An Intelligence Sports Training of Improving Poor College Student Self-Efficacy: Simulation, Experiment and Analysis

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Abstract: The physical and mental health of impoverished college students has always been the focus of poverty alleviation work. In order to improve the sense of self-efficacy of poor college students, this paper innovatively puts forward an intelligent training method, the effectiveness of the proposed training method is verified by simulation and experiment. In this paper, the guiding principles are given, the method of surface electromyography information extraction and the design principle are proposed, and the self-efficacy promotion questionnaire is developed, finally, through the questionnaire survey, factor analysis and confirmatory factor analysis of 126 impoverished college students, the questionnaire is verified to meet the requirements of psychometrics and Bandura' s self-efficacy theory. The test results show that the intelligent sports training method can effectively improve the self-efficacy of impoverished college students in a short time. The research results of this paper provide an innovative solution for the development of poor college students' physical and mental health.

Keywords: intelligent sport straining; self-efficacy precise; poor college students; simulation

1 Introduction

As a special group, poor college students bear greater psychological pressure than non poor students in the process of studying. Therefore, how to do a good job in mental health education and assistance for poor students is an important work. The poor college students, they devote more energy to the acquisition of living and learning costs, and ignore the importance of sports. However, people pay attention to the continuous decline of poor college students' physical fitness level, but there is a lack of in-depth and systematic research on its influencing factors and occurrence mechanism. Since Bandura put forward the theory of self-efficacy, self-efficacy

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has become an important field of psychological research [1-4]. Many scholars have made a lot of empirical research on students' learning efficacy and related factors by means of psychological measurement [5-7]. With the development of the times and the in-depth study of our educational system reform, our colleges and universities have fully implemented the “Integration” system, and today’s higher education has gradually moved towards socialization and marketization [9-11]. In recent years, people have paid more attention to the financial aid work for college students. At present, the main research results are focused on the definition of poor students, funding policies, funding forms, psychological development of college students, the impact of sports on mental health, etc. [12-15] It has promoted the impoverished university student and the special group financial aid work greatly the development. But the sports help pattern has not yet discovered. As a new help mode, the diversified sports help means and the diversified combination promotion, will better serve the poor student financial aid work and will gradually improve and standardize [16-18].

The physical and mental health of poor college students has always been the key area of national poverty alleviation work. Aiming at the improvement of self-efficacy of poor college students, this paper creatively puts forward an intelligent sports training method [19-21].

2 Basic Principles and guidance

2.1 Combining sports support with state and school aid

Colleges should combine funding education with the fundamental task of moral education, and combine funding education with employment and life development, so as to realize the parallel progress of funding work and mental health education, and give full play to the moral education function of developmental funding education. The combination of sports security work and subsidized education in Colleges and universities has changed from the "material security type" of increasing income to the "ability type" of improving education quality, paying attention to the all-round development of ability training and quality education.

2.2 According to the specific circumstances of each person to help

Different students have different needs for help, in the process of help should be correct to listen to the inner will of the help, the implementation of precise personalized help. The psychological state of the college students to be supported is measured by random sampling, and according to the measured results, the sample feature library is obtained, and the measured results are compared and analyzed, development and arrangement of sports intervention means. According to the result of the analysis of the measured data, the sports intervention program was designed according to the special unhealthy psychological characteristics of the impoverished college students. Finally carries on the sports to help the activity the development, and in the help process unceasingly consummates the plan and the measure.

3 Concrete Implementation Measures of intelligent sports training

The intelligent motion training and analysis system proposed in this paper is to acquire the data of the front, back and side of the human body through the intelligent recognition technology of

the key points of the human body, as shown in Fig.1. And the system can recognize several key parts of the human body automatically, using my application layer algorithm, I can deduce the muscle state before and after the training. Then, the effect of sports training will be formatted data evaluation, and give relevant guidance and advice to the Organization of sports training, as shown in Fig.2.

