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An Investigation of Whether Different Kinds of External Sounds Would Influence Meditation Process

FAN Yixin
Jinan Thomas School, Jinan, China

It is worth mentioning that meditation, which acts as emotional therapy, has become popular in human lives nowadays. Some psychology-related software provides users with guided meditation. However, after experiencing this, several users cannot detect the effect of meditation on their mood and sleep quality. This study aims to investigate whether different kinds of sounds would affect meditation effectiveness. Specifically, it provides a reference for that software to improve the meditation function. In this context, meditation is defined as a mental exercise that trains attention and awareness. To test the hypothesis that white noise meditation would be the most effective one, while silent meditation is the least effective, an online meditation was carried out among 40 participants. They were divided into four conditions, A for vocal guidance, B for white noise, C for pure music, and D for silent condition. Responses were recorded using both pre-questionnaire and post-questionnaire about meditation, and then it was analyzed through bar charts. The results and hypothesis deviated insignificantly: Guided meditation is the most effective one in affecting participants' mood and sleep quality, while silent meditation is the least effective one. These results suggested that the meditation software provided do have a positive impact on users' mood calming and sleep quality improvement. By contrast, some participants who did not have meditation experience before this study support that software should also concentrate on white noise meditation.

Keywords: meditation, mood, sleep quality, white noise, guided meditation

Introduction

Meditation is a mental exercise that trains attention and awareness. Its purpose is often to curb reactivity to one's negative thoughts and feelings. It has been also associated with stress reduction (Levin et al., 2014). To a certain degree, meditation can be classified into two types, namely mindfulness meditation and contemplative meditation. The former one illustrates that the meditation process would involve sitting quietly with closed eyes, to bring awareness to the breath or body sensations. This develops the unresponsive state of the heart, the basis of a calm and peaceful state of consciousness; both Vipassana and Zen belong to such a kind of meditation. The latter one can be classified as a spiritually-centred observation and consideration of a specific idea, question or situation to receive insight from the still small voice, inner wisdom or the divine.

It has become increasingly evident that music, which is the sounds that are sung by voices or played on musical instruments, plays a significant role in affecting meditation effectiveness. This can be supported by that music can be regarded as a support for mindfulness meditation (Dvorak & Hernandez-Ruiz, 2019). By contrast, there is someone who considers the music as a distraction during the meditation process. Therefore, four

FAN Yixin, Senior High School student, Jinan Thomas School, Jinan, China.

different kinds of sounds, which are pure music like piano tracks, white noise like the sound of rain, vocal guidance, and silence, are chosen to investigate which background noise would impact meditation, through whether participants' sleep quality has improved or not, and how they feel after meditation.

To reach the aim, it is possible to prepare a pre-questionnaire and a post-questionnaire to find out the changes in participants' sleeping quality, by grouping them into different conditions, such as meditation with white noise. Then participants in each condition are told to do a 15-minute meditation with different sounds. The collected data from the post-questionnaire will be analyzed through bar charts.

The origin of the study is to give psychological applications a reference to improve meditation function. Before the study being carried out, many software on the market have introduced psychological knowledge, (e.g. Meditation Planet, etc.) and many meditation functions go hand in hand with vocal guidance, but after personal testing, a significant number of people find that they are unable to concentrate when they are in guided meditation, and the effect of meditation just drops out of their expectation. However, with pure music or white noises, it is easier for them to do meditation.

Literature Review

Mindfulness meditation applications have been investigated as beneficial to people's mental health development. In previous studies, it was noticed that mindfulness meditation apps are promising self-management tools for improving mental health and well-being (Gál, Ștefan, & Cristea, 2021). However, the most popular meditation-based applications may focus mostly on guided meditation while providing limited support for monitoring the intrinsic meditation processes or for measuring the effectiveness of the training (Roquet & Sas, 2018). What's more, meditation apps can be an effective and relaxing method to recover from cognitive and affective fatigue, but more research is needed to test if this restoration is significant (Hart, 2020). These findings offer useful insight for this study to evaluate the limitations of recent meditation applications through various sound surroundings.

Many researchers prove mindfulness meditation has benefits on sleep improvement. Specifically, mindfulness meditation can act as a short-term solution to address the moderate sleep disturbance problem of old adults (Black et al., 2015). This is useful in trying to assess the impact of it on older participants' sleep problems in this study. What's more, mindfulness meditation provides a foundation for healthcare, especially the interventions in sleep disturbed populations (Rusch et al., 2019). For the exact kind of meditation, guided meditation has the potential to improve people's sleeping quality (Canfield et al., 2021). From the information mentioned above, the effectiveness of meditation on improving sleep can be tried analyzed.

Most of the time, meditation is considered to have a positive effect on mood. Specifically, daily meditation does help to reduce negative mood state and stress (Basso et al., 2019). Such a reference gives the research a basic understanding of meditation effects, especially on moods. In the meantime, meditation improves people's creative performance, mood, and personality (Ding et al., 2015). However, although a large number of studies support that meditation will improve people's mood state, individual differences still exist. Maybe some people's mood will not be affected by meditation; maybe meditation can negatively affect some people's mood states. That cannot be judged arbitrarily.

