

# Robots or Monks? Measuring the Physiological Consequences of Insight Meditation Courses

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# 1 Introduction

## 1.1 Relevance

Claiming to reduce stress and improve overall mental health, residential meditation courses are attracting flocks of Americans [Cel19]. Estimates show an over three-fold increase [Cel19] in the number of meditation practitioners in the United States in the past decade. Blog posts which purport physiological benefits of meditation courses abound. Do these individual anecdotes match up with the science? How well do the promises greater well-being of meditation courses hold up?

## 1.2 Related Work

One style of meditation which is taught at residential meditation courses is insight, or Vipassana, meditation. Known as the basis for mindfulness practices which have been popularized in the West, insight meditation is centered around observation of the self to cultivate awareness of one’s breath and body. Insight meditation courses have come into focus by several research studies. During these multi-day long residential, silent meditation retreats, students spend long hours in deep meditation with no access to personal devices and no contact with the outside world. Multiple papers have measured the general well-being of participants in these courses (i.e. heart rate variability [Kry+13], memory [BS21], personal fulfillment [Al+01]), finding that these courses have induced a small but meaningful effect on improving mental health and overall well-being [QMY14].

There are a few explanations for this phenomenon. Today, entering an insight meditation course is as much about adding hours of daily meditation as it is about removing hours of daily usage of personal devices. Today, as people conduct a large portion of their lives through personal computing devices like phones and laptops, excessive smartphone usage has become a growing social concern. Since excessive usage is correlated with worsened mental health [WW21], the practice of removing these devices could be a plausible reason for students’ reported sense of well-being after a course [Bha+16] [BCG21]. As a result, this study aims not just to evaluate the effects of insight meditation, but of the monastic lifestyle at a residential insight meditation course, on one’s physiological state. The monastic lifestyle, which this study examines is described further in section 2.1.

One element that has left significant intrigue is the empathetic state of the participants of insight meditation courses. Some preliminary studies (though speaking more generally to mindfulness training writ-large) suggest that insistence on externalizing emotions may induce feelings of apathy and detachment [Bri19] [Rob21]. This practice, in turn, may increase the likelihood of anxiety and depression [Sch+19]. Other studies report the opposite – meditation training might increase pro-social behaviors such as compassion and empathy for others, with one possible explanation being oxytocin-mediated improvements in attachment style [Lub+17]. Whether these general critiques of mindfulness training apply to insight meditation has been an open research question, as much of the existing literature on this controversy has been concentrated around short-term or non-residential meditation programs in contrast to a longer, residential meditation course.

## 1.3 Purpose

To fill this gap in the literature, this study launches a holistic investigation into the physiological states of participants of silent, residential insight meditation courses. It departs from the field in two ways. First, it looks not purely at the effect of adding brief mindfulness meditations to one’s morning, but to entering a monastic lifestyle devoted to mindfulness and devoid of devices. Second, it examines empathetic state, a component of well-being which is often overlooked in related research. Along with empathetic state, the study also looks at concentration levels and interoception, or one’s “sense of the internal state of their body,” two attributes which are commonly reported to increase through residential meditation courses.

Upon reviewing the literature, this study’s hypothesis is that participants, after taking a silent, residential insight meditation course, will be more self-aware of the psychological state of their bodies, more concentrated and able to sustain focused attention for longer, and empathetic with a better emotional understanding of others.

## 2 Methodology

### 2.1 Course Description

The subjects of this study were students of a seven-day, silent, residential insight meditation course. The course, titled “Spring Renewal: The Blossoming of Insight,” was offered by InsightLA, a non-profit Vipassana meditation organization (more information is available at <https://insightla.org>). It took place from Monday, 4/18/2022 to Sunday, 4/24/2022 at Big Bear Retreat Center, a meditation center tucked away in the San Bernardino mountains of Southern California. The meditation center informed students of the research study in advance, and the research team set up a table during the check-in and check-out periods of the course for students to voluntarily offer 5 to 10 minutes to participate. All data was collected directly at the meditation center; the pre-course study was conducted on Monday, April 18th afternoon, and the post-course study was conducted on Sunday, April 24th morning. Students at the course were taught mindfulness meditation practices and diligently practiced them during the week. Each day consisted of roughly six hours of sitting meditation, two hours of walking meditation, and a 45 minute period of mindful movement such as yoga or gentle exercise. Students also practiced 45 minutes of Brahmavihara meditation each day with the aim of cultivating joy, equanimity, compassion, and metta, or loving-kindness. The instruction was led by Christiane Wolf and Celeste Young, each with over a decade of experience leading residential meditation courses through InsightLA.

