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The Influence of Body Usage on Creative Drawing: A Comparison of Calisthenics and Meditation in Junior High School Students

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Abstract

This study investigates the influence of body usage on creativity drawing. We examined the effects of physical exercise and meditation on creativity in second-year junior high school students (N=97) through a within-subjects experiment. Participants performed three-minute sessions of calisthenics and meditation before drawing, and their artworks were analyzed for differences in area, color usage, and the presence of warm/cold colors. The results showed that 1) drawings after meditation tended to have larger areas, while those after calisthenics showed an increased use of warm colors; 2) In the questionnaire, the students who felt that calisthenics activated their creative drawing often commented on body image, while other students who felt that meditation activated them commented on thinking and feeling.

Keywords: Creativity Education, Creative Drawing, Physical Exercise, Mental Exercise, Calisthenics, Meditation

1 Introduction

In recent years, the question of whether creative thinking and expressiveness can be cultivated in school education has been attracting increasing attention. In the current trend of global education reform, the development of creativity is emphasized as an important skill required of learners in the 21st century. In particular, art education, due to its uniqueness, is an ideal subject for practically learning the creative process. However, there is currently a lack of systematic research and practice on methods to effectively promote creativity in art education. Focusing on this current gap, the aim of this study was to explore the effectiveness of an approach that consciously utilizes sensory experiences such as the five senses through the use of the body to cultivate creativity. In the experiment, calisthenics as a physical exercise and meditation as a mental exercise were introduced to observe the differences in expression due to each experience. If an approach to the body affects expressive activities, it may be possible to provide a new perspective on the theory and practice of creativity education by incorporating recognition of how the body is used into the art education process.

One educational method in the 21st century skills reform is STEAM Education, which integrates Science, Technology, Engineering, Art, and Mathematics. The addition of art to STEM Education also shows that art is important as an element that integrates each field.

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Creativity is said to be linked to an environment with diverse knowledge and skills in art and science, and this integrated learning is said to enhance problem-solving and innovation abilities in the real world. Today, the introduction of Art + Design Education curricula and programs is progressing in the United States, and educational institutions and schools are working to integrate art into education in the STEM field [1]. Art is often sensory and has limitations, and the role of art in STEAM Education is often seen as unclear. However, proposing something new of value such as creating things and events requires human senses that are not limited to knowledge and technology, and the role of sensory art is thought to be important. Therefore, we examined wanted to examine the role of this sensory art by focusing on the engaging the body in expressive activities.

In this study, we will examine the influence of a physical approach on the development of creativity through a within-subject experiment. In the experiment, we will introduce calisthenics as a physical exercise and meditation as a mental exercise to observe the difference in the influence of each sense. If this approach to using the body has an impact on expressive activities, then incorporating effective ways of using the body to bring out creative thinking and expression into art education could provide a new perspective on creativity education.

2 Literature Review

Physical movement cannot be separated from the process of expressing what one thinks in one’s head considering that thinking and expression are interrelated, this research will investigate how the approach to the body, including sensory experiences influences each student's thinking and expression in the process of creative expressive activities. In other words, we believe that there is a possibility of enhancing educational effects by incorporating a process that is conscious of the use of the body in order to foster creative thinking and expression.

First, we examined the interaction between the use of the body and creativity. Although creativity has many definitions, Mihaly Csikszentmihalyi's research is closely tied to a state of immersion known as 'flow'." could be improved for flow. When asked how creative people feel when they are engaged in the activities they enjoy most, they list “designing or discovering something new” [2]. Even though the activities may vary, the experience that immersion produces is similar to the process of discovery, and thinking and using one's body to create something new is an important component of creativity. The first process of generating ideas for a theme is drawing, in which words and figures that come to mind are written out on a blank sheet of paper such as a sketchbook. When generating ideas, thinking while moving one's hands expands one's imagination, and the image is gradually materialized. Moving one’s hands while thinking can be described as a warm-up physical activity for drawing out ideas and giving shape to images. Warming up is mainly used before athletic competitions, but it is also used as a preparatory stage for musical performances and other activities that require the use of various body parts. In idea generation, it is sometimes used as a preparatory exercise before thinking, such as when it is introduced as a brainstorming session before a company meeting, etc. A.W. White says, “The importance of warming up and getting started is recognized in athletic competitions, music, dance, and other human activities. When it comes to problem solving, however, their importance is seldom recognized. When answering

creative thinking tests, even a simple five-minute warm-up has been shown to be very helpful" [3]. He also mentions the importance of a physical warm-up.

