Study Protocol

Title:

# Effects of instrumental lo-fi background music versus silence on cognitive interference during the stroop task in university students

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***Abstract***

*Background*

Instrumental low-fidelity (lo-fi) music is widely used as background music during studying; however, empirical evidence regarding its effects on attentional control remains inconsistent. The present study aims to examine the effect of instrumental lo-fi background music on selective attention and cognitive interference in university students.

*Methods*

This study will use a randomized between-subjects experimental design. A total of 72 undergraduate students will be assigned to either an instrumental lo-fi music condition or a silence (control) condition. Selective attention and inhibitory control will be assessed using a paper-based Stroop colour–word task. Performance will be measured using the Stroop interference score, calculated as the difference between the number of correct responses in the colour–word interference condition and the colour naming condition.

*Discussion*

The findings of this study will contribute evidence on whether instrumental lo-fi background music enhances or impairs selective attention in a controlled laboratory setting. The results may have implications for optimizing study environments among university students. Limitations will be considered such as convenience sampling and the employed between-subjects design. Results will be shared in the form of academic publication and presentation at a conference.

*Keywords:*

lo-fi music; selective attention; Stroop task; inhibitory control; auditory distraction

***Background***

Background music is increasingly common in university study settings, particularly instrumental low-fidelity (lo-fi) music, which many students report using because they perceive it as helpful for concentration. However, empirical evidence on the cognitive effects of background music remains inconsistent. Meta-analytic findings suggest that background music may impair performance on memory-related tasks, while its effects on other cognitive tasks vary depending on task demands and specific musical properties (Kämpfe et al., 2010; Souza & Barbosa, 2023). These mixed findings highlight the need for further research on how specific forms of background music, including instrumental lo-fi music, influence attentional control, particularly in interference-based tasks such as the Stroop task.Selective attention is a core cognitive process that enables individuals to focus on task-relevant information while inhibiting irrelevant distractions. This ability is especially important in academic settings, where students are frequently required to perform cognitively demanding tasks in the presence of competing environmental stimuli. From an attentional resource perspective, cognitive capacity is limited, and irrelevant auditory input may interfere with task performance by competing for processing resources (Lavie, 2005). In this context, background music may act as a distractor that affects the efficiency of executive attention, particularly during tasks requiring inhibition of conflicting information.

Several theoretical frameworks may help explain the relationship between background music and cognitive performance. Perceptual Load Theory proposes that the extent to which irrelevant stimuli are processed depends on the perceptual demands of the primary task (Lavie, 2005). Under high perceptual load, attentional resources are largely allocated to task-relevant stimuli, leaving fewer resources available for distractor processing. In contrast, alternative accounts suggest that background auditory stimulation may influence performance through changes in arousal or engagement. These competing perspectives make the effect of instrumental lo-fi music on selective attention in interference-based tasks theoretically unclear, highlighting the need for empirical investigation using the Stroop colour–word task. Attention has also been conceptualised as a limited cognitive resource associated with mental effort and arousal (Bruya & Tang, 2018). From this perspective, background music may influence performance through multiple mechanisms. On one hand, music may enhance task

engagement by increasing arousal; on the other hand, it may impair performance by introducing competing auditory stimuli that draw on limited attentional resources. These competing mechanisms suggest that the effect of background music on attentional performance depends on task demands and processing load. One of the most widely used paradigms for assessing selective attention and cognitive control is the Stroop Colour–Word Task. In this task, participants are required to name the ink colour of words while inhibiting the automatic tendency to read the word itself. When the semantic meaning of the word conflicts with the ink colour, performance typically declines, resulting in the Stroop interference effect (MacLeod, 1991; Wallace, 2010). In the present study, a paper-based Stroop task will be used, in which performance is measured as the number of correct responses within a fixed time interval (45 seconds), reflecting processing efficiency rather than reaction time. Recent research has examined the effects of background music on attentional states in more naturalistic contexts. For example, Kiss et al. (2024) investigated the relationship between background music, mind-wandering, and task engagement using pupillometry. Their findings suggest that background music may increase baseline arousal and support sustained attention; however, arousal alone does not fully account for variations in attentional performance. Overall, the relationship between music and cognition appears to be complex and dependent on multiple interacting factors, including task characteristics and properties of the auditory stimulus. Instrumental lo-fi music has become an increasingly popular form of background study music. It is typically characterised by slow tempo, repetitive structure, and the absence of lyrics, which may create a relatively stable auditory environment. Although such features are often assumed to support concentration, empirical research specifically examining the cognitive effects of lo-fi music remains limited. Silence is commonly used as a control condition in studies examining the cognitive effects of auditory stimuli, providing a baseline against which facilitative or disruptive effects of background music can be evaluated. In the present study, silence will be operationalised as a no-audio condition in which participants wear the same noise-cancelling headphones as those in the music condition, with noise cancellation active in both conditions to control for headphone-related effects. From a cognitive load perspective, the Stroop task imposes substantial intrinsic load due to the need to inhibit automatic responses and resolve interference. Background music may act as an additional source of extraneous load by introducing task-irrelevant auditory input that competes for limited cognitive resources. Alternatively, it may influence performance through arousal-related mechanisms that modulate engagement with the task. This distinction highlights the importance of examining how auditory context

