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Comparing 432 Hz And 440 Hz Music In Relation To Emotional Safety Among Hospitality Management Students

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Abstract

Music listening is frequently used to regulate emotions and manage stress, but limited evidence exists regarding whether music tuning frequency is associated with emotional safety among students. This exploratory study compared changes in emotional safety among Hospitality Management students exposed to music tuned to either 432 Hz or 440 Hz. A two-group experimental pretest-posttest design was employed with 16 participants randomly assigned to the 432 Hz condition (n = 8) or the 440 Hz condition (n = 8). Emotional safety was measured before and after the listening session using a 10-item scale. Responses were converted so that higher total scores consistently represented greater emotional safety. Descriptive statistics, change scores, a point-biserial correlation, and Welch's independent-samples t-test were used in the analysis. The 432 Hz group began with higher emotional-safety scores, but both groups attained similarly high posttest scores. The 440 Hz group demonstrated a larger mean change (M = 11.13, SD = 3.44) than the 432 Hz group (M = 4.50, SD = 6.44). Welch's test indicated a statistically significant difference in change scores, t(10.70) = -2.57, p = .027. Nevertheless, the pronounced baseline difference, possible ceiling effects, and small sample limit causal interpretation. The findings suggest that both listening conditions were associated with improved emotional safety, while the apparent advantage of 440 Hz requires confirmation through larger experiments with stronger baseline equivalence and validated measurement procedures.

Keywords: *emotional safety; music tuning frequency; 432 Hz music; 440 Hz music; student well-being; experimental psychology*

1. Introduction

Emotional safety is an important dimension of student well-being. It reflects the extent to which students feel emotionally secure, comfortable, and able to participate without excessive fear, discomfort, or psychological distress. In demanding academic environments, emotional safety may influence students' engagement, concentration, emotional regulation, and capacity to manage academic pressure. Identifying accessible strategies that support this condition is therefore relevant to educational institutions and student-wellness programs. In the Philippine university context, mental-health risks have likewise been shown to span interconnected individual, interpersonal, and systemic domains, indicating that students' emotional conditions cannot be reduced to a single influence (Malabanan, 2026).

Music listening is commonly used to regulate emotions, alleviate stress, and restore mood. Saarikallio (2011) identified emotional self-regulation as an important function of musical engagement across adulthood. Among first-year university students, music listening was also reported as an effective strategy for coping with stress during the COVID-19 pandemic (Vidas et al., 2021). These findings suggest that controlled music listening may contribute to a more comfortable emotional state, although responses may vary according to the music, listener, and surrounding circumstances.

Beyond comparisons between listening and not listening to music, researchers have examined whether particular musical properties produce different psychological or physiological responses. One such property is tuning frequency. Music tuned to 440 Hz is widely used as a contemporary tuning standard, whereas 432 Hz music is sometimes described by listeners as calmer or more relaxing. Such perceptions do not establish a measurable psychological advantage, but they provide a basis for controlled empirical investigation.

Previous experiments comparing 432 Hz and 440 Hz music have reported differences in anxiety, physiological responses, stress, and sleep. Aravena et al. (2020) examined dental anxiety and salivary cortisol under the two tuning conditions. Calamassi and Pomponi (2019) investigated possible health-related differences through a double-blind cross-over pilot design, while Calamassi et al. (2022) compared the frequencies among emergency nurses working under stressful conditions. Calamassi et al. (2020) also examined the two frequencies in relation to sleep among patients with spinal cord injuries. Collectively, these studies indicate that music tuning frequency can be treated as an experimentally manipulable condition rather than merely a matter of musical preference.

Nevertheless, much of the available evidence originates from clinical, occupational, or specialized settings. Comparatively limited research has examined whether tuning frequency is associated with emotional safety among students in an academic environment. Emotional safety is also conceptually different from anxiety, stress, sleep quality, and general relaxation, even though these constructs may be related. Findings involving these adjacent outcomes cannot automatically establish that one tuning frequency produces greater emotional safety.