In "Thinking Through the Body" Richard Shusterman, in his theory of bodily sensibility, argues that "the body is not only an essential dimension of our humanity, but is the basic means of all human action, the instrument of tools, and is essential in all our perceptions and actions, and even in our thinking" [4]. Importantly, physical activity is closely linked to both emotion and intellect, and art can be seen not merely as intellectual understanding, but as something embodied through bodily technical sensations, actions, and inner feelings.

One example of the need for physical learning can be found in the education at Bauhaus, a national school of plastic arts established in Germany, which established the framework of modern design as a comprehensive educational institution for art and architecture. Johannes Itten, the leader of the school at that time, stated the importance of "the ability to think with one's hands" and "No matter how much technological innovation has been achieved today, education that cultivates sensitivity depends on how to connect the relationship between the 'hand' and the 'brain' and establish it as an education of sensitivity." [5] In fact, Bauhaus introduced a physically conscious curriculum that included singing songs, moving the body, and massages as preparatory exercises. Recently, Belinda MacGill et al. have introduced CBL (Creative and Body-based Learning), an educational approach that emphasizes learning through artistic expression and physical experience. This approach incorporates physical movement and sensory experiences to deepen students' understanding and promote self-expression and critical thinking through the creative process, and argues that CBL can enhance students' emotional and physical engagement and elicit deep learning. It has attracted attention as an innovative approach that enhances the quality of learning by integrating learning and artistic inquiry [6]. Although the body is an essential part of expressive activities, it is not given much attention in the current educational curriculum. The aim is to acquire the ability to recognize the body as the subject of creation, to organize sensory information acquired not only from information organized in words but also from one's own experiences, and to utilize this information as knowledge and concepts [7].

Based on these previous studies, this study analyzes the influence of the body on expressive activities through students' drawing works. It aims to examine the effects of the physical approach in art education and to clarify how the use of the body and sensory experiences contribute to the development of creativity.

3 Experiment

3.1 Methods

This study investigated how incorporating the use of the body before idea generation and expressive activities such as idea sketching and drawing affects creative thinking and expression. Junior high school students (N=97) were asked to draw simple figures after calisthenics and after meditation. We compared two drawings made by the same subjects after physical exercise and after meditation, and analyzed the effects of body use on their drawing expressions.

3.2 Participants

Of the 104 second-year Junior high school students (13-14 years old), 97 students participated, excluding those who were absent or tardy and whose participation was insufficient. Interest in the classes was high and participation was active. The regular class format was a classroom lecture, in which each student was given a desk, under the same conditions as in a regular class.

3.3 Experiment Design

The class was divided into two groups (A and B) so that about half of the class was in each group. 3 minutes of physical exercises and meditation were performed alternately in A and B groups. After the calisthenics and meditation, the participants drew figures for 7 minutes. The drawing procedure and conditions were (1) drawing six dots, (2) connecting the dots with nine lines, and (3) painting the divided colored surfaces with colored pencils. The drawing was designed to be easy to do and to allow a certain degree of freedom in expression. The conditions for drawing are the same for both groups.

This study chose calisthenics and meditation as the conditions for the use of the body because previous studies have shown that creativity is enhanced by physical conditions that calm the body and mind through physical exercise and meditation, and we thought it would be possible to analyze trends in how these different physical conditions are expressed in the drawings. According to Oppezzo et al, walking has been demonstrated to promote creative ideation in real time and immediately afterwards, with divergent thinking test results showing that walking increased participants' creativity by 81percent [8]. In meditation and Creativity, Müller et al. found that two groups of experienced meditation practitioners conducted meditation sessions (mindfulness meditation or concentration meditation), and the results assessed participants' creativity and cognitive flexibility, indicating that meditation improves creative performance regardless of meditation style. They explain that the results show that meditation improves creative performance [9]. Based on these findings, we designed the study with the expectation that physical conditions would affect students' creative thinking and expressive activities.

