

ANALYSIS OF THE IMPACT OF SHOOTING SPORTS ON THE PSYCHOLOGICAL QUALITY OF TEENAGERS—BASED ON THE INVESTIGATION AND ANALYSIS OF SHOOTING CLUBS

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Abstract: The requirements for teenagers' psychological resilience are getting higher in modern society, shooting sports are beneficial to teenagers' mental health. This paper studies the impact of shooting on teenagers' psychological factors such as concentration, emotional control ability, adjustment ability, endurance and stress adaptation ability. By means of the cluster sampling, a questionnaire survey is conducted in shooting clubs, and the results of the questionnaire survey are systematically analyzed. The analysis shows that through shooting training, the three comprehensive indicators of self-control, concentration and psychological stability of the trainees have been significantly improved, and the effect is more obvious for trainees who have trained for more than one year. Moreover, the surveyed trainees all have a positive willingness to promote shooting sports.

Keywords: Shooting sports; Psychological quality; Sampling survey

1 INTRODUCTION

Shooting sports are gradually becoming a popular sports activity among teenagers. It originates from hunting and military activities and is a new sport added to human activities in the era of hot weapons. It is also the most direct inheritance and embodiment of modern military skills. In modern society, the requirements for teenagers' psychological resilience are getting higher, and a high psychological quality is the guarantee for learning and work. Shooting sports can cultivate teenagers' concentration, emotional control ability, and psychological resilience, and play an important role in enhancing teenagers' self-confidence and self-identity.

In order to study the impact of shooting sports on the psychological education of teenagers, I conducted a questionnaire survey from July to August 2025 during the summer vacation. I designed a questionnaire and conducted the survey among members of Guangzhou Shuimu Shooting Club and Haizhifeng Youth Shooting Training Base. The respondents are mainly people aged 25 and below.

2 OBJECTIVES AND METHODS

2.1 Survey Participants

This survey is conducted by using cluster sampling, selecting two shooting clubs in Guangzhou and Hefei of Anhui Province for the investigation. The survey subjects are the trainees who participate in shooting training, and there are no restrictions on the gender and age of the trainees. In cases involving younger participants, the questionnaires are completed with the assistance of their guardians.

2.2 Survey Tools

This survey is conducted in the form of a questionnaire, which is divided into three parts: basic information, psychological condition rating scale and recommendation intention scale. The basic information covered basic questions such as age, gender, current educational stage, and duration of shooting training.

The psychological condition rating scale is consisted of 19 questions, covering five aspects: concentration, self-control, stress resistance, psychological stability, and comprehensive psychological quality. Each question is presented in a Likert scale, with five options ranging sequentially from “completely not conforms”, “less conforms”, “moderately conforms”, “basically conforms”, to “completely conforms”. All items are positive questions. After verification, the Cronbach's alpha coefficient for the scale questions is 0.959, indicating a high level of reliability.

The recommendation intention scale consists of a single item, and is used to reflect the trainees' willingness to recommend shooting sports. It also employs a Likert-scale with five predefined response options.

2.3 Statistical Analysis Methods

This questionnaire analysis is conducted using Python 3.11.5 and SPSS 27.0, with the method of mean comparison and variance analysis; the analysis of influencing factors adopts binary categorical variable Logistic regression.

3 ANALYSIS OF BASIC SITUATION

3.1 Distribution of School Age of the Survey Participants

A total of 109 questionnaires are actually collected in this survey, of which 2 respondents have never received shooting training, so the actual number of questionnaires include in the analysis is 107. According to the age range of the respondents, they are divided into 6 age groups.

Table 1 Age Distribution

Age	Frequency	Proportion
Preschool	4	3.74%
Primary School	68	63.55%
Junior High School	17	15.89%
High School	6	5.61%
Others	12	11.21%
Total	107	100%

By age group, students in the primary school age range of 6-11 years, account for the highest proportion of 57.01%; followed by the junior high school age group of 12-14 years with a proportion of 25.23%. The combined proportion of these two age groups reaches 82.24%, indicating that the primary and junior high school age groups are the main groups practicing shooting.

3.2 Gender Distribution of the Survey Participants

From the perspective of gender, 67 of the respondents are male and 40 are female, accounting for 62.62% and 37.38% respectively, indicating that the shooters are mainly male.

