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ANALYZING CHILDREN'S LYING BEHAVIORS WITH FUZZY LOGICS

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ABSTRACT. *The purpose of this study is to explore children lying as they relate to responsive behavior and motivations in elementary schools. Conducting nonparametric procedures by using the fuzzy questionnaire, the study seeks to address the fuzzy mode, fuzzy nonparametric test, and fuzzy cluster analysis to clarify the lying related data. The study shows that using fuzzy logics to detect lying behaviors is a practical method to improve the traditional one. The fuzzy methods also reveal that students were afraid of being caught when they lied, and that they tended to be more tensed when lying. Students were not concerned with whether their lying made people felt bad. When students lie, they tended toward nervous.*

Keyword: Lying Behavior; Fuzzy Theory; Fuzzy Cluster Analysis

1. Introduction. The present study shows that although morals and judgment vary greatly in the e-generation, people still believe in the importance of honesty. Educators encourage students to tell the truth, nonetheless, lying and deceptive behavior are still common in schools. In recent years, there have been numerous studies on lying but their methods usually fellowed the traditional logics. Like researchers have examined motivation and other factors related to lying from different aspects, including social-cognitive development (Polak and Harris, 1999), practical applications in educational settings (Lyon, 2000; Talwar et al., 2002), and different cultural impact (Gilli et al., 2001; Lee et al., 1997; Lee et al., 2001).

Typically, lying in schools is viewed as a negative behavior. This behavior involves a speaker making a false statement with the intention to deceive the recipient (Lee, 2000). The liar wants to send wrong information to someone. It is common for children not to be completely honest about what they do. Under some settings, they may tell a lie to avoid punishment, get a reward, protect friends, etc. The related impact factors of lying are complicated, and previous studies show that children have lying experiences in childhood, even as young as 4 years old (Vrij, 2002). Previous studies have found that children

perceive lying as being bad (Bussey, 1999) and make them feel guilty (Watson et al., 1999). Even preschool-aged children demonstrate an elementary understanding of a speaker's sincerity in highly specialized conditions (Hogrefe et al., 1986; Siegal and Peterson, 1998). As early as age 3, children already have a rudimentary concept of telling lies for antisocial purposes, and they evaluate such lies negatively and conceal them using a temptation resistance paradigm (Lewis et al., 1989). After 3 years old, children begin to understand false-belief reasoning, and that the mind is an active constructor of knowledge (Flavell et al., 1995). Children aged 7 and 8 lie more frequently than those aged age 6 (Gervais et al., 2000). Adults function as indirect role models for children's moral and value judgment, with the family being the first social setting for children (Saltzstein et al., 2003). Children sometimes tell lies to avoid a scolding from their parents, or to get praise from their brothers or sisters, and to protect peers. The pervasiveness of lying in school raises the question of whether there is a practical way to address the issue, i.e., whether there is a reasonable way to collect and interpret such ambiguous, psychological data. Using the traditional inquiry method, it would be difficult to get obtain a reasonable description of a complicated situation (Zadeh, 1975).

Fuzzy theory allows diverse answers, and is ideally suited to addressing human motivations and feelings. Fuzzy theory may be useful for interpreting children lying. The purpose of this paper is to use fuzzy methods to explore children lying related to their feelings, responsive behavior, and motivations in elementary school. We used fuzzy questionnaires to collect data from children in elementary school and applied the fuzzy methods to answer the following questions: Firstly, how can the fuzzy mode help with interpreting children's lying? Secondly, is there a difference between boys' and girls' lying? Thirdly, when students are lying, is there a difference between boys' and girls' responsive behavior? Finally, can fuzzy logic be used to classify the children's motivation to lie?

2. Lying and Fuzzy Logic. A lie is a message delivered by oral presentation or writing, with the intent to give wrong information. One can identify a lie based on three semantic elements of lying, namely (a) the statement is factually false, (b) the speaker believes that the statement is false, and (c) the speaker intends to deceive the hearer (Lee and Ross, 1997). Gervais et al. (2000) found that frequent liars showed more disruptive behavior, such as fighting, biting, and bullying, than youngsters who are not frequent liars. Children consider lying either to be prosocial or antisocial in nature (Lee et al., 1997). They also tend to lie in naturalistic conditions (Newton et al., 2003). Although teachers often instruct children in right morals and value judgments, children still tell lies with the justification of trying to stay "out of trouble" or because they are only "white lies" (Kelley et al., 2005).