Hospitality Management students may encounter academic workload, performance expectations, practical activities, and interpersonal demands that affect their emotional condition. A short, controlled listening activity can provide an accessible means of examining whether exposure to different music-tuning frequencies corresponds with measurable changes in emotional safety. Such an investigation must nevertheless distinguish a possible tuning-frequency association from general relaxation during music listening and from initial differences in participants' emotional states. Comparable research in demanding professional programs also portrays psychosocial well-being as embedded within interacting academic, institutional, and generational pressures (Bermido et al., 2025).

This study therefore compared emotional safety among Hospitality Management students exposed to music tuned to 432 Hz and 440 Hz. Specifically, it aimed to:

1. determine the participants' pretest and posttest emotional-safety scores under the 432 Hz and 440 Hz listening conditions;
2. determine the change in emotional-safety scores within each music-frequency condition;
3. examine the association between music-frequency condition and change in emotional-safety scores; and
4. determine whether the mean change in emotional safety differed significantly between the 432 Hz and 440 Hz groups.

2. Review of Related Literature

2.1 Music-Tuning Frequency and Emotional Responses

Music can be administered under controlled conditions while particular auditory characteristics are manipulated. One characteristic examined in experimental research is tuning frequency, particularly the comparison between music tuned to 432 Hz and the conventional 440 Hz standard. Although claims regarding the inherent superiority of either frequency remain unsettled, empirical studies show that tuning frequency can be investigated in relation to subjective and physiological outcomes.

Aravena et al. (2020) compared 432 Hz and 440 Hz music in a dental context and assessed anxiety alongside salivary cortisol. Both music conditions produced lower anxiety than the no-music condition, while the 432 Hz condition was associated with lower salivary cortisol. Calamassi and Pomponi (2019) likewise used a double-blind cross-over pilot design to explore possible health-related differences between music tuned to the two frequencies. Their findings were exploratory and did not justify universal claims concerning either tuning standard.

Frequency comparisons have also been extended to recovery and occupational outcomes. Calamassi et al. (2020) compared 432 Hz and 440 Hz music in relation to sleep among patients with spinal cord injuries. In an occupational setting, Calamassi et al. (2022) examined anxiety and stress among emergency nurses during the COVID-19 pandemic. These studies involved populations and outcomes different from those of the present investigation, but they demonstrate that tuning frequency can be incorporated into controlled research. They do not establish that 432 Hz consistently produces superior emotional outcomes across populations and settings. In an adjacent student experiment, even a modest environmental manipulation such as desk organization was examined through short-term task-performance outcomes,

illustrating the broader analytical value of testing seemingly minor contextual conditions rather than assuming their effects (Manio et al., 2026).

2.2 Music Listening, Stress Regulation, and Student Well-Being

Music listening is widely used for emotional self-regulation. Saarikallio (2011) found that adults employ music for mood improvement, distraction, relaxation, and other regulatory purposes. This perspective suggests that emotional responses to music depend not only on acoustic properties but also on the listener's goals and current emotional condition.

Research involving university students provides further evidence that music may be used as a coping resource. Vidas et al. (2021) found that first-year university students regarded music listening as one of several effective strategies for managing pandemic-related stress. The effectiveness of music listening was associated with better well-being, although the study did not establish that a particular tuning frequency produced the effect. Related Philippine evidence shows that student stress and emotional exhaustion may coexist with lifestyle factors such as sleep, physical activity, and screen exposure, reinforcing the need to situate brief wellness activities within students' wider behavioral routines (Quinto et al., 2025).