Table 2 Distribution of Gender

Gender	Frequency	Proportion
Male	67	62.62%
Female	40	37.38%
Total	107	100%

3.3 Distribution of Training Duration of the Survey Participants

All 107 individuals surveyed have practiced shooting, however, their training duration varied significantly. Among them, 65 individuals, accounting for 60.75% of the total, have practiced for less than 6 months, which is the highest proportion. Additionally, 18.69% and 12.15% of the participants have practiced for less than one year and less than three years respectively. The participants with training durations of more than five years are relatively few, accounting for only 8.41%, and they are aged 18 or above, with the oldest being 26 years old. This indicates that the shooters are mainly new learners, and relatively few have persisted in learning for a long period.

Table 3 Distribution of Practice Duration

Options	Frequency	proportion
Less than 6 months	65	60.75%
6 months to 1 year	20	18.69%
1 to 3 years	13	12.15%

3 to 5 years	0	0%
More than 5 years	9	8.41%
Has not participated in any shooting training	0	0%
Total	107	100%

3.4 Validation of the Survey Scale's Reliability and Validity

The reliability of 19 scale questions is tested, yielding a Cronbach's alpha coefficient of 0.959, which exceeds 0.7. This result indicates that the questionnaire possesses a high level of reliability.

The validity of the questionnaire is tested using the principal component analysis method, with variance maximization rotation. According to the purpose of questionnaire design, 5 principal components are extracted. After testing, there are two questions, namely "competition pressure management" and "high-pressure decision-making ability" among the 19 scale questions, whose matrix loadings on each factor are all less than 0.5, indicating that they are invalid questions. In the subsequent analysis, these two questions are excluded, and the remaining 17 questions are discussed and analyzed.

4 RESULT ANALYSIS

4.1 Factor Analysis

The data is first subjected to KMO and Bartlett tests for the 17 questions of the questionnaire scale. The results show that the sample data is suitable for factor analysis, with a KMO value of 0.935 and a Bartlett's test p-value of less than 0.01.

Combining the five aspects of the questionnaire design, the principal component analysis is used to extract the principal factors, and the factor loadings are rotated using the variance maximization method. The 5 principal factors, based on their factor loadings, account for 75.79% of the total variance, and the rotated component matrix is presented in the table below.

Table 4 Rotated Component Matrix

	1	2	3	4	5
Daily concentration ability	.761				
Long-term psychological resilience	.692				
Emotional transfer	.610				
Reduction in impulsive behavior	.576				
Impact of external evaluation	.531				
Muscle Relaxation Techniques	.522				
Heart rate control		.771			
Recovery of emotions after a mistake		.684			
Operational stability		.628			
Task switching and restoration		.627			
Visual focus			.784		
Resist environmental interference			.688		
Execution of the training plan				.758	
Suppressing impulsive shooting				.667	
respiratory control				.515	
Long-term concentration endurance					.779
Stress adaptation					.664

Based on the factor loadings, factor 1 can be named as the comprehensive psychological quality factor, factor 2 as the psychological stability factor, factor 3 as the concentration ability factor, factor 4 as the self-control ability factor, and factor 5 as the endurance and stress adaptation factor.

4.2 Gender Differences in Participants

The results of the variance analysis of the five factors based on gender as the classification variable are shown in Table 5. The results indicate that, at the 0.05 significance level, there are no significant gender differences in four out of the five factors, however, there are significant differences in the factor of anti-interference ability. Further analysis reveals that the mean value of the anti-interference ability factor for females is significantly higher than that for males, indicating that shooting training effectively enhances the anti-interference ability of females.