Young children may consider contextual factors when categorizing untruthful statements (Siegal, Surian, Nemeroff and Peterson, 2000), and recognize that a speaker's intention in lying depends on the communicative context (Peterson, Peterson and Seeto, 1983; Wimmer, Gruber and Perner, 1984). Children can find some clues in a statement or an emotional reaction, like gazing, nervousness, strange tongue movement, and other behavior in the speaker. Their understanding seems to develop with age (Xu, Luo, Fu and Lee, 2009). People often perceive wrong answers as lies when they cannot clearly understand what the speaker wants to present, because lies are full of ambiguity and uncertainty messages.

Researchers often use several related factors to interpret lying and their motivation to lie as follows.

2.1. Psychological Factors. Higher order psychological processes involve in goal-oriented behavior under conscious control (Zelazo and Muller, 2002). Children choose different ways of avoiding punishment and pursuing reward; some perform well, while others attempt to satisfy teachers and parents by lying. Children tell their earliest lies mostly to escape punishment. Later in childhood and during early adolescence, more complex patterns of lying become apparent, such as lying to obtain rewards and to cover up for friends. Talwar et al. (2002) found no relationship between children's actual lie- and truth-telling behavior and their conceptual and moral understanding of lies. This means that while children may know the right moral judgment, they may not obey social rules or the teacher's instructions. This is a potential reason why many children tell lies.

2.2. Social Learning Factors. DePaulo et al. (1996) explored lying from a social learning and emotional perspective, finding that when people lie, they consume more cognitive resources and waste more energy monitoring their own expression to make the lie more rational and credible. In some situations, if children want to protect their friends, siblings, or someone they like, they may tell a lie. However, many people consider lying to persons who are close to you to be more socially unacceptable than lying to acquaintances (Backbier et al., 1997). Especially, in the case of lying to a best friend, they may consider a lie as an act of betrayal. Some consider the proper use of "white lies" to be a social skill that enhances people's competence in social relationships; adolescents are often very competent in such lying. Some people consider "white lies" to be acceptable behavior in some conditions, and helpful in creating warm, intimate, and satisfying relationships (Kashy and DePaulo, 1996).

Children learn to avoid lying through social learning, because of the emotions associated with ethical judgments, and from experience with punishment and reward. Peers may have a greater influence on children's value judgments than adults may. Children closely consider the value judgments of their peers. Parents maintain conversational coherence by challenging the lies and punishing the transgressions of their children (Wilson, Smith and Ross, 2003). Teenagers have an easier time accepting "altruistic lies," and use lying to keep themselves and others out of trouble (Kelly, Young, Denny and Lewis, 2005). In fact, children might not consider lying to be wrong until their parents punish them, or until teachers and gradually form their values.

2.3. Psychological Growth and Lying. Children's cognition of moral judgment and behavior continues to change, as they get older. Teenagers pay more attention to behavior using moral judgment. Young children may not distinguish what is right or wrong, but older children understand moral considerations like mutual benefit and cooperation.

Children's moral development process is dividable into two stages. The first stage is compulsory moral realism, where moral judgments lack variability. In this stage, children think any behaviors that are against rules are wrong, and should result in severe punishment. Thus, punishment affects the moral judgment of preschoolers, but not of older children

(Bussey, 1992). However, just because children have moral judgments does not mean they obey rules; sometimes they still do wrong things, such as lie, but their lying frequency stabilizes at 3 years old (Gervais et al., 2000). The second stage is co-operative morality, in which moral judgments are more flexible. Children can consider other's feeling and try to understand the intention behind the action. Five-year-old children can distinguish that lying behavior is not appropriate. Children 6 to 10 years old began to think that lying is fake, unreal, pretending, and not true (Taylor et al., 2003).

Children's conceptual and moral understanding of lying and truth telling emerges early in preschool and develops rapidly throughout education (Bussey, 1999; Siegal and Peterson, 1998; Talwar et al., 2002; Lee, 2000).

