



# Effectiveness of humor training among adolescents with autism

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## ABSTRACT

Humor training has been applied to educational and clinical cases and has been found to be effective, but humor training for individuals with autism is relatively rare. The present study proposed a humor-knowledge and humor-skill training workshop to enhance the humor comprehension and appreciation of individuals with autism and examined the effects of the training. Participants were 20 adolescents with autism and average intelligence (above 70 in WAIS-III). They were randomly divided into experimental and control groups. Both questionnaire of joke comprehension and appreciation and a humor style questionnaire were used as instruments. The results supported the effectiveness of the 15-h training. The comprehension and appreciation of nonsense humor were significantly increased in the experimental group in comparison with the control group, although the incongruity-resolution jokes remained difficult to comprehend. The tendency to use affiliative humor was greater among individuals with autism in the experimental group, suggesting that the appreciation of humor can be learned.

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## 1. Introduction

Individuals with autism have difficulties with communication, social interaction, behaviors and learning due to their impaired neurodevelopmental function (American Psychiatric Association, 2013). They are also generally assumed to lack a sense of humor (Samson et al., 2013). Humor plays an important role in interpersonal relationships, resolving interpersonal conflict (Zand et al., 1999); therefore, the lack of a sense of humor might be one of the reasons that people with autism frustrated in social interaction. Previous studies have indicated that a sense of humor can be improved through training (Ziv, 1988; Nevo et al., 1998; Salameh, 2007). Humor training also has a positive influence on major depression and schizophrenia (Falkenberg et al., 2011; Cai et al., 2014). However, the condition of lacking a sense of humor differs among mental disorders. There is a positive correlation between melancholy trend and self-defeating humor (Martin et al., 2003), but there are no significant differences regarding self-defeating humor between autistic and normal people (Samson et al., 2013; Wu et al., 2014). This difference indicates that previous successful interventions might not be suitable for autism, and furthermore, there is no humor-training program for autism. The present study, therefore, aims to develop a training course for individuals with autism according to previous findings of humor behavior among individuals with autism (Wu et al., 2014; 2015), and it investigates

the effectiveness of the humor training course by comparing changes in humor appreciation and comprehension.

### 1.1. Humor among individuals with autism

Humor is a multi-dimensional and unique advanced cognition skill of human beings. Based on how it is interpreted and employed, humor can be investigated in terms of humor appreciation and comprehension as well as in terms of humor style (Martin et al., 2003; Chan et al., 2012). The former refers to how individuals understand humor content and then generate a sense of funniness; the latter concerns the tendency toward various types of humor adopted by individuals.

The cognitive skill associated with humor is to accept funniness by understanding humorous content (Ruch and Hehl, 1998). Comprehension-elaboration theory describes the humor process: After reading humorous content, individuals experience an incongruous feeling and thus re-interpret the entire context to solve this weird feeling, subsequently generating amusement during the process of elaboration (Wyer and Collins, 1992). Furthermore, humor can be classified by its level of comprehension: 'Incongruity-resolution humor' refers to how the incongruity caused by a punch line can be fully solved with logical reasoning through context. Whether 'nonsense humor' references the incongruity element of a joke cannot be fully answered, but such jokes still make people laugh (Ruch, 1992). Even in that case, different ways of understanding humorous content exist, some of which are not easy to understand, but individuals can still feel amusement.