It can be confirmed that different sounds have various effects on meditation. To be more detailed, Didgeridoo sound meditation is as effective as silent meditation for decreasing self-perceived negative arousal, tiredness, and energy and more effective than silent meditation for relaxation and acute stress reduction in

undergraduate students, which is useful in assessing the impact of meditation without sound and giving future meditation research an idea of a new type of music called Didgeridoo (Philips, Brintz, Moss, & Gaylord, 2019). Moreover, there was not a significant increase in calm brainwave peaks and lower skin temperature in the meditation with Mantra, compared to the silent and guided meditations (Abrahim, 2020). From this, we can suggest guided meditation and silent meditation help to relax, and the consequences may be remarkable. Overall, these findings offer a useful insight into the effects of different sounds on meditation.

Through continuous research, it is apparent that some studies related to meditation software did not give further experiments on specific sounds, while some studies that concentrated on the effect of specific sounds on meditation did not mention the meditation software as well. Therefore, this study combines these two factors, by investigating the effects of various sounds on meditation; it provides some reference for sound selection for today's meditation software.

Whether white noise is the most effective one on calming mood and improving sleep quality, while the silent condition is the worst or not, is the hypothesis of this study.

Methodology

The study focuses on how various sounds influence participants' sleep quality and moods, to see the meditation effectiveness. First of all, the sounds used in the experiment are chosen from the software, which is called Meditation Planet. Compared to others, this software has more users, which means these users' views of the guided meditation it provides can be very representative. Based on this finding, the advice provided by this experiment may be more effective in dealing with the problem that users of this software find the guided meditation useless.

The data of both sleeping quality and mood changes are collected from participants by self-report. The fully informed participants are selected from Jinan Thomas School through opportunity sampling, including 16 males and 24 females who are all in the age group of 15-40. Among them, 50% have previous meditation experiences and 50% do not. The experiment is benefited from these participants because the experienced can quickly enter a meditative state, even though inexperienced participants can speedily understand the experimental steps as well. This greatly improves the efficiency of the entire study. However, such an opportunity sampling may generate bias, since, during the participants' selection, the experimenter deliberately looked for people who seemed to agree to participate in the experiment, rather than giving everyone an equal chance. Besides, because the experiment was conducted online, considering personal preferences, some participants turned off the camera during the meditation, which could make their behavior during the meditation unpredictable. At the same time, this may also affect the final result to some extent.

The laboratory experiment uses matched pairs design, by dividing participants into four groups, which represent different sounds, A for vocal guidance, B for white noise, C for pure music, and D for silent condition. In each group, there are four males and six females, including two males and three females who have had meditation experience before. Such a kind of experiment brings plenty of strengths, like high internal validity, due to the highly-manipulated conditions and standardized procedures, like different situations which represent pure music, white noise, vocal guidance, and silence.

For the music choices, it is suggested that fluctuations in alpha brainwave were relatively higher in the case of the classical music genre (Ramdinmawii, 2017). Since there is almost no psychological software on the market today that uses alpha brainwave as meditation music, this experiment does not refer to this option but

chooses four sounds with a wider audience. Also, although there is little research on the relationship between white noise and meditation, white noise can help deal with sleeping problems quite well (Rosalez, Johnson, Bradley-Johnson, & Kanouse, 2020), which helps to do deeper research on white noise effectiveness.

On the contrary, laboratory experiments can generate demand characteristics—participants may realize the real experimental aims gradually—and low ecological validity, since extraneous variables cannot be controlled completely.

Because of the COVID-19, all the experiment procedures are completed through zoom, which means the study may be affected by some extraneous variables like the volume of the sounds. However, it is worth mentioning that before the experiment began, to ensure that all participants could hear the music clearly, they were told to adjust the volume of the music to 50%, to ensure that they were alone in their environment, and to maintain a sitting posture to enter the meditation, because standing meditation would make participants more awake, and lying-in bed will make them sleepy. These steps are used as control over extraneous variables.

This study uses two questionnaires: One is the pre-questionnaire, which is used to collect participants' raw sleep and mood data through closed questions, and the post-questionnaire, which is mainly used in collecting participants' data after the meditation, analyzing it, and helping to get the conclusion. The ranking scale of the questionnaires' closed questions, which is from 1 = nothing changes to 5 = completely changes, references the study which has mentioned ranked rating of usefulness and preferences in their study, from 1 = most useful to 4 = least useful (Dvorak & Hernandez-Ruiz, 2019), which offers a useful insight to this experiment, while there is a study which suggested that two questionnaires were completed immediately before and after each 30-minute meditation intervention (Philips et al., 2019). It is important however that we treat this information with caution, since some participants may not have enough patience to complete two questionnaires at once, so some data may not be much valid.

