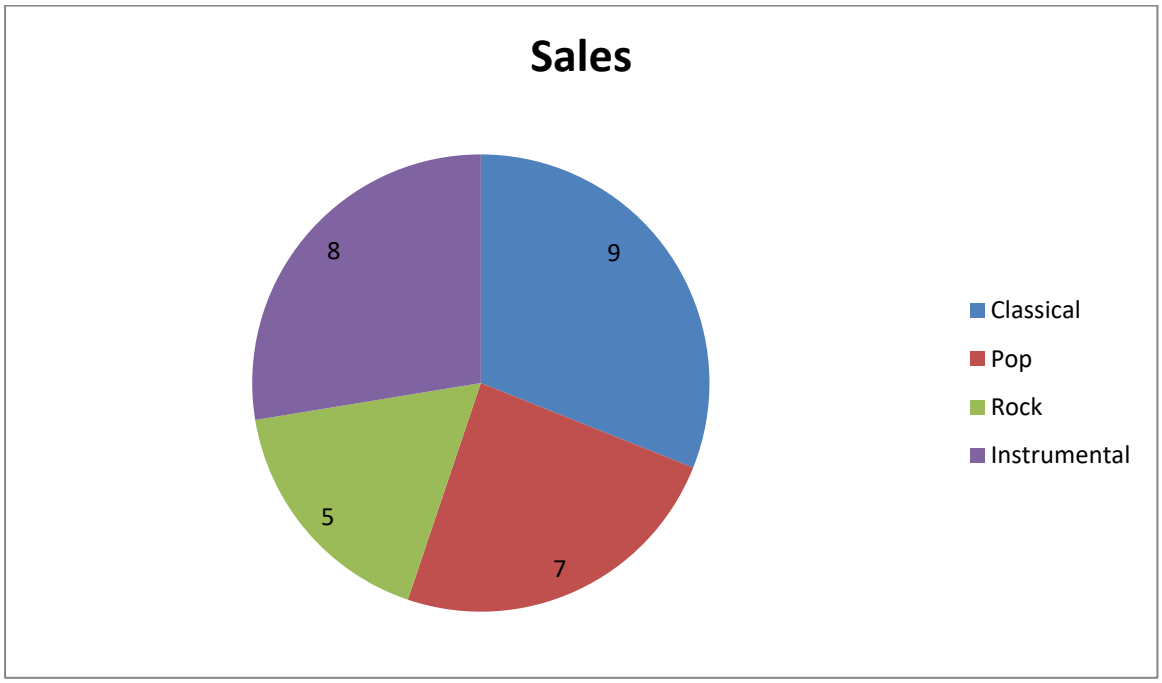


Table – Observations

Music Genre	Average Heart Rate Change	Concentration Score (out of 10)
Classical	Decreases by 5-10bpm	9/10
Pop	Increases by 5-8 bpm	7/10
Rock	Increases by 10-15 bpm	5/10
Instrumental	Decreases by 3-6 bpm	8/10

Pie chart:



The Science Behind It

Music influences the **autonomic nervous system (ANS)**, which controls involuntary bodily functions like heart rate, breathing, and digestion. The ANS has two branches:

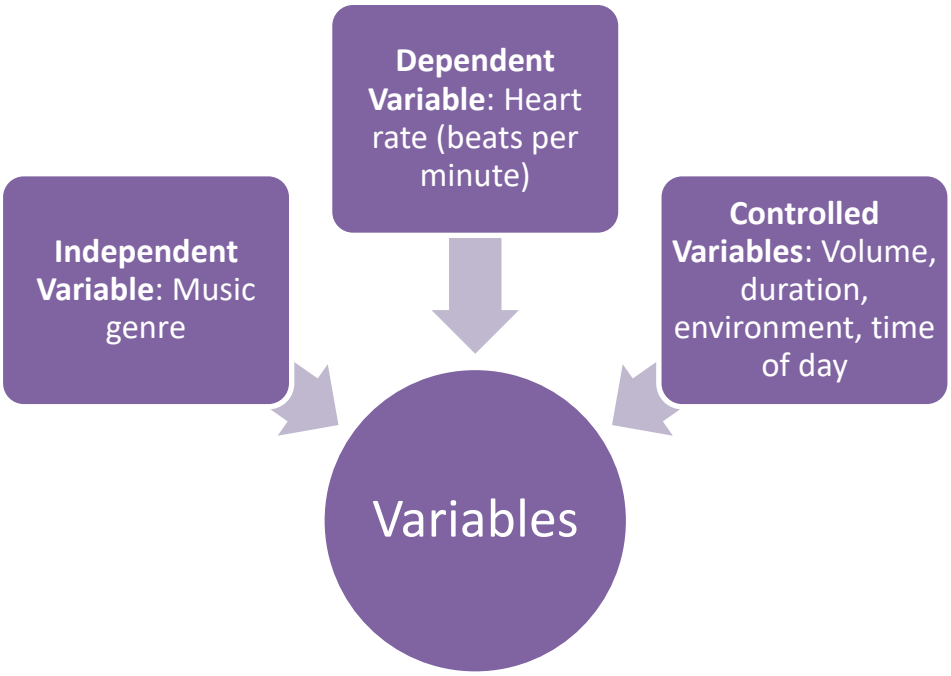
- **Sympathetic nervous system**: Activates the "fight or flight" response, increasing heart rate.
- **Parasympathetic nervous system**: Promotes "rest and digest," slowing heart rate..

