

Experimental Research on Sports Morality Intervention for Young School Children under the Background of Double Reduction

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Abstract: To implement the “double reduction” policy, promote moral education, and promote the overall development of young school children, this study used two kinds of programs, namely degree centrality intervention and random intervention, to carry out sports moral intervention for middle and primary school students in physical education class, which is based on social network analysis. The results demonstrated that the social preference network structure of primary and middle school students is concentrated, and the specific students at the center of the network are more able to control and influence the whole network. Moreover, there is a network effect among the students in the degree centrality intervention group, and this method was superior to the random treatment. Social network analysis provides a new perspective of network structure for studying primary and secondary school students' behavioral attributes and provides an operable scientific paradigm for studying sports morality intervention.

1. Introduction

For a long time, Chinese education has been in the five educational imbalance situations of “being better than intelligence, less than morality, less than physical beauty, and less than labor.”^[1,2] On July 24, 2021, the General Office of the CPC Central Committee and The General Office of the State Council issued the “Opinions on Further Reducing the Homework Burden and Off-campus Training Burden of Students in Compulsory Education” (after this, referred to as “double reduction”). As the leading carrier to implementing the “double reduction” policy, the physical education classroom bears an arduous historical mission. How to build sports moral character through sports classroom is the primary task of education front in the new era. There are fruitful research results on sports morality in China. Yang Yi (2021), Du and Li (2021), and other researchers believe that the integration of sports morality into the sports curriculum is a new model for