The Effects of Meditation on Cognitive Function

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Meditation is something that has been a part of society for thousands of years and is typically thought of as a religious act. However, it has increased in popularity in secular culture as a way to center one's self and become more mindful of their thoughts. In the realm of cognitive psychology, this practice has been theorized to improve cognitive function. Moore and Malinowski (2009) studied the link between meditation, self-reported mindfulness, cognitive flexibility, and other attentional functions. Their research suggested that those who regularly practice meditation had higher scores on their cognitive tasks, and so they theorized that regular meditation can help improve cognitive abilities (Moore & Malinowski, 2009). Some people practice meditation every day on a regular basis, such as a group of Tibetan monks recruited by Dalai Lama to participate in brain research. They are a unique group to research in this realm, as they have tens of thousands of hours of meditation in their portfolio. Davidson (2008) used an fMRI to measure electrical activity in the brain, and his research suggested that "expert" meditators such as these Tibetan monks experience an increase in neuroplasticity, contributing to having a significantly easier time sustaining attention (Davidson, 2008).

The use of meditation as opposed to medication for improving cognitive function can serve as a more holistic method and does not involve putting any possibly harmful chemicals into the body. So and Johnson (2000) studied the longitudinal effects of daily Transcendental Meditation (TM) practice on cognitive function and presented the theory that those who regularly practice TM for years at a time will be likely to show an increase in performance on cognitive tasks such as attention, creativity, and reaction time. TM is a technique in which one practices "wakeful hypometabolic or restful alertness" for around 20 minutes, focusing on the breath and consciousness (So & Johnson, 2000). Other previous research by O'Halloran et al. (1985)

showed that TM practice increases the neuropeptide vasopressin, which Van Londen at al. (1998) has been shown to increase memory.

Improving cognitive functions can translate to better performance in academics, more efficiency in the workplace, and is simply overall beneficial for anyone who wishes to think on a more complex level than before. Currently, drugs such as amphetamines and caffeine are climbing in popularity as methods of improving cognitive function, especially in college students. Olfson et al. (2002) reported significant increases in the amount of psychoactive medications being prescribed in the United States, including mostly amphetamines and other ADHD meditation. A study done by McCabe, Knight, Teter, and Wechsler (2003) showed that around 6.9% of college students reported non-medical use of prescription stimulants, and 4.1% reported non-medical use in the past year. There are multiple different types of ADHD drugs that are being used non-medically, however this is not only illegal but can also be dangerous if one is not prescribed and is buying illegal drugs without being certain they are what they claim to be. Aside from illegal users, legal users who have a clinical ADHD diagnosis who are seeking a more natural fix for attention deficit can find benefits in meditation as means of improving cognitive functioning. The purpose of this study is to show that there are other means of improving various cognitive abilities that do not require potentially harmful medication or drugs of any sort.

The current study will test the effects of regular, long-term meditation by having one meditator group and one non meditator group. The change in scores from before and after the manipulation of assigning the meditator condition will be assessed through a pre and post test cognitive test series, also known as the second manipulation (time 1 and time 2). It is hypothesized that the cognitive test scores will show statistically significant improvement from

time 1 to time 2 in the meditator condition, while the scores from the non meditator group will not show significant improvement or any significant change.

Methods

Design

The proposed study is a 2(meditation type: meditation vs. no meditation) x 2(time: time 1 vs. time 2) mixed subjects experiment. This will be done by randomly assigning half the subjects (all subjects have never meditated before) to register for a 6-month long meditation class. The non meditator group will not register for any meditation class and will be asked to not meditate for the duration of the 6 months. Meditation is operationalized by researchers Cahn and Polich (2006) as, "practices that self-regulate the body and mind, thereby affecting mental events by engaging a specific attentional set" (p. 180). Regular, long term meditation is operationalized in this specific experiment by regarding the 30-minute long meditation class, 5 days a week, as "regular, long-term meditation", and non meditators will be operationalized by those who do not meditate at all over the course of the 6 months. The dependent variable is the scores from cognitive tasks administered by means of a pre and post-test test that will measure the difference in scores from the independent variables of 2 meditation types and 2 times of testing, called "time 1" and "time 2".

Measures

The cognitive pre and post tests will be the same exact tests. It will test memory, attention, and emotional cognition. The tests are from *Cambridge Cognition,* whose cognitive

assessment tests have been used in thousands of clinical trials, health settings and academic institutions, in over 100 countries.