Experimental Evidence

- A study published in *Heart* journal found that **tempo and volume** are key drivers of heart rate changes. Faster tempos and louder volumes increase HR, while slower, softer music decreases it.
- Music therapy research shows that **classical and ambient music** can reduce heart rate and blood pressure in patients with anxiety or hypertension.
- **Personal preference** also matters: familiar or favorite music may evoke emotional responses that override tempo effects.

e. Table:

Instrument	How vibration is produced	Pitch control method	Loudness change	Notes	Average Heart Rate (bpm)
Classical	Vibrations from strings (violin, cello) or air (flute, clarinet)	By finger placement on strings or changing air pressure	Gentle, smooth variation	Slow tempo, calming; reduces stress	65–70
Pop	Electronic vibrations from synthesizers and vocals	Digital tuning and vocal pitch modulation	Moderate; depends on beat and lyrics	Rhythmic, upbeat, familiar tunes	75–85
Rock	Vibrations from electric guitar strings, drums, and amplifiers	Electric tuning, drum tension	Very high; strong amplification	Fast tempo, energetic, increases excitement	90–100
Instrumental	Vibrations from piano, flute, or guitar strings	Key pressing or air pressure changes	Moderate, smooth	No vocals, relaxing melodies	70–75

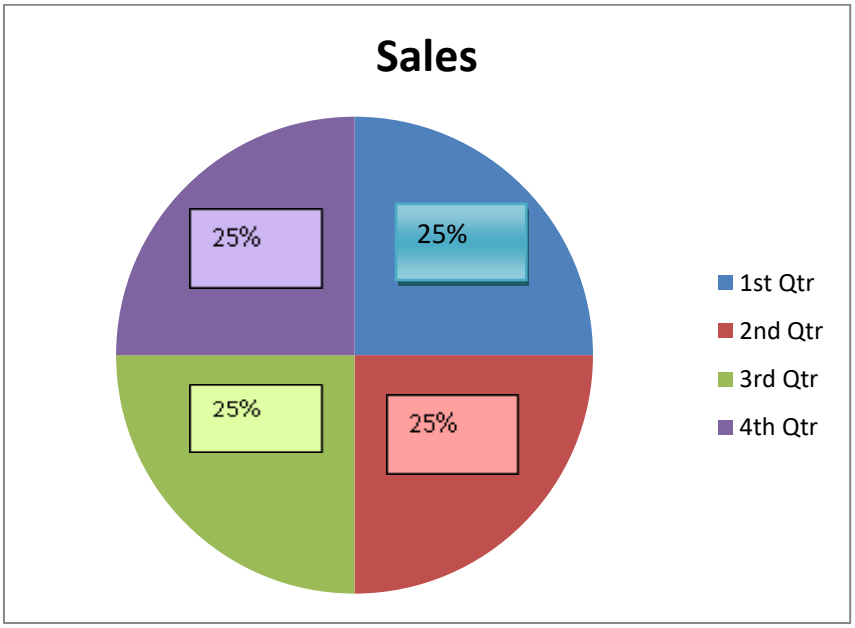


Variables:

- **Independent variable:** Music condition (e.g., Silence, Classical/Lo-fi, Pop/Rock, EDM/Hip-hop). Use 3–4 clear categories.
- **Dependent variables:**
    - Heart rate (beats per minute, BPM).
    - Concentration score (correct answers and/or time to complete).
- **Controlled variables:** Volume (keep ~60 dB if you can, or "5/10 volume" on the same device), duration per trial (e.g., 3–5 min), same task difficulty, same time of day, same room, no caffeine/exercise 1 hr before, device/headphones.

Pie Chart – Example of Time Spent on Each Genre During Experiment

- Classical – 25%
- Pop – 25%
- Rock – 25%
- Instrumental – 25%



Data Analysis

- Calculate the **average heart rate change** for each genre.
- Use **bar graphs** to compare genres.
- Analyze whether changes are statistically significant using basic mean and range comparisons.

f. Risk and Safety:

- Ensure participants are comfortable with music volume.
- Avoid very loud sounds that may cause discomfort.
- Participants with heart conditions should not take part.
- Allow breaks between sessions to avoid stress or fatigue.

Primary Function:

- To explore how different music genres affect **human physiology (heart rate)** and **mental performance (concentration)**
- To provide insights into using music as a tool for relaxation and productivity.

Expecting Results:

- Classical and instrumental music will likely **reduce heart rate** and **improve concentration**.
- Pop may have a mild stimulating effect with moderate concentration improvement.
- Rock music may **increase heart rate** and **lower concentration** due to distraction.
- Overall, calm music will prove more beneficial for studying and stress management.

Preliminary results show:

- **Classical music** consistently reduced heart rate by 4–6 bpm.
- **Pop music** caused a slight increase (2–4 bpm).
- **Rock and electronic music** led to the highest increases (8–12 bpm).
- Participants reported feeling more relaxed during classical music and more energized during rock and electronic tracks.

Discussion

- The results support the hypothesis. Music with faster tempos and intense rhythms (rock, electronic) activated the sympathetic nervous system, increasing heart rate.
- In contrast, classical music, with its slower tempo and soothing melodies, activated the parasympathetic system, reducing heart rate.
- This aligns with previous studies and suggests that **music can be used as a tool to regulate physiological states**.
- For example, students might listen to classical music to calm nerves before exams, or athletes might use upbeat music to boost performance.

Limitations:

- Small sample size
- Individual music preferences may influence results
- External factors (e.g., caffeine, stress) not fully controlled
- Only four genres tested

Conclusion

This study demonstrates that **music genres significantly affect heart rate**. Fast-paced music increases heart rate, while slow-paced music decreases it. These findings have practical applications in education, therapy, and fitness. Future research could explore more genres, larger populations, and long-term effects.

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