Table 5 Analysis of Variance of the Impact of Gender Factors on the Factors

			sum of squares	DOF	mean square	F	significance
Factor 1 (Comprehensive Psychological Quality) *	Group Comparison	(combination)	.060	1	.060	.060	.807
		Intra-group	105.940	105	1.009		
		Total	106.000	106			
Factor 2 (Psychological Stability) * Gender	Group Comparison	(combination)	.383	1	.383	.381	.538
		Intra-group	105.617	105	1.006		
		Total	106.000	106			
Factor 3 (Concentration) * Gender	Group Comparison	(combination)	6.206	1	6.206	6.530	.012
		Intra-group	99.794	105	.950		
		Total	106.000	106			
Factor 4 (Self-control) * Gender	Group Comparison	(combination)	.538	1	.538	.535	.466
		Intra-group	105.462	105	1.004		
		Total	106.000	106			
Factor 5 (Endurance and Stress Adaptation) * Gender	Group Comparison	(combination)	1.587	1	1.587	1.596	.209
		Intra-group	104.413	105	.994		
		Total	106.000	106			

4.3 The Impact of the Educational Stage on Trainees' Psychology

The participants surveyed cover five stages: preschool, primary school, junior high school, senior high school, and other. The results of the variance analysis indicate that there are significant differences in the impact of shooting training on the execution factor across different educational stages at the 0.1 significance level, while the impact on other factors is not significant.

Table 6 Analysis of Variance of the Impact of Educational Stage on Factors

		Sum of Squares	DOF	Mean Square	F	Significance
Factor 1 (Comprehensive Psychological Quality) * Educational stage	Group Comparison	4.519	4	1.130	1.136	.344
	Intra-group	101.481	102	.995		
	Total	106.000	106			
Factor 2 (Psychological Stability) * Educational Stage	Group Comparison	2.390	4	.597	.588	.672
	Intra-group	103.610	102	1.016		
	Total	106.000	106			
Factor 3 (Concentration) * Educational Stage	Group Comparison	5.945	4	1.486	1.515	.203
	Intra-group	100.055	102	.981		
	Total	106.000	106			
Factor 4 (Self-control) * Educational stage	Group Comparison	7.847	4	1.962	2.039	.095
	Intra-group	98.153	102	.962		
	Total	106.000	106			
Factor 5 (Endurance and Stress Adaptation) * Educational Stage	Group Comparison	3.408	4	.852	.847	.499
	Intra-group	102.592	102	1.006		
	Total	106.000	106			

Considering that the educational stage is a multiclass variable, multiple comparisons are adopted to further investigate the impact of different educational stages on the self-control ability of the trainees. The statistical quantity calculated by the double comparison is LSD, and the formula is the following:

$$LSD = t_{\alpha/2} \sqrt{MSE \left(\frac{1}{n_i} + \frac{1}{n_j} \right)} \quad (1)$$

Based on the actual situation of this survey, the value of t in the formula is taken as the critical value of a two-sided test with a degree of freedom of 102, and the significance level is set at 0.05; MSE is the within-group mean square error, which is 0.962285; “ n_i ” is the sample size of the i -th educational stage. The absolute value of the mean difference between the i -th and j -th educational stages is calculated, and compared with the corresponding LSD value. If the former is less than the latter, it indicates that there is no significant difference between the two educational stages; if the former is greater than the latter, it indicates that there is a significant difference between the two educational stages. The test results show that significant differences exist between educational stage 1 and stage 5, and between stage 2 and stage 5, while the other educational stages are not obvious. Since the mean score of the factor in educational stage 5 is significantly higher than that of stages 1 and 2, it indicates that the students in the “other” educational stage have a significantly greater impact on shooting in terms of self-control compared to those in the preschool and primary school stages.

Further analysis of the sample data reveals that there are a total of 12 students in educational stage 5, all of whom are

adults (aged 18 or above), and 5 of them are over 25 years old.

4.4 The Impact of Training Duration on the Mind

From the perspective of training duration, the results of the variance analysis indicate that there are significant differences in the effects of practice duration on aspects such as psychological stability, anti-interference ability, and execution ability at the 0.1 significance level. Specifically, the psychological stability is the best during the 1-3 year practice period; the anti-interference ability of the trainees with a practice duration of 5 years or more is the strongest, followed by those with a training duration of 1-3 years, who are significantly higher than those with other training durations; the execution ability of the trainees with a practice duration of 5 years or more is the best.