Many studies show that individuals with autism cannot

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integrate separate messages to complete information and to understand another person's mental state due to weak central coherence (Frith, 1989) and deficits in theory of mind (Baron-Cohen et al., 1985; 2001); hence, they have difficulty in understanding humorous content (Emerich, et al., 2003; Samson and Hegenloh, 2010; Samson et al., 2013; Wu et al., 2014). However, this study also found that, regarding the nonsense humor photos, ASD subjects could comprehend the funny point without using logical thinking and enjoy the same pleasure as normal subjects (Emerich et al., 2003). Additionally, Wu et al. (2014) first used incongruity-resolution humor and nonsense verbal jokes as their material to investigate differences in humor comprehension and appreciation among joke types for individuals with autism. Their results indicated that individuals with autism could still appraise a nonsense joke at the same level of funniness that controls did, even if individuals with autism did not understand the content of the jokes well. Regarding incongruity-resolution humor, humor comprehension and humor appreciation positively correlated (Chan et al., 2012), but people would feel nonsense humor amused even they didn't exactly understand certain type of the joke (Ruch, 1992). People with ASD could not understand the incongruity-resolution humor and don't think it funny as well, but they could enjoy the nonsense humor without any understanding of the joke content. Therefore, if we could train and improve the humor comprehension of humor content for people with ASD, it might help them to catch the humor content and further improves their humor appreciation. It is worthwhile to take a deeper look at this possibility.

Additionally, people use humor to express their sense of humor, i.e., humor styles (Chan et al., 2011). Martin et al. (2003) established four humor styles, i.e., affiliative humor: to be friendly to others, self-enhancing humor: to be kind-hearted to oneself, aggressive humor: to be malicious to others, and self-defeating humor: to be malicious to oneself. The structure of humor styles helps us distinguish between humor expressed towards the self or towards others and between kind-hearted and malicious humor. The recognition of this structure has been used to develop a humor-style questionnaire to measure spontaneous humor used in daily life and to distinguish between possibly well-intended humor and mean humor. In the studies of humor styles that differentiate between individuals with autism and controls, results show that individuals with autism tend to use a less positive humor style than controls, a finding that is consistent for samples of adults with autism (Samson et al., 2013) and adolescents with autism (Wu et al., 2014). However, no differential tendency to use negative humor has been detected between individuals with autism and control groups. Individuals with autism are usually mocked by peers for their behavioral comportsment and difficulties in social communication (Carter, 2009). However, middle school students excel at the humor of sarcasm or imitation in responding to social dilemmas, and further, they frequently adopt hostile humor (Chang et al., 2014). Considering this social context, this study may offer a model of positive humor to test whether ASD subjects can acquire positive humor that is beneficial to interpersonal interactions through the observation and imitation mechanism.

### 1.2. Humor-skill training

To date, many humor training programs have been developed (Ziv, 1988; Payo, 1993; Nevo et al., 1998; Chiou et al., 2003; Chen and Hsu, 2006; Salameh, 2007; Falkenberg et al., 2011; Cai et al., 2014) and are widely used in the fields of education, clinical health and others. Many of them are proven to be efficient in practical, grounded uses.

Ziv (1988) investigated the relationship between the sense of

humor of teachers in universities and the resulting classroom learning of their students. He found that if the teachers brought humorous elements into their courses, the students had better final-exam results than students receiving traditional teaching methods. In Asia, Chen and Hsu (2006) implemented a humor training course that combined aspects of cognition, emotion, motivation, and behavior; they recruited 34 teachers to take this training course, which consisted of 27 lessons. Their results showed that the experimental group scored higher on measures of 'humor creation', 'humor in social contact', 'humor coping', 'humor attitude', and 'laughing tendency' than did the control group when using the Multidimensional Sense of Humor Scale. Chiou et al. (2003) provided a training course on humor creation that lasted ten hours in a single week and used undergraduates as a sample. The results showed that participants turned to humor-creation skills frequently and manifested gains in the skills of 'homonym', 'word-combination', 'lexical ambiguity', and 'syntactic ambiguity'. A sense of humor could be acquired by education.

Humor training has already been applied to clinical cases and found to be effective. Falkenberg et al. (2011) designed an eight-week humor training course for people with major depression and invited six cases to the skill training. The participants tended to use humor as their strategy for mood coping after training. Furthermore, in Asia, Cai et al. (2014) invited patients with schizophrenia to a humor training that lasted 600 min over five weeks and regarded this intervention as a treatment. Thirty participants were randomly assigned to the experimental group or the control group. The results of the training showed that humor courses could clearly improve the senses of humor of people with schizophrenia in the recovery stage.

