Impact of Restorative Environment on State Anxiety and Cognitive Control in College Students

Xiaokang Lin[1,a], Xiwen Yuan[2,b], Shu Xu[1,c,*]

[1]Guangzhou Huashang College, Guangzhou, Guangdong, 511300, China
[2]Guangzhou Songtian Polytechnic College, Guangzhou, Guangdong, 511370, China
[a]744599537@qq.com, [b]1952915349@qq.com, [c]xushu@gdhsc.edu.cn
[*]Corresponding author

Abstract: In order to explore the effect of restorative environment on college students' anxiety level and cognitive control level, 60 college students were selected as subjects in this study and randomly divided into experimental and control groups, with the experimental group watching the restorative environment video and the control group watching the urban environment video. The state anxiety of the subjects was evoked through the fear trauma movie paradigm, and the State Anxiety Scale and Stroop task were used to measure the state anxiety level and cognitive control level of the subjects, and both were assessed before and after watching the video. The results found that subjects' state anxiety levels decreased significantly and cognitive control levels increased significantly after watching the restorative environment video. There was no significant change in subjects' state anxiety levels and cognitive control levels after watching the urban environment video. These results suggest that restorative environments have a significant impact on alleviating college students' anxiety as well as improving cognitive control.

1. Introduction

With the intensification of social competition and the increase of future employment pressure, more and more college students are experiencing anxiety problems. A survey shows that the level of anxiety among college students has been on the rise in recent years. The detection rate of anxiety among college students in China is as high as 21.51% [1], and anxiety has become a high-frequency and major issue among many current mental sub health problems. Long-term anxiety may lead to learning difficulties, cognitive impairment, and even an increased risk of suicide [2-4]. Therefore, exploring effective methods to alleviate anxiety among college students is of great significance.

The Restorative Environment Theory was proposed by Kaplan and Talbot [5], which suggests that the natural environment can improve mental health by providing psychological rest and restoring cognitive resources. Numerous studies have shown that elements in the natural environment, such as green spaces and natural light, can significantly reduce anxiety and stress levels [6-8]. In addition, Berman et al. [9] compared the restorative effects of urban and natural environments on individual cognitive function. It was found that compared to urban environments, natural environments can

significantly improve an individual's cognitive function and emotional state. However, there is still limited empirical research on the impact of restorative environments on anxiety among college students.

This study aims to explore whether watching restorative environment videos can effectively reduce anxiety levels in college students and improve their cognitive control abilities. This study adopted a single-factor intergroup experimental design. After inducing anxiety states in participants through video, the participants were randomly divided into an experimental group and a control group. The experimental group watched restorative environment videos, while the control group watched neutral urban environment videos. State anxiety levels and cognitive control abilities were measured before and after watching the videos.

2. Methods

2.1 Participants

This study recruited 60 undergraduate students from a certain higher education institution in Guangzhou, with an average age of 18.89 ± 0.76 years old. All are undergraduate students in school. All participants had no significant mental health issues and signed informed consent forms prior to the experiment. The subjects were randomly divided into an experimental group and a control group, with 30 people in each group.

2.2 Materials

Previous studies have confirmed that the fear-trauma film paradigm can effectively induce state anxiety in participants [10,11]. Referring to previous research [12], a traffic accident scene from the movie *Death Comes* was selected as the material to induce anxiety in the participants, lasting for 5 minutes.

Select the State Trait Anxiety Inventory (STAI) section [13] to measure the current level of anxiety among participants. This scale consists of 20 items, each rated on a 4-level scale (1=none, 4=very severe). The higher the score, the higher the level of anxiety. The Cronbach's alpha coefficient of this scale is 0.82.

The video materials include restorative environment videos and urban environment videos. Restorative environment video includes natural landscapes such as forests, streams, lakes, and green spaces, with a duration of 10 minutes. The video content includes calm natural sounds such as bird songs, water currents, and wind sounds, aiming to simulate a realistic natural environment experience. Urban environment video includes city streets, traffic, buildings, and pedestrians, with a duration of 10 minutes. The video content includes urban noise, such as the sound of vehicle horns, pedestrian conversations, and construction noise.

Select the Stroop task to evaluate the cognitive control ability of the subjects [14,15]. This study selected "yellow", "blue", "green", and "red" characters written in four colors as Stroop stimuli, with a total of 16 types. The experiment is divided into two conditions. One is the consistency condition, which means that the meaning of the target word is consistent with the font color of the target word (such as green "green". The other is the inconsistency condition, which means that the meaning of the target word is inconsistent with the font color of the target word (such as green "red"). The difference between the average reaction time of the participants to the inconsistent test and the average reaction time of the consistent test is the level of cognitive control, and the lower the score, the higher the level of cognitive control.

The experiment used E-prime3.0 software to develop Stroop tasks. This task contains 160 trials, of which 20 are consistent in red, yellow, blue, and green, and 20 are inconsistent. Firstly, a white

fixation point "+" is presented in the center of the screen for 500ms. Then, 16 different color word images are presented in the center of the screen for 2000ms. Participants are required to eliminate interference from the meaning of the target word and quickly and accurately determine the font color of the target word. Press the "1" key in red, press the "2" key in blue, press the "3" key in yellow, and press the "4" key in green. If the subject fails to make a corresponding judgment within the specified time, it will automatically enter the next trial. Before entering the formal experiment, 16 practice tests need to be completed.