Participants were told to do a pre-questionnaire related to the study a day before the meditation process. On the experiment day, according to the group they are in, participants were asked to do a 15-minute independent mindfulness meditation—since some participants are likely to be affected by others if group meditation is carried out. Besides, independent meditation can relieve the pressure better for someone—with various sounds at 8 pm, which is used to ensure they were all in a state of exhaustion. During the meditation, participants are observed by the experimenter, for determining the state of each participant in time, as well as to collect some subliminal behaviours and facial expressions of them more intuitively. After the meditation, they were allowed to sleep immediately. A post-questionnaire, which mainly focuses on the changes in participants' mood and sleep quality, by using a five point scale of worse (1), don't know (3), better (5), etc., was handed out on the following day and collected a day later at 8 am. The data are then analysed through graphs. However, the mood changes when finishing the questionnaire can be a factor affecting experiment results. To cite an example, if something happened before the questionnaire finished, that would directly influence the results, like happiness will lead to positive results and negative things will make participants have a negative attitude towards meditation.

Results

Participants (N = 40) were mainly female (60%) and male (40%), aged 15 to 20 (55%). Half of them have had meditation experiences before. All participants are equally distributed into different conditions, A for vocal guidance, B for white noise, C for pure music, and D for silent condition. The data analysis method involved in

this study focused on collecting participants' scores in the post-questionnaire on mood and sleep quality after meditation.

This study illustrates the meditation effectiveness through participants' mood and sleeps quality changes. The following graphs reveal the mood and sleep quality change within various variables; all data were collected from the post-questionnaire.

Meditation Has Positive Influence on Participant's Mood and Sleep Quality

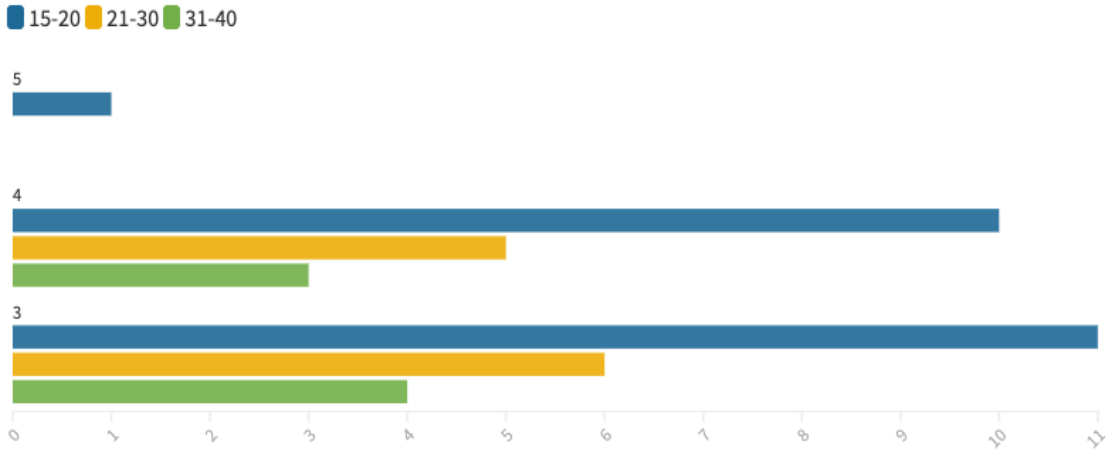

Figure 1. Mood changes according to different age groups.

Meditation had a positive effect on mood for most participants. The data for participants aged 15 to 20 were distributed among 3, 4, and 5 in three levels, and the data for participants aged 21 to 40 were concentrated in two levels, 3 and 4. Even after only one night of data was collected, for the adolescent group, one participant felt that meditation had a very large role in calming mood; the number of participants who thought meditation had a slight improvement in mood was similar to that of the participants who had no improvement. Combined with data from this group of 21 to 40-year-old, the number of participants who thought mood had not been changed was overall higher than those who thought meditation had little effect on calming mood, for 21 and 18 participants relatively, which would give the study a reference that the experimental results may be more effective once extending the process to a longer period.

Meditation With Different Sounds Result Various Emotional Effects

It is apparent that meditation surrounded by different sounds also has various emotional effects. Regardless of the musical accompaniment during the meditation, most of the participants' moods remained unchanged or changed slightly, while one participant thought that guided meditation could make her mood very calm, and five participants in the same group believed that this meditation could improve mood. In addition, among 10 participants in the silent condition, eight participants believed that silent meditation did not affect their mood, which gave this experiment a reference that meditation may not be effective in a silent environment. Moreover, for 10 participants in pure music conditions, half thought that pure music-surrounded meditation had no effect on mood, and the other half thought that this kind of meditation could slightly improve mood. Besides, for the meditation surrounded by white noise, six out of 10 participants agreed that the meditation would have an improving effect on mood.