Breakfast, lunch, and dinner were provided to the students each day. Accommodations for the course cost between one and two thousand dollars per student, and financial aid was offered to those who needed it. Most students turned in their cell phones and did not use them for the duration of the course.

### 2.2 Study

The study administered to the students consisted of three components: an interoception biometric test, a concentration game, and an empathy questionnaire.

#### 2.2.1 Interoception Biometric Test

To assess how well long-term meditation students were attuned with their own physiology, the participants were informed of the standard range of resting heart rates (80 to 120) and asked to guess their current heart rate. Each participant then had their heart rate measured, and the difference between the estimate and measurement was recorded. Participant heart rates were measured using a brand of smartwatch called the Fitbit Charge 2. Participants wore the smartwatch for some time until their heart rate was detected and then measured by the research team.

#### 2.2.2 Concentration Game

To assess the concentration level of long-term meditation students, the participants were asked to play a tricky-cup game through the web browser [Mem]. In tricky-cup, players have to track a coin under cups being shuffled and guess which cup contained their coin; the levels become progressively harder after each successful guess. Each student tried the game once and their best score and level was recorded.

#### 2.2.3 Empathy Questionnaire

To assess their empathetic state, the participants were asked to answer 6 scenario-based questions (3 before and 3 after the course). These questions situated the participant in an emotionally arousing situation involving another person and asked the participant to describe how they would react. One sample scenario is as follows: “Imagine you are a student and a friend in your class has just failed a major test or exam. Your friend is distraught because she studied really hard and still failed. Meanwhile, you actually received a perfect grade on the test. How would you react? Why?” The text responses of the students were collected and analyzed.

While the study initially intended to classify the responses using emotion classifiers such as NLTK sentiment analysis [Mog] and the IBM Watson Tone Analyzer [IBM], empathy was found to be in an orthogonal

category to the emotions identified by these tools. Empathy could be either positive or negative, conjoined by multiple simultaneous emotions.

Instead of using emotion classifiers, four alternative categorizations were utilized: “Emotional Level”, “Self Action”, “I Words”, and “Social Words”. “Emotional Level” and “Self Action” measured the emotional strength of the response and willingness to take action, respectively. These two variables were ranked on a scale from 1 to 5, and were scored independently then averaged between two members of the research team. The coders were not aware of whether the text came from before or after the course. Verifying the reliability of the data annotations, a Krippendorff’s Alpha value of 0.868 was calculated between the two coders – above the 0.8 standard for reliability. The “I Words” and “Social Words” were scored by the Linguistic Inquiry and Word Count (LIWC) tool [LIW], assessing how self-centered or others-oriented the participant’s text was. In aggregate, these 4 variables provided the basis of the study’s observations on empathetic state.

### 2.3 Demographics

There were 19 participants in the study. The subjects were primarily over 45 years old (63 percent), female (74 percent), and had some level of prior meditation experience (79 percent).

## 3 Results

Data collected from all participants were filtered through a two-tailed t-test to assess statistical significance. The following are the results for each component of the experiment.

### 3.1 Interoception Biometric Test

The study found statistically significant results ( $p = .035$ ) that taking an insight meditation course enhances a person’s interoceptive awareness (Figure 1). The biometric data suggested a statistically significant reduction in the difference between the participant’s guessed and measured heart rate upon taking the course.

### 3.2 Concentration Game

The study found no statistically significant correlation ( $p = .778$ ) in concentration for participants after taking the course (Figure 2).