Empirical studies of humor training for individuals with autism are rarer than those for other clinical syndromes. Most training for individuals with autism has centered around the topic of interpersonal skills (Laugeson et al., 2012; Karst et al., 2014; Mandelberg et al., 2014), and their results have been fruitful. The skills of individuals with autism have been shown to increase by learning. Although humor plays important role in interpersonal relationships, it is not equal to social behavior that includes, e.g., humor comprehension, appreciation and application (Wu et al., 2014). To address this issue, it is worthwhile to develop a humor training course for individuals with autism.

### 1.3. The present study

Previous studies have indicated that individuals with autism have weak central coherence and have deficits in theory of mind (Baron-Cohen et al., 1985; 2001; Frith, 1989). Therefore, they cannot fully understand humorous content, but they can nonetheless enjoy nonsense jokes as well as a control group can (Wu et al., 2014). Such studies have shown that individuals with autism can find humor in nonsense jokes just as controls do when reading ordinary jokes. However, individuals with autism do not understand nonsense humor as well as controls do. Moreover, individuals with autism tend to be more limited in their use of positive humor than controls are (Samson et al., 2013; Wu et al., 2014). For that reason, individuals with autism show room for improvement with respect to nonsense humor comprehension and the use of positive humor. Previous studies have noted that training courses improve the sense of humor (Chiou et al., 2003; Chen and Hsu, 2006; Falkenberg et al., 2011), but such courses designed for individuals with autism are lacking. Hence, the purpose of the present study was to develop a humor-skill training course to meet this requirement. We used three teaching methods: instruction, group discussion, and practice. The results of the course were measured in terms of changes in humor comprehension, appreciation, and humor style between the experimental

**Table 1**  
Sample items for measures.

Measures	Sample items
<b>Humor style</b>	
Affiliative humor	I don't have to work very hard at making other people laugh – I seem to be a naturally humorous person.
Self-enhancing humor	If I am feeling depressed, I can usually cheer myself up with humor.
Aggressive humor	If someone makes a mistake, I will often tease them about it.
Self-defeating humor	I often try to make people like or accept me more by saying something funny about my own weaknesses, blunders, or faults.
<b>Humor appreciation</b>	
Nonsense joke	A male deer is walking in a vast forest alone. While walking, it begins running faster and faster and finally becomes a highway (In Chinese, "highway" and "deer" are pronounced the same way).
Incongruity-resolution joke	After dinner, a mother and daughter are washing dishes, and the father and son are watching TV in the living room. Suddenly, there is the sound of broken dishes. After a moment of silence, the son tells the father that his mother must take responsibility for the broken dish. The father asks, "How do you know?" The son replies, "My mother did not scold anyone."

and control groups after taking the course. We hope to provide a pedagogical solution for enhancing the humor skills of individuals with autism.

According to the effectiveness of humor training reported in previous studies (Chiou et al., 2003; Chen and Hsu, 2006; Falkenberg et al., 2011; Cai et al., 2014), the hypotheses of the present study were the following: After humor-skill training, (1) the comprehension and funniness of incongruity-resolution jokes will increase more in the experimental group than in the control group; (2) the comprehension and funniness of nonsense jokes will increase more in the experimental group than in the control group; and (3) the participants in the experimental group will have a strong tendency to use positive humor.

The experimental design was a non-equivalent pretest-posttest design. The independent variable was taking the training/not taking the training. The dependent variables were the comprehension and funniness of the incongruity-resolution jokes and nonsense jokes as well as the difference in the average values of the humor styles before and after the training.