2.3 Experimental Process

After the participants entered the laboratory, they signed an informed consent form, and then the main subject explained the experimental purpose and tasks to them to ensure that they understand the experimental process. The experimental process was divided into four stages. Induction stage: Before the start of the experiment, the subjects were given 5 minutes to adjust their sitting posture and equipment. They can choose to sit still, close their eyes to rest, or deep breathing training to ensure that the subjects are in a quiet and relaxed state before watching the video. Next, watch a 5-minute anxiety inducing video. Pre-test: After watching the video, participants completed the State Anxiety Scale and Stroop task. Intervention: After completing anxiety assessment and cognitive control level assessment, the subjects were randomly divided into an experimental group and a control group. The experimental group watched restorative environment videos, while the control group watched urban environment videos for 10 minutes each. Post-test: After watching the corresponding video, the subjects then completed the State Anxiety Scale and Stroop task.

3. Results

3.1 Test for Differences in State Anxiety Scores between Two Groups of Participants

After inducing the fear-trauma movie paradigm, both groups of participants completed the state anxiety scale. In the pre-test stage, independent sample t-test showed that there was no significant difference between the experimental group's state anxiety score (M=2.14, SD=0.28) and the control group's state anxiety score (M=2.18, SD=0.26), t (58) =-0.473, p=0.638.

In the post-test stage, two groups of participants rated their state anxiety again after watching the corresponding intervention videos. Independent sample t-test showed that the state anxiety score of the experimental group (M=1.82, SD=0.30) was significantly lower than that of the control group (M=2.07, SD=0.22), t (58) =-3.692, p<. 001).

In addition, after watching the corresponding intervention videos, paired sample t-tests were conducted on the state anxiety scores of the pre-test and post-test of the two groups of subjects. The results showed that the state anxiety scores of the experimental group were significantly reduced, t (29) =4.602, p<. 001, while there was no significant difference in the state anxiety scores of the control group before and after watching the corresponding intervention videos, t (29) =2.003, p=0.055. The results showed that watching restorative environment videos could significantly reduce the level of state anxiety of the subjects.

3.2 Differences in Cognitive Control between Two Groups of Participants

Paired sample t-tests were used to test the differences in cognitive control between two groups of participants before and after watching the corresponding intervention videos. The test results are shown in Table 1. After watching the corresponding intervention video, the cognitive control level of the experimental group significantly improved, with t (29) =3.251, p<. 01. There was no Table

1significant difference in the cognitive control level of the control group before and after watching the intervention video, with t (29) =-0.134, p=0.894. The results showed that watching the restorative environment video could significantly enhance the cognitive control level of the subjects.

Table 1: Differences in cognitive control levels before and after testing in groups

Group	N	Cognitive control pre-test	Cognitive control post-test	t	p
Experimental group	30	90.99(54.26)	58.47(48.20)	3.251	0.003
Control group	30	66.38(45.18)	67.46(51.44)	-0.134	0.894

4. Discussion

This study supports the theory of restorative environment, which effectively reduces anxiety levels and improves cognitive control abilities among college students by watching restorative environment videos. The research results indicate that there is no significant difference between the experimental group and the control group in inducing state anxiety. After watching the corresponding intervention videos, the post-test state anxiety level of the experimental group is significantly lower than the pre-test state anxiety level. There is no significant difference in the pre-test and post-test state anxiety level of the control group, which is consistent with previous research results [16, 17]. Compared to urban environments, natural environments are more effective in reducing anxiety levels among participants [18]. The natural environment can help individuals better regulate their emotional state by reducing negative emotions and enhancing positive emotions [19]. Mizumoto et al. [20] found that viewing natural environment images has a positive effect on alleviating anxiety. In addition, Bratman et al. [6] found that briefly experiencing the natural environment can reduce activation of the anterior cingulate cortex, thereby lowering anxiety levels. This indicates that the natural environment can alleviate anxiety by influencing the emotional regulation regions of the brain. Elements in the natural environment, such as green plants and the sound of flowing water, can create a peaceful and harmonious atmosphere for individuals, reduce external stimuli, help individuals relax, and thus alleviate anxiety [20, 21].

In addition, this study also found that watching restorative environment videos can improve the cognitive control level of participants. The research results indicate that after watching restorative environment videos, the cognitive control post-test score of the experimental group was significantly lower than the cognitive control pre-test score, indicating a significant improvement in cognitive control level. After watching the urban environment video, there was no significant difference in the cognitive control post-test scores and cognitive control pre-test scores between the control group, which is consistent with previous research results [9]. Compared to urban environments, natural environments help to restore cognitive resources and enhance cognitive control abilities. Berg et al. [22] also used horror movies to deplete individuals' emotional and cognitive resources, and found that the natural environment not only alleviated their anxiety and stress states, but also promoted the recovery of cognitive resources. As a relatively passive intervention method, the natural environment does not require a significant amount of cognitive resources to suppress the interference of irrelevant information, allowing individuals to experience it freely. Immersion in this situation can help individuals relax and have a positive impact on the recovery of cognitive resources [23].

5. Conclusion

This study verified the positive effects of restorative environment on anxiety levels and cognitive

control abilities of college students through experiments. The results indicate that watching restorative environment videos can significantly reduce anxiety levels and improve cognitive control abilities.

Acknowledgements

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