Impact of Outdoor Activities in Different Landscape Environments on the Physical and Mental Health of College Students

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Abstract To investigate whether outdoor activities have an improvement effect on the emotions of young people and the differences in the impact of outdoor activities on the emotions of young people under different landscape environmental conditions, the participating students are asked to engage in outdoor activities in different landscape environments and divided into four groups. Each group is assigned to engage in outdoor activities in four types of landscape areas: open lawn area, low shrub area, dense forest area, and waterfront area. The activities include outdoor yoga and making leaf mandalas. The results show that outdoor yoga has the best effect on reducing pulse and blood pressure and regulating emotions in open lawn area and waterfront area, followed by leaf mantras in waterfront area and outdoor yoga in dense forest area. However, both activities have no significant effect in low shrub area.

Keywords Outdoor activities, College student, Emotional regulation, Landscape environment
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Emotion is a stress response of a person to external stimuli. According to the different reactions caused by emotions, emotions can be divided into positive and negative emotions[1]. Positive emotions can not only reduce the risk of infectious diseases, and affect the condition, course, and mortality rate of noninfectious diseases[2]; but also face unexpected negative events in life with a better mindset, reduce an individual's sensitivity to the surrounding environment, and generate a sense of dullness. The ability to regulate emotions is the foundation of mental health, and the theory of environmental resilience suggests that landscapes have a healing effect in relieving negative states and promoting positive states. Research shows that outdoor activities in landscape environments can effectively improve the mental health level of participants[3-4]. Appropriate outdoor activities can significantly improve the emotional state of college students.

College students are a new force in the development of the country, but at the same time, they are also a vulnerable group in society. After major stress events occur, college students have lower tolerance and are more likely to show fear and anxiety than other groups of people[5]. The research by Chen Zhengyong[6] shows that horticultural activities, as an activity closely related to nature, can effectively alleviate the psychological pressure of college students and enhance their emotional state. This study found through comparative analysis that engaging in horticultural activities in environments with rich natural landscapes, such as gardens and forests, can more effectively improve people's mental health levels than engaging in these activities in artificial environments[6]. In addition, the research of Liu Siyuan et al.[7] further confirms that different types of natural environments have different positive effects on the emotions of college students.

Activities in the natural environment can make college students feel the beauty of nature, reduce stress and fatigue, and increase a sense of relaxation and calmness; and different landscape spaces in the natural environment provide different feelings for themselves[8]. There is a relative lack of research on the effects of different outdoor activities in different landscape environments, especially for the specific group of college students.

1 Materials and methods

1.1 Test site and participants

Clear and windless weather is chosen, and Changhong Park in Tianjin is used as the experimental site. 32 senior students from the east campus of Tianjin Agricultural University are selected, with a male to female ratio of approximately 1:2. The participants are physically and mentally healthy, without serious physical illnesses. Participants are required to voluntarily participate, actively cooperate with the measurement, refrain from vigorous exercise or consuming stimulating foods before the experiment, and maintain a relaxed and stable state.

1.2 Measurement indicators

1.2.1 Physiological indicators. Blood pressure and pulse, among which blood pressure includes two indicators: diastolic blood pressure and systolic blood pressure. The experiment uses an upper arm electronic blood pressure monitor as the measuring instrument, and the participants' blood pressures and pulses are measured once before entering the venue and once after leaving the venue to observe their physiological changes.

1.2.2 Psychological indicators. The experiment uses the College Student Positive and Negative Affect Scale (PANAS) to investigate the changes in participants' emotions before and after the activity. The scale is divided into two indicators: positive emotion and negative emotion. After the subjects complete the questionnaire, positive and negative emotion questions are scored separately, and the higher the score, the more obvious the corresponding emotion.

1.3 Test method

32 students participate in outdoor activities in different landscape environments. They are randomly assigned to four types of landscape areas: open lawn area, low shrub area, dense forest area, and waterfront area, with 8 people in each area. Participants in each area engage in two activities: outdoor yoga and making leaf mandalas. Outdoor yoga is conducted collectively in the designated area following the leader's exercise. The yoga activity lasts for 20 min, and the leaf mandala involves members of the group working together to collect leaves and create the desired pattern for the group. The indicators are measured before entering the venue and after leaving the venue after the activity. The indicators are measured before and after each activity. Each participant needs to undergo three pre- and post-tests. Instruments are used to measure the participants' heart rate and blood pressure, as well as PANAS is used for pre- and post-tests

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(Table 1).