Table 7 Analysis of Variance of the Psychological Impact Caused by Practice Duration

		Sum of Squares	DOF	Mean Square	F	Significance
Factor 1 (Comprehensive Psychological Quality) * Practice Duration	Group Comparison (combination)	2.230	3	.743	.738	.532
	Intra-group		103	1.007		
	Total		106			
Factor 2 (Psychological Stability) * Practice Duration	Group Comparison (combination)	11.468	3	3.823	4.165	.008
	Intra-group		103	.918		
	Total		106			
Factor 3 (Concentration) * Practice Duration	Group Comparison (combination)	12.714	3	4.238	4.679	.004
	Intra-group		103	.906		
	Total		106			
Factor 4 (Self-control) * Practice duration	Group Comparison (combination)	6.621	3	2.207	2.287	.083
	Intra-group		103	.965		
	Total		106			
Factor 5 (Endurance and Stress Adaptation) * Duration of Training	Group Comparison (combination)	2.772	3	.924	.922	.433
	Intra-group		103	1.002		
	Total		106			

5 REGRESSION ANALYSIS

5.1 Multivariate Linear Regression Analysis

In order to further verify the causal relationship between shooting sports and psychological qualities, this study constructs the following regression model:

$$fa_i = a_0 + a_1 ge_i + a_2 ed_i + ex_i + \mu_i \quad (2)$$

In the above equation, the value of i ranges from 1 to 5. fa represents the aforementioned factors, a_0 is a constant term, ge represents gender, ed represents the educational stage (indicating age), ex represents the training duration, and μ_i is a random term. Using the OLS regression method, the regression results of the model with these 5 factors as dependent variables are as follows:

Table 8 Regression Results of Comprehensive Psychological Quality

	Coef	Std err	t	P > t
Gender	-0.0467	0.207	-0.226	0.822
Educational Stage	0.1499	0.122	1.233	0.220
Training Duration	0.0292	0.104	0.280	0.780
Const	-0.3724	0.337	-1.106	0.271

As shown in Table 8, the factors of gender, educational stage, and duration of shooting practice have no significant impact on Factor 1 (Comprehensive Psychological Quality). The Comprehensive psychological quality includes six indicators such as daily concentration, long-term psychological resilience, emotion transfer, reduction of impulsive behavior, influence of external evaluation, and muscle relaxation techniques. No significant correlation is observed between the duration of shooting training and this composite indicator.

Table 9 Regression Results of Psychological Stability

	Coef	Std err	t	P > t
Gender	-0.1377	0.202	-0.683	0.496
Educational Stage	-0.1644	0.119	-1.403	0.160
Training Duration	0.2903	0.102	2.854	0.005

Const	0.1040	0.329	0.317	0.752
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Factor 2 is characterized by psychological stability, which is composed of four indicators: heart rate control, emotional recovery after mistakes, operational stability, and task-switching recovery. From Table 9, it can be seen that gender and educational stage have no significant impact on psychological stability, while the duration of shooting training has a significant correlation with psychological stability. This indicates that as the duration of shooting practice increases, the psychological stability of the trainees improves. Thus, it can be concluded that the duration of shooting training has a positive impact on psychological stability.

Table 10 Regression Results of Concentration Ability

	Coef	Std err	t	P > t
Gender	0.4648	0.193	2.404	0.018
Educational Stage	-0.1510	0.114	-1.328	0.187
Training Duration	0.3179	0.098	3.259	0.002
Const	-0.8119	0.315	-2.576	0.011

Factor 3, Concentration, is consisted of two indicators: visual focus and resistance to environmental interference. As can be seen from the results in Table 10, there is a significant positive correlation between gender, practice duration and concentration ability. This indicates that after shooting training, the concentration ability of girls has improved more significantly than that of boys; and the longer the shooting practice time for teenagers, the stronger their concentration ability. It can be seen that shooting sports have a significant enhancing effect on concentration ability.

Table 11 Regression Results of Self-Control Ability

	Coef	Std err	t	P > t
Gender	0.0206	0.203	0.101	0.919
Educational Stage	0.1619	0.119	1.356	0.178
Training Duration	-0.0916	0.102	0.895	0.373
Const	-0.6061	0.331	-1.833	0.070

Factor 4, Self-control, is composed of four indicators: execution of the training plan, suppression of impulsive shooting, and adjustment of breathing. From the results in Table 11, the influence of gender, educational stage, and practice duration on self-control is not significant. This might be due to the limited sample size, however, the results may differ if the sample size is expanded.