Experimental evidence has also considered brief music experiences among college students experiencing anxiety. Hernandez-Ruiz (2022) reported decreased anxiety following a structured receptive-music experience among performing-arts college students during the COVID-19 pandemic. Because that study involved a small sample and a different outcome, it offers contextual support for music-based investigation rather than direct evidence concerning emotional safety or the relative benefit of 432 Hz and 440 Hz. Students may also turn to nonmusical activities for emotional regulation; for example, some Generation Z students reported using passive social-media engagement to calm themselves after stressful experiences (Dancel et al., 2026).

2.3 Emotional Safety in Academic Environments

Emotional safety refers to a condition in which individuals feel emotionally secure and sufficiently comfortable to participate and function without excessive fear, threat, or distress. Within academic environments, it may affect students' willingness to participate, express themselves, interact with others, and respond to demanding activities. Emotional safety is related to anxiety, stress, emotion regulation, and well-being, but it is not interchangeable with these constructs. Evidence from college students further indicates that self-control and self-efficacy function as coping-related psychological resources, suggesting another source of individual variation in responses to short-term interventions (Rui, 2026).

The studies by Saarikallio (2011), Vidas et al. (2021), and Hernandez-Ruiz (2022) suggest that music may support emotional regulation or coping under certain circumstances. However, they also imply that responses can depend on personal regulatory goals, baseline distress, the listening context, and the characteristics of the intervention. An emotionally favorable response therefore cannot necessarily be attributed to tuning frequency alone. Interpersonal context may also matter, as peer experiences have been examined alongside personal-social competencies among late adolescents in higher education (Balut et al., 2026).

This distinction is important when emotional safety is measured through a brief self-report scale. The validity of the inference depends not only on observed score changes but also on the measurement properties of the instrument, baseline equivalence of comparison groups, and control of alternative explanations.

2.4 Synthesis and Research Gaps

The available literature demonstrates that music listening can be examined in relation to emotional regulation, anxiety, stress, sleep, and well-being (Calamassi et al., 2020, 2022; Hernandez-Ruiz, 2022; Vidas et al., 2021). Studies directly comparing 432 Hz and 440 Hz further indicate that tuning frequency can be manipulated and evaluated through psychological or physiological outcomes (Aravena et al., 2020; Calamassi & Pomponi, 2019). However, the evidence does not establish a uniform advantage for either frequency across populations and settings.

Several gaps remain. Limited evidence addresses tuning frequency among students in ordinary academic environments, and prior studies typically examine anxiety, stress, sleep, or physiological responses rather than emotional

safety itself. Individual preferences, baseline emotional states, and contextual characteristics may also affect listening outcomes independently of tuning frequency. The present study responds to these gaps by comparing changes in emotional safety among Hospitality Management students assigned to 432 Hz and 440 Hz listening conditions. The findings are treated as exploratory because the small groups and unequal baseline scores restrict causal interpretation. A related pilot involving engineering students used a pretest-posttest controlled design to examine perceived sleep quality and similarly emphasized that small samples and subjective outcomes require cautious interpretation (San Juan et al., 2026). Research on other student well-being indicators has also produced nonsignificant exposure-outcome relationships, cautioning against attributing multidimensional psychological conditions to a single environmental behavior or stimulus (Ruela et al., 2026).

3. Methodology

3.1 Research Design

The study employed a two-group experimental pretest-posttest design to compare changes in emotional safety among students exposed to music tuned to 432 Hz and 440 Hz. The 432 Hz condition was designated as the experimental condition, while the 440 Hz condition served as the comparison condition. Both groups completed the same emotional-safety measure before and immediately after the listening session. The room, instructions, duration, and data-collection procedures were standardized across the two conditions. Because the final groups differed substantially in their pretest scores, the findings were interpreted as exploratory rather than definitive evidence of a frequency-specific effect.

3.2 Participants and Sampling

The study involved 16 third-year Hospitality Management students selected from one class comprising approximately 44 students. The class was chosen through convenience sampling based on availability and accessibility. From the identified class, 16 participants were selected using a random-number generator and assigned to two equal groups: the 432 Hz condition (n = 8) and the 440 Hz condition (n = 8). Selecting participants from one accessible class limits representativeness, although random selection within the class and random assignment to the listening conditions were used to reduce selection and allocation bias.