## 2. Method

### 2.1. Participants

The participants consisted of 20 Taiwanese high school students with autism, including 19 males and one female. The participants' ages ranged from 12 to 18 years; the average of their ages was 14.10 years ( $SD=1.80$ ). The participants were randomly assigned to the experimental group and the control group, with 10 participants in each group. All participants were described in terms of their levels of autism syndrome using the Clancy Behavior Scale (Hsieh, Sung and Hsu, 1969) or the Behavioral Rating Scale for Children with Autism (Chang and Wang, 2005). Furthermore, special education workers from the government or psychiatrists were consulted. These professionals diagnosed participants according to the DSM-IV norms to confirm that they had (1) notably impaired verbal and non-verbal communication, (2) notably impaired social interactions, and (3) restricted and repetitive behavior and that they owned a Disability Manual issued by the authorities. All students with autism had IQs of 70 or greater. Each participant with autism was age, gender and intelligence matched to a control student. Every student was invited to participate by the teacher and received a set of stationary as a gift after the experiment was completed.

The present study was reviewed by the Institutional Review Board (IRB) of Taipei Medical University and was qualified to carry out the experiments. All participants were well informed about the content of the experiment, and all provided informed consent before the experiment started.

### 2.2. Material

The jokes used in the questionnaire of joke comprehension and appreciation were sampled from a Chinese jokes norm compiled by Cheng et al. (2013). Twenty incongruity-resolution jokes and 20 nonsense jokes were included. There were two versions of the questionnaire: a pretest version and a posttest version. Each version of the questionnaire contained 10 nonsense jokes and 10 incongruity-resolution jokes; the degree of comprehension was controlled at the same level in the two versions, as was the degree of appreciation. The participants were asked to rate their understanding of and the funniness of each joke on a 9-point scale after reading each joke. The mean score of understanding for each joke type was used to represent the level of comprehension; the mean score of funniness was used to indicate the level of appreciation. A higher mean score indicated that the joke was more understandable (funnier) (samples are given in Table 1).

The Humor Style Questionnaire discriminates among four styles of humor: affiliative humor, self-enhancing humor, aggressive humor, and self-defeating humor (Chan et al., 2011). Each style is measured by 8 items, and the questionnaire has 32 items in total. Each item is rated on a 7-point scale. The average HSQ score ranged from 1 to 7. A score greater than 4 indicates a tendency to use a certain type of humor. The internal reliabilities of every style ranged between 0.73 and 0.88. The criterion validity was found by taking the scores of personality, aggressive behavior, and self-esteem assessments as criteria ( $r_s > 0.21$ ).

### 2.3. Procedure

According to previous studies on the comprehension, appreciation, and the use of humor for individuals with autism (Wu et al., 2014; 2015), and based on the empirical results of humor-skill improvement training (Chiou et al., 2003; Falkenberg et al., 2011), the present study aimed to increase the understanding and appreciation of nonsense humor of individuals with autism and to increase the tendency to use positive humor.

We designed a workshop for humor-knowledge and -skill training that lasted five days over one week. The participants attended 3 classes (150 min) per day. The total training time was 750 min. The training course contained two themes: knowing humor (humor appreciation and humor comprehension) and humor coping (interpreting social interaction, adopting humor styles, and creating humor).

In the course of humor appreciation and humor comprehension, first, we introduced to participants articles and pictures with humorous content so that they would be conscious of funny information in ordinary life and would appreciate the various styles of humor. Second, we explained to participants how to understand the humor articles by finding the incongruous elements within them, such as finding homonyms, shifting between the meaning of

