

The Effects of Short-Term Meditation on the Creativity of Novice Designers: A Pilot Design Task Study Using TTCT-Figural Assessment

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ABSTRACT

Creativity is long regarded as one of the fundamental traits that indicates design capability. The concept of creativity encompasses the capacity to produce innovative and novel concepts or ideas, to devise or articulate imagination and intellect, and to stimulate the potential of imagination and ingenuity embodying their capacity to conceive, craft, and develop innovative ideas for products. Previous studies have revealed the connection and functionality between meditation and creativity. However, general creativity measurements, which studies to date have mainly focused on, might not be able to demonstrate the performance of designers in a creative process adequately. Therefore, this study applied a design task-based evaluation with traditional TTCT assessment, which might be more suitable to describe the creative performance of novice designers. The study aims to explore: (1) the relationship between short-term meditation and creativity; (2) the effects of short-term meditation on the design qualities in design tasks of novice designers. 42 first-year design students were recruited and were divided into meditation group ($n = 24$) and control group ($n = 18$). Participants conducted a demographic survey and the Torrance Tests of Creative Thinking (TTCT, in its figural variant) firstly. The meditation group was then given a 110-minute audio tape-based meditation intervention, and the control group was given a 110-minute audio tape intervention, which is a recording of scientific articles. Both interventions were performed twice on a weekend. After that, TTCT was given to the participants again. Then each participant received an interview on the changes in mood state and creativity. After the TTCT on the second day, the participants completed the Design with Morphological Table Task (DwMT) to assess their design qualities in a product design task. Through data analysis, TTCT results indicate that short-term meditation can significantly improve the creativity of novice designers and the meditation group outperformed the control group significantly in fluency and elaboration. DwMT results show that the meditation group significantly provided better design qualities than the control group.

Keywords: Creativity, Short-term meditation, Product development, Design quality

INTRODUCTION

Creativity is the ability to create works that are both original and appropriate. One of the basic principles of design is also innovation (Dieter Rams, 1980), so one of the essential abilities a designer has is creativity. There are 4Ps of creativity: person, process, product and press (Rhodes, 1961). Creativity is characterised by processes with phases of divergence and convergence (Childs et al. 2022). In this process, a person uses skills to produce novel and valuable ideas, solutions, and products (Chulvi & González Cruz, 2016). Therefore, the main factors in assessing product creativity are novelty and practicality (Taura, 2011).

The popularity of meditation in the Western world over the past 40 years, building on centuries and millennia of practice across different cultures, has led to extensive research on its physiological and behavioural effects, including creative performance (Murphy et al., 2004). Previous studies have explored the relationship between creativity and meditation, and research on the link between creative performance and meditation has shown that overall creative performance is improved after meditation training (Ball, 1980; Colzato et al., 2012; Ding et al., 2011; Ding et al., 2014a; Ding et al., 2014b; Ren et al., 2011; Strick et al., 2012), but the reverse has also occurred (O’Haire & Marcia, 1980; Otis, 1974). Another study taking the TTCT-FormB test to measure creative thinking skills found an unsupported relationship between three years of meditation experience and creative performance. However, some meditators scored relatively high on the originality of graphics (O’Haire & Marcia, 1980). These sources of differences may be due to measurement errors in the TTCT or other factors, such as aspects of the subjects’ personality and mood. Previous research investigated the effects of a seven-day intervention as a short-term meditation on the creativity. The effects of short-term meditation less than seven days, single and successive meditations on the creativity are ignored in the existing research.

This paper aims to explore the possibility whether short-term meditation can improve the creativity of the novice designers. As for the assessment methods of the creativity, the current methods may only partially or abstractly reflect the results. On the contrary, task-based assessment method is more appropriate to evaluate designer’s creative performance in real scenarios together with traditional method. Therefore, a specific design task was used to assess the creativity of the novice designers together with TTCT-Figural in this study.

The research questions of this study are:

RQ1: What are the effects of short-term meditation on the creativity of the novice designers?

RQ2: How does short-term meditation affect novice designers’ design qualities in design tasks?

Accordingly, the proposed hypotheses of this study are:

H1 (for RQ1): A single short-term meditation intervention cannot significantly improve the creativity of novice designers.

H2 (for RQ1): Successive short-term meditation interventions can significantly improve the creativity of novice designers.

H3 (for RQ2): Successive short-term meditation interventions can significantly improve the design qualities of novice designers in design tasks.

METHODOLOGY

Participants

The study was conducted in XJTU-POLIMI Joint School of Design and Innovation in Xi'an Jiaotong University. Forty-two eligible first-year design students with little design experience were recruited. Inclusion criteria for the recruitment included no previous experience of meditation practice. They were randomly divided into a meditation group ($n = 24$) and a control group ($n = 18$). All participants voluntarily joined in the experiment and provided informed consent.