3.3 Research Instrument and Materials

Emotional safety was measured using a researcher-prepared 10-item Emotional Safety Scale administered as both the pretest and posttest. Each item used a five-point Likert-type response format. Item responses were transformed using the formula Converted score = 6 - original response, and the converted items were summed. Higher total scores represented greater emotional safety. With 10 items, possible scores ranged from 10 to 50. The source manuscript did not report reliability or validity evidence for the scale.

The listening materials consisted of prepared audio recordings tuned to 432 Hz and 440 Hz. Participants used personal earphones. Other materials included the pretest and posttest forms, informed-consent forms, and a timer. The activity was conducted in a quiet room to minimize distractions and maintain comparable conditions.

3.4 Data-Gathering Procedure

Permission to conduct the activity was obtained before participant recruitment. Students were informed about the study's purpose and requirements, after which those who agreed to participate completed an informed-consent form. Sixteen participants were selected and allocated to the two listening conditions. Before exposure, participants completed the Emotional Safety Scale as a pretest. The first group listened to the 432 Hz recording, while the second group listened to the 440 Hz recording for 15 minutes under comparable room conditions and instructions. Immediately afterward, both groups completed the scale as a posttest. Participants were then debriefed and were not pressured to report any particular emotional response.

3.5 Data Analysis

Means and standard deviations summarized the pretest, posttest, and change scores. Individual change scores were calculated as posttest score minus pretest score. Positive values represented increased emotional safety, whereas negative

values represented decreased emotional safety. The association between binary-coded frequency condition and change score was examined using Pearson's r; because the condition was dichotomous, this calculation is equivalent to a point-biserial correlation. The conditions were coded as 0 for 440 Hz and 1 for 432 Hz. Welch's independent-samples t-test determined whether mean change scores differed between the groups. Statistical significance was evaluated at the .05 level. Given the small sample and baseline imbalance, inferential results were interpreted cautiously.

3.6 Ethical Considerations

Participation was voluntary, and informed consent was obtained before the experiment. Participants were informed about the procedures, expected duration, confidentiality of responses, and their right to withdraw without penalty. No identifying information was included in the reported results. The listening activity was considered minimal risk, but participants could discontinue if they experienced discomfort. Responses were kept confidential and used exclusively for research purposes.

4. Results and Discussion

4.1 Pretest and Posttest Emotional-Safety Scores

Table 1 presents the emotional-safety scores of participants assigned to the 432 Hz and 440 Hz conditions. Scores were converted so that higher values represented greater emotional safety.

Table 1. Descriptive Results for Emotional Safety by Music-Frequency Condition

Condition	n	Pretest M	Pretest SD	Posttest M	Posttest SD	Mean Change
432 Hz	8	43.25	3.99	47.75	2.92	4.50
440 Hz	8	36.25	1.67	47.38	2.29	11.13
Overall	16	39.75	-	47.56	2.50	7.81

The 432 Hz group reported higher emotional safety at the pretest (M = 43.25, SD = 3.99) than the 440 Hz group (M = 36.25, SD = 1.67). The seven-point difference demonstrates that the groups were not equivalent at baseline despite reported random assignment. Following the listening session, the posttest means became highly similar: 47.75 (SD = 2.92) for 432 Hz and 47.38 (SD = 2.29) for 440 Hz. The difference was only 0.37 point and did not demonstrate a meaningful descriptive advantage for either condition.

The posttest means were close to the maximum possible score of 50, suggesting a possible ceiling effect. Participants who began with relatively high emotional-safety scores, particularly those in the 432 Hz group, had less numerical opportunity to demonstrate further improvement.

4.2 Changes in Emotional Safety and Between-Group Differences

Change scores were calculated by subtracting each participant's pretest score from the corresponding posttest score. Positive values represented improved emotional safety, while negative values represented decreased emotional safety.