interacts with the cognitive demands of interference-based tasks. Despite extensive research on attention and environmental distraction, there remains a lack of empirical studies specifically investigating the effects of instrumental lo-fi music on interference-based cognitive tasks. Existing evidence suggests that the impact of background music varies depending on task characteristics, properties of the auditory stimulus, and individual differences (Speer, 2011; Hofbauer et al., 2024; Souza & Barbosa, 2023). The present study addresses this gap by experimentally comparing Stroop interference performance under instrumental lo-fi background music versus silence in a controlled laboratory setting. By using a between-subjects design, the study aims to minimise carryover and practice effects, providing controlled evidence on the role of instrumental background music in selective attention and interference processing.

### *Objectives*

The objective of the present study is to examine the effect of instrumental lo-fi background music on cognitive interference and inhibitory control in university students using the Stroop Colour–Word Task. Specifically, performance will be compared between a lo-fi music condition and a silence control condition.

### *Hypotheses*

Given competing theoretical accounts (e.g., perceptual load and arousal-based frameworks), it is hypothesised that exposure to instrumental lo-fi background music will have a significant effect on Stroop interference performance compared to a silence condition, without specifying the direction of the effect.

A secondary hypothesis is that exposure to instrumental lo-fi background music will have a significant effect on error rates on the Stroop task compared to a silence condition.

### *Design*

The study adopts a randomized controlled experimental design with two parallel groups. A total of 72 undergraduate students will be randomly assigned at the individual level to either a lo-fi music condition (intervention group) or a silence condition (control group) in a 1:1 allocation ratio using computer-generated block randomisation. The randomisation sequence

will be generated in advance using a computer-based algorithm and implemented using a pre-prepared allocation list.

To minimise selection bias, allocation will be concealed from the experimenter at the point of participant enrolment until assignment. However, due to the nature of the intervention, blinding of the experimenter is not feasible. This introduces a potential risk of experimenter expectancy effects, which will be acknowledged as a limitation.

Participants will complete a paper-based Stroop Colour–Word Task under standardised laboratory conditions. Cognitive interference and inhibitory control will be assessed using the Stroop interference score.

## ***Methods***

### *Study Design and Setting*

This study is conducted in the psychology laboratory at Canadian University Dubai (CUD). The study adopts a randomized controlled between-subjects experimental design with two auditory conditions: instrumental lo-fi music and silence.

Participants will be randomly assigned at the individual level to one of the two conditions in a 1:1 ratio using a computer-generated block randomization procedure. A fixed block size of 4 will be used to ensure balanced group allocation. The randomisation sequence will be generated in advance using Microsoft Excel software by a researcher not involved in data collection. Allocation will be concealed using a pre-prepared assignment list, and participants will be assigned sequentially upon enrolment according to the allocation list.

Due to the nature of the intervention, blinding of the experimenter is not feasible. All sessions will be administered by the same experimenter, which introduces a potential risk of experimenter expectancy effects.

All testing sessions will be conducted individually in a quiet, controlled laboratory environment. Participants in different conditions will be tested in separate sessions to prevent cross-condition contamination. The laboratory will maintain consistent environmental conditions, including standardised fluorescent indoor lighting and minimal ambient noise. The door will remain closed during testing, and external noise will be minimised to ensure

equivalent acoustic conditions across sessions. Participants will be seated at a desk and complete the task under uniform conditions.

This study protocol is reported in accordance with the SPIRIT 2013 guidelines. The SPIRIT checklist is provided in Appendix E.

*Participants*

A convenience sample of 72 undergraduate students from Canadian University Dubai (CUD) will be recruited. No stratification or quotas will be applied based on gender, academic major, or nationality. This may result in group imbalances, which will be acknowledged as a limitation. Basic demographic information (e.g., age, gender, academic year, and habitual music use during study) will be collected for descriptive purposes only and will not be included as covariates in the primary analysis.