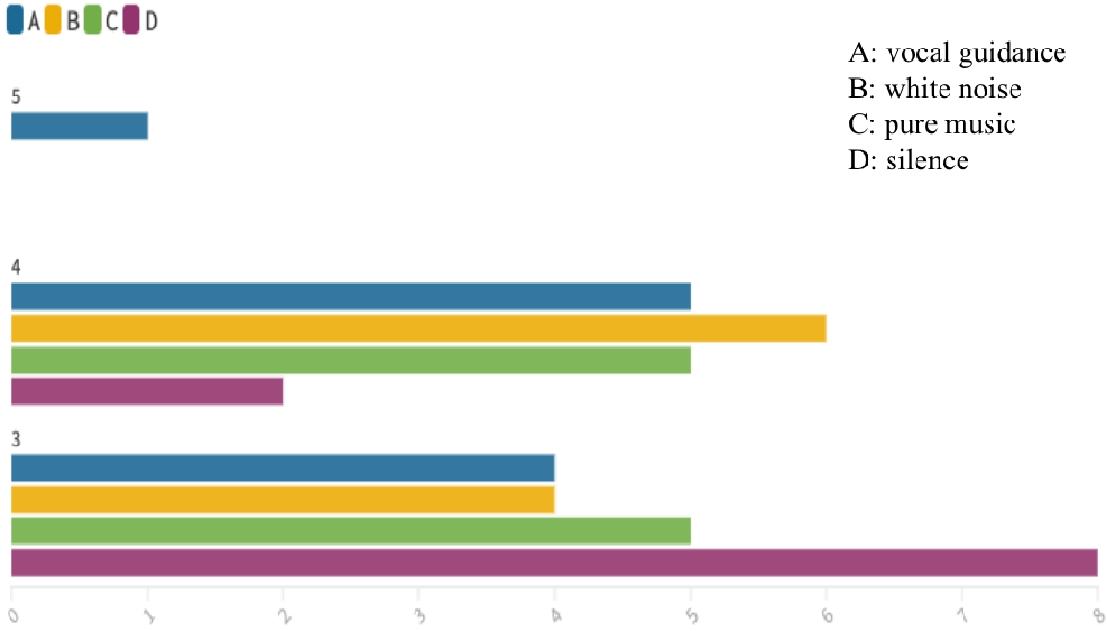

Figure 2. Mood changes according to different conditions.

Different Genders Consider Different Mood Effects on Various Music With Meditation

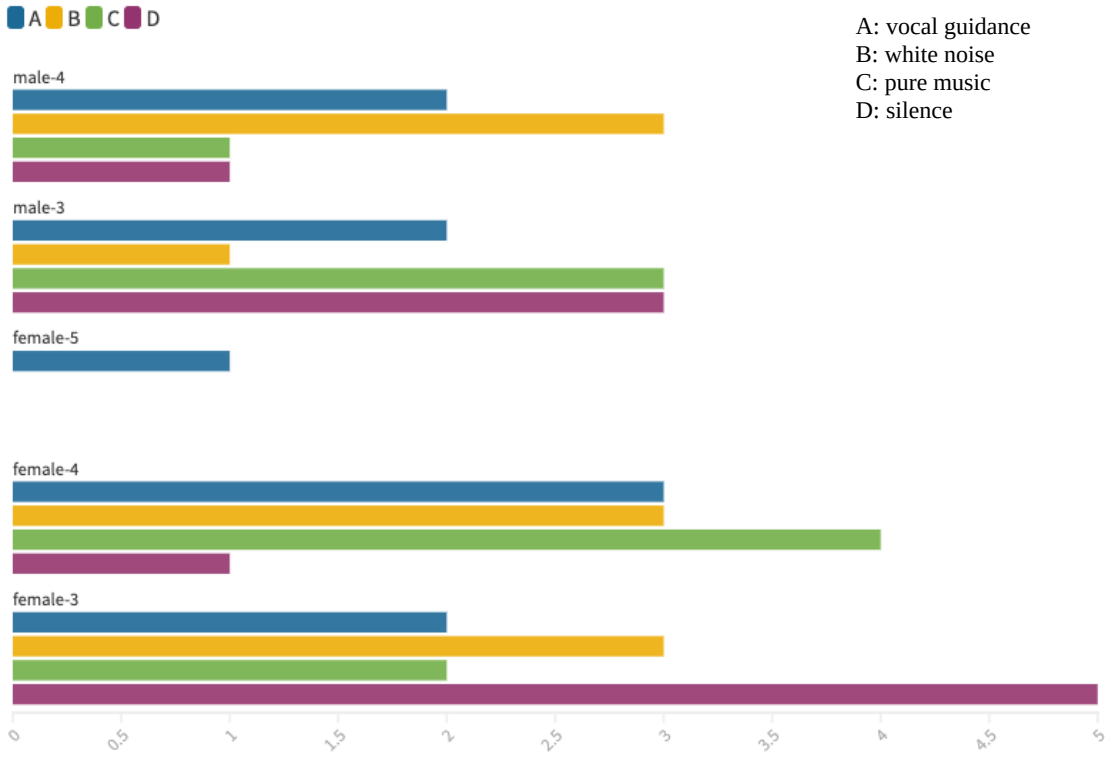

Figure 3. Mood changes according to different gender.