1.4 Data processing

The experimental data are processed using SPSS 27.0 software. Firstly, a normality test is conducted on the sample data (N<30) in each region until the significance P of the obtained data is greater than 0.05. Then, paired sample t-test is used to test the pre- and post-test data of diastolic blood pressure, systolic blood pressure, pulse, positive emotion, and negative emotion to analyze the impact of outdoor activities on physiological and psychological indicators. Using one-way analysis of variance, the differences in the impact of outdoor activities on various indicators in different environments are compared, and then the combination of environment and activity is compared using the same method to select landscape environments that can achieve better results when combines with outdoor activities.

2 Results and analysis

2.1 Impacts of outdoor activities on physiological indicators in different landscape environments

Paired sample t-test is conducted on the pulse and blood pressure pre- and post-test data of participants under 8 combinations of landscape and activity, and the different combinations of landscape and outdoor activity are numbered (Table 2).

According to Table 2, after outdoor yoga in an open lawn area, the subjects' pulse extremely significantly decreases, and diastolic blood pressure significantly decreases. After outdoor yoga in the waterfront area, the subjects' pulse and diastolic blood pressure extremely significantly decrease, while their systolic blood pressure significantly decreases. After outdoor yoga in low shrub and dense forest areas, the changes in pulse, diastolic blood pressure, and systolic blood pressure are not significant. However, there are no significant changes in pulse, diastolic blood pressure, and systolic blood pressure in the four environments after making leaf mandalas.

Through univariate analysis of variance, different combinations of landscape environment–activity are compared. It is found that 8 landscape–activity combinations have a significant impact on the subjects' heart rate (P<0.001, P<0.05), while the differences in systolic blood pressure (P=0.377) and diastolic blood pressure (P=0.128) are not significant. There is significant difference in the impact on heart rate between outdoor yoga in an open lawn area and landscape–activity combinations other than outdoor yoga in dense forest area, outdoor yoga in waterfront area, and leaf mandala in waterfront area. There is significant difference in the impact on students' heart rate between outdoor yoga in a waterside area and leaf mandala in a low shrub area (P<0.05). The analysis results are shown in Table 3.

2.2 Impact of outdoor activities on psychological indicators in different landscape environments

Paired sample t-tests are conducted on the pre- and post-test data of positive and negative emotions of participants under 8 combinations of landscape and activity.

According to Table 4, the results show that the positive emotion is significantly increased after outdoor yoga in an open lawn area, while the positive and negative emotions do not change significantly after practicing leaf mandala. After practicing outdoor yoga in a dense forest area, negative emotion is significantly decreased, while there is no significant change in positive and negative emotions after practicing leaf mandala. After outdoor yoga in the waterfront area, positive emotion is significantly increased, and negative emotion is significantly decreased. After practicing leaf mandala, negative emotion is significantly decreased. After completing two activities in the low shrub area, there is no significant change in both positive and negative emotions (Table 4).

Further comparison of different landscape environment–activity combinations through univariate analysis of variance reveals that the eight landscape environment–activity combinations have no significant difference in the degree of change in subjects' positive emotions (P=0.486) and negative emotions (P=0.310) before and after measurement (P>0.05).

3 Discussion

3.1 Impact of outdoor activities on physiological and psychological indicators of college students

Related studies have shown that outdoor activities can comprehensively meet the participants' goals: sports participation, improving their physical and mental health, sports skills, social adaptability, and other aspects, especially adjusting their physical and mental health[9].

In addition, when people engage in outdoor gardening activities, an environment that can alleviate their tension and provide a sense of warmth and security is created. It can encourage them to express their traumatic experiences and

Table 1 Landscape area allocation and activity content

Group	Landscape type	Activity content
A	Open lawn area	Outdoor yoga
B		Leaf mandala
C	Low shrub area	Outdoor yoga
D		Leaf mandala
E	Dense forest area	Outdoor yoga
F		Leaf mandala
G	Waterfront area	Outdoor yoga
H		Leaf mandala

Table 2 Paired sample *t*–test results for measuring pulse, systolic blood pressure, and diastolic blood pressure before and after outdoor activities (n=8)