*Eligibility Criteria*

*Participants will be included if they meet all the following criteria:*

• Aged between 18 and 24 years (based on self-report at screening)

• Currently enrolled as an undergraduate student at Canadian University Dubai

• Sufficient proficiency in English to understand task instructions and perform colour-naming responses

• Normal or corrected-to-normal vision (self-reported)

• Normal hearing (self-reported)

*Participants will be excluded if they report:*

• Any form of colour vision deficiency (e.g., red–green colour blindness)

• A neurological or psychological condition known to affect cognitive performance (e.g., ADHD, major depressive disorder, or learning disabilities), based on self-report

• Current use of prescribed medication that may affect cognitive functioning (self-reported)

*Materials and Measures*

Selective attention and inhibitory control will be assessed using a paper-based Stroop Colour–Word Task based on the original Stroop (1935) paradigm. The task will consist of three separate sheets representing the Word Reading, Colour Naming, and Colour–Word Interference conditions. Each sheet will contain 100 stimuli arranged in a 10 × 10 grid, using four colours (red, blue, green, and yellow) printed in a standardised font size (e.g., 20 pt).

In the interference condition, participants will be required to name the ink colour while inhibiting the automatic tendency to read the word. Performance will be measured as the number of correct responses within a fixed time interval of 45 seconds per condition, reflecting processing efficiency (throughput) rather than reaction time.

*Materials*

• Printed Stroop task sheets (standardised format)

• Soundcore by Anker Q20i Hybrid Active Noise Cancelling Over-Ear Headphones

• Laptop for audio playback

• Digital stopwatch (or mobile device set to airplane mode and used exclusively for timing)

• Standardised response recording sheets

• Quiet laboratory room with controlled ambient noise and standardised fluorescent indoor lighting

• Desk and chair to ensure consistent seating conditions

*Intervention / Conditions*

Participants in the experimental group will listen to a standardised instrumental lo-fi music track delivered via over-ear noise-cancelling headphones. The selected audio track will contain no lyrics and will maintain a consistent tempo (approximately 60–80 BPM) to ensure a stable auditory stimulus.

The audio file will be stored locally (e.g., USB flash drive) and played via a laptop to ensure consistent playback quality across participants. Volume will be standardised across all participants and set to a fixed level (approximately 50–60% of device output), with no adjustments permitted during the task. Participants in the control condition will wear the same headphones with active noise cancellation enabled, but no audio will be played, ensuring equivalent sensory conditions across groups. Disposable hygienic headphone covers will be replaced between participants to maintain hygiene standards.

*Procedure*

*Recruitment and Consent:*

Participants will be recruited through university-based communication channels, including student WhatsApp groups, campus announcements, and in-person invitations at Canadian University Dubai. A QR code will also be made available on campus to allow students to access study information and register their interest easily.

Participation in this study is entirely voluntary. No compensation, course credit, or incentives will be provided. Participants may decline or withdraw from the study at any time without penalty or consequences. To minimise potential coercion, researchers will not recruit students from courses in which they have any evaluative authority.

*Randomization:*

Participants will be randomly assigned at the individual level to one of two conditions using a computer-generated block randomization procedure implemented in Microsoft Excel. The allocation sequence will be generated in advance and concealed until participant assignment. Participants will be assigned sequentially according to the allocation list.

*Preparation and Standardisation:*

All sessions will be conducted in the same psychology laboratory to ensure consistency across conditions. The same laptop and headphones will be used for all participants. Disposable hygienic headphone covers will be replaced for each participant.

A standardised instrumental lo-fi track will be used for all participants in the experimental condition. Identical printed copies of the Stroop task sheets will be provided to each participant to ensure consistency. The testing environment will be controlled to minimise external noise and distractions, with consistent lighting and seating conditions across all sessions.

*Experimental Task:*

Participants will complete a paper-based Stroop Colour–Word Task (Stroop, 1935). In this task, participants will be presented with colour words printed in either congruent or incongruent ink colours. They will be instructed to name the ink colour while suppressing the automatic tendency to read the word.

Cognitive interference and inhibitory control will be assessed using the Stroop interference score:

Interference Score = Correct (Colour–Word) − Correct (Colour Naming)

Each condition will be administered for 45 seconds. Performance will be measured as the number of correct responses within this time window, reflecting processing efficiency.