2.4. Fuzzy Logics and Lying. Traditional studies dealing with human behavior often follow binary logic, which might present some problems in application. A common problem in following the traditional method is that the relationship between elements and sets must be very clear, instead of ambiguous. Using fixed sentences to describe reality sometimes results in unreasonable hypotheses; also, some responses go beyond simply "yes" or "no", "good" or "bad", "right" or "wrong", etc. Take, for example, a question like "How is the food in this restaurant?" The question itself is related to individual satisfaction and psychology—maybe the food is neither bad nor good. In such cases, traditional questionnaires do not provide suitable responses.

Zadeh (1965) proposed the "fuzzy theory" to match real situations more closely, suggesting that human thinking and feeling are fuzzy. Complicated issues can support fuzzy mathematical analysis by converting semantic or colloquial statements into fuzzy sets and presenting a membership function.

Traditional questionnaires may force subjects to choose only one answer, despite the ambiguity of emotions and psychological concepts, thus resulting in data that does not reflect the subject's attitudes. A fuzzy questionnaire can solve this problem using the "traditional question, but answer blur" technique, extracting more information from the blur data.

Lies are often unclear, especially if a liar makes up a lie carefully, because the modification of unreal content makes it difficult to detect mistakes. The main purpose of lying is to gain other people's trust, even if the statements content is false and elusive. In these cases, fuzzy method is useful for solving blur phenomena in the real world. Fuzzy logics may provide a more suitable technique for measuring ambiguous human minds.

3. Method.

3.1. Participants. The sample for this study consisted of 39 children from elementary school in a small city located in the middle of Taiwan. The children ranged in age from 11 years to 12 years 6 months, and the group included 11 fifth grade children and 28 sixth grade children (20 boys and 19 girls). All of the participants had told lies before and came from families of mixed socioeconomic backgrounds. The children's parents gave informed consent and permission for them to participate in the study.

3.2. Instruments. The survey instrument was a self-developed fuzzy questionnaire based on the analysis of related literature, addressing three main factors of students' lying. Three professors who taught child psychology, child development, and child behavior courses, and two elementary school teachers examined the questionnaire to confirm its content validity. Then, the questionnaires were administered to the children at school. Before the survey, parents were informed about the purpose of the study and had the option to return a form that stated whether they would like their children to participate in it. The scale consists of 13 items, and the response categories range included "don't agree at all," "disagree," "common," "agree," and "strongly agree."" Children filled out their intention scores, ranging from 0 to 1, in the response categories.

3.3. Measures. This research uses fuzzy mode, Wilcoxon's signed rank test, Spearman rank correlation test, and fuzzy *c*-mean cluster to analyze the data collected by fuzzy method. This study uses fuzzy mode and fuzzy mean to examine the lying behaviors, the nonparametric tests to compare lying behaviors among students with different backgrounds, and the fuzzy *c*-mean cluster method to classify the lying motivations of students.

Traditional classification, however, might result in incoherent outcomes caused by forcing statistic values into specific groups. The fuzzy cluster method helps solve potential problems through soft computing. The fuzzy option is a logical choice for analyzing the uncertainty of the minds and highlighting its main characteristics. The fuzzy cluster method is used to deal with different properties of different types of data.

3.3.1. Fuzzy mode. This study proposes the following fuzzy mode statistic definitions and their tests:

Set U is a discourse, let $L=\{L_1,L_2,...,L_k\}$ is k language variables on U $X_i=\left\{\frac{m_{i1}}{L_1}+\frac{m_{i2}}{L_2}+...+\frac{m_{ik}}{L_k},i=1,2,...,n\right\}$ is a set of fuzzy samples, $\sum_{j=1}^{k} m_{ij}=1$, set $T_i = \sum_{i=1}^{n} m_{ij}$, then the L of the largest T was fuzzy mode *(F* mode):

$$F\,\mathrm{mode}=\left\{L_j:\ j\ ,\ T_j=\max_{j=1,2...k} T_j\right\}$$

3.3.2. Wilcoxon's signed rank test. Using Wilcoxon's signed rank test, we randomly chose samples "*m*" and "*n*" from independent *X* and *Y* according to their values, let all *m* + *n* = *N* samples from small to large in order, in this mix samples, the smallest value is 1, sub-small value is 2..., the largest value is N, if the mix value is equal, then taking the average value of the corresponding rank.