In the nonverbal tasks of the TTCT by Torrance, a well-known creativity study, there is a test using shapes. The Minnesota study using four nonverbal tasks (incomplete figures, picture composition, circles and squares, and creative drawing) is said to be a successful creativity research task. The "nine dots" problem for incomplete figures consists of nine dots placed in three rows and three columns of three dots each and connected by four lines, which are drawn in a single stroke style without taking the pen or pencil away from the paper [10]. In most cases, the artist has an image of a rectangle within the nine dots and tries to fit the figure within the rectangle. This task challenges the viewpoint from which we look at the nine dots, breaking through this image based on our own assumptions. The conditions of the experimental task were determined through discussions with art teachers at the school site, such as determining a reasonable number of points and lines that could be drawn in 7 minutes.

3.4 Procedure

For the purpose of a within-subjects experiment, we wanted to analyze the effects of differences in body use by having the same students experience the two conditions (calisthenics and meditation) and comparing them. For this purpose, one class was divided into two groups, A (physical exercise before drawing) and B (meditation before drawing), and the counterbalance was adjusted by repeating with Group A doing the meditation and Group B the physical exercise before drawing (Table 1).

The physical exercise procedure included physical movements over a period of 3 minutes. The contents of the movements included Japan's radio exercise, which is familiar to the public as a national preparatory exercise. The mental exercise condition included three minutes of meditation (closing the eyes and relaxing the body and mind) while listening to calming healing music. The following is a brief description of the mental exercise. The participants were placed on cushions on the floor and asked to sit in a position of their choice, such as in *Zazen* (seated meditation). To enhance the relaxation effect, the participants were told to concentrate on the *Tanden* (an area of the body 5 cm below the navel) and to breathe in through the nose and out slowly through the mouth. This breathing technique activates the parasympathetic nervous system and is scientifically believed to facilitate access to the subconscious mind by creating a meditative state.

After the completion of the calisthenics and meditation, a 7-minutes drawing session was conducted. An A4 sheet of white paper and 20 colored pencils were distributed to each student for coloring. The students were told to use the color of the paper for the white color. In addition to the drawing survey, a questionnaire was distributed after the drawing and several questions were asked. The participants were asked to write their self-evaluations and post-experience impressions about which of the two ways of using the body, calisthenics or meditation, they felt activated their expressive activities more. After drawing, the participants were asked to give a title to each drawing. Figure 1 shows the experimental scene.

Table 1: physical exercise and meditation in the experimental group

Group A : Exercise	⇒	Meditation
Group B : Meditation	⇒	Exercise

Figure 1: Experimental Scenes: (a) Exercise, (b) Meditation, (c) Drawing

3.5 Analysis Method

In order to compare the drawings made by the same students after calisthenics and meditation, the differences in area, number of colors, increase or decrease of warm or cool colors, etc. were analyzed. First, the drawn figures were scanned and converted into data, which were then measured using the measurement log function in Adobe Photoshop. In addition to the data, the responses to the questionnaire were also used as a reference to analyze trends. The measurement log function of Photoshop, which was used to measure the data of the figures, has a function to specify objects, and if the selection is surrounded by lines, the number of pixels in each color area can be measured. Since the drawn figure is colored inside the contour line divided by connecting the points, it is easy to specify the color range inside the contour line. Therefore, the measurement of each color area could be performed with high accuracy.

