

*A Quantitative and Qualitative Evaluation of a Growth Group Program for Empathy Training*

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The Asian Conference on Education 2023  
Official Conference Proceedings

**Abstract**

Empathy can be conceptualized as three components: cognitive capacity, emotional capacity, and expressive and communicative motive. A growth group program is designed to comprise these three components of empathy. Mu wave (8-13 Hz band) in human electroencephalography (EEG) is a signature of mirror neurons which involve in social functions such as empathy and theory of mind. This study aims to investigate whether a growth group can improve the performance and change the activity of the mirror neuron system. Among twenty-seven undergraduate students selected from a class of taking a general education course, fifteen students are randomly assigned to the experimental group to attend a growth group. Twelve students are randomly assigned to the control group to attend a regular psychology class. After ten times of meetings, both control and experimental groups receive the measures of an empathy scale and then EEG. Participants' feeling and thoughts after the meeting were recorded for a qualitative analysis. The results show that the experimental group performs better than the control group on the testing scores of empathy scale. Mu wave suppression measured from Cz electrode site is significantly larger in the experimental group compared to the control group, indicating that mirror neurons are more active under the condition of self-movement in the experimental group. The qualitative data show that participants feel more confident with using empathic skills in their daily life. The conclusion is that a growth group for empathy training can change the behavior and the brain to some extent.

Keywords: Empathy Training, Mu Wave, Mirror Neuron, Empathy Scale

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## **Introduction**

The mirror neuron system (MNS) was first found to be firing in the monkey's premotor cortex when the monkey performed action or observed others' action (Rizzolatti and Fadiga, 1998). The study further showed that the MNS was responsible for understanding the feelings and intentions underlying the observed action (Iacoboni et al., 2005). The human EEG mu wave (8-13 Hz band) suppression was a validated index of the MNS activity and modulated by the degrees of social interaction (Oberman et al., 2007). Some individuals with autism spectrum disorder showed not only the deficit of social interaction, but also the dysfunction of the mu wave suppression when they were observing the others' hand movements (Oberman et al., 2005). Cheng et al. (2009) also found that the degree of mu wave suppression was positively related with the empathic scores of interpersonal reactivity index. Moore et al. (2012) found that the mu wave suppression was related to the recognition of human facial emotions (including both positive and negative emotions). Braadbaart et al. (2014) found that the degree of the mu wave suppression was positively related to the degree of correctly imitating the others' facial expressions. Overall, the evidence mentioned above suggests that the MNS played an essential role for many social skills, such as facial emotion recognition and empathy.

Rogers (1957) defined empathy as: the ability to sense the client's private world as if it were your own, but without ever losing the 'as if' quality. According to Hoffman (1977, 1984) and Smith (2006), empathy can be conceptualized as three components: cognitive capacity, emotional capacity, and expressive and communicative motive. Cognitive capacity means that one can understand the other's inner (maybe hidden) thoughts from a perspective of the other. Emotional capacity means that one can sense the other's emotions and feelings from his/her words and body language, yet without one's own emotions getting bound up in it. The expressive and communicative motive means that one can sincerely respond to what one has understood and sensed and communicate with the other. Therefore, empathy can be cultivated by training and experiences for empathic practices. For example, Higgins (1990) and Long (1999) have shown that no matter college students or married adults can improve not only their empathic abilities but also interpersonal relationships after they participate in a growth group for ten hours. Overall, literature reviewed above indicate that empathy training can enhance the empathic abilities and seem to have a positive effect on the interpersonal behaviors. However, whether the empathy training can change the brain seem to remain unclear. This study aims to investigate whether empathy training can not only improve the knowledge and behavioral performance but also change the activity of the MNS.

## **Methods**

### ***Participants***

Among twenty-seven NCUE undergraduate students selected from a class of taking a general education course, fifteen students are randomly assigned to the experimental group to attend empathy training group for practicing emotional, cognitive and expressive empathy. Twelve students are randomly assigned to the control group to attend a regular class for learning the knowledge of general psychology.

### ***EEG Measurement***

Participants put on an electrode cap with 32 electrode channels connected to Neuroscan Synamps system. EEG (and EOG) data collection is performed in the following four conditions: (1) moving own hand, (2) watching a video of a moving hand, (3) watch a video of two bouncing balls, and (4) watch a video of visual white noise. In condition 2 and 3, the moving hand or ball is sometimes paused for about 2 seconds, and participants are asked to count the number of times when the hand or ball stops moving and report the number of stops to the experimenter at the end of the block. Each condition is performed for about 90 seconds. The reference electrodes are located on the earlobes of both ears. Vertical eye movements were recorded above and below the left eye. The recording position of horizontal eye movement is about 1 cm outside the corner of the eye. Electrodes and skin contact resistance are below 5k Ohm. Filter settings were high pass (0.01 Hz) and low pass (50 Hz). The sampling rate is 500 Hz.