Method: Set *R (Xi), R (Yj),* means rank *Xi*, *Yj* in the mixed samples, the sum of two sets of samples is:

$$W_x=\sum_{i=1}^{m} R(X_i),\quad W_Y=\sum_{i=1}^{n} R(Y_i) \tag{1}$$

The minimum possible value of W_X is 1 +2 +3 + ... + *m*; the maximum possible value is (n +1) + ... + (n + m). The minimum possible value of W_Y is 1 +2 +3 + ... + *m*; the

maximum possible value is (n +1) + ... + (n + m). Therefore, if the sample value of X is bigger than Y, it means that W_X is bigger.

3.3.3. Spearman rank correlation test. The Spearman rank correlation test is used to analyze the two random variables. If the samples does not fit the assumption of normal distribution, we use the rank correlation to justify its correlation coefficient (r_s).

$$r_s = 1 - \frac{6\sum_{i=1}^{n} d_i^2}{n(n^2-1)} \tag{2}$$

In the formula (2), $d_i = R(X_i) - R(Y_i)$; i is the difference between a pair of sample ranks; $R(X_i)$ means X_i rank in X; $R(Y_i)$ means Y_i rank in Y; and "n" is the number of sample.

3.3.4. Fuzzy *c*-mean cluster method. In the study, the fuzzy c-mean cluster method requires a pre-designated number of clusters c, and setting a real number m and a small positive number ε . The range of membership function for detecting the lying behaviors is from 0 to 1 in real number. The definition of fuzzy cluster statistic is as follows:

A set of data $X = \{x_1, x_2, \cdots, x_n\}$ is to be classified into a fuzzy set $P = \{P_1, P_2, \cdots, P_c\}$, and matches the following conditions: $\sum_{i=1}^{c} P_i(x_j) = 1$, for $k \in N$, and $0 < \sum_{j=1}^{n} P_i(x_j) < 1$

Set a group of data $X = \{x_1, x_2, x_3, x_4\}$, if $P = \{P_1, P_2\}$ is a partition for X, the membership as the following table:

TABLE 1. the membership of X

X	x_1	x_2	x_3	x_4
P_1 membership	0.2	0.9	0.6	0
P_2 membership	0.8	0.1	0.4	1

$P_1 = 0.2I_{x_1} + 1I_{x_2} + 0.7I_{x_3} + 0x_4$, $P_2 = 0.5I_{x_1} + 0.1I_{x_2} + 0.3I_{x_3} + 1I_{x_4}$, $P = \{P_1, P_2\}$ is a fuzzy cluster.

To a set of data, in general, a factor of fuzzy cluster analysis is to identify a fuzzy c center of the cluster. These centers of clusters are as clear as possible, thus, we need some rules to express this conception. The results in the same element cluster would converge, therefore, the definition of fuzzy c matrix is the sample j cluster membership degree belongings to i, like the equation (3.1), (3.2) and (3.3)

$$\mu_{ij} \in [0,1];\ i=1,\ldots,c;\ j=1,\ldots,n \tag{3.1}$$

$$\sum_{i=1}^{c} \mu_{ij} = 1;\ j=1,\ \ldots,\ n \tag{3.2}$$

$$0 < \sum_{j=1}^{n} \mu_{ij} < n \tag{3.3}$$

Then, the fuzzy cluster function is

$$J_{fc}(P,\mathbf{v}) = \sum_{j=1}^{n}\sum_{i=1}^{c} (\mu_{ij})^m \left\| x_j - v_i \right\|^2 \tag{3.4}$$

The weighted parameter controls the cluster ambiguity process in the space and associates with the Euclidean distance. In (3.1), (3.2) and (3.3) under the condition of (3.4) is to seek the smallest value

$$v_i = \frac{\sum_{j=1}^{n} (\mu_{ij})^m x_j}{\sum_{j=1}^{n} (\mu_{ij})^m} \quad , i=1, 2,\ldots,c \tag{3.5}$$

$$\mu_{ij} = \frac{(1/\left\| x_j - v_i \right\|^2)^{1/(m-1)}}{\sum_{i=1}^{c} (1/\left\| x_j - v_i \right\|^2)^{1/(m-1)}}, \; i=1,2,\ldots,c; \; j=1,..n \tag{3.6}$$

The v_i value has been regarded as a fuzzy center of classification, because it is a weighted average of the data. The χ_j value is the m^2 of fuzzy set membership.

The function has been used to measure the sum of settle center and been weighted from a fuzzy set. Hence, the smaller value $J_m(P)$ is the better fuzzy classification.