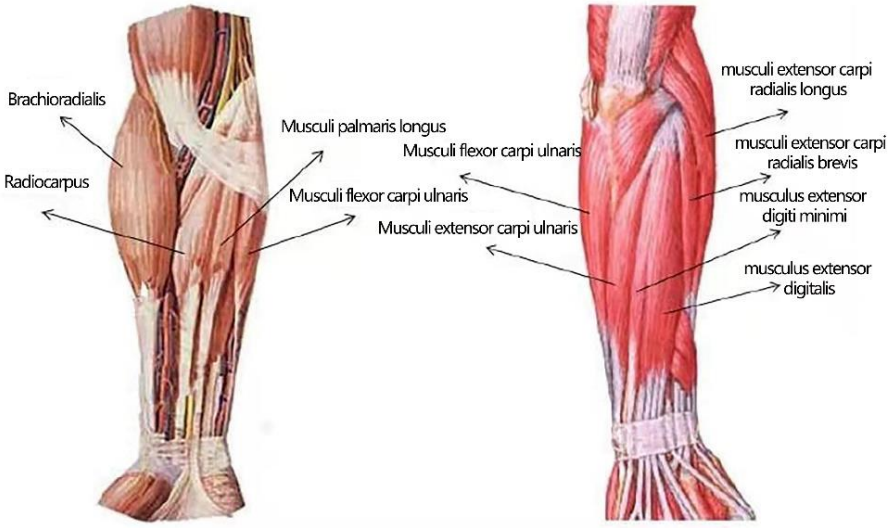


Fig. 1 Human forearm muscle group

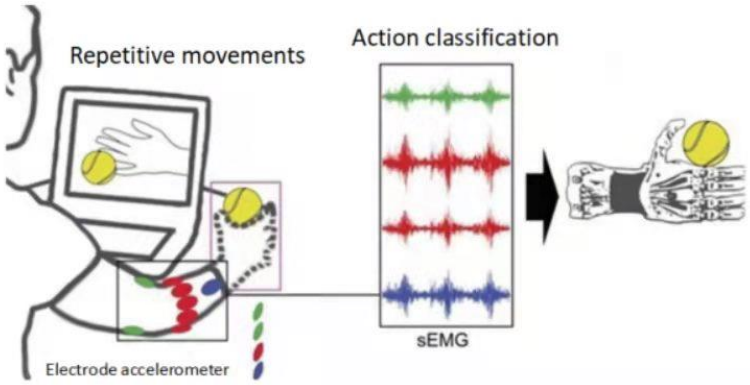


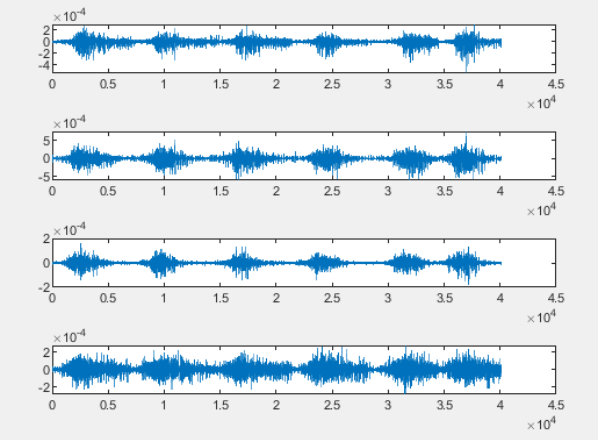
Fig. 2 Database EMG signal acquisition process

By observing the original waveform of human surface EMG signal, it is found that it is very similar to the waveform of sound signal. Therefore, the active segment detection method based on short-time energy for speech signal processing is applied to the active segment detection of EMG signal. The following is a brief description of the steps of the active segment detection algorithm based on short-term energy: With n sampling channels, x_{kij} represents the i-th sampling point of the k-th active section in the jth sampling channel. In the following 32ms,

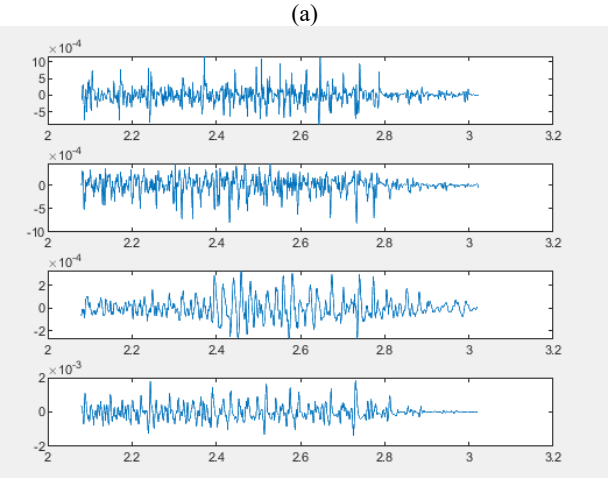
there are 64 sampling points at the sampling frequency of 2KHz, then the average short-time energy within 32ms is (1):

$$\overline{E_K} = \frac{1}{64n}\sum_{i=0}^{63}\sum_{j=1}^{n} x_{kij}^2 \tag{1}$$

Set threshold TH and data length L when $\overline{E}_k$>TH is a valid active segment, otherwise, it is invalid data, that is, it is non action data. The algorithm is concise and easy to program, and should be used in SEMG signal processing. Figure 3 shows the four channel effective data after active section detection. By comparing the abscissa of figure (a) and figure (b), it can be found that effective data segments that are easy to be processed later are extracted.