Group	Pre-test of pulse	Post-test of pulse	P value	Pre-test of systolic blood pressure	Post-test of systolic blood pressure	P value	Pre-test of diastolic pressure	Post-test of diastolic pressure	P value
A	79.25±1.172	74.75±1.752	0.001**	121.12±4.452	118.50±2.621	0.143	79.63±2.441	75.00±2.766	0.029*
B	81.25±2.504	82.00±2.030	0.584	120.38±3.149	120.62±0.159	0.685	75.63±2.364	75.50±2.154	0.732
C	83.38±2.439	82.88±0.888	0.573	119.63±1.361	119.75±0.349	0934	77.00±2.333	77.50±23.748	0.590
D	78.75±2.898	79.75±2.306	0.240	118.13±2.489	118.38±0.452	0.833	77.63±2.578	77.88±0.127	0.790
E	77.00±2.655	76.00±2.301	0.121	119.38±2.481	118.75±2.487	0.448	77.13±2.366	77.00±1.457	0.890
F	77.25±1.384	76.88±1.681	0.623	121.63±2.357	121.00±2.159	0.279	76.00±1.475	75.88±2.553	0.862
G	80.75±2.461	77.75±2.364	0.006**	121.88±1.487	119.75±2.357	0.042*	78.50±1.778	76.38±2.658	0.018**
H	84.38±2.354	83.13±1.364	0.060	120.75±2.988	119.75±1.681	0.252	79.50±2.670	78.50±1.366	0.121

Note: * shows P<0.05, and there are significant differences between data; ** shows P<0.01, and the difference between data is extremely significant.

emotions directly or indirectly, thereby gaining support and affirmation from others. This is beneficial for people to vent negative emotions, release stress, and promote a shift towards a positive mindset[10]. After analyzing the data from this experiment, the results are consistent with previous research findings. It can lower blood pressure and pulse, and relieve stress and emotions by engaging in outdoor activities.

The decrease in pulse and the regulation of positive and negative emotions have become more significant, indicating that outdoor activities combined with the natural landscape environment of the park can play the greatest role in activities. This is because the natural landscape of the park is mostly constructed with water, rocks, and green plants, which can better relieve people's stress and improve their physical and mental health under the stimulation of nature on people's senses.

3.2 Impact of outdoor activities on physiological and psychological indicators of college students in different landscape environments

After previous studies by scholars, the following description has been derived: emotion is a pattern related to the environment, which responds to events by organizing important and stimulating adaptive responses for the survival and well-being of organisms[11]. Due to viewing or experiencing the environment, the public may experience changes in emotions, which is an emotional response. So there is a certain correlation between emotional changes and the surrounding environment.

Engaging in outdoor activities in the waterfront area not only significantly reduces the subjects' pulse, but also significantly increases their positive emotions and significantly reduces their negative emotions. It is preliminarily believed that engaging in outdoor activities under the waterfront landscape is more conducive to achieving the effect of relieving emotions. In contrast, although outdoor activities in dense forest area have the effect of reducing negative emotions, there is a significant difference in the indicator of pulse reduction compared to the other three landscape environments. Additionally, the pulse of the participants is significantly decreased, and their positive emotions are significantly increased while engaging in activities on open lawns. It is speculated that for lawn and waterfront areas, the surrounding space is larger and the view is wider, making it easier for people to relax.

There are studies showing that pond like water landscapes can bring greater relaxation to people, and this type of water landscape does not provide many auditory stimuli that make subjects alert. For example, the lack of water sound in ponds in parks makes it easier for people to achieve a relaxing effect physiologically[12]. Moreover, larger water bodies can stimulate positive emotions, while higher green vision can increase people's fear of the natural environment and instead increase their negative emotions[13].

For low shrub area, different types of green plants in the landscape have a greater visual impact, and green vision rate is higher, which is also the reason why outdoor activities in low shrub area do not significantly reduce negative emotions among participants.

3.3 Comparing the effects of different combinations of landscape and activity on the emotional impact of college students

Yoga mainly improves the physical and mental health of practitioners through the improvement of breathing, the mastery of balance, and the persistence of perseverance, thereby improving negative emotions both mentally and psychologically. Research has shown that practicing yoga should be done in a quiet, well ventilated, moderately humid, and minimally disturbed environment, such as the seaside, lakeside, or forest. An open and fresh air environment allows yoga practitioners to appreciate the power of nature, while a quiet environment allows yoga practitioners to concentrate better[10]. The results of this experiment are similar to those of the study. Yoga has a significant effect on regulating the emotions of college students in open lawn area, dense forest area, and waterfront area.