Primary data will be recorded using standardised scoring sheets and entered into a secure Excel spreadsheet for analysis.

*Experimental Conditions*

*Lo-fi Music Condition:*

Participants will wear over-ear noise-cancelling headphones and listen to a standardised instrumental lo-fi music track with a consistent tempo (approximately 70 BPM) and no lyrics. The audio file will be stored locally and played via a laptop. The same 5-minute segment will be used for all participants. Volume will be fixed (approximately 50–60% of device output), with no adjustments permitted.

*Silence Condition:*

Participants will wear the same headphones with active noise cancellation enabled but without audio playback. The testing environment will remain quiet to ensure comparable sensory conditions.

*Post-Task Procedures*

Following completion of the task, participants will be debriefed regarding the purpose of the study. The full debriefing statement is provided in Appendix D. Participants will be given the opportunity to ask questions. Each session will last approximately 15–20 minutes.

*Outcome Measures*

The primary outcome measure will be the Stroop interference score, calculated as the difference in the number of correct responses between the Colour Naming condition and the Colour–Word Interference condition:

Interference Score = Correct (Colour Naming) − Correct (Colour–Word Interference)

This score will be based on the raw number of correct responses obtained within a fixed 45-second time window for each condition. A larger positive interference score indicates greater cognitive interference and poorer inhibitory control.

Secondary outcome measures will include the number of correct responses and error rates for each Stroop condition (Colour Naming and Colour–Word Interference), which will be reported descriptively to provide additional insight into task performance.

*Statistical Analysis*

Statistical analyses will be conducted using IBM SPSS Statistics (Version 29), with Jamovi used for verification of results where necessary. Raw data will be recorded on standardised Stroop scoring sheets and subsequently entered a secure digital spreadsheet (e.g., Microsoft Excel) for analysis. Data entry will be performed by the primary investigator and verified through double-checking to minimise entry errors.

Descriptive statistics (means and standard deviations) will be calculated for all outcome variables in each experimental condition.

The primary analysis will involve an independent-samples t-test to compare mean Stroop interference scores between the lo-fi music condition and the silence condition. All tests will be two-tailed, with a significance level set at $\alpha = .05$. Effect sizes (Cohen's d) and 95% confidence intervals will be reported.

Prior to inferential analysis, data will be screened for missing values and outliers. Outliers will be identified using standardized z-scores ($|z| > 3$). Assumptions of normality and homogeneity of variance will be assessed using the Shapiro–Wilk test and Levene's test, respectively, alongside visual inspection of Q–Q plots. It is acknowledged that the Shapiro–Wilk test may have limited power with the current sample size.

If assumptions for parametric testing are violated, the non-parametric Mann–Whitney U test will be used as an alternative.

Secondary analyses will include descriptive comparisons of correct response counts and error rates across conditions. As these analyses are exploratory, no correction for multiple comparisons will be applied; this will be acknowledged as a limitation.

*Sample Size Calculation*

An a priori sample size estimation was conducted using G*Power software (Version 3.1). The calculation was based on an independent-samples, two-tailed t-test comparing mean Stroop interference performance between two groups: an experimental group exposed to instrumental lo-fi music and a control group tested in silence. A medium effect size of $d = 0.60$ was assumed. This estimate was selected as a conservative and practically feasible effect size, informed by the mixed findings reported in the background music and cognition literature, rather than assuming a large effect.

The significance level was set at $\alpha = .05$, with a desired statistical power of $1 - \beta = .70$, and an allocation ratio of 1:1. The power analysis indicated a minimum required sample of 72 participants, with 36 participants per group. Participants were randomly assigned using a computer-generated randomization procedure to either the lo-fi music condition or the silence condition while completing the Stroop task.

A between-subjects design is expected to introduce variability related to individual differences, such as habitual music use and sensitivity to auditory stimulation, which may reduce statistical sensitivity. A total sample of N = 72 was considered sufficient to provide stable group estimates and allow meaningful comparison of cognitive interference and inhibitory control between conditions. Although the selected statistical power (.70) is below the conventional benchmark of .80, this is acknowledged as a limitation and was considered acceptable given the feasibility constraints of the current study.

### *Trial Status*

At the time of manuscript submission, ethical approval has been obtained from the Research Ethics Committee at Canadian University Dubai (Project No. CUD-20260402-X; approved April 2, 2026). Participant recruitment has not yet commenced.

### *Trial Registration*

This study has been registered at ClinicalTrials.gov. The registration number will be provided upon approval.