(a)



(b)

Fig. 3 Comparison of detection effect of fist exhibition movement

Because the amplitude of EMG signal is small and the amplitude fluctuation is small, it is not easy to extract the subsequent features. In order to speed up the data convergence, the sensor data with uncertain value range is converted according to a certain data conversion method. It is convenient for the indexes of different units or orders of magnitude to be compared and weighted, so as to reduce the amount of calculation of model training. Select according to formula (2) and normalize its amplitude to [-1,1]. Firstly, subtract the minimum value from the EMG signal amplitude of each action, divide it by the difference between the maximum value and the minimum value, then double the quotient, and finally subtract 1, so that the amplitude falls between [-1,1].

$$X = \frac{x - \min}{\max - \min} * 2 - 1 \tag{2}$$

4 Experimental verification of self-efficacy promotion effect

4.1 A questionnaire analysis of learning self-efficacy of poor college students

Study subjects: At Xidian University, Huizhou University, Guangzhou Sports University and Xi'an Urban Architectural College, 126 undergraduates were randomly selected for the test. The results of 60 out of 126 college students were analyzed by exploratory factor analysis to understand the questionnaire structure. Confirmatory factor analysis was used to analyze the reliability and construct validity of the questionnaire.

Collecting and compiling the information of research questionnaire: According to the principle of Specificity and Situation and the dimension of perceived learning efficacy, the interview outline is drawn up, interviews were conducted with 20 psychology teachers, sports teachers and students, as well as university financial aid workers to obtain basic information about the links, processes and goals of poor students' learning On this basis, 30 items of poor college students' learning self-efficacy questionnaire were compiled and scored with a five-grade questionnaire (from Not in the least accord to Very accord) .

Methods: exploratory factor analysis, confirmatory factor analysis and reliability analysis were conducted by using SPSS22 and Amos5.0.

Factor analysis showed that 10 factors with eigenvalue greater than 1 accounted for 71.184% of the total variance. Determination of two common factors by Cartesian slope test. Two common factors were found to account for 52.866% of the total variance. In order to test its ideality, we do an oblique rotation. The results showed that the factor structure was stable, the order of position and the item of factor coverage did not change. The questionnaire made up of 25 items can be divided into 12 items of learning ability efficacy and 13 items of learning behavior efficacy. The Reliability Analysis of SPSS was used to analyze the internal consistency coefficient of the questionnaire was 0.88. The homogeneity coefficient between each item score and the total score was above 0.42. The split-half reliability is 0.85. After two weeks, the test-retest reliability was 0.93.

The fitting degree is an important index to test whether the hypothesis model is consistent with the original data. The theoretical expected value of x2/df for each fit index (table 1) is 1. The fitting degree is good when the x2/df is close to 2. In this study, x2/df = 2.2, the fit index is acceptable. Other fitting indexes GFI, NFI, AGFI, NNFI, CFI are limited to 0-1. The closer the values are to 1, the better the fitting degree of theoretical hypothesis is. All the indexes in this study are above 0.80, which shows that the two-factor model fits well in general.

Table 1. Confirmatory factor analysis of questionnaire reliability and validity

X2 / df	GFI	AGFI	NFI	NNFI	CFI	IFI
2.2	0.88	0.81	0.80	0.82	0.84	0.84

4.2 An analysis of the poor college students' learning self-efficacy questionnaire

After helping the participants with sports, through competition and physical exercise, the health level and sports ability of the helping participants were constantly strengthened. The self-efficacy score of the helping participants increased by an average of 8 points by GSES, both male and female students showed a higher sense of self-efficacy and formed a positive state of mind, as shown in Table 2.

Table 2. Eelf-efficacy (GSES) test statistics (N = 126, Male, 86; female, 40)

	Male	Score	Female	Score
Before intervention	86	19	40	21
After intervention	86	27	40	29
Difference value		8		8

Before the intervention, 44(34.9%) did not participate in physical exercise. After the intervention, the number of participants who exercised once or twice a week decreased from 72 to 46. The number of people who exercised 3-4 times a week increased by 47.6% from 8 to 68, while the number of people who exercised more than 4 times a week increased by 7.9% from 2 to 12, therefore, through the help of sports can effectively affect the enthusiasm of students to exercise, as shown in Table 3.