Meditation also has varying degrees of influence on the mood of different genders. It is easy to see from Figure 3, the emotional data for men are distributed in two grades 3 and 4, and the emotional data for women

are distributed in three grades of 3, 4, and 5. Of the 24 women, one believed guided meditation had a positive effect on her mood. Three of the female participants in the white noise condition felt that the meditation had slightly calmed her mood, while the remaining three did not experience a noticeable mood change. Four of the six female participants in pure music conditions felt that the meditation had slightly improved their mood. Of the female participants in the silent condition, only one felt that this meditation positively improved her mood, although such a change is insignificant.

For the 16 males, half of the guided meditation condition believed that the meditation would slightly positively improve their mood, while the other half of participants felt no change. Compared to most participants in the white noise condition who believed that this type of meditation could improve their mood, most participants in pure music contention and silent condition believed that these two meditations were imperceptible for mood changes.

Meditation With Different Sounds Has an Impact on the Sleep Quality of Different Ages Participants

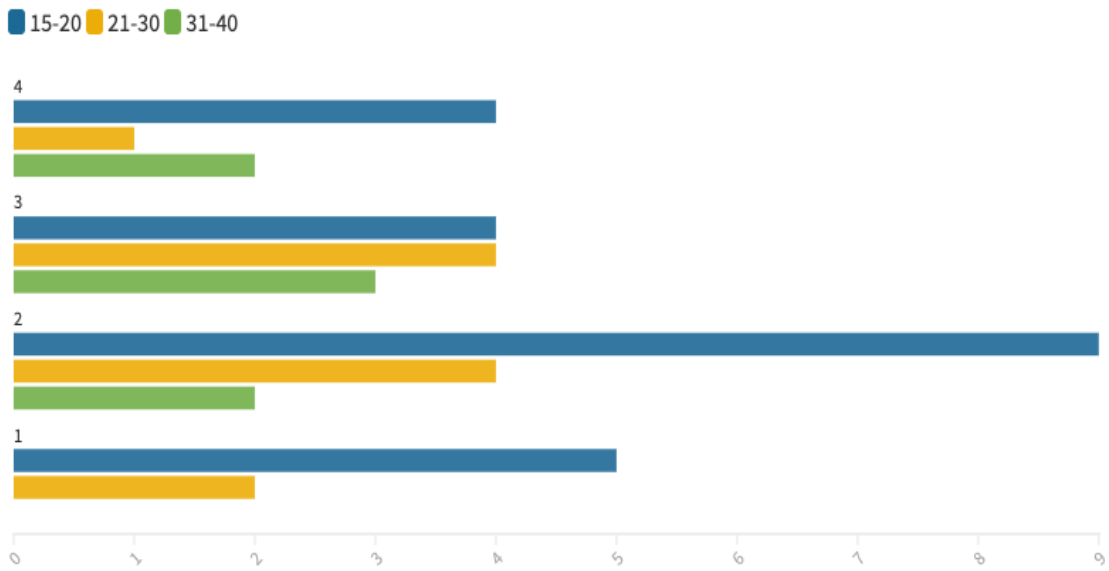

Figure 4. Sleep quality changes according to different age groups.

Figure 4 revealed changes in the quality of sleep of participants of different ages after meditation. Data for all participants were distributed between 1 and 4 for four levels. For teens, most participants felt that the improvement in their sleep by meditation was weak or even senseless. For participants aged 21 to 30, meditation had an improvement in their sleep indeed, but they did not know if the improvement in sleep quality was because the meditation situation existed. For participants aged 31 to 40, who were convinced that meditation affected sleep quality mainly, they did not know if the change in sleep quality resulted from meditation.

Meditation With Different Sounds Result Various Sleep Quality Changes

This figure reveals changes in the quality of sleep among participants under the influence of different kinds of meditation. It can be seen that most participants believe that meditation has some positive effects on sleep quality, only one participant in the white noise condition and six participants in silent condition believe that meditation does not affect their sleep quality. Most participants who experienced white noise surrounding meditation thought it would improve the quality of their sleep, while participants who experienced silent

meditation felt that meditation did not affect the quality of their sleep. Seven participants who experienced guided meditation felt that it positively improved their sleep quality to varying degrees. Some participants in pure music conditions detected the effect of white noise during meditation on their sleep quality, but four participants did not know if their sleep quality had improved as a result of meditation.