For the analysis of hue, it is necessary to consider how to divide the number of colors. Humans have the ability to distinguish colors, which is said to be "300,000, 2,280,000, and 895,000, even according to estimates from the beginning of the 20th century" [11]. However, while we can distinguish subtle differences in color, we sometimes lump into red, blue, etc. Roberson compared how people from different languages and cultures perceive and classify colors, and showed that color categories are not universal but are greatly influenced by language and cultural background [12]. Various studies have been conducted on human color perception mechanisms from the retinal level to the cerebral level, and it is known that one of the functions of color vision is that all colors are classified according to 11 basic color categories (red, green, yellow, blue, brown, purple, pink, orange, white, black, and gray),. In other words, categorical color perception is named after the general tendency to divide all colors into 11 colors. The color classification method used in this study was based on colors that can be distinguished by the human eye, even in works with mixed colored pencils, which are difficult to classify at first glance, so as to avoid differences in color perception. 11 colors were measured based on the classification table in Table 2.

Table 2: Classification table based on categorical color perception

Classification	Category hue	Category Colors
Categorical color perception	Warm color	Red, Yellow, Orange, Peach, Brown
	Cold color	Blue, Green, Purple
	Neutral color	White, Black, Gray

4 Results

4.1 Analysis from Student Work Data

The results of the students' artwork data are summarized in Table 3. The average total area of the drawings from the group that incorporated calisthenics before drawing was 361,049.4 pixels, while the average after meditation was 477,252.6 pixels. Comparing the total area after calisthenics and meditation, the post-meditation drawings covered 116,203.2 pixels more (approximately 32.2%), with a p-value of 0.02, indicating a statistically significant difference. However, Cohen's

d was 0.27, suggesting a small effect size.

Regarding the total number of colors used, the calisthenics group averaged 5.2 colors, whereas the post-meditation group used an average of 4.9 colors, with a p-value of 0.14 and Cohen's d of 0.18, indicating that slightly more colors were used after calisthenics. Focusing on hue, the area covered by warm colors post-calisthenics was 152,788.4 pixels compared to 232,341.2 pixels post-meditation (p=0.11, Cohen's d=0.23), showing a trend toward greater warm color area following meditation.

For cool colors, the post-calisthenics area was 130,991.0 pixels, while the post-meditation area was 164,959.9 pixels, with a p-value of 0.13 and Cohen's d of 0.20. Although the cool color area was 33,968.9 pixels larger (approximately 25.8%) post-meditation, the effect size was small, and the difference was not statistically significant. In terms of the number of colors, the difference was minimal, at only 0.1 color.

For achromatic colors (black, white, and gray), the area after calisthenics was 77,270.1 pixels, compared to 79,951.6 pixels after meditation, with a p-value of 0.88 and Cohen's d of 0.02. This represented a slight increase of 2,681 pixels (approximately 0.03%) after meditation, but no change in the number of colors was observed. Overall, these results suggest a trend toward increased area following meditation, with increases in the areas of warm, cool, and achromatic colors. Nevertheless, there were no significant differences in area or color count resulting from the different physical activities of calisthenics and meditation as reflected in the drawings.

Table 3: Comparison of drawing after calisthenics and after meditation

N=97

Area and number of colors	Mean		SD		p-value	Cohen's d
	calisthenics	meditation	calisthenics	meditation		
Total Area	361049.4	477252.6	266268.8	534098.6	*0.02	0.27
Total Number of Colors	5.2	4.9	1.8	1.8	0.14	0.18
Warm Color of Area	152788.4	232341.2	140665.7	469722.1	0.11	0.23
Number of warm colors	2.7	2.6	1.2	1.2	0.46	0.10
Cool Color Area	130991.0	164959.9	134142.4	199010.6	0.13	0.20
Number of cool colors	2.7	2.6	1.2	1.2	0.46	0.10
Neutral Color Area	77270.1	79951.6	178999.2	177701.0	0.88	0.02
Number of Neutral colors	0.6	0.6	0.8	0.8	1.00	0.00

paired T-test/ * p<.05, ** p<.01 Effect size guidelines: 0.2 = Small, 0.5 = Medium, 0.8 = Large