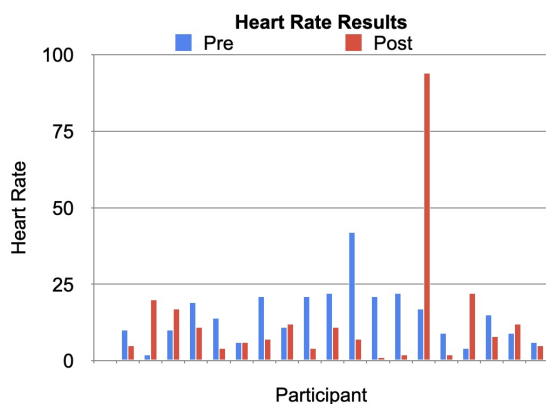


Figure 1: Heart rate awareness grows after long-term meditation courses

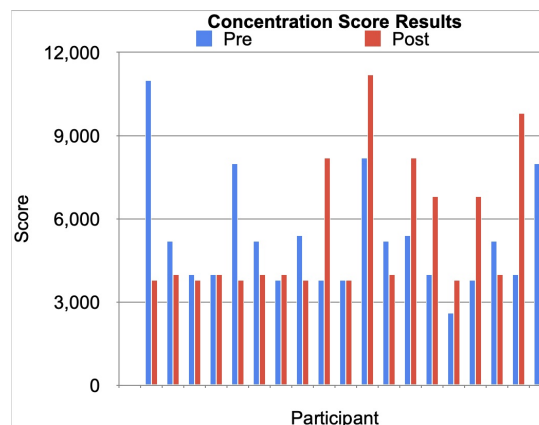


Figure 2: No evidence was found of concentration increasing after the course

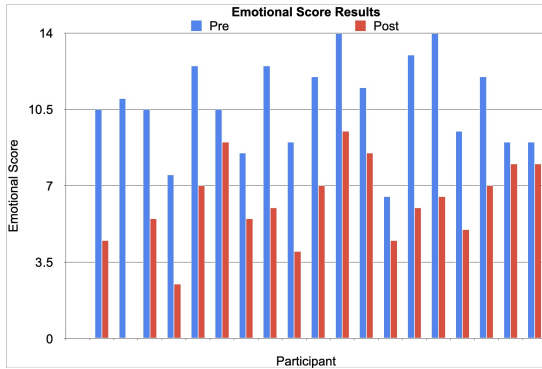


Figure 3: Emotion level increased statistically significantly after the course

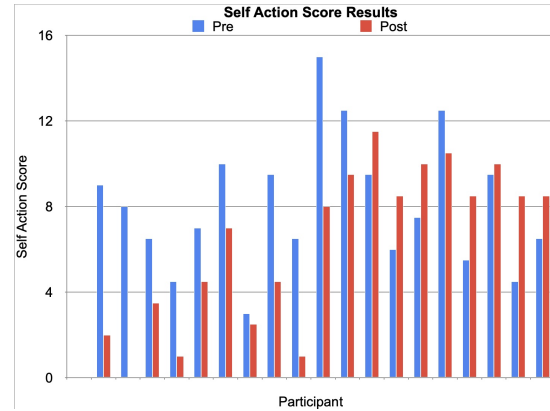


Figure 4: Self-action scores declined statistically significantly after the course

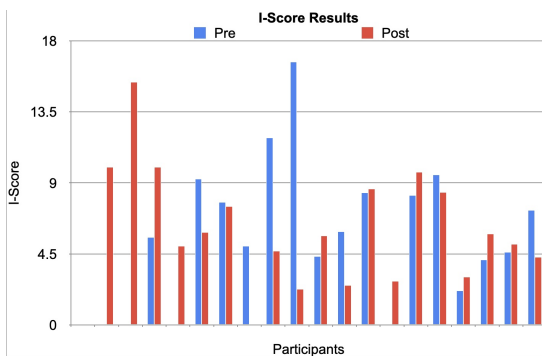


Figure 5: There was no statistically significant influence on I words

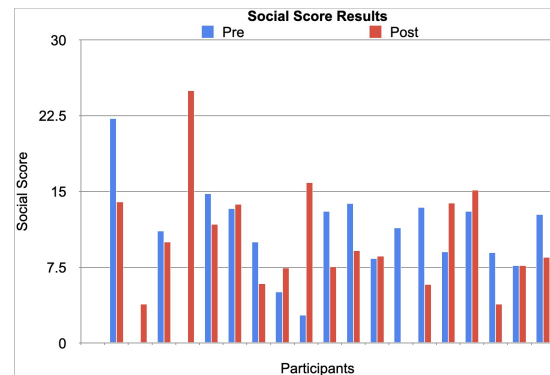


Figure 6: There was no statistically significant influence on social words

### 3.3 Empathy Questionnaire

#### 3.3.1 Emotion Level

The study found that subjects were less emotional with their responses after the course than before (Figure 3). The data suggests a statistically significant ( $p < .001$ ) drop in the emotional level score of the participants' response to the questions.

#### 3.3.2 Self Action

The study found that subjects reacted less actively to situations after the course compared to before (Figure 4). The data suggests a statistically significant ( $p = .005$ ) drop in the self action score of the participants' response to the questions.

#### 3.3.3 I Words

The study did not find any significant correlation between "I" words and taking the meditation course. (Figure 5).

### 3.3.4 Social Words

The study did not find any significant correlation between social words and taking the meditation course (Figure 6).

## 4 Discussion

While a 7-day trial of monastic living does not seem to significantly impact concentration rates, it may increase a participant’s awareness of their own body and make them less emotionally driven in their reactions to situations.