Procedures

The study began with the Torrance Test of Creative Thinking–Figural (TTCT-F), lasting for 3 minutes. The demographic survey was used to collect basic information on age and gender. Then, the meditation group received a 110-minute meditation intervention accompanied by an audio tape for meditation, while the control group received a 110-minute control intervention accompanied by a tape of scientific articles. The whole intervention contains 105-minute audio-based guided intervention and 5-minute preparation period in order to let subjects understand the aim of this study and adjust their sitting postures. As this study is a comparative project with the study conducted by Ding et al., (2014), the researchers aimed to discover the effects of the extreme short-term meditation intervention which only contains two-day practices. The compared study applied a seven-day meditation intervention with 30-minute practice for each day; to ensure the total time is equal, this study adopted 2-day intervention with 105-minute practice for each day. Both tapes are recorded by the same person and the same speed of speech as the audio applied to the meditation group, to ensure the scientific nature of the protocol design (Norris et al., 2018). The interventions were provided twice on a weekend. After the intervention, participants conducted the TTCT-F again and received a personal interview. At the end of the experiment on the second day, participants conducted a design task (DwMT). The procedures of this study are shown in Figure 1.

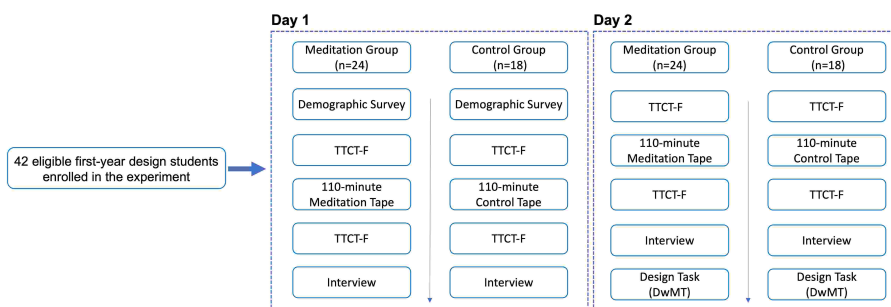


Figure 1: The protocol of the meditation interventions in two days..

Torrance Test of Creative Thinking–Figural (TTCT-F)

The Torrance Test of Creative Thinking (TTCT) was used to assess participants' creativity performance. There are two principal versions: TTCT-Verbal

and TTCT-Figural. In this experiment, only TTCT-Figural was used to evaluate participants' figure-related creativity. The TTCT-F consists of the following five subsections (Alabbasi et al., 2022): (a) Fluency, which is the numbers of figural-relevant responses to the stimulus, reveals the level of idea generation. (b) Originality, which is the numbers of unusual relevant responses determined by statistical infrequency, reveals the level of idea originality. The scoring procedure needs to count all the relevant answers to produce a uniqueness statistic table, and then give a score based on the percentage of each answer. (c) The abstractness of the title reveals the level of capturing critical information and the ability of synthesising and organising thinking. (d) Elaboration, which is the number of added elements based on the minimum necessary of response, reveals the level of imagination and exposition of detail. (e) Resistance to premature closure reveals the ability to stay open and tolerate ambiguity long enough to come up with a creative response. For the purpose of article, Abstractness of title and Resistance to premature closure will not be discussed. The raw scores (Fluency, Originality, Elaboration) in each activity are converted to standard scores by z-score normalization. Each subscale was rated by a single proficient scorer with previous experience in a training of scoring TTCT who was blind to the conditions of the participants.

Design With Morphological Table Task (DwMT)

The task, consisting of three chronological stages, required participants to design an amphibious bicycle based on the requirements in 15 minutes (see Figure 2). The instructions showed participants the detailed requirements of this task (Li et al., 2023). The morphological table (Childs, 2019) provided 3 aspects of design requirements and 11 features of an amphibious bicycle, serving as a detailed guideline for the participants.

Stage 1 DwMT Task Guidelines
Design an amphibious bike/a human-powered vehicle capable of operation on both land and water) by combining All the features proposed in the morphological table. Please propose one preferred concept and illustrate it by means of sketch and text notes.

Requirements:

1. support at least 2 people
2. transition time between water and land mode less than 2min
3. be transportable on vehicle bike racks or in trunk(length <6m)

Stage 3

Sketching & Annotating

Stage 2












Features	A	B	C	D
Number of wheels	0	1	2	3
Wheel type	Inflatable bicycle tyre 	Airless tyre 	Rigid floating tyre 	
Type of propulsion in water	Propeller 	Paddle wheel 	Paddles 	
Number of propulsion units	0	1	2	3
Powered by	Hand	Foot	Both	
Riding position	Reclined seating 	Upright seating 	Upright standing 	
Seat arrangement	Side by side	Fore to aft		
Steering	Flexible shaft propeller 	Rudder 		
Power transmission	Chain	Drive shaft	Belt	
Frame material	Aluminum	Composite (e.g. carbon fiber)	Plastic	
Buoyancy	Inflatable elements	Hull	Rigid float	

Figure 2: Three stages of DwMT: (upper left) stage 1: reading the requirements (lower left) stage 2: analysing and selecting part of the solutions from morphological table (right) stage 3: sketching.

