Cranial Nerve Feedback Mechanism of Adolescents Practicing Classical Ballet and Their Psychological Health

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Abstract
Reverse psychology is commonplace among adolescents, who undergo rapid changes both physically and psychologically. This paper proposes to improve the psychological health of adolescents through classic ballet training, and analyzes the cranial nerve feedback mechanism of classical ballet in relieving the reverse psychology and rebellious behavior of adolescents. The analysis was carried out through a comparative experiment, using the Positive and Negative Affect Schedule (PANAS) and electroencephalogram (EEG) signals. The results show that classical ballet with slow and soothing rhythms can effectively stabilize the emotion of adolescents, strengthen their psychological health, and enhance their ability to control behavior. On the cranial nerve mechanism, the soothing-type classical ballet makes the EEG trends similar across different regions in the brain. In this way, the adolescents can control their emotions and behaviors, reducing the emergence of reverse psychology.

Key words: Classical Ballet, Adolescent Psychology, Rebel Psychology, Nerve Feedback Mechanism.

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INTRODUCTION
Adolescent stage is an important period for the development of mankind, it is between the childhood and the adulthood (Dosamantes-Beaudry, 1999). Adolescent stage is a period in which the human body and psychology change fastest, and the characteristics of unbalanced physical and psychological development are quite prominent (Van Puyvelde, Rodrigues, Loots et al., 2014). For most people, one of the phenomena that one must face during the adolescence is the rebel psychology and rebellious behaviors. Studies have shown that the main characteristics of adolescents’ rebel psychology include increased independence, severe emotional polarization, transitional and premature mentality, and impulsive behavior, etc. (Varon & Riley, 1999). The vast majority of adolescents can successfully survive the rebellious period, have fully mature mentality and establish a correct outlook on life and values. However, the rebel psychology of a few adolescents has not been well resolved, and their psychological characteristics of the rebellious period have not matured with the maturity of the body. In such case, the psychological problems of adolescents transform into adult psychological problems which would accompany their whole life and become a serious social problem.

According to the research results of modern psychology, the rebel psychology of adolescents does not disappear naturally, and the correct guidance and psychological counseling can effectively alleviate rebel psychology (Weiss, 2016). These psychological counseling methods include chatting, approaching nature, and psychotherapy. Many studies in recent years have shown that ballet has a good effect on soothing emotions and regulating psychological state (Koch, Mehl, Sobanski et al., 2015). Many Western scholars have applied Western ballet to
the study of emotion regulation and healthy psychology cultivation, and proved the effectiveness of the ballet method (Meyler, Stimpson, & Peek, 2007). However, few scholars have introduced the ballet method into their research on adolescents' rebel psychology, also few scholars have studied the influence of classical ballet on shaping healthy psychology with Chinese classical ballet as the research object. In this context, this paper takes Chinese classical ballet as the starting point to study whether classical ballet can alleviate the symptoms related to adolescents' rebel psychology and shape the healthy psychology of adolescents. The relevant conclusions of this paper are of high reference value for solving the psychological problems of adolescents' rebellious period.

**BALLE T THERAPY AND HEALTHY PSYCHOLOGY SHAPING**

Many studies have pointed out that ballet can play a key role in shaping human psychology. Different styles of ballet can shape people with different personalities and affect their psychological state. For example, some scholars have focused on the effects of heavy metal ballet on human personality and psychology and found that people who have watched heavy metal ballet for long time would act more actively and more provocatively, they tend to take radical actions when encountering situations (Baxter & Porter-Armstrong, 2012; Kuys & Fleming, 2016). Other studies have shown that soothing ballet can make people's emotions more relaxed and stable, and their psychological condition is better (Pilkington & Malinowski, 2002; Carmel-Gifilen, 2011). In response to the conclusions of these empirical studies, some scholars have designed experiments to explore the specific mechanisms, and found that ballet is related to both the internal and the external factors of people's emotion and psychology shaping. Internal factors include people's age level, personality characteristics, etc., and the external factors include the characteristics of ballet, etc. Different ballet regulates and influences psychology mainly by affecting the human's nerve reflex, namely the fluctuation of brain waves.

From the perspective of research methods, the research of ballet’s influence on psychology in recent years bases not only on psychological questionnaires, but also on the use of neural feedback and brain electrical activity principles (Peacock, Richardson, Carter et al., 2007). The research methods include functional magnetic resonance imaging (fMRI), positron emission tomography (PET), transcranial magnetic stimulation (TMS) and other brain imaging tools, as well as the event-related potential (ERP) and the electroencephalography (EEG) (Mcgarry & Aubeeluck, 2013). This paper mainly uses electroencephalogram (EEG) as the main research method to study the neurofeedback mechanism for the influence of classical ballet on the psychological health of adolescents. The most important experimental tool is a 64-channel EEG cap. The main detection positions are 1-3 and 1-5 shown in the figure below.