### *Discussion*

This study aims to provide controlled experimental evidence on the effect of instrumental lo-fi background music on cognitive interference and inhibitory control during performance on the Stroop Colour–Word Task (Stroop, 1935). Although background music is widely used in study environments, prior findings on its cognitive effects remain inconsistent, and limited empirical research has specifically examined instrumental lo-fi music in interference-based tasks (Kämpfe et al., 2010; Souza & Barbosa, 2023).

This study contributes to the literature by clarifying whether instrumental lo-fi background music enhances, impairs, or has no measurable effect on Stroop interference performance under controlled laboratory conditions. By using a standardized auditory stimulus, a fixed administration procedure, and a paper-based Stroop task, the study seeks to reduce methodological variability and provide a more controlled test of the relationship between background music and cognitive performance.

Several limitations should be acknowledged. The use of a convenience sample of undergraduate students may limit the generalizability of the findings to broader populations. In addition, the between-subjects design may introduce variability due to individual differences in habitual music use and sensitivity to auditory stimulation. The absence of experimenter blinding may also introduce expectancy effects. Furthermore, the use of a count-based Stroop measure reflects processing efficiency (throughput) rather than reaction time.

The significance level ($\alpha = .05$) and statistical power ($1 - \beta = .70$), although acceptable under feasibility constraints, are below the conventional threshold of .80 and may increase the risk of Type II error; therefore, null findings should be interpreted with caution. From a practical perspective, the study is considered feasible within a university setting, as it relies on a simple and widely used cognitive task and requires minimal equipment. Given the large undergraduate population at Canadian University Dubai, recruitment of 72 participants within a short time frame is considered achievable. The use of a controlled laboratory environment supports internal validity by reducing environmental variability across testing sessions. From a cognitive load perspective, the Stroop task imposes substantial intrinsic load due to interference resolution demands (Paas et al., 2003). Background music may introduce additional extraneous load, potentially impairing performance. However, if instrumental lo-fi music reduces environmental distractions or supports attentional engagement, it may offset some of these effects. This dual possibility aligns with the non-directional hypothesis of the present study. Future research could extend this work by examining the effects of different types of background music, including lyrical music (e.g., pop and rap) and variations in tempo and intensity, to better understand how specific musical features influence cognitive interference. In addition, future studies should consider using computerized Stroop tasks that allow for the measurement of reaction time alongside accuracy. Increasing sample size and including more diverse participant populations would further strengthen generalizability.

In conclusion, this study addresses a gap in the literature by examining the effect of instrumental lo-fi background music on cognitive interference and inhibitory control using a controlled experimental design. Strengths include the use of a standardized auditory stimulus, controlled testing conditions, and a clear operationalization of interference performance. Limitations should be considered when interpreting the findings.

## *Abbreviations*

CUD: Canadian University Dubai

SPSS: Statistical Package for the Social Sciences

lo-fi: low-fidelity instrumental background music

CLT: Cognitive Load Theory

## *Declarations*

*Ethics Approval and Consent to Participate:*

The study is conducted in accordance with the ethical principles outlined in the American Psychological Association Ethical Principles of Psychologists and Code of Conduct (2017) and the World Medical Association Declaration of Helsinki.

Ethical approval has been obtained from the Research Ethics Committee at Canadian University Dubai (Project No. CUD-20260402-X; approved April 2, 2026).

Written informed consent will be obtained from all participants prior to participation. Participants will be informed about the purpose of the study, the procedures involved, and the expected duration of participation (approximately 15–20 minutes). Participation will be voluntary, and participants will have the right to withdraw at any time without penalty.

No personally identifiable information will be collected. All data will be recorded using numerical participant codes to ensure anonymity. Data will be stored in password-protected and encrypted files, accessible only to the research team, and will be reported in aggregate form. The study will be conducted in a controlled laboratory environment at Canadian University Dubai. Hygiene procedures will be maintained through the use of disposable headphone covers, which will be replaced between participants.

*Consent for Publication*

All authors have read and approved the manuscript and consent to its submission and publication.

Availability of Data and Materials

The datasets generated and/or analysed during the current study will be available from the corresponding author on reasonable request.

*Competing Interests*

The authors declare that they have no competing interests.

*Funding*

This study received no external funding.

*Authors' Contributions*

S.Y.: Conceptualization, Methodology, Formal Analysis, Writing – Original Draft.

F.M.: Methodology, Data Curation, Writing – Review & Editing.

Both authors contributed to study design refinement and approved the final manuscript.