4.2 Analysis of Student Questionnaire Responses

The student questionnaires were analyzed for insights into their experiences. Regarding their impressions after engaging in calisthenics and meditation, 46 students (47.4%) reported that drawing after calisthenics had a positive effect due to the physical activity involved, while 51 students (52.6%) indicated a preference for drawing after meditation, showing no substantial difference. Student feedback was categorized into themes of Body Image, Thinking, Feeling, Satisfaction, Method of Expression, and Other. Among those who felt more activated by calisthenics, Body Image (13 students), Satisfaction (12 students), Method of Expression (9 students), and Thinking (9 students) were rated highly. For students who preferred meditation, the main themes were Thinking (18 students), Feeling (14 students), and Satisfaction (10 students). Each student's feedback reflected distinct features attributed to the physical activity. Students who favored calisthenics highlighted that moving their bodies helped them generate ideas more quickly and complete their artwork faster, resulting in a sense of freedom and satisfaction. Conversely, students who preferred meditation often mentioned that the time spent not thinking helped them organize their thoughts and experience mental clarity, which facilitated the generation of ideas. Some students

also noted fatigue from the calisthenic suggesting that a calm environment, such as meditation, was more suited to their needs. These responses indicate that students' reactions varied according to their individual sensory preferences, showing that both calisthenics and meditation have distinct benefits for creativity.

Table 4: Classification of priorities and reasons for calisthenics and meditation

N=97

Group	Total Priority	Classification of answers					
		Body image	Thinking	Feeling	Satisfaction	Method of expression	Other
calisthenics	46 (47.4%)	13(28.3%)	9 (19.6%)	5(10.9%)	12(26.1%)	9(19.6%)	0(0.0%)
meditation	51 (52.6%)	8(15.7%)	18(35.3%)	14(27.5%)	10(19.6%)	7(13.7%)	3(5.9%)

4.3 Analysis of Drawing Results (Figures 2–6)

The students' drawing results were analyzed based on selected examples (Figures 2–6). In this within-subjects experiment, the drawings on the left and right are created by the same student; the left side represents drawings completed after calisthenics, and the right side after meditation. Comparing these left and right drawings reveals similarities in form and color scheme, reflecting the unique characteristics of each student. In Figure 2, the drawing completed after calisthenics has a greater area covered by warm colors. The student commented that the exercise made them feel more cheerful, while meditation induced a relaxed state, suggesting a potential relationship between mood and color choice. Figure 3 shows a notable difference in overall area, with the post-meditation drawing featuring more linear and detailed elements. The student reported that meditation helped them structure the composition more cohesively.

Figure 4 illustrates bolder, freer strokes in the post-calisthenics drawing, while the post-meditation drawing features shapes with finer, segmented color areas, displaying delicate detail. The student mentioned that they drew the post-physical exercise piece without overthinking, highlighting differences in intricacy between the two drawings.

Figures 5 and 6 exhibit highly individualistic expressions. The post-calisthenics drawings show extended strokes and dynamic movement, indicating expressive, active hand movements. In contrast, the post-meditation drawings contain more color variety and hue variation, with more complex blending than in the post-calisthenics drawings. This reflects a more intricate approach after meditation.