The effect of leaf mandala on reducing pulse and blood pressure, as well as regulating positive and negative emotions, is not very significant in any landscape environment. Only after the activity is carried out in the waterfront area, do the negative emotions of the subjects significantly decrease. It is considered that the landscape in the waterfront area itself has the effect of reducing negative emotions. Therefore, it can be inferred that both outdoor activities have the effect of reducing pulse and negative emotions in different environments. In contrast, outdoor yoga is more suitable for lawn and

Table 3 Multiple comparisons of physiological indicators for 8 landscape–activity combinations

Group	Landscape type	Activity type	Mean difference between pre- and post-test pulse	Mean difference between pre- and post-test systolic blood pressure	Mean difference between pre- and post-test diastolic blood pressure
A	Open lawn area	Outdoor yoga	4.50 a	2.63 a	1.63 a
B		Leaf mandala	−0.75 bc	−0.25 a	0.13 a
C	Low shrub area	Outdoor yoga	0.50 bc	−0.13 a	−0.50 a
D		Leaf mandala	−1.00 b	−0.25 a	−0.25 a
E	Dense forest area	Outdoor yoga	1.00 ab	0.63 a	0.13 a
F		Leaf mandala	0.38 bc	0.63 a	0.13 a
G	Waterfront area	Outdoor yoga	3.00 ac	2.13 a	2.13 a
H		Leaf mandala	1.25 abd	1.00 a	1.00 a

Note: If there is a same lowercase letter behind the average difference between pre- and post-test, it indicates that the difference is not significant. If there is no same lowercase letter, it indicates that the difference is significant.

Table 4 Paired sample *t*–test results of positive and negative emotions before and after a single outdoor activity (*n*=8)

Group	Pre-test of positive emotions	Post-test of positive emotions	*P* value	Pre-test of negative emotions	Post-test of negative emotions	*P* value
A	29.63±2.318	33.50±0.322	0.007**	26.63±0.235	26.87±2.356	0.850
B	32.63±1.360	34.63±1.348	0.255	25.37±1.240	25.50±1.232	0.936
C	28.88±1.548	30.50±1.431	0.292	27.13±1.654	27.38±0.369	0.794
D	30.23±1.665	30.63±1.578	1.426	27.12±2.107	28.25±0.988	0.344
E	31.75±2.484	35.00±1.020	0.058	26.50±2.354	26.00±0.203	0.031*
F	30.63±1.557	31.87±1.365	0.548	26.50±1.357	26.25±0.240	0.826
G	30.13±2.500	34.75±2.609	0.017*	22.62±0.357	21.12±0.345	0.020*
H	31.87±1.320	33.75±0.247	0.260	25.75±0.350	24.37±0.751	0.045*

Note: * shows $P<0.05$, and there is significant difference between data; ** shows $P<0.01$, and the difference between data is extremely significant.

(To be continued in P69)

conservation, reasonable utilization of land resources, respect natural terrains and waters, and avoid large-scale land deterioration. The already-polluted natural environment should be improved through ecological restoration. In the renovation of buildings, energy-saving technology, renewable energies and environment-friendly materials can be more applied to reduce the energy consumption. Moreover, the health-care facilities, water and power facilities of the villages should be improved to make the villagers' life more convenient. Education and propaganda activities should be organized to enhance the villagers' environment protection consciousness, the villagers encouraged to engage in the environment conservation. The village renovation must adhere to the road of sustainable development, target at the long-term development, and avoid the irreversible destruction to rural ecological environment because of the pursuit for short-term benefits.

5 Conclusions

Through the researches on postmodernism and analysis on the cases of traditional village renovation, the study put forward strategies of renovating traditional villages based on postmodernism in view of the problems of traditional villages. The strategies stressed inheriting and innovating unique cultures of the traditional villages, paid attention to villagers' needs, and focused on the sustainable development of villages. However, limited study cases could not reflect the application of postmodernism in the renovation of traditional villages comprehensively. The study aimed to improve the ecological environment of traditional villages using these strategies, inherit cultural contexts of the villages, and show the unique beauty of these villages.

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waterfront landscapes.

When designing university campuses, more attention should be paid to the setting of water landscape and waterfront activity areas. In addition, the coverage of green plants in the activity areas should be reduced to lower people's green vision rate, which can help people engaging in outdoor activities in the park better release stress and regulate emotional states. In addition, these different environmental landscapes also provide residents with spaces for social activities, opportunities for leisure and recreation, habitats for natural species, and maintain biodiversity.

4 Conclusions

Outdoor yoga in open lawn area and waterfront area has the best effect on reducing pulse and blood pressure and regulating emotions. Additionally, leaf mandala in waterfront area and outdoor activities in lawn area and waterfront area can significantly reduce the pulse of college students, and these two landscape areas have a significant effect on reducing negative emotions. The waterfront area not only has a regulatory effect on negative emotions, but also has a significant impact on the improvement of positive emotions. Low shrub area can significantly reduce the diastolic blood pressure of college students, while dense forest area can significantly reduce their negative emotions. Outdoor yoga in dense forest area has a significant effect on reducing negative emotions, while both activities have no significant effect in low shrub area.

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