*Acknowledgments*

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***Data Saving and Management***

All data will be stored in encrypted and password-protected files, with secure backups maintained. Data will be stored on an institutional server or an approved secure cloud storage platform authorised by Canadian University Dubai. Access to the data will be restricted to the

research team only. All data will be anonymised using numerical participant codes, and no personally identifiable information will be collected. Data will be used solely for research purposes and will not be shared with external parties unless required for academic or publication purposes. Statistical analyses will be conducted using IBM SPSS Statistics, with Jamovi used for verification where necessary. The primary analysis will involve an independent-samples t-test to compare group performance.

### *Feasibility and Risk Mitigation*

The study is considered feasible within the university setting, as it involves a short, low-risk cognitive task that requires minimal equipment and time commitment (approximately 15–20 minutes per participant). Recruitment is expected to be achievable due to the large undergraduate population at Canadian University Dubai. The study involves minimal risk. Potential discomfort may include mild fatigue or frustration during the Stroop task. Participants will be informed that they may withdraw at any time without penalty. Standardised procedures will be used to ensure consistency across participants, including controlled laboratory conditions and identical task administration. Hygiene will be maintained using disposable headphone covers, which will be replaced between participants.

***Word Count: 4311 words***

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# Appendix

## Appendix A: Demographic Questionnaire

1

**Demographic Questionnaire**

This questionnaire will be completed before the experimental task.
If you do not meet the eligibility criteria, you will not be able to proceed with the study.

Please answer the following questions.
Do not write your name. All questions are optional.

Participant Code: _____

1. Age: _____ years
   (Participants must be between 18–24 years)
2. Gender
   ☐ Male
   ☐ Female
   ☐ Other: _____
   ☐ Prefer not to say
3. Academic Year
   ☐ Year 1
   ☐ Year 2
   ☐ Year 3
   ☐ Year 4
   ☐ Other: _____
   ☐ Prefer not to say

2

4. Do you usually study while listening to music?
   ☐ Never
   ☐ Rarely
   ☐ Sometimes
   ☐ Often
   ☐ Always
   ☐ Prefer not to say
5. Approximately how many hours per week do you listen to music while studying?
   _____ hours per week
   ☐ Prefer not to say
6. Do you have any hearing difficulties that may affect your ability to listen to audio clearly?
   ☐ Yes
   ☐ No
   ☐ Prefer not to say
7. Do you have any form of color vision deficiency (color blindness)?
   ☐ Yes
   ☐ No
   ☐ Prefer not to say

Thank you for your participation. Your responses will remain confidential.

## Appendix B: Consent Form

**REQUEST FOR YOUR PARTICPATION IN RESEARCH**

**TITLE OF THE STUDY**

**Effects of Instrumental Lo-fi Background Music on Cognitive Interference During the Stroop Task in University Students**

**NAME OF THE RESEARCHER**

Shahad Yousif – Undergraduate Psychology Student, Canadian University Dubai

Farah Mosalami – Undergraduate Psychology Student, Canadian University Dubai

**Faculty Supervisor:**
Dr. Efthymios Papatzikis
Canadian University Dubai

**PURPOSE**

This study examines whether instrumental lo-fi background music affects attention and cognitive performance during a Stroop task. The Stroop task is a short cognitive task that measures how people process information and manage interference when identifying colours and words. The purpose of comparing music versus silence will be explained to you after completing the study.

The purpose of this research is to better understand whether listening to background music influences cognitive performance in university students.

**PROCEDURES**

If you agree to participate in this study:

- You will complete a short demographic questionnaire before starting the task
- You will complete a paper-based Stroop task consisting of three short sections (Word Reading, colour Naming, and colour–Word Interference).
- Each section will last 45 seconds.
- The total session will take approximately 15–20 minutes.
- You will be randomly assigned (by chance) to one of two conditions: completing the task while listening to instrumental lo-fi music through headphones at a standardized moderate volume (approximately 50–60%) or completing the task in silence while wearing the same headphones.
- The study will take place individually in the Psychology Laboratory at Canadian University Dubai.
- Participants with Color blindness or those who do not meet the eligibility criteria will not be able to participate in the study.
- Your responses will be recorded by the researcher on a scoring sheet.
- No audio or video recordings will be made.

**POTENTIAL RISKS**

This study involves minimal risk. You may experience mild fatigue or temporary frustration while performing the Stroop task due to the concentration required.

To minimize discomfort, the task is short and lasts only a few minutes. Participants may stop the task or withdraw from the study at any time without penalty.