In order to clarify how creativity is manifested under this design task, the design quality was scored according to the assessment criteria listed in Table 1. The task and assessment criteria are adopted from the former research conducted by two authors of this study (Li et al., 2023). The design task was rated by a single proficient scorer with 20-year experience in design education who was blind to the conditions of the participants.

Table 1. Assessment criteria of DwMT.

Clarity-Level of Detail (only Sketch)		Viability		Explicit Use of the Matrix	
To assess the presentation of the design		To assess the implementability of the design		To assess whether the design contains the features provided and meets the given design requirements in the morphological table	
Score	Criteria	Score	Criteria	Score	Criteria
2	Barely understandable	2	Does not work/ make sense	2	3 or fewer features and 1 design requirement
5	Understandable but superficial	5	Likely not working	5	4–6 features and 1 design requirement
7	Clear and with some details	7	New research required, possible	7	6–7 features and 2 design requirements
10	Clear and detailed	10	Workable	10	8 or more features and 2 design requirements

Interview

An interview was provided to each participant to learn more about their subjective perception about their changes in mood state and creativity. The questions asked in the interview are introduced in Table 2.

Table 2. Questions asked in the interview.

Day	Dimension	Question
Day 1	Changes in mood state	Compared to the mood state when you entered the lab, do you feel any changes in your mood state? How does the mood state change? Please use some adjectives to describe your current mood or inner state.
Day 1	Changes in creativity	Compared to the TTCT-F you did when you entered the lab, do you have any changes in your creative thinking, problem-solving and fluency in the process of doing TTCT-F?
Day 2	Changes in mood state	Compared to the mood state you had when you entered the lab in the first day, do you have any changes in your mood now? Please use some adjectives to describe your current mood or inner state.
Day 2	Changes in creativity	Compared to the TTCT-F you did when you entered the lab in the first day, do you have any changes in your creative thinking, problem-solving and fluency in the process of doing TTCT-F?

Statistical Analysis

The scores of TTCT-F and DwMT are analyzed using IBM SPSS version 26. Descriptive statistics of each of TTCT-F and DwMT were calculated, including median and interquartile range (IQR). The differences between the meditation group and the control group in DwMT were tested using the Mann-Whitney U test (non-normally distributed). Meanwhile, the differences of and TTCT-F between two groups were tested using the Mann-Whitney U test (non-normally distributed). The comparison of each dimensions of TTCT-F between the pre-test and the post-test in the same group were tested using Wilcoxon signed-rank test(non-normally distributed). A p-value of <0.05 was considered as statistically significant.

RESULTS

Through data analysis, the results are consistent with the research hypothesis and are introduced in detail as follows.

Scores of TTCT-F

In the pre-test of the first day (see Table 3), the Mann-Whitney U test shows no significant difference in TTCT-F (Fluency, Originality, Elaboration, $p>.05$) between the meditation group and the control group.

Table 3. Descriptive statistic for TTCT-F of participants in pre-test of day 1.

Dimensions	Total TTCT-F Median (IQR)	Meditation TTCT-F Median (IQR)	Control TTCT-F Median (IQR)
Fluency	0.19 (1.58)	0.39 (1.58)	-0.21 (1.58)
Originality	0.18 (1.56)	0.39 (1.56)	-0.21 (1.58)
Elaboration	0.02 (1.41)	0.02 (1.41)	0.02 (0.88)
Total	0.36 (3.13)	0.76 (3.21)	-0.39 (3.16)

Note: Statistically significant results with $p<0.05$.

After the first intervention, compared to the pre-test (see Table 4), the meditation group shows no significant difference between the pre-test and post-test in TTCT-F (Fluency, Originality, Elaboration, $p>.05$, Wilcoxon Signed Rank Test). The results are consistent with the research hypothesis.

Table 4. Descriptive statistic for TTCT-F of meditation group in pre and post-test of day 1.

Dimensions	Meditation-pre TTCT-F Median (IQR)	Meditation-post TTCT-F Median (IQR)
Fluency	0.39 (1.58)	0.42 (0.00)
Originality	0.39 (1.56)	0.46 (0.16)
Elaboration	0.02 (1.41)	0.42 (1.77)
Total	0.76 (3.21)	1.24 (1.86)

Note: Statistically significant results with $p<0.05$.