a word and its metaphor, inferring metaphors, re-defining words, completing missing phrases, and employing other skills so that they could find the punch line while reading the jokes. In particular, while reading the incongruity-resolution humor and nonsense humor, individuals experienced the stage of incongruity and tried to understand the jokes with aforementioned strategy. The difference of comprehension between two types of humor was, nonsense humor required the basic humor skills, such as finding homonyms, or switching between word meaning and metaphor, understanding the logical context of the nonsense jokes was not necessary. Take the material in [Table 1](#) as example, we could describe a reindeer who ran fast as “highway”, the skill used to understand it was only knowing the words with homophonic but different meaning, even these words were not relevant logically, readers could be amused due to certain comical link. On the other hand, understating incongruity-resolution humor required some advanced humor skills, such as metaphor reasoning, new interpretation, elaborating the mind process of other people, and it also needs reader to understand the sequential logic of material content. Take the content of [Table 1](#) as example, mother and daughter were washing dishes in the kitchen, father and son were watching TV in the living room. When the son heard smashing sound from kitchen, he instantly knew that was mommy broke it, the key point was that mommy didn't blame anyone. Readers needed to combine the information of “dishes smashing” and “mommy didn't response”, and had a prior knowledge that mommy always blames someone when dishes broken, except that was herself did it. Mommy treats herself kind but others mean, however, this time, there was no others. By agreed to this embarrassment, readers finally had humorous feeling inside. As for the humor coping, shortly after the humor appreciation and comprehension, we explained how to interpret social interactions so that participants would learn how to empathize with others' feelings and how to identify facial expressions and the possible reasons behind others' behaviors. Then, the idea of friendly humor and malicious humor was introduced. Participants practiced the styles of affiliative humor and aggressive humor by demonstration. Finally, we directed participants to see everything from various viewpoints and to see embarrassment in interpersonal relationships with a positive attitude so that they could build the habit of using positive humor.

At the beginning of the workshop, the instructors invited participants to share jokes with each other as an ice-breaker so that participants could learn more about each other. Then, the course began by introducing humor principles and hands-on activities. The instructors explained the action items corresponding to the humor theory and asked the participants to practice the items and to share them to the class as a group. The instructors provided instant feedback so that participants could elaborate on the humor skills they had just learned.

Before the workshop, both groups completed the pretest by filling out the ‘Humor Style Questionnaire’ and the pretest version of the questionnaire on joke comprehension and appreciation. Then, the experimental group participated in the ‘workshop for humor-knowledge and -skill training’, whereas the control group did not take any course. After the workshop finished, both groups took the posttest by completing the ‘Humor Style Questionnaire’ and the posttest version of the questionnaire of joke comprehension and appreciation. The scores from the pretests and posttests were used to investigate the workshop's results in terms of humor appreciation, comprehension, and use among the individuals with autism.

#### 2.4. Statistical analysis

Because the participants were few in number ( $N=10$ ), the assumptions on homogeneity and generalization could not be

satisfied, and we used Mann-Whitney  $U$  tests to compare the progress of the two groups (i.e., the difference between the pretest and posttest). We could understand the effectiveness of the workshop for the experimental group by observing changes in humor comprehension and appreciation towards each type of joke as well as by observing changes in the tendencies of humor styles between the two groups.

### 3. Results

#### 3.1. Humor comprehension and appreciation

[Table 2](#) lists the results of the descriptive statistical analysis, including the levels of comprehension and funniness before/after reading nonsense jokes and incongruity-resolution jokes for the two groups. Due to the small number of participants ( $N=10$ ), the scores of two groups were not normally distributed. Therefore, we compared the changes in humor comprehension and appreciation to different types of jokes between the two groups with non-parametric statistics.

With respect to changes in joke understanding, by drawing conclusions from [Fig. 1a](#), the comprehension of nonsense jokes increased more in the experimental group than in the control group after attending the workshop ( $U=1$ ,  $Z=3.705$ ,  $p < 0.001$ ); moreover, the participants with autism understood the nonsense jokes better after humor-skill training. However, the comprehension of incongruity-resolution jokes was worse in the experimental group than in the control group ( $U=11.5$ ,  $Z=2.916$ ,  $p=0.002$ ). The experimental group experienced less understanding of the incongruity-resolution jokes than control group after the humor-skill training.

Finally, to summarize [Table 1](#) and [Fig. 1b](#) regarding changes in appreciation, the change in funniness for the nonsense jokes was significantly greater for the experimental group than for the control group ( $U=28$ ,  $Z=1.663$ ,  $p=0.048$ ). The humor-skill training helped participants have more fun with nonsense jokes. However, the changes in funniness for the incongruity-resolution jokes did not differ between the two groups ( $U=31$ ,  $Z=-1.438$ ,  $p=0.075$ ).