The goal of fuzzy *c* mean classification method is to find a set of fuzzy classification, *P*, and has the most small value $J_m(P)$.

Step 1: Selecting a starting cluster centers, *c* value, initial fuzzy classified $P^{(0)}$, *m* and the error value, ε.

Step 2: $P^{(t)}$ owns *c* center of cluster $\mathbf{v}^{(t)} = \{ v_1^{(t)}, \cdots, v_c^{(t)} \}$ from the equation (3.5).

Step 3: Calculating new fuzzy classification, $P^{(t+1)} = \{ P_1^{(t+1)}, \cdots, P_c^{(t+1)} \}$, and (3.6).

Step 4: Comparing $P^{(t)}$ and $P^{(t+1)}$, if $\| P^{(t)} - P^{(t+1)} \|$, stopping to calculate, or setting *t* = t+1, returning to Step 2. $\| P^{(t)} - P^{(t+1)} \|$ is the distance of $P^{(t)}$ and $P^{(t+1)}$, and setting $\| P^{(t)} - P^{(t+1)} \| = \max_{i=1,\ldots c, j=1,\ldots n} | \mu_{ij}^{(t+1)} - \mu_{ij}^{(t)} |$.

In this algorithm, *m* can be chosen according to problem. When *m* closes to 1, the classified result is more closed to the traditional classified method. When *m* is approaching infinity, the value of $J_{wfc}^{(t)}$ function is near to 0; results would be more ambiguous. Although literatures about how to select the *m* are not many, the best option is range 1.25 to 5 according to experience. There is no theory about how to select the best *m* value, but for all "*m*", the algorithm will converge.

The steps of fuzzy statistical classified assessment, as follows:

Step 1: Defining classified samples, according to experts, and calculating the important relative weight.

Step 2: According to the process of individual fuzzy weight, defining fuzzy relative weight of items, aw_{1i}, aw_{2j}, aw_{2j}, (i = 1,2, ..., j = 1,2, ..., k_{A_2}).

Step 3: Calculating the sum score of three clusters.

Step 4: Selecting a starting *c* cluster centers, initial fuzzy classification are $P^{(0)}$, *m* and the error ε.

Step 5: Calculating *c* cluster center of $P^{(t)}$, $v^{(t)} = \{v_1^{(t)}, v_2^{(t)}, \cdots, v_c^{(t)}\}$ (This study has two centers $C_1 = (c_{11}, c_{12})$, $C_2 = (c_{21}, c_{22})$, $C_2 = (c_{21}, c_{22})$ from equation (3.5).

Step 6: For the *t* value, re-cutting matrix $P^{(t)} = (\mu_{ij}^{(t)})$ and calculating the new fuzzy classification $P^{(t+1)} = \{P_1^{(t+1)}, P_2^{(t+1)}, \cdots, P_c^{(t+1)}\}$.

Step 7: Comparing $P^{(t)}$ and $P^{(t+1)}$, if $\left\| P^{(t)} - P^{(t+1)} \right\| < \varepsilon$, calculating would stop, or setting $t = t+1$, returning to Step 2.

Step 8（hard classification）:Selecting the maximum value of membership from sample to center of clusters.

Step 9 (soft classification): Selecting the standardized distance of negative exponential from samples to center of clusters, that is, the point for the membership function of cluster.

The membership of formula as follows: (m_1, m_2) is the maximum distance of samples to all cluster centers):

Samples x_i to $C_1 = (c_{11}, c_{12})$, $\mu_1(x_i) = \exp(-\sqrt{(x_{i1} - c_{11})^2 + (x_{i2} - c_{12})^2} / m_1)$

Samples x_i to $C_2 = (c_{21}, c_{22})$, $\mu_2(x_i) = \exp(-\sqrt{(x_{i1} - c_{21})^2 + (x_{i2} - c_{22})^2} / m_2)$

4. Results.

4.1. Fuzzy Modes of Lying and Children's Motivations. After obtaining the fuzzy membership function, the individual membership functions were added, and the highest result is the fuzzy mode, indicating the individual's intention. Table 1 shows the results. The fuzzy mode of "Fear" (Fuzzy mode=11.30, strongly agree), and the intention is tend to "Agree", which means children feel fear to be discovery they tell lies. The fussy mode of "Nervous" (Fuzzy mode=10.90, strongly agree) tend to be "agree", and the result means children are nervous if they tell les. Consequently, this indicates that most of the subjects were afraid that others would discover them when they were lying, and thus became nervous. Most parents/teachers do not want their children/students to lie, and always teach them to be honest, thus making the subjects afraid of being discovered for their wrong behavior. The fuzzy mode of "Lying Invent" (Fuzzy mode =11.20, not agree at all), which means children would not make up lies in advance. In general condition, children would tell lies, but they intend to lying result from facing special condition, such as not finishing homework, protecting friends, or help others. The fuzzy mode of "Fun" (Fuzzy mode =28.60, "not agree at all") indicates that children do not feel happy when they lie.