### 4.1 Interoception

The study’s observations on interoception, or the afferent feedback of a person’s physiological state, align well with the objectives of insight meditation courses. Since the participants sat for long periods of time with sustained concentration on their breath and body, it would not be unreasonable to suggest that the course improved the accuracy of their own heart rate prediction at a given moment. This kind of sustained mindfulness practice and monastic living may grant greater awareness to overall activity occurring in the parasympathetic and sympathetic nervous system.

### 4.2 Concentration

The study’s observations on concentration (the lack of any significant correlation) may have been in part due to the experimental design of that section of the test. Some participants were unfamiliar with the game, and some found it too time consuming to play multiple rounds. The result present in the study could be chalked up to a general skill and interest discrepancy between players rather than any meaningful insight into concentration and meditation. It is difficult to conclude whether there is any relationship between concentration ability and taking a long-term meditation course.

### 4.3 Empathy

The study’s observations on empathetic state align well with previous studies on meditation’s potential influence on emotional non-attachment. Mindfulness practices often teach students some form of objective observation of their present emotional state. By continually observing, rather than reacting to, their emotions, practitioners become less likely to immediately engage with them in an emotional situation. Thus, the overall decline in emotional quality and self action across participants’ written reactions to hypothetical emotional scenarios falls within expectations. From a qualitative standpoint, participants before the course answered with more action words, seeking to change someone’s emotional state (e.g., “offer an ear to listen to how she feels”, “try to comfort her”). After the course, participants responded from more of an observational stance, keeping their emotions in check (e.g. “loving kindness for my friend withholding my experience”). In their written response, students of the insight meditation course showed less emotion and more hesitancy to act within each scenario.

While the “I Words” and “Social Words” turned out to not show a significant change before and after the course, this may have been due to many participants writing shorter passages (2 to 3 sentences). Thus, any significant variation in pronoun usage might not have had the chance to show itself. In this experimental context, the degree of emotion and decision expressed by the participant would likely be the stronger indicator of empathy than raw text analysis.

## 5 Conclusion

### 5.1 Findings

This study adds further support to both meditation advocates and skeptics in the mindfulness literature base – silent, residential insight meditation courses both boost self-awareness and reduce emotionally

driven reactions. With statistically significant results in both of those areas (and no significant findings in concentration), the research contributes to the robustness of a somewhat paradoxical finding – that one can simultaneously detach from one’s human emotions while also being more in tune with one’s human body.

## 5.2 Future Work

Future research aimed at reconciling this seeming contradiction should be considered. It would be relevant to see not just whether these long-term meditation courses can influence participant’s immediate emotions, but also how they can have a long-term emotional impact on the students. How students return to a routine lifestyle – specifically, whether students maintain a similar level of parasympathetic awareness and empathy once re-integrated into normal life – would give further insight onto the effect on empathy. In order to determine if changes persist into daily life, a similar experiment should be run which conducts the post-course study after a reasonably large time interval following the course.

Additionally, studying changes in the participant’s relationships (both with people in their personal lives and with fellow meditation course participants) may expand the empathy discussion to an interpersonal realm. It would be useful to hear from people in their life if they noticed a change. Students might finish a course with the ideals of being more calm and kind in their lives, but their thoughts might not translate into action. It is one thing to respond empathetically to a questionnaire and another thing to act empathetically in real life. A person’s actual response to a situation will be more textured than a short blurb they write about how they would respond if it was them.

## 5.3 Limitations

Ideally, the heart rate variability (HRV) of the students would have also been examined alongside their actual and estimated heart rate at a given moment as HRV is a good measure of well-being and has been used in several other similar studies. However, because Fitbit Charge 2s do not measure HRV, but simply heart rate, this data point could not be gathered.

Before participants guessed their heart rate, they were informed of an average range for heart rates. Furthermore, after their pre-course guess, participants were informed of their actual heart rate. Being informed of their actual heart rate might have given the participants a better idea of what number to guess during their post-course evaluation.

Because of the limited time of during the check-in and check-out process, some participants could not spend as much time as they would have liked answering the questionnaire and their answers might have been shorter or less descriptive than ideal.

## 6 Team Members and Roles

Adam Novak led the coordination and contact with the InsightLA meditation center. Mauli Trivedi and Gaurav Chaudhari were in charge of creating the experiment and required implementations by creating the three components of the study that we conducted on the participants. Everyone in the team participated in the data collection process at the Big Bear Retreat Center. Siddhi Panchal and Garauv worked on data processing and analysis. They created a grading guidelines and checked for statistical significance in the results. Kevin Sun was in the charge of documentation and writing the report.

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