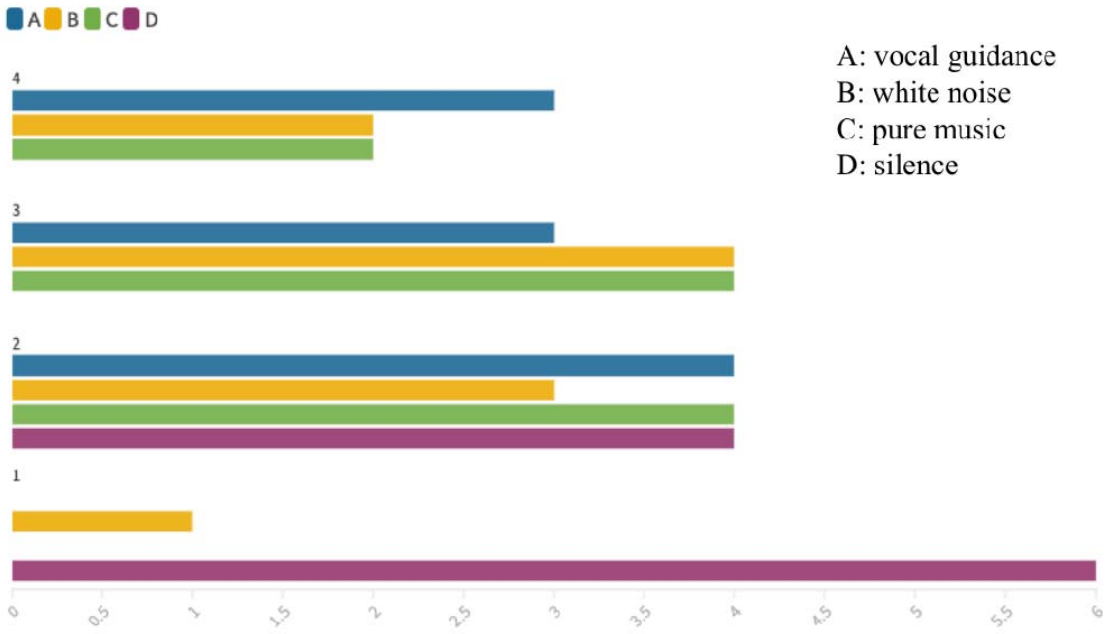

Figure 5. Sleep quality changes according to different conditions.

Different Genders Consider Different Sleep Quality Changes on Various Music With Meditation

It is worth mentioning that different types of meditation have antithetic effects on various genders. Except for one white noise condition and two silent condition participants who felt that meditation did not affect their sleep quality, and two participants who guided meditation condition did not notice changes in sleep quality, the remaining 11 male participants all noticed improvements in sleep quality caused by meditation. Besides, most of the female participants in the silent group did not feel any improvement in their sleep quality through meditation, and eight female participants in white noise condition and pure music condition did not know how meditation improved sleep quality. However, female participants in the guided meditation group were able to detect small changes in the quality of their sleep.

Non-experienced Participants Have Different Options for Mediation Expectations

This figure illustrates the expectations of participants who had no previous meditation experience with future meditation attempts after the experiment. Most participants tended to meditate with sound in the future, only 1 male participant was willing to continue to try silent meditation in the future. Among the participants who were willing to try meditation with sounds, more men wanted to continue trying guided meditation, and women preferred to try meditation with pure music or white noise.

Overall, the results do not fully validate that my hypothesis was correct. According to the statistical results, guided meditation is the most effective in terms of mood and sleep quality improvement, while silent meditation is relatively ineffective. This contradicts my assumption that meditation with white noise is the most effective, while silent meditation is the least effective.