As to lying motivation, the results of "Self-profit (Fuzzy mode =21.60, not agree at all) reveals that children seldom tell lie for self-profit. The fuzzy mode of "Punishment" (Fuzzy mode =13.50, common), but the sum of "agree" and "strongly agree" is bigger than sum of "not agree" and "not agree at all", thus, the intention is tend to be "agree" option which means that children worry about punishments for lying. The results of "Reward" (Fuzzy mode =18.80, not agree at all), which means children would not tell lies for getting reward. The fuzzy mode of "Friendship" is 11.80, indicates that children would not lie for friendship.

TABLE 1. Fuzzy mode of lying motivation table

Item	Not agree at all	Not agree	Common	Agree	Strongly agree
Fear	.90	4.40	11.30	11.10	11.30
Nervous	4.40	3.80	8.90	10.80	10.90
Invent	11.20	6.80	8.30	8.00	4.70
Fun	28.60	6.90	3.00	.20	.00
Self-profit	21.60	7.10	4.90	4.10	1.30
Punishment	3.6	8.4	13.5	8.2	5.3
Reward	18.80	11.70	5.60	1.60	1.30
Friendship	9.10	11.80	8.70	5.00	4.50

Note: Range from 0 to 39

4.2. Anti-fuzzy and Gender Difference Testing. The non-parametric analysis in Table 2 first uses an anti-fuzzy method to translate the original scores and obtain the sum of scores, then uses Wilcoxon's signed rank test to explore the gender difference. The results in Table 2 reveal that there is no significant gender difference in the categories of being "Fear" (W=388.50), "Nervous" (W=363), "Invent" (W=318.5), "Fun" (W=354.5), "Self-profit" (W=377.5), "Punishment" (W=371), "Reward" (W=365), and "Friendship" (W=377.5).

TABLE 2. Wilcoxon rank sum test table

Factors	Gender	Rank Mean	Wilcoxon W
Fear	Boy	19.43	388.5
	Girl	20.61	
Nervous	Boy	18.15	363.0
	Girl	21.95	
Invent	Boy	23.08	318.5
	Girl	16.76	
Fun	Boy	17.73	354.5
	Girl	22.39	
Self-profit	Boy	20.13	377.5
	Girl	19.87	
Punishment	Boy	20.45	371.0
	Girl	19.53	
Reward	Boy	20.75	365.0
	Girl	19.21	
Friendship	Boy	18.88	377.5
	Girl	21.18	

4.3. Fuzzy Spearman Rank Correlation Test. In Table 3, the correlation coefficient of "Nervous" and "Fear" is .59, it is significant difference at $\alpha = .05$. It means that when children tell a lie, he may fear to be explored, thus, he would feel nervous; The correlation coefficient of "Fun" and "Reward" is negative significantly ($r = -.33$), which presents children desires to get reward from others and they often have no nervous feeling; The another correlation coefficient of "Invent" and "Reward" is positive significantly ($r = .34$), thus, we discover when children tell a lie to get reward, they often make up a perfect lying

Invent to achieve their purpose; The correlation coefficient of "Fun" and "Self-profit" is positive significantly (r = .44), according to the result, children would tell a lie for fun to obtain self-profit; It is interesting that the correlation of "Punishment", "Reward", and "Friendship" is positive significantly, which refers to children desire to get reward and friendship, and they would more afraid to been punished.