**POTENTIAL BENEFITS**

There are no direct personal benefits to participants in this study. However, your participation may contribute to research on attention, cognitive performance, and the effects of background music among university students. The findings may help improve understanding of how study environments influence cognitive tasks.

**COMPENSATION**

Participants will not receive any financial compensation, course credit, or other incentives for participating in this study.

**CONFIDENTIALITY**

No identifying information will be collected from participants. Each participant will be assigned a numerical participant code, and no names or personal identifiers will be linked to the data.

All data will be stored in password-protected digital files accessible only to the researchers and the faculty supervisor. Paper scoring sheets will be stored securely by the researchers.

All data will be securely stored for a period of 5 years after study completion and then permanently deleted by the researchers; to remain confidential the collected information will be used for research purposes only. Results of the study will be reported in aggregate form, and no individual participant will be identifiable in any reports or publications.

**PARTICIPANT RIGHTS**

Your participation in this study is completely voluntary.

You may refuse to participate or withdraw from the study at any time without any negative consequences.

Participation or non-participation will not affect your grades or academic standing in any way.

You also have the right to skip any demographic question that you do not wish to answer without penalty.

This consent form is not a contract, and you will not waive any legal rights by choosing to participate or not participate.

**QUESTIONS OR PROBLEMS**

You are encouraged to ask questions at any time during the study.

For further information about the study, please contact:

Shahad Yousif – 20220001717@students.cud.ac.ae
Farah Mosalami – 20220001138@students.cud.ac.ae

If you feel you have been harmed in any way by your participation in this study, please contact:

Dr. Adam Fenech
Provost of Research, Canadian University Dubai
adam.fenech@cud.ac.ae

Participant Code: _____

Participant Signature: _____

Date: _____

# Appendix C: Stroop Task Sample

## STROOP TEST
Part 1

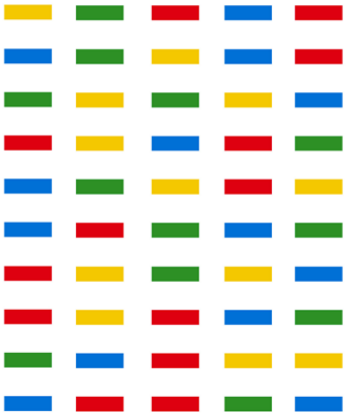
Duration: 45 seconds
Principle: Read the words by following the lines, and this as quickly as possible. When you reach the end of the page, start again from the beginning.

| | | | | |
|---|---|---|---|---|
| GREEN | YELLOW | RED | BLUE | YELLOW |
| GREEN | RED | BLUE | GREEN | BLUE |
| RED | YELLOW | BLUE | GREEN | RED |
| YELLOW | YELLOW | GREEN | BLUE | RED |
| GREEN | YELLOW | BLUE | RED | RED |
| BLUE | YELLOW | GREEN | YELLOW | RED |
| GREEN | BLUE | RED | GREEN | BLUE |
| YELLOW | YELLOW | BLUE | RED | GREEN |
| BLUE | YELLOW | GREEN | RED | BLUE |
| GREEN | RED | YELLOW | GREEN | YELLOW |



## STROOP TEST
Part 2

Duration: 45 seconds
Principle: Line by line, name the color of each rectangle and this as quickly as possible. When you reach the end of the page, start again from the beginning.







## STROOP TEST
Part 3

Duration: 45 seconds
Principle: Line by line, name the color of each word (not what the word says) and this as quickly as possible. When you reach the end of the page, start again from the beginning.

| | | | | |
|---|---|---|---|---|
| BLUE | YELLOW | BLUE | RED | BLUE |
| GREEN | YELLOW | RED | GREEN | YELLOW |
| GREEN | RED | GREEN | YELLOW | YELLOW |
| YELLOW | RED | YELLOW | GREEN | BLUE |
| BLUE | RED | YELLOW | YELLOW | GREEN |
| RED | BLUE | GREEN | YELLOW | GREEN |
| RED | YELLOW | BLUE | RED | GREEN |
| BLUE | GREEN | YELLOW | YELLOW | YELLOW |
| BLUE | RED | RED | YELLOW | RED |
| GREEN | BLUE | RED | GREEN | BLUE |



# Appendix D: Debriefing Form

**Debriefing Form**

**Debriefing Statement**

Thank you for participating in this study.