#### 3.2. Humor style

[Table 3](#) lists the results of the descriptive statistical analysis, including the tendency of humor styles. Because the participants were few in each group ( $N=10$ ), some scores of the two groups were not normally distributed. Therefore, we compared the changes in humor styles of the two groups with nonparametric statistics. Of the information presented in [Fig. 2](#), only the tendency to use affiliative humor significantly increased in the experimental group ( $U=28$ ,  $Z=1.669$ ,  $p=0.048$ ) after attendance at the workshop. The tendencies to use the other three humor styles did not increase. The effectiveness of our humor training course was shown by the individuals with autism's greater interest in using affiliative humor following attendance at the workshop. Moreover, the change in using self-defeating humor approached a level of significance for both groups (one-tailed  $p=0.5$ ). This change was due to score increases at posttest in the control group but not in the experimental group; it did not reflect the effectiveness of the humor training course.

### 4. Discussion

Previous studies have claimed that individuals with autism cannot express humor as well as controls can, but empirical studies of training courses aimed at improving this situation are few



**Table 2**

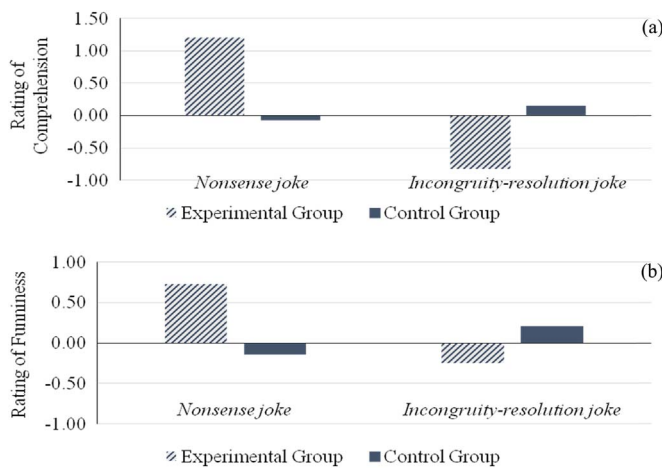
The descriptive statistics of the comprehension and funniness of nonsense jokes and incongruity-resolution jokes in the experimental group and the control group.

Variable		Exp. (N = 10)				Con. (N = 10)				U	Z
		Mean	SD	Skewness	Kurtosis	Mean	SD	Skewness	Kurtosis		
<b>Comprehension</b>											
Nonsense joke	T1	4.26	0.60	0.58	−0.21	6.37	1.39	−0.87	0.20	1	3.71 <sup>**</sup>
	T2	5.47	0.77	−0.30	−1.08	6.30	1.26	−1.22	1.74		
Incongruity-resolution joke	T1	7.27	1.44	−0.75	−0.77	6.48	1.26	−0.45	0.06	11.5	2.92 <sup>**</sup>
	T2	6.45	1.24	−1.13	0.45	6.63	1.43	0.30	−1.07		
<b>Funniness</b>											
Nonsense joke	T1	5.62	1.28	0.28	−1.33	6.09	1.12	1.05	2.06	28	1.66 <sup>*</sup>
	T2	6.35	1.33	−0.67	−1.16	5.95	1.41	0.84	1.74		
Incongruity-resolution joke	T1	5.00	0.79	0.55	0.75	5.87	1.29	−0.46	−1.47	31	1.43
	T2	4.75	0.51	0.30	−0.89	6.08	1.02	−0.25	−1.37		

Note: **Exp.**=experimental group; **Con.**=control group; **T1**=pretest score; **T2**=posttest score.

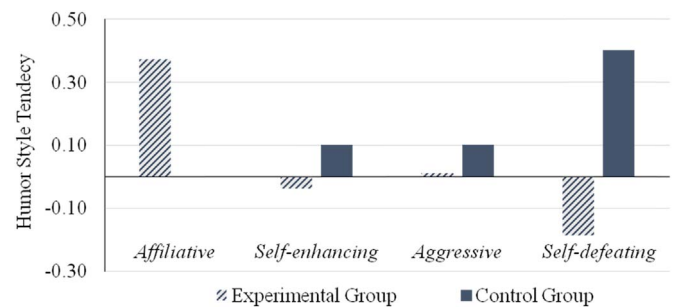
<sup>\*</sup> One-tailed  $p < 0.05$ .