TABLE 3. Fuzzy Spearman Rank Correlation Test Table

Factors	Fear	Nervous	Invent	Fun	Self-profit	Punishment	Reward
Nervous	.59**						
Invent	.14	-.03					
Fun	-.26	-.13	.01				
Self-profit	-.15	-.29	-.01	.44**			
Punishment	.11	-.17	.27	-.09	-.04		
Reward	.03	-.33*	.34*	.18	.26	.39*	
Friendship	.27	-.01	.25	.17	.18	.36*	.23

*P < .05

4.4. Fuzzy C-Mean Clustering for Factors Related to Lying Motivation. The result of fuzzy *c*-mean cluster analysis reveals that the equation stopped in the 29th calculation. It is divided into three clusters in table 4, the first cluster is "Friendship (3.44)," the second cluster is "Reward (4.00)," and the third cluster is "Punishment (2.99)."

TABLE 4. Fuzzy c-mean clustering table

Factors	Cluster 1	Cluster 2	Cluster 3
Punishment	3.09	3.66	2.29
Reward	1.79	4.00	1.72
Friendship	3.44	3.51	1.80

The Kruskal Wallis test helps illuminate the differences between the clusters. The results reveal that there are significant differences between each cluster. According to the figures of Table 5, children's lying motivation depends on three factors: "Rewards", "Punishment", and "Friendship".

TABLE 5. Kruskal Wallis test table

Factor	Cluster	Rank Mean	χ^2
Punishment	1	26.56	14.221*
	2	33.00	
	3	15.04	
Reward	1	17.61	12.769*
	2	37.00	
	3	17.46	
Friendship	1	31.56	19.458*
	2	29.20	
	3	14.00	

***p < .05**

5. Discussion.

5.1. Lying Behavior Phenomenon. The survey results indicated that all of the survey participants had told a lie before. Lying behavior is a common phenomenon in school, with no difference between genders and grades. The possibility of being caught makes most students nervous when they lie. Most students make up the content of a lie before they tell it. This means that when children lie, they do not expect others to discover it. When children tell occasional lies, they are afraid of being found out. According to Lee and Ross (1997), children are still developing the concept of lying between the ages of 12 and 19. Younger children (4-, 8-, and 11-year-olds) can categorize untruthful statements as lies whether they are polite statements, jokes, or statements to conceal a transgression (Bussey, 1999). Younger children may lack the cognitive abilities to be convincing liars (Talwar & Lee, 2002). Adolescents with low self-esteem or feelings of depression may try to make themselves look better by lying. Researchers consider lying behavior to be an early indicator of antisocial behavior problems, such as aggression, delinquency, loss of self-control, and disruptive behavior in class (Gervais, Tremblay, Desmarais-Gervais, & Vitaro, 2000). Education can play an important role by asking young children to tell the truth, which may reduce their tendency to lie.

5.2. Lying Behavior and Its Response. Correlation analysis reveals that students who lie causally and not make up lie content in advance do so because they are nervous. Students who are afraid of being punished may make up content in advance or have psychological reactions such as being tense and nervous. Typically, children's altruistic and egotistical judgment takes into account what type of benefit the lie might achieve (Barnett et al., 2000). When caught lying, young children try to modify their non-verbal communication to avoid punishment (Shennum & Bugental, 1982). Therefore, when they make up content, there is no inherent difference between content and non-verbal behavior. Older children and adults appear to consider the outcome when judging whether an utterance is a lie in situations when the sincerity of the speaker's intention is unclear. They realize that one person can present misinformation to another to influence the second individuals' beliefs (Templeton & Wilcox, 2000).

The social learning experience of young children is different from older children. Young children tend to think that people whose lies go undiscovered experience a pleasurable psychological reaction, whereas people whose lie are discovered experience negative psychological reactions such as sadness, guilty, shame, etc. When lying, children may feel negative psychological reactions due to their own moral judgment. When lying randomly, the liar is nervous and does not have pleasant emotions.

5.3. Understanding Motivations for Lying. The *c*-mean cluster results are suitable for discussing the students in special culture. In Chinese culture, parents and teachers always pay attention to children's performance in school. The Chinese parents put a lot of pressure on their children, which causes children to be afraid of their parents if they do not work hard or finish their homework. In these cases, students may lie to their parents and teachers to avoid punishment. Sometimes students might lie with the hope of getting a reward from

their parents or teachers. Classmates and friends also play a key role in lying motivation. Sometimes children tell lies in an attempt to gain friendship. The importance of lying motivation means that teachers and parents need to focus on addressing the motivation behind lying behavior and helping children develop good moral judgment and behavior, instead of focusing on punishment and blame.

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