Meanwhile, compared to the pre-test (see Table 5), the control group shows no significant difference between the pre-test and post-test in TTCT-F (Fluency, Originality, Elaboration, $p > .05$, Wilcoxon Signed Rank Test). The results are consistent with the research hypothesis.

Table 5. Descriptive statistic for TTCT-F of control group in pre and post-test of day 1.

Dimensions	Control-pre TTCT-F Median (IQR)	Control-post TTCT-F Median (IQR)
Fluency	-0.21 (1.58)	0.42 (0.40)
Originality	-0.21 (1.58)	0.32 (0.63)
Elaboration	0.02 (0.88)	-0.53 (0.94)
Total	-0.39 (3.16)	0.26 (2.13)

Note: Statistically significant results with $p < 0.05$.

In the pre-test of the second day (see Table 6), the Mann-Whitney U test shows no significant difference in TTCT-F (Fluency, Originality, Elaboration, $p > 0.05$) between the meditation group and control group.

Table 6. Descriptive statistic for TTCT-F of participants in pre-test of Day 2.

Dimensions	Total TTCT-F Median (IQR)	Meditation TTCT-F Median (IQR)	Control TTCT-F Median (IQR)
Fluency	0.51 (1.09)	0.51 (1.09)	0.51 (0.27)
Originality	0.06 (1.05)	0.34 (1.22)	0.04 (0.86)
Elaboration	0.29 (1.02)	0.29 (1.02)	-0.22 (1.27)
Total	0.58 (1.84)	0.63 (1.91)	0.15 (1.96)

Note: Statistically significant results with $p < 0.05$.

After the second intervention, compared to the pre-test (see Table 7), the Wilcoxon Signed Rank Test reveals that the meditation group obtained significantly better scores in Fluency (0.51 vs 0.77, $p < 0.05$) and Elaboration (0.29 vs 0.33, $p < 0.05$). In sum, the meditation group performed significantly better than pre-test after the meditation intervention (0.63 vs 1.68, $p < 0.05$). The results are consistent with the research hypothesis.

Table 7. Descriptive statistic for TTCT-F of meditation group in pre and post-test of day 2.

Dimensions	Meditation-pre TTCT-F Median (IQR)	Meditation-post TTCT-F Median (IQR)
Fluency	0.51 (1.09)	0.77 (0.61)*
Originality	0.34 (1.22)	0.59 (0.88)
Elaboration	0.29 (1.02)	0.33 (1.89)*
Total	0.63 (1.91)	1.68 (1.70)*

Note: Statistically significant results with $p < 0.05$.

In the Hypothesis test summary for DwMT, the Mann-Whitney U Test show significant difference between meditation group and control group on Clarity, Viability, Explicit use of matrix and total score, the significant difference is 99.99%, the significance level is .050. The results are consistent with the research hypothesis.

Interview

In the interview on the first day, 10 out of 18 participants in the control group reported that their mood state after the intervention did not change much, instead, they felt a little dull. For the creative performance in TTCT-F, 13 out of 18 participants felt little changes in agility and mental dispersion after the intervention compared to when they entered the lab. On the other hand, 23 out of 24 participants in the meditation group said that they felt calmer and more relaxed after the intervention than when they first entered the lab. For the TTCT-F, 21 out of 24 participants reported that they completed the test more smoothly after the meditation compared to when they first entered the lab, and their thinking became more agile and creative, with a lot of new ideas coming into their minds.

On the second day, 11 out of 18 participants in the control group felt little changes in mood state compared to the first day. For the TTCT-F, 14 out of 18 participants thought that there was no significant improvement compared to the first day. Instead, 19 out of 24 participants in the meditation group felt calmer and more relaxed compared to the first day. For the TTCT-F, all the participants in the meditation group noticed that they had more ideas than the first day.

CONCLUSION

This study aimed to explore the effects of short-term meditation on the creativity of novice designers. A pilot study using the TTCT-figural assessment was undertaken with a sample of 42 design students. Based on the results, the following conclusions are obtained from this study. Firstly, short-term meditation can improve the creativity of novice designers, especially in fluency and elaboration indicated by TTCT. Secondly, short-term meditation can improve the design qualities of novice designers in a specific design task.

However, the current study has some limitations. Firstly, neurophysiological measures, such as electroencephalography (EEG), would provide a more comprehensive understanding of the differences between the two groups from a neuroscience perspective. Secondly, we only used interview to investigate the effects of meditation on mood state, rather than using quantitative data to undertake measurements. Thirdly, we only recruited 42 participants in the study. In the future more participants need to be enrolled in to obtain more reliable results representative of a wider population. The study further explores the relationship between short-term meditation, creativity and design quality in a specific design task, contributing to the creativity research in the design society.

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