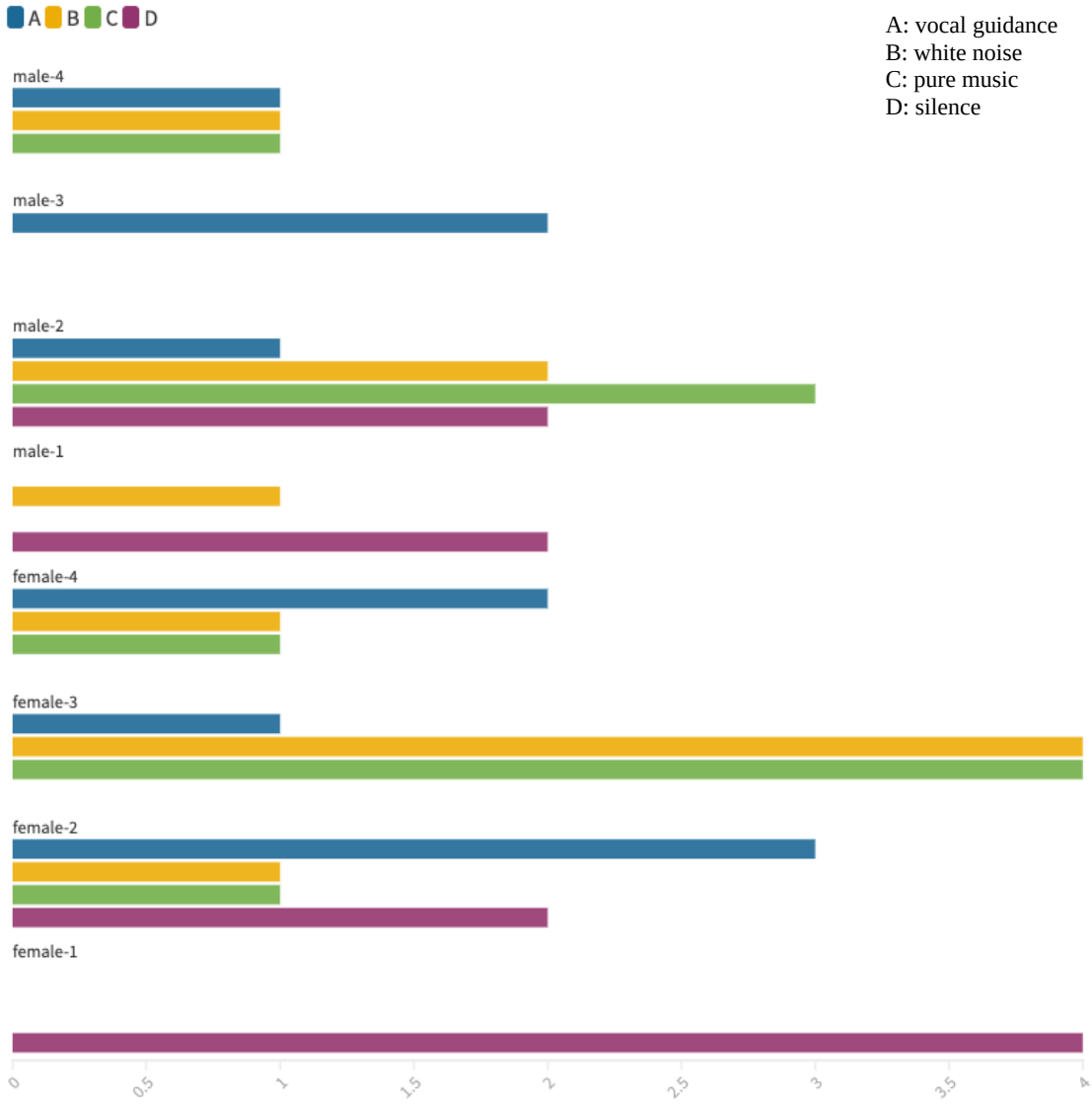

Figure 6. Sleep quality changes according to different genders.

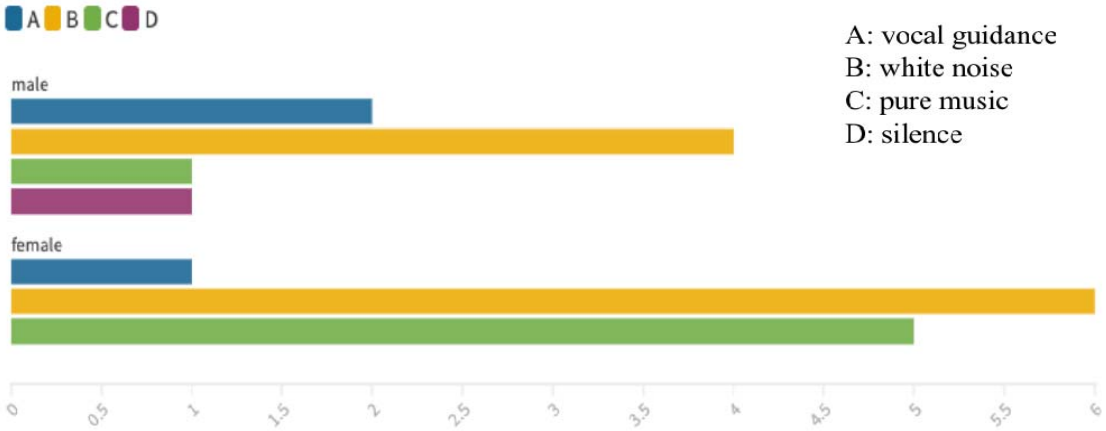

Figure 7. Expectations according to non-experienced participants.

Discussion

In this study, it is found that meditation does have positive effects on mood and sleep quality since most participants report that meditation changes their mood state and sleep quality. Specifically, meditation can act as an effective option for insomnia treatment (Gong et al., 2016). From this, we can suggest that using meditation to help with sleep disorders is effective. What's more, mindfulness meditation may be introduced as a short-term solution to remediate sleep disturbances (Black et al., 2015).

According to the experiment, the effectiveness of guided meditation and silent meditation was completely different.

Guided meditation is the most effective one among four different types, not only on mood influencing but on sleep quality improvement. Specifically, five participants (50%) in guided meditation believed that it could calm their mood, while seven participants (70%) who experienced such a meditation felt that it positively improved their sleep quality to varying degrees. Besides, guided meditation has the potential to improve people's sleeping quality (Canfield et al., 2021). That does help in investigating the effectiveness of the meditation with vocal guidance.