Table 2. Change in Emotional-Safety Scores by Music-Frequency Condition

Condition	n	Range	Mean Change	SD
432 Hz	8	-9 to 11	4.50	6.44
440 Hz	8	5 to 17	11.13	3.44
Overall	16	-9 to 17	7.81	6.05

The 432 Hz group had a mean increase of 4.50 points, but its change scores ranged from -9 to 11, indicating that improvement was not uniform and that at least one participant reported lower emotional safety at posttest. The 440 Hz group obtained a mean increase of 11.13 points, with all reported change scores falling within the positive range of 5 to 17. The larger improvement must be interpreted in light of the group's lower pretest mean. Its members began farther from the maximum score and therefore had more opportunity to demonstrate numerical improvement.

Table 3. Association and Difference Between Frequency Condition and Emotional-Safety Change

Analysis	Statistic	df	p	Result

Analysis	Statistic	df	p	Result
Point-biserial correlation	r = -.566	-	.022	Significant
Welch's independent-samples test	t = -2.57	10.70	.027	Significant

The binary-coded frequency condition was significantly associated with change in emotional safety, r = -.566, p = .022. Because 440 Hz was coded as 0 and 432 Hz as 1, the negative coefficient indicates that assignment to the 432 Hz condition corresponded with a smaller change score. This point-biserial correlation reflects the same between-group pattern examined through the independent-samples test.

Welch's test showed that mean change scores differed significantly between conditions, t(10.70) = -2.57, p = .027. The observed change was larger in the 440 Hz group. Statistical significance, however, does not establish that 440 Hz was intrinsically more effective. The result may have been influenced by baseline imbalance, regression toward the mean, ceiling effects, individual listening preferences, or sampling variation arising from the small groups.

4.3 Discussion

Both conditions recorded higher mean scores at posttest and attained nearly identical posttest means. This pattern suggests that participants generally reported favorable emotional states after the listening activity. However, because the study did not include a no-music comparison group, the observed increases cannot be attributed specifically to music listening. They may also reflect repeated measurement, participant expectations, the quiet environment, temporary relaxation, or other procedural features.

The generally favorable posttest pattern is broadly consistent with literature describing music as a resource for emotional regulation and stress management (Saarikallio, 2011; Vidas et al., 2021). Hernandez-Ruiz (2022) likewise found decreased anxiety following a brief music experience among college students. Nevertheless, anxiety, stress coping, and emotional regulation are related to, but not identical with, emotional safety. The present findings therefore offer exploratory support for further investigation rather than direct confirmation of earlier evidence.

Contrary to popular claims that 432 Hz music is necessarily more calming, the 432 Hz condition did not demonstrate greater improvement in this sample. The 440 Hz group obtained the larger mean change, and the difference was statistically significant. This illustrates why frequency-specific claims should be evaluated empirically rather than inferred from listener expectations. The verified literature also does not establish that either tuning frequency is uniformly superior across populations and circumstances (Aravena et al., 2020; Calamassi et al., 2019, 2020, 2022).

The substantial pretest difference presents the most important interpretive limitation. The 432 Hz group began with a mean of 43.25, compared with 36.25 for the 440 Hz group. Consequently, the 432 Hz participants had relatively limited room for upward movement, whereas the 440 Hz participants could demonstrate larger increases. The nearly equivalent posttest means support the possibility that the change-score difference was partly driven by unequal starting positions rather than tuning frequency itself.

The small sample of eight participants per condition further limits precision and generalizability. Random assignment can produce imbalanced groups when samples are very small, and individual responses can substantially influence group means and inferential tests. The wide variability within the 432 Hz condition supports this concern. In addition, reliability and validity evidence for the Emotional Safety Scale was not reported, preventing a complete evaluation of whether the instrument consistently measured the intended construct. More broadly, resilience-related capacities differ across individuals and may influence how people respond to demanding circumstances, although such capacities were not measured in the present experiment (Adame, 2026).