<sup>\*\*</sup>  $p < 0.01$ .



**Fig. 1.** The changes in ratings of the (a) comprehension and (b) funniness of the nonsense jokes and incongruity-resolution jokes in the experimental group and the control group.

in number. There is a shortage of data on the verbal humor comprehension and appreciation (cognition) as well as the humor styles (disposition) of individuals with autism; the present study is the first to develop a humor workshop for individuals with autism. The results show that after 15 h of learning, the comprehension of nonsense humor had significantly increased among individuals with autism, and they also reported greater experiences of funniness. Although participants with autism better understood nonsense humor, their comprehension of incongruity-resolution jokes decreased, and their tendency towards affiliative humor



**Fig. 2.** The changes in four humor styles in the experimental group and control group.

increased. The results elucidate the effects of humor-skills training for individuals with autism.

After a short-term training, individuals with autism can learn and better enjoy nonsense humor. Because individuals with autism have weak central coherence, difficulty integrating the complete meaning (Frith, 1989), and deficits in theory of mind, it is hard for them to know the mental state of others and to catch the point of jokes (Baron-Cohen, 1997). They lack the ability to appreciate humor. However, this situation can be changed. After training, they can catch the point of nonsense jokes, which do not require knowing the logic of the content or the mental state of the people involved in the joke. Previous research has found that individuals with autism enjoy nonsense humor as much as control groups do, even if they cannot understand the jokes as well as the control group, particularly humor articles or pictures containing homonyms and double meaning (Emerich et al., 2003; Wu et al., 2014). The current study indicates that such individuals' ability to

**Table 3**

The descriptive statistics of each humor style in the experimental group and the control group.

Humor Style		Exp. (N = 10)				Con. (N = 10)				U	Z
		Mean	SD	Skewness	Kurtosis	Mean	SD	Skewness	Kurtosis		
Affiliative	T1	4.53	0.89	0.03	−0.25	3.68	1.00	0.95	0.63	28	1.67 <sup>*</sup>
	T2	4.90	1.08	0.74	−0.28	3.68	0.92	0.24	−0.51		
Self-enhancing	T1	4.76	1.08	0.45	−1.06	4.33	0.66	0.82	0.11	45	0.34
	T2	4.73	1.12	−0.07	−0.57	4.43	0.80	0.49	−0.77		
Aggressive	T1	3.49	1.07	−0.50	−0.86	3.00	0.74	−0.03	−2.05	41	0.69
	T2	3.50	1.20	0.48	−0.33	3.10	0.63	−0.42	−1.01		
Self-defeating	T1	3.18	1.03	0.10	−0.22	2.83	0.76	−0.06	−1.67	29	1.59
	T2	2.99	1.47	0.07	−1.26	3.23	0.70	−0.50	−0.31		

Note: **Exp.**=experimental group; **Con.**=control group; **T1**=pretest score; **T2**=posttest score.

<sup>\*</sup> One-tailed  $p < 0.05$ .

appreciate humor can be improved after training and practice. The results show that humor training has a significant effect on normal people and individual clinical cases (e.g., major depression, schizophrenia), and the tendency for the adoption of positive humor and appreciating nonsense humor among ASD subjects as well (Cai et al., 2014; Chen and Hsu, 2006; Falkenberg et al., 2011).