![Figure 1. Experiment apparatus](image)

**RESEARCH DESIGN**

**Research object selection**

The subjects of this paper are junior school students from three schools in Beijing, all subjects are adolescents aged between 12 and 15. Before selecting the subjects, the experimental team introduced the purpose of the experiment to the school teachers and the parents of the students, and emphasized that there’s no risk factor in the experiment process. In the subsequent voluntary registration, a total of 106 applications were collected, after screening, 98 adolescents had met the experimental requirements. During the experiment, we randomly divided all the
subjects into three groups, and the number of subjects in each group was 33, 32 and 33 respectively. Before the experiment, we tested the basic situation of the three groups of subjects, and the results showed that they met the experimental requirements. In addition, the psychological survey of the subjects shows that the vast majority of adolescents have rebellious psychological symptoms.

**Experimental steps**

The purpose of this paper is to explore the influence of classical ballet on the psychological health development of adolescents, especially to explore the influence of classical ballet on relieving the rebel psychology of adolescents. Considering that classical ballet also has different styles and characteristics, this paper chose two well-known classical ballet performances for the tests, namely the "Swan Lake" and the "Sleeping Beauty". Wherein, "Swan Lake" represents the soothing and slow beat classical ballet, while "Sleeping Beauty" represents the fast beat classical ballet.

The experimental period lasted for 6 months. Within the experimental period, the subjects watched classical ballet at a fixed time each week, and took the psychological state test once a month. Among them, group A subjects watched the "Swan Lake", and the group B subjects watched the "Sleeping Beauty", group C is the control group so they did not watch any ballet performance. The test results were recorded and statistically analyzed. The main logical framework of this paper is Figure 2.

**Observation indicators**

There are two observation indicators in this experiment, one is the Positive & Negative Affect Schedule (PANAS), and the other is EEG. The role of PANAS is to directly collect changes in the factors of adolescents' rebel psychology during the experiment period (Johnson et al., 2015; Storvoll & Wichstrøm, 2003), which has a good predictive effect on adolescent behavior. The purpose of EEG is to explore the neurofeedback mechanism for the influence of classical ballet on the adolescents’ healthy psychology development. The test positions of the EEG have been described above, including two positions 1-3 and 1-5. When the EEG fluctuation trends of the two positions are similar, it indicates that the subject’s emotion is relatively stable, and his/her cognition and self-control abilities are relatively good (Jankowski, 2013). When the EEG fluctuation trends of the two positions are not similar, it indicates that the subject’s emotion is fluctuant, and his/her cognition and self-control abilities are relatively weak (Fontaine et al., 2014).

**EXPERIMENTAL RESULTS AND DISCUSSION**

**PANAS**

The above figure shows the PANAS scores of the three subject groups. The scores were recorded once every month, and recorded 6 times in all. Among the 6 times PANAS scores,
the average scores of group A subjects were 71, 75, 72, 74, 70, and 72, respectively. It can be seen that the score of group A does not show a very significant increase or decrease, and basically fluctuated around 72 points. The average scores of the B group were 69, 73, 78, 80, 82, and 86 points, respectively. It can be seen that the average score of group B shows a relatively significant upward trend, rising from 69 points to 86 points. In PANAS, scores of more than 85 points are a direct proof of healthy adolescent psychology. Among the 6 times PANAS scores, the average scores of group C subjects were 71, 72, 69, 68, 70, and 67, respectively. It can be seen that the average score of the group C shows a slight decline, although the trend of this decline is not very obvious.

As mentioned above, the ballet performed for group A subjects is the fast beat classical ballet "Swan Lake"; the ballet performed for group B subjects is the slow beat classical ballet "Sleeping Beauty", and the group C subjects had not watch any ballet performance in the experiment. In addition, according to the relevant scoring rules of PANAS, higher scores indicate more stable emotion and better psychological state; scores of more than 85 points indicate that the psychological state has reached a good standard, while scores below 60 are considered to be not qualified. Judging from the above experimental results, the classical ballet "Sleeping Beauty" has effectively eased the subjects' emotion within the training period, and the psychological status of the group B subjects is better. There is no significant improvement in the psychological status of the subjects in group A and group C.