### ***Empathy Measurement***

A Chinese version of the Interpersonal Reactivity Index (Andrew and Shek, 2002) is adopted to measure the behavioral performance of empathy. The empathy score is calculated from two subscales: perspective taking and empathic concern, made up of 11 items, each of which is answered on a 5-point Likert scale ranging from “Does not describe me well” (0 point) to “Describes me very well” (4 point). The higher score indicates a better performance, except for three items scored in reverse fashion.

### ***Procedure***

The experiment group participated once a week in a growth group described as the following: In week 1, the activity was called “who is who”. Every two group members introduced to each other and then introduced his/her partner to all. After this warm-up activity, each member chose two characteristic terms to describe self and the partner, then shared the difference between self-perception and what the partner has perceived. The purpose of week 1 meeting was to make each group member learn how to observe and give feedback to the other member.

In week 2, the activity was called “nonverbal perception”. Every two group members talk about a personal story to each other and then write down what had been talked about and what had been perceived in addition to words when the partner was talking. The purpose of week 2 meeting was to learn how to concentrate on verbal and nonverbal information when listening to the other.

In week 3, the activity was called “listening without looking”. Every two group members with eyes closed described one apple in a basket of apples to each other and then found out the special apple just described by the partner. The purpose of week 3 meeting was to learn about the difference in perspective of how people perceived a thing.

In week 4, the activity was called “a touching picture”. Every two group members together looked at a scenery picture and write down which part had touched the self while taking a guess what part had touched the partner. The purpose of week 4 meeting was to learn how to express own feelings and to sense the other’s feeling.

In week 5, the activity was called “sentence completion”. Each member finished a homework of sentence completion by using at least an emotional word, and then picked up a sentence and read out it with a tone matched to the emotional words. The purpose of week 5 meeting was to be aware of what kind of feeling was expressed in the words and sentence and give a genuine feedback.

In week 6, the activity was called “listening to body talking”. Each member kept his/her mind on the body and shared what had been felt about his/her body after the leader told each member to stretch out his/her hands and legs to a limit. The purpose of week 6 meeting was to be aware of information emitted from the body and learn how to express own feelings and sense the other’s feelings.

In week 7, the activity was called “what happened”. Every two group members talked to each other with the first words “what happened” and then the listener helped to clarify what was really happened by using the questions of who, how, when, where and what. The purpose of week 7 meeting was to learn how to clarify what had not been told yet during the conversation.

In week 8, the activity was called “role-playing”. The leader invited one member to share his/her negative interpersonal experience and then direct a drama about that experience. The other members played one role in the drama. The purpose of week 8 meeting was to learn how to sense the inner world of a role in the drama and communicate with the other actor.

In week 9, the activity was called “compassion meditation”. Each member breathed with mindfulness for three minutes and then meditated on someone who ever gave him/her unconditional love. Each member perceived self being loved and felt happiness and peacefulness that love brought. Finally, each member meditated on the partner and wished him/her happiness and peacefulness. The purpose of week 9 meeting was to feel compassion on self and the partner.

In week 10, the leader reviewed all activities and the special moments that each member had experienced. Each member shared thoughts and feelings of the group and made a wish that he/she would perform empathy in everyday life.

After ten times of meetings, both control and experimental groups received the measures of the Interpersonal Reactivity Index (Chinese version) and then EEG.

### ***EEG Analysis***

EEG was analyzed using a Neuroscan Synamps system (Scan 4.3). At first, EOG signals were deleted in each experimental condition. The fragments about 15 seconds from the beginning and to the end were also deleted to avoid alpha wave interference from the visual area. Data for each experimental case was combined, so there was approximately 2 minutes of data for each experimental condition. For every 2-second segment, fast Fourier transformation was used to calculate the power of the 8–13Hz bandwidth ( $\mu$  wave). Considering the individual differences in the absolute value of  $\mu$  wave power, the  $\mu$  power obtained in experimental condition 4 was used as the baseline. The ratio value was obtained from dividing the  $\mu$  power of each experimental situation by the baseline, and then did log conversion for final analysis. A negative value indicates  $\mu$  suppression. Larger negative values indicate greater suppression.