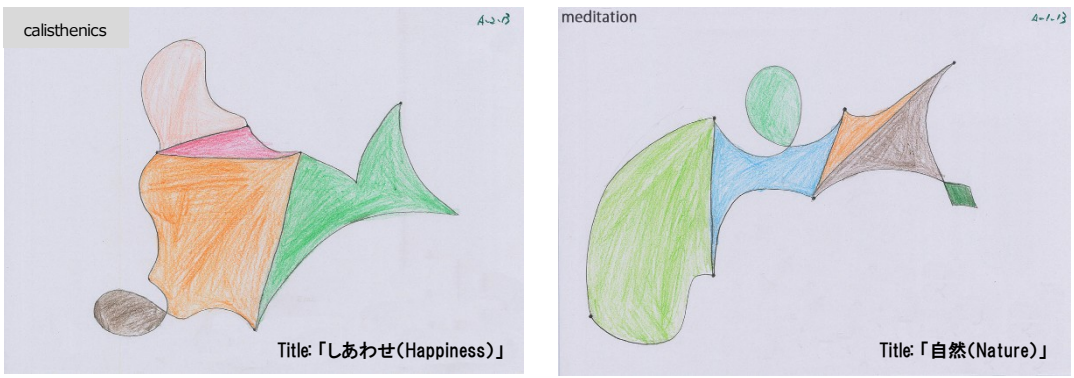

Figure 2: Student Work 1

Figure 3: Student Work 2

Figure 4: Student Work 3

Figure 5: Student Work 4

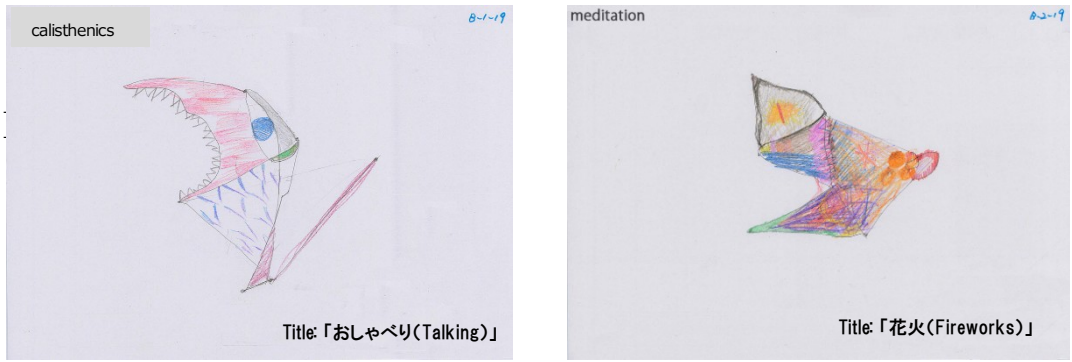

Figure 6: Student Work 5

5 Discussion

In this within-subjects experiment, we compared drawings created by each student after engaging in either calisthenics or meditation. To analyze the effects of each three-minute physical condition (calisthenics or meditation) on creative expression, we examined student drawings by area, number of colors used, and color tone categories. Results showed that drawings created after meditation had a larger area than those produced after calisthenics. Additionally, warm colors, cool colors, and achromatic tones also showed greater area coverage following meditation, yielding results contrary to our initial hypotheses. Prior to the experiment, we hypothesized that greater physical movement would stimulate increased blood flow, muscle relaxation, and emotional release, leading to more expansive expressions, and that warm colors would increase, given their psychological effects. However, no significant differences were observed between calisthenics and meditation. Although limited to specifically-colored pencils, the analysis revealed no substantial differences in color use. Additionally, a survey question asked students which condition-meditation or calisthenics they felt more effectively stimulated their creativity. Although five more students reported feeling enhanced expression following meditation, the results were nearly evenly split. Given the minimal differences observed, the relationship between physical activity and expressive output may be influenced by individual sensory variations. Another noteworthy observation emerged from the titles students assigned to their drawings. Some used concrete titles like “Bird” or “Fish,” while others added adjectives, resulting in phrases such as “Graceful Bird” or “Energetic Fish,” and some chose abstract titles like “Nature” or “Happiness.” Students with unique or unexpected titles tended to produce more distinctive drawings, highlighting individual differences in creative expression. Creativity is inherently difficult to define and measure, making it challenging to elucidate the relationship between physical activity and creativity. However, studies by Oppezzo et al. and Müller et al. [8] indicate that physical approaches, such as physical exercise and meditation, can promote idea generation and enhance creative performance. These findings suggest potential for incorporating these activities into educational programs aimed at fostering creativity.

6 Conclusion

This study did not conclusively clarify the relationship between embodiment and creativity; however, the results suggest that individual preferences in bodily movement and situational factors may influence students’ performance. By optimizing the ways in which students use their bodies according to situational contexts, it may be possible to trigger and enhance their cognitive and expressive abilities. This research focused on bodily approaches as a means to unlock each student's unique thinking and expressive capacities, with an emphasis on the body as the primary medium of expression. Specifically, the study aimed to explore the effectiveness of intentionally utilizing sensory experiences, such as those involving the five senses, through various physical activities. Future research should expand upon this approach by incorporating sensory stimuli, such as tactile or auditory experiences, to develop educational methodologies that foster creativity through comprehensive sensory engagement.

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