Table 3. Statistics of frequency of students participating in physical exercise before and after helping (N = 126, week/time)

	0	1-2 times	3-4 times	>4 times
Before intervention	44	72	8	2
Percentage	34.9%	57.1%	6.4%	1.6%
After intervention	0	46	68	12
Percentage	0	36.5%	54%	9.5%

5 Conclusion

Through the exploratory factor analysis and confirmatory factor analysis of 126 college students, we found that the poor college students' learning self-efficacy questionnaire has the characteristics of psychometrics and Bandura's self-efficacy theory. This paper innovatively puts forward an intelligent training method, the effectiveness of the proposed training method is verified by simulation and experiment. The research results of this paper provide an innovative solution for the development of poor college students' physical and mental health.

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References

[1] Bandura, A. (1997) Self-efficacy: The exercise of control. New York: Freeman.
[2] Bandura, A. (2001) Social cognitive theory: An agentic perspective. Annual Review of Psychology, 52, 1-26. doi:10.1146/annurev.psych.52.1.1.
[3] Bandura, A. (2006) Guid for constructing self-efficacy scales. In F. Pajares, & T. Urdan (Eds.), Self-efficacy beliefs of adolescents (pp. 307-337). Greenwich, CT: Information Age Publishing.
[4] Besharat, M. A., Abbasi, Q. R., & Shojaoldin, S. (2002) An investigation of the relationship between self-esteem and sport achievement among footbalers and wrestlers. Harakat, 12, 31-44.
[5] Burton, D. (1998) Measuring competitive state anxiety. In J. L. Duda (Ed.), Advances in sport and exrecise psychology measurement, 129-148.
[6] Carver, C. S., & Scheier, M. F. (1988) A control-process perspective on anxiety. Anxiety Research, 1, 17-22.
[7] Compeau, D., & Higgins, C. (1995) Computer self-efficacy: Development of a measure and initial test. MIS Quarterly, 19, 189-211.
[8] Craft, L. L., Magyar, T. M., Becker, B. J., & Feltz, D. L. (2003) The relationship between the Competitive State Anxiety Inventory-2 and sport performance: A meta-analysis. Journal of Sport and Exercise Psychology, 25, 44-65.
[9] Hanin, Y. L. (1986) State-trait anxiety research on sport in the USSR. In C. D. Spielberger, & R. Diaz-Guerrero (Eds.), Cross-cultural anxiety (2, 45-64). Washington, DC: Hemisphere Publishing.
[10] Hanton, S., & Connaughton, D. (2002) Perceived control of anxiety and its relationship with self-confidence performance: A qualitative explanation. Research Quarterly for Exercise and Sport, 73, 87-97.
[11] Hanton, S., O'Brien, M., & Mellalieu, S. D., (2003) Individual differences, perceived control and competitive trait anxiety. Journal of Sport Behavior, 26, 39-55.
[12] Zhang X, He H. (2015) A real-time, practical sensor fault-tolerant module for robust EMG pattern recognition[J]. Journal of Neuroengineering & Rehabilitation, 12(1): 1-16.
[13] Graupe D. (1980) On convergence of least-squares identifiers of autoregressive models having stable and unstable roots[J]. 25(5):999-1002.

[14] Reddy N.P., Gupta V. (2007) Toward direct biocontrol using surface EMG signals: control of finger and wrist joint models[J]. Med Eng Phys, 29(3):398-403.
[15] Huang H., Yang Q. (2013) Real-time implementation of a self-recovery EMG pattern recognition interface for artificial arms[C], IEEE Annual International Conference on Engineering in Medicine and Biology Society (EMBC), 5923-2959.
[16] Zhen, Y., X., & Qian J. (2020) Classification of finger movements for prosthesis control with surface electromyography. Sensors and Materials, 32(4), 1523.
[17] Atzori M., Cognolato M., Muller H. (2016) Deep Learning with Convolutional Neural Networks Applied to Electromyography Data: A Resource for the Classification of Movements for Prosthetic Hands[J]. Frontiers in Neurorobotics, 10.
[18] Phinyomark K., Limsakul C., and Phukpattaranont P. (2011) Application of Wavelet Analysis in EMG Feature Extraction for Pattern Classification, Measurement Science Review, 11(2), 45-52.
[19] Nazarpour K., Sharafat A.R., and Firoozabadi S.M.P. (2005) Surface EMG Signal Classification Using a Selective Mix of Higher Order Statistics," 4(4), 4208-4211.
[20] Laverde, G., Salinas, S., Montero, D., Rueda, C. , & Altuve, M.. (2020) Characterization of hand movements using a low cost electromyography sensor. Journal of Physics: Conference Series, 1514(1), 012012 -012018.
[21] Hartwell A., Kadirkamanathan V., Anderson S.R. (2020) A temporal-to-spatial neural network for classification of hand movements from electromyography data.