Taken collectively, the findings indicate that the groups reached similarly high posttest emotional-safety scores, while the initially lower-scoring 440 Hz group demonstrated greater numerical improvement. The results should not be interpreted as conclusive evidence that 440 Hz music is superior. Instead, they identify a pattern requiring replication through a larger experiment using a validated instrument, stronger baseline equivalence, and an appropriate no-music comparison condition. This caution is consistent with evidence that psychological well-being can be grounded in internal and relational sources of meaning, underscoring the likelihood that favorable emotional states reflect more than a single immediate exposure (Aguilar, 2026).

5. Conclusions, Recommendations, and Implications

5.1 Conclusions

The study compared changes in emotional safety among Hospitality Management students assigned to 432 Hz and 440 Hz music-listening conditions. The 432 Hz group had substantially higher emotional-safety scores before listening. After the session, however, the groups obtained nearly identical posttest means, indicating comparably high emotional-safety scores under both conditions.

The 440 Hz group demonstrated a larger mean change. The association between frequency condition and change score was statistically significant, and Welch's test indicated a significant difference in mean change scores. Based strictly on the calculated changes, 440 Hz was associated with greater improvement within this sample.

Nevertheless, the larger increase cannot be conclusively attributed to 440 Hz music. The 440 Hz group began with considerably lower scores and had more opportunity for improvement, whereas the 432 Hz group began closer to the scale maximum. Baseline imbalance, possible ceiling effects, regression toward the mean, and the small sample provide plausible alternative explanations.

The results therefore do not establish that either tuning frequency is inherently superior. They indicate that the groups reached similarly high posttest scores while the magnitude of change differed in the context of unequal starting positions. The findings should be regarded as preliminary evidence requiring replication under stronger experimental conditions.

5.2 Recommendations

Future researchers should use a larger sample drawn from multiple classes, programs, or institutions. Random assignment should be retained, but baseline equivalence should be evaluated before differences are interpreted.

A no-music or neutral-audio comparison group should be included to distinguish effects associated with music listening from tuning frequency, repeated measurement, and the quiet environment.

A validated emotional-safety instrument should be used, with its source, item structure, scoring procedure, reliability, and validity reported. A researcher-developed scale should undergo expert review, pilot testing, and psychometric evaluation.

Subsequent studies should standardize the musical selection, duration, listening volume, equipment, room conditions, and instructions. Musical preference, familiarity, current mood, and expectations concerning the frequencies should also be measured or controlled.

Where baseline differences occur, researchers should consider analytical procedures that account for initial scores, provided that sample size and statistical assumptions support the method. Repeated sessions and delayed posttests may determine whether changes persist.

Educational institutions may explore voluntary music-based wellness activities, but the present findings should not be used to prescribe either tuning frequency as an established intervention.

5.3 Implications of the Study

The study contributes to behavioral and social analytics by demonstrating how a subtle auditory condition can be examined in relation to a student-centered psychological outcome. It also illustrates the value of analyzing initial scores and changes over time rather than relying exclusively on post-intervention comparisons.

Methodologically, the results emphasize that statistical significance must be interpreted alongside baseline equivalence, measurement quality, sample size, and possible ceiling effects. A significant difference in change scores does not necessarily establish that an experimental condition caused the difference when groups begin at substantially different levels.

Practically, music listening remains a potentially accessible component of student-wellness activities, but its outcomes may depend on individual preferences, baseline emotional condition, environmental characteristics, and the

broader listening experience rather than tuning frequency alone. The study provides a foundation for more rigorous investigation of music, emotional regulation, and emotional safety among students. Student emotional functioning may also be connected with identity and willingness to express personal experiences, further supporting interventions that remain sensitive to differences in emotional openness (Qi, 2026).

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