The memory test will be the Pattern Recognition Memory (PRM) test which will present the subject with a series of visual patterns, one at a time, in the center of the screen. They are unconventional patterns that cannot be easily verbally labeled. In the recognition phase, the participant is required to choose between a pattern they have already seen and a novel pattern. In this phase, the test patterns are presented in the reverse order to the original order of presentation. This is then repeated, with new patterns. The second recognition phase can be given either immediately or after a delay. The scores from this task will be measured by the number and percentage of correct trials, and response time will be taken into consideration if needed to break a tie between scores.

The attention test will be the Reaction Time (RTI) test, in which the subject will select and hold a button at the bottom of the screen while 5 circles are presented above. In each case, a yellow dot will appear in one of the circles, and the participant must react as soon as possible, releasing the button at the bottom of the screen, and selecting the circle in which the dot appeared. The scores from this task will be equally measured by the subjects' reaction times and movement times.

Lastly, the emotional cognition test will be the Emotion Recognition Task (ERT), in which computer-morphed images derived from the facial features of real individuals that each have a specific emotion assigned are shown on a screen, one at a time. Each face is only shown for 200 milliseconds and then immediately covered up to prevent residual processing of the image. The participant must select which emotion the face displayed from 6 options: sadness, happiness, fear, anger, disgust, or surprise. The scores from this task will be measured by the number and percentages of faces that were accurately paired with their respective emotions.

Response time will also be taken into consideration if needed to break a tie between scores.

Participants

The participants will be recruited by UCSB Sona Systems and their incentive to participate will be financial compensation in the form of Amazon gift cards of $204 each. In total, 200 participants will be recruited by a first-come-first-serve basis. Of the 100-person subject pool, half will be randomly assigned to the meditators condition, while the other half will be randomly assigned to the non meditators condition. A restriction will be put on the initial subject pool to only allow those who have never participated in meditation so as to avoid a third condition in the meditator type independent variable, as those who have previously practiced regular meditation could have some type of an advantage over the other participants on the cognitive tests . Also, because this experiment takes place over 6 months, the listing on Sona Systems will include in the description that it can require the daily weekday participation for 30 minutes a day. Confounds such as socioeconomic status, grade level, and ethnicity will be controlled for by the random selection and random assignment of participants. This experiment has been sent to the IRB for approval and is now pending approval.

Procedure

The participants will be recruited by UCSB Sona Systems and their incentive to participate will be financial compensation in the form of Amazon gift cards of $204. Of the 100-person subject pool, half will be randomly assigned to the meditators condition, while the other half will be randomly assigned to the non meditators condition. All participants will be brought into the research laboratory and will be given a consent form to sign that informs them that they are able to withdraw from the experiment at any time, and that their data can be withdrawn from

the results of the experiment. Everyone will be told that the experiment is measuring the effects of routine actions on cognition, and everyone will take the initial pre test (time 1) in the laboratory on a computer which includes the 3 cognitive tasks: memory, attention, and emotional cognition, and scores will be recorded. Then, the assigned meditators will be registered for a 6-month online meditation class, from which they will take a 30-minute Transcendental Meditation class everyday weekday, Monday through Friday. All participants will be asked to come in to the research laboratory once a month over the 6-month period to do a check-in and be evaluated to see whether they have been consistent with their randomly assigned experimental condition of meditator or non meditator. The researchers will have some form of proof of class attendance for the meditation classes because the meditation website notifies the researchers if the participant does and does not log onto the website on any given weekday. During each monthly laboratory evaluation, they will get a $34 gift card to keep them motivated to come back in and avoid attrition, eventually totaling to $204. At the end of the 6-month period, all participants will the take same post-test (time 2) cognition task tests as they all took in the beginning (time 1) of the experiment. Scores will be quantified the same way as in the pre-test, and all participants will be debriefed on the true purpose of the study in that meditation versus non meditation was the variable studied in order to see its possible effects on cognitive abilities. The word “routine” was used in the initial description of the experiment, so included in the debrief will be an apology for the deception. Finally, all participants will be given a consent form for the researchers to be able to use their experimental data or not.

Proposed Statistical Analysis

The current study will use a two-way ANOVA because it is a 2(meditation type:

meditation vs. no meditation) x 2(time: time 1 vs. time 2) mixed subjects design. As previously mentioned, there are two experimental factors, meditator type and time of testing, both with two conditions (meditator vs non meditator and time 1 vs time 2). This Analysis of Variance will analyze the dependent variable, which is the scores from the cognitive tests administered to all subjects during time 1 (before the manipulation of meditation type) and during time 2 (after the manipulation of meditation type). The dependent variable is continuous because the scores from the cognitive tests can fall anywhere within the minimum and maximum values possible for each cognitive task.

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