**EEG**

As mentioned above, whether the EEG fluctuation trends of different regions are similar is an important cranial nerve basis for demonstrating stable emotion and healthy psychological state. The higher the synchrony degree of the EEG, the more stable the emotion and the better the psychological health. The lower the synchrony degree of the EEG, the
worse the emotional stability, and the worse the psychological health status. The EEG data collection time is 6-month after the end of the experiment.

**Figure 4. EGG of group A**

![Graph showing EGG of group A](image)

**Figure 5. EGG of group B**

![Graph showing EGG of group B](image)

**Figure 6. EGG of group C**

![Graph showing EGG of group C](image)

The above figure shows the average fluctuations in the EGG of group A subjects. The EEG collection points include two points, 1-3 and 1-5. It can be seen from the figure that, for the group A subjects, the fluctuations in the EEG of the 1-3 and 1-5 points have certain similarities in the trends, but they are not very obvious. During some time periods, the two EEG curves rise or fall simultaneously; while during other time periods, the two EEG curves run toward opposite directions. We continue to quantify the trend synchrony degree of EEG at the two positions 1-3 and 1-5 using statistical methods. Non-parametric estimation shows that the trend similarity between the two sets of data is not significant (P>0.05), which basically confirms our previous judgment. There is no significant trend similarity between 1-3 and 1-5 EEGs, indicating that after the fast beat classical ballet experiment, the emotion and psychological status of group A subjects did not show significant improvement, and their self-control ability and cognitive ability did not change much, which means that the fast beat classical ballet does not have a significant improvement effect on the rebel psychology of adolescents.

The above figure shows the average fluctuations in the EGG of group B subjects. It can be seen from the figure that, for the group B subjects, the fluctuations in the EEG of the 1-3 and 1-5 two points have a very similar trend, the two rise and fall at almost the same time. We continue to quantify the trend synchrony degree of EEG at the two positions 1-3 and 1-5 using statistical methods. Non-parametric estimation shows that the trend similarity between the two sets of data is significant (P<0.05), which basically confirms our previous judgment. There was a significant trend similarity between 1-3 and 1-5 EEGs, indicating that after the slow beat classical ballet experiment, the emotion and psychological status of group B subjects had improved significantly, their self-control ability and cognitive ability did not change significantly. The slow beat classical ballet has a significant improvement effect on the rebel psychology of adolescents. Actually, the EEG experiment results corresponded to the PANAS results. The PANAS scores of group B subjects increased with the progress of the experiment, which also shows that the emotional and psychological status of the adolescents has been improved.

The above figure shows the average fluctuations in the EGG of group C subjects. Group C is the control group in this experiment, and the experimental results of this group can be
used as a contrast to the experimental results of groups A and B, so that the experimental results are more scientific and reliable. It can be seen from the figure that, for the group C subjects, the EEG trend similarity of the two positions is not significant. Further non-parametric estimation shows that the two sets of data do not have trend similarity (P > 0.05). By comparing the experimental results of group A and group C we can see that, although the EEG trend similarity of group B is more obvious than that of group C, neither of them is statistically significant, therefore, it can be considered that the EEGs do not have significant trend similarity. In contrast, for group B subjects, the trend similarity of the EEG of the two positions is very obvious.

**RESEARCH CONCLUSIONS**

The rebel psychology that occurs extremely frequently in adolescents is a social issue that has received wide attention. Many studies have shown that ballet has a positive effect on regulating emotion and psychology. Based on this cognition, this paper designed a comparative experiment to study the effect of classical ballet on the cultivation of adolescents’ healthy psychology and the remission of rebel psychology. The main findings are as follows:

1. Judging from the PANAS scores, the soothing type classical ballet effectively improved the scores of adolescents, indicating that this kind of classical ballet has an obvious positive effect on soothing emotion and regulating psychology. Correspondingly, the classical ballet with faster rhythm does not show such function.

2. From EEG experiment results we can see that, the soothing classical ballet makes the EEG of different brain regions of the adolescents show higher trend similarity, which indicates that the adolescents’ emotion control ability, cognitive ability and behavior control ability are all stronger, their rebel psychology and the negative behaviors generated by the rebel psychology are significantly alleviated. Correspondingly, the classical ballet with faster rhythm does not show such function.

3. From the perspective of the cranial nerve feedback mechanism, the soothing-type classical ballet achieves the goal of relieving rebel psychology and rebellious behaviors by enhancing the trend similarity of the EEG fluctuations in different brain regions of adolescents.

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