The purpose of this research is to examine whether listening to instrumental lo-fi background music influences cognitive performance during a Stroop task. This study specifically compares performance under background music versus silence to understand how environmental factors may influence attention and cognitive processing.

The Stroop task is a widely used psychological test that measures how people process information and manage interference between competing stimuli. During the task, participants were asked to name the Colour of the ink rather than read the word itself. This condition requires inhibitory control and selective attention.

All responses remain confidential and will be used only for research purposes. No identifying information will be linked to your data. The results of the study will be reported in aggregated form.

If you have any questions about this research, you are welcome to contact the researchers.

Thank you again for your participation.

Researchers:
Shahad Yousif- Psychology Undergraduate Student

20220001717@students.cud.ac.ae

Farah Mosalami – Psychology Undergraduate Student

20220001138@students.cud.ac.ae

If you feel you have been harmed in any way by your participation in this study, please contact:
Dr. Adam Fenech
Provost of Research, Canadian University Dubai
adam.fenech@cud.ac.ae

Thank you again for your participation.

Psychology Undergraduate Student
Canadian University Dubai

## Appendix E: SPIRIT 2013 Checklist

## Appendix A: Ethical Approval Letter

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Your portal to Canadian education

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c/o: Ms. Shahad Yousif, Student Researcher
Ms. Farah Mosalami, Student Researcher
Dr. Efthymios Papatzikis, Supervisor

April 2, 2026

Dear Applicant,

**Re: Application for Ethics Approval for a research project**

| | |
|---|---|
| **Project title:** | **"Effects of Instrumental Lo-fi Background Music on Cognitive Interference During the Stroop Task in University Students"** |
| **Project #:** | CUD-20260402-X |
| **Effective Date:** | April 2, 2026 |

**Ethical Approval Decision:** **Approved with minor changes required**

This approval expires on **April 2, 2027**. It is your responsibility to request extension if necessary.

Sincerely,

Institutions Research Ethics Committee
Canadian University Dubai

INSPIRING MINDS
TRANSFORMING LIVES

CUD Human Subjects- Research Ethics Committee
**RESEARCH ETHICS APPLICATION:**

| **Research Ethics Committee use only** | | |
|---|---|---|
| Final Decision: **Approved with Minor Changes** | Approved | ☐ |
| | Approved – Minor changes | ☐ |
| | Deferred – Major changes | ☐ |
| | Rejected | ☐ |
| | | |
| Project title: **Effects of Instrumental Lo-fi Background Music on Cognitive Interference During the Stroop Task in University Students** | | |
| Approved by: **Members of the Ethics Committee** | Date: 02/04/2026 | |
| Signature: *CUD's Research Ethics Committee* | | |
| Details of any conditions upon which approval are dependent:<br><br>1. Recruitment message includes personal phone numbers, while consent form uses emails . This raises privacy concerns and lacks consistency across documents.<br>2. Copyright issue with music stimulus: Music is downloaded from YouTube, no confirmation of legal or licensed use. This violates ethical standards for use of materials<br>3. No defined safe audio level : "Moderate volume" is mentioned but not standardized or measurable. Potential risk of participant discomfort or hearing strain<br>4. Participants are randomly assigned to conditions, but this is not clearly stated in simple terms in the consent form. Limits fully informed consent<br>5. Participants recruited within the university setting. No strong statement that participation will not affect grades or academic standing<br>6. Debrief form does not clearly explain study hypothesis and why music vs silence is being tested ? Participants are not fully informed after participation. | | |

7. Color blindness and other exclusions are mentioned, but when/how participants are excluded is unclear.
8. The participants' criteria in the Recruitment Message doesn't specify that the participants should be students enrolled at Canadian University Dubai unless the invitation email will be only for CUD students.
9. If the participant is not eligible to questionnaire criteria, it is recommended to add this statement: "If you do not meet the eligibility criteria, your responses will not be recorded" or "If you do not meet the eligibility criteria, you will not be able to proceed with the questionnaire".
10. It is not clear when the **Demographic Questionnaire** will be conducted.
11. It is essential to clarify the test location/labs and the environment of the study sessions.
12. It is not clear the rationality of specifying 72 undergraduate students as the potential participants.
13.In the consent form, the contact persona in case of participant's feeling been harmed in any way should be Dr. Adam Fenech, Provost of Research at CUD at adam.fenech@cud.ac.ae
14. In the Debriefing Statement, this statement needs to be added: "If you feel you have been harmed in any way by your participation in this study, please contact Dr. Adam Fenech, Provost of Research at CUD at adam.fenech@cud.ac.ae