From the participants' perspective, silent meditation is the least effective one, not only on their mood or sleep quality. To be specific, eight participants (80%) in silent condition cannot feel the effects of meditation on calming their mood. This is supported by the research conducted that Didgeridoo sound meditation is more effective than silent meditation for relaxation and acute stress reduction (Philips et al., 2019), but we need to treat this information cautiously; because of the various choice of sounds for the experiment, this project cannot reveal the effectiveness of Didgeridoo and compare it with other sounds. Besides, with the study which suggested that there was a significant effect of relaxation in guided and silent conditions, for the effectiveness of silent meditation (Abrahim, 2020), further research should be done to investigate that.

Although it is proved that guided meditation is the most effective one, white noise seems to be the best choice for the freshman of meditation, because 10 non-experienced participants (50%) chose to expect such a kind of sound to be their next-time meditation sound, including both male and female participants. According to the results, six participants (60%) from the white noise condition felt the effects meditation brings to their mood calming. Since there are almost no previous studies for the relationship between meditation and white noise, the study references some papers that investigate white noise and sleep. To be more detailed, white noise is an inexpensive and effective way to mitigate sleep disruption in a high noise environment, which helps to support the relationship between sleep quality improvement and white noise use (Ebben, Yan, & Krieger, 2021).

Overall, from the results, the mood change of female participants is more obvious than it of male participants. To be more specific, men had stronger emotional experiences, whereas women had stronger emotional expressivity (Deng et al., 2016), which illustrates that the emotional expression of female participants may affect the data. Although the effects meditation made to change participants' mood positively cannot be ignored, it can be doubted that the mood change from female participants may not result from meditation in the experiment but from themselves.

Moreover, according to different age groups, the mood can be affected as well. Specifically, older adults were not impacted by negative emotions (You et al., 2019). The younger adults, however, were significantly impacted by negative emotions. That may affect the validity of the data collected from these participants, since the data they reported may not as a result of meditation. Even when they are just finishing the

post-questionnaire in this study, their mood would affect their answers to a certain degree, which make some of their data given become less valid.

For sleep quality, it is widely acknowledged that teenagers tend to have better sleep quality than adults for not only the low pressure from working but also they need longer and better sleep to ensure the growth of the brain and skeleton. This theory can be supported by that sleep problems were prevalent among the rural Chinese adults aged 45 years or above, the influencing factors included marital status, individual income, and chronic diseases (Dong et al., 2018). Although there is no participant aged over 45 in this study, this study still gives the support for investigating the difference between different age groups. Therefore, some data from participants who are in the 15 to 20-year-old age group, even the validity of the data provided by the participants who are in the 31 to 40-year-old age group, should be reconsidered.

Therefore, according to the discussion above, it is suggested that recent applications with meditation function can consider adding some white noise like a piece of music accompany, but not only providing guided meditation; such an approach may allow more people who have not been exposed to meditation before to experience the substantial changes it has brought to their lives.

Evaluation

This study focuses on both the software and specific sounds to investigate the meditation effectiveness, which fills in the research gap that only concentrates on one particular area. However, the findings of this project can only be applied to first-time meditators, since high-level meditators' experience may produce stronger effects.

To some extent, this project has limitations in design. Just before the meditation began, to avoid the problem made by mixing sounds, participants were told to mute. But considering privacy, some participants still closed their cameras during the meditation process. Combining these two factors, participants' behaviours began to become unpredictable, which may cause the validity of the data collected to decrease.

Moreover, the sampling is biased. When choosing participants for the experiment, some people who were likely to grant the request or had shown a keen interest in meditation were asked, but those who were not interested in this exact project, or who were felt they would not take time out of their way for an experiment did not have such an opportunity. Even though the small-size participants were chosen from a certain school, all of these factors made the sampling become unrepresentative.

Besides, the use of two questionnaires may generate social desirability bias. Because some participants may only focus on getting the final result, but do not care about the meditation itself. Therefore, for further study, offline meditation should be carried out, since online meditation is limited by some network issues. What's more, for participants' data distinguishing, future questionnaire designing should be paid more attention to.

Conclusion

In this study, I investigated that meditation has a positive effect on both sleep quality and mood. Regardless of participants' age group or gender, guided meditation had the greatest impact on their mood and sleep improvement, which may because the vocal guidance would remind participants to focus their full attention on breathing. What's more, based on participants' attempts and data, silent meditation was the most ineffective meditation, which can be attributed to the fact that they tend to be distracted by sudden thoughts in a silent environment.

This study aimed to determine effective types of meditation for meditation software. The results also showed that white noise meditation was popular among inexperienced participants, as most of them would choose to meditate with this music in the future. This may give some software producers advice to consider adding the white noise meditation to attract users.

In further research, alpha brainwaves may be added as a form of meditation music. Moreover, organizing offline group meditations to observe participants' subconscious behaviours can also be studied in depth.

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