Table 12 Regression Results of Endurance and Stress Adaptation

	Coef	Std err	t	P > t
Gender	0.1682	0.205	0.820	0.414
Educational Stage	0.2197	0.121	1.821	0.071
Training Duration	-0.1098	0.104	-1.061	0.291
Const	-0.6018	0.334	-1.800	0.075

Factor 5, Endurance and Stress Adaptation, is consisted of two indicators: long-term concentration endurance and stress adaptation. From the regression results in Table 12, it can be seen that the educational stage has the most significant impact on this comprehensive indicator. In the questionnaire, the educational stage is divided into five stages: preschool, primary school, junior high school, senior high school, and others. It can be seen that the educational stage is an indicator representing age. The educational stage has a positive impact on endurance and stress adaptation. For the surveyed adolescent trainees, their endurance and stress adaptation abilities become stronger as age increases.

5.2 Logistic Regression Analysis of Recommendation Intention

The five levels of recommendation intention are converted into binary values in this article. The two options of “basically conform” and “completely conform” are defined as 1; the three options of “completely not conform”, “less conform”, and “moderately consistent” are defined as 0. A binary Logistic regression analysis is conducted to examine the trainees' recommendation intentions for shooting sports, with the five factors serving as independent variables.

Table 13 Logistic Regression Results of Recommendation Intent

	Coef	Std err	z	P
Factor 1 (Comprehensive Psychological Quality)	2.437	0.544	4.480	0.000
Factor 2 (Psychological Stability)	0.547	0.313	1.747	0.081
Factor 3 (Concentration)	0.565	0.342	1.652	0.098
Factor 4 (Self-control)	0.961	0.331	2.903	0.004
Factor 5 (Endurance and Stress Adaptation)	0.766	0.338	2.265	0.024
Const	1.966	.436	4.512	0.000

The regression results in Table 13 show that at all five factors significantly influence the willingness of trainees to recommend at the 0.1 significance level. Among these factors, the odd ratio (OR) of the comprehensive psychological quality factor is the highest at 11.435, indicating its strongest impact on the willingness to recommend; the second highest is the self-control, endurance and stress adaptation factor, with ORs of 2.615 and 2.15 respectively; the ORs of the psychological stability and concentration factors are 1.727 and 1.759 respectively. In summary, the willingness of trainees to recommend is influenced by all five factors, but the most significant is the comprehensive psychological quality factor, indicating that trainees value the impact of shooting on the improvement of their comprehensive psychological quality the most, which is the main factor for trainees to consider when recommending.

6 CONCLUSION

The vast majority of adolescents are in full-time education, and primary and secondary school students are under the pressure of further education, leading to frequent mental health issues. Mental health issues have become an important factor affecting students' learning and life. This article aims to study the positive impact of shooting sports on adolescent mental health. As can be seen from the above analysis, shooting sports have a significant impact on adolescent mental health, and different ages, genders, and training durations play different roles in this process.

In terms of the impact of shooting training on mental health, the age factor is mainly reflected in the gradual increase in stress adaptation ability, or stress resistance, and endurance of the surveyed trainees as they grow older. In terms of gender, it is mainly reflected in the significant improvement in concentration of female trainees through shooting training. This indicates that compared to males, females are more easily influenced by their surroundings, and shooting training can improve their ability to resist interference and focus.

The duration of shooting training is a crucial factor in enhancing the mental health of adolescents. Research indicates that the longer the shooting training duration, the higher the individual's psychological resilience and emotional stability. Analysis reveals that through shooting training, students significantly improve in three key areas: self-focus, psychological stability, and their ability to endure and adapt to stress. For students who have trained for over a year, the effects are even more pronounced.

In terms of willingness to recommend shooting sports, the five indicators of comprehensive psychological quality, psychological stability, concentration, self-control, endurance, and stress adaptation are all significant. From the perspective of improving comprehensive psychological quality, the willingness to recommend shooting sports is the highest, followed by the willingness to recommend shooting sports from the perspective of improving self-control, and then endurance and stress adaptation, psychological stability, and concentration. The findings suggest that improvement in any single dimension of psychological quality is sufficient to foster a strong willingness in trainees to promote shooting sports.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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