The study found that, after the training in knowledge and abilities, the comprehension and appreciation of humor by ASD subjects are significantly reduced. Because of the limitations of central coherence and theory of the mind, the comprehension of incongruity-resolution jokes by ASD subjects was relatively reduced, which is not in line with the research expectations. The cause may be that individuals need to completely master the content logic or deduce the mind status to effectively comprehend incongruity-resolution jokes. However, ASD subjects fail to acquire joy from incongruity-resolution jokes, and they do not naturally regard incongruity-resolution jokes as a type of humor. Although the examples used in the class were mostly the incongruity-resolution humor, but the students hadn't yet well catch the logics of humor content, the interference unfortunately happened while trying what they learned. The training of the theory of the mind for children with autism lasts for over 10 weeks (Feng et al., 2008; Begeer et al., 2011). This result indicates that the enhancement of the mind's theoretical abilities lasts at least 10 weeks. To enhance the theoretical abilities of individual minds such that they can effectively understand the close correlation of incongruity-resolution jokes (Samson et al., 2013), it is highly necessary to extend the training courses.

In addition, after a group discussion and practice, individuals with autism are more willing to use affiliative humor, which pulls people closer. This finding supports the fact that individuals with autism can learn to use positive humor by observing and imitating external behaviors, only if the methods are simple to understand (Wu et al., 2014). Using kind-hearted humor to interact with others is an important skill in social relationships (Yip and Martin, 2006). The long-term grounded research has found that individuals with autism can improve their social skills after training courses (Karst et al., 2014; Mandelberg et al., 2014). However, social skills is a big topic. The training effect in previous research has focused primarily on interpersonal relationships and less on the way to cope with embarrassment in daily life. To address this issue, our training emphasizes the use of affiliative humor, which leads individuals with autism to face difficult situations with humor and in a kind-hearted way so that they can expand their humor skill using scope.

#### 4.1. Implications and future directions

The results indicate that humor comprehension, appreciation, and use by individuals with autism increased after skills training and that gains in humor ability can be achieved through learning. These findings are inspiring with regard to the humor-skills training of individuals with autism because these individuals have long been conceptualized as lacking a sense of humor (Reddy et al., 2002). Although the effectiveness of humor-skills training for individuals with autism has been confirmed, will these skills be elevated to the average level of typical people or even higher? That question merits further research.

Individuals with autism prefer nonsense humor, which is characterized by its illogical nature, and they appraise the same level of funniness as controls do (Emerich et al., 2003; Wu et al., 2014). The comprehension of nonsense humor is increased by training, which also helps individuals with autism enjoy nonsense jokes. However, is what makes them laugh the same thing that controls feel? This question also requires more investigation. We found that individuals with autism had a greater tendency to use

affiliative humor after the skills training; this finding suggests that observing and analyzing how participants transfer these skills to daily life and how they use them to overcome interpersonal difficulties will be important research questions to address in the future.

#### 4.2. Limitations

The present study used purposive sampling. Each group had only ten participants, which might harm the generalization of the results, and we used only a self-report questionnaire as a research tool. Using a greater variety of methods to obtain more information, such as parents' opinions, teachers' and peer's comments, in-field observations, or individual interviews. Because we had only one week to complete the training course, the lasting influence of the courses were hard to achieve. The study also recommends follow-up with the maintenance of these newly learned skills among participants. In the present study, the course subjects focused on verbal jokes. It is recommended to teach other types of humor comprehension and appreciation, such as humorous pictures and videos, which could raise the comprehension and appreciation of other types of humor. Then, we could generalize the results of humor training courses to other situations. Finally, there are no activities involved during the pre-test and post-test periods. The differences between the control and the experimental groups are not only due to the humor-training course but also the group activities. Future research will consider the conduction of traditional teaching activities for the control group to effectively enhance the internal validity of this study.

#### 4.3. Conclusions

The present study found that humor training is helpful to improve the comprehension and funniness of nonsense humor for individuals with autism and their willingness to increase their use of affiliative humor. The results provide a deeper look into an aspect of skill learning for individuals with autism and their capability of presenting humor.

#### Contributors

1. We develop a humor training course for people with autism.
2. Humor-skill training improve the comprehension and funniness of nonsense humor for people with autism.
3. Improving the understanding of incongruity-resolution humor of people with autism need more hours of training.
4. Willingness of people with autism to use affiliative humor increase after the humor skills training.

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## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.psychres.2016.09.016>.

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