## Results

### A Quantitative Analysis

The results of Student's t test show that the experimental group performs ( $M = 30.4$ ,  $SD = 4.2$ ) better than the control group ( $M = 26.2$ ,  $SD = 4.6$ ) on the testing scores of empathy scale in the Interpersonal Reactivity Index,  $t(25) = 2.49$ ,  $p < 0.05$ . Mu wave suppression (shown in Table 1 and Figure 1) in experimental condition 1 measured from Cz electrode site is significantly larger in the experimental group compared to the control group,  $t(25) = 2.07$ ,  $p < 0.05$ , indicating that mirror neurons are more active under the condition of self-movement in the experimental group. However, mu wave suppression measured from C3 and C4 electrode sites is not significantly different between two groups,  $t(25) = 0.84$ ,  $p = 0.41$ ,  $t(25) = 1.57$ ,  $p = 0.13$ , respectively. The qualitative data show that participants feel more confident with using empathic skills in their daily life.

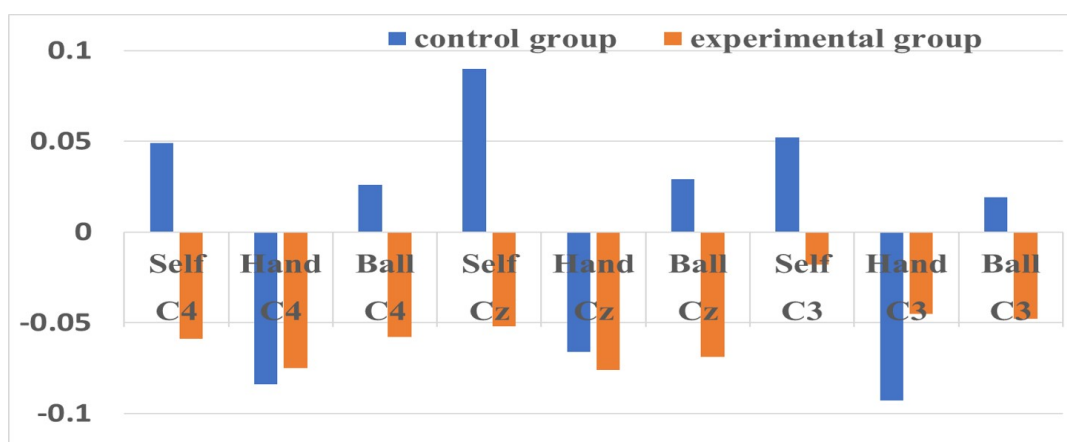


Figure 1. Mu suppression in control and experimental group. A negative value indicates mu suppression. Larger negative values indicate greater suppression. A symbol (\*) means a significant difference.

Table 1. Mu suppression in control and experimental group measured from three experimental conditions (moving own hand, watching a video of a moving hand, and watch a video of two bouncing balls) and three electrode sites (C4, Cz, and C3).

	Control group			Experimental group		
	Self	Hand	Ball	Self	Hand	Ball
C4	0.049	-0.084	0.026	-0.059	-0.075	-0.058
Cz	0.090	-0.066	0.029	-0.052	-0.076	-0.069
C3	0.052	-0.093	0.019	-0.018	-0.045	-0.048

## *A Qualitative Analysis*

According to data collected from the feedback of each participant during the growth group activity of each week, participants (coded as A through O) showed their cognitive and emotional empathy. For example, when D said that he was an introvert and liked reading and being alone, G responded, "I feel that D is a thinker, full of ideas, but may be just not good at showing them." When E observed that G kept her head down and silent for a long time, E said to G, "You look unhappy, do you want to talk about what happened?" When O talked about her story that she hated her younger brother because she felt that her brother stole my mother's love from me, F responded, "If I were you, I may feel the same as you.", and N responded, "it is just a feeling, neither your fault nor anybody else." In the last meeting, participants felt more confident with using empathic skills in their daily life. For example, participant D talked about his change:

*Before joining the growth group, I always feel that my interpersonal relationships are very poor and I have few friends. At the beginning of the group, I feel a little nervous and don't dare to express my opinion. About the second time, I hear C say to me: He can understand my uneasiness because he is also an introvert and is not good at expressing his inner thoughts and feelings. I suddenly felt a sense of acceptance and understanding. I gradually learn to be more attentive to the thoughts and feelings of other members when they shared. I also hope to bring that feeling of being understood to others.*

## **Conclusion**

After participating in ten meetings of a growth group designed for empathy training, the empathic performance in the experimental group on the Interpersonal Reactivity Index is significantly increased. At the same time, the MNS has become more activated in the experimental group. Therefore, the empathy training can change the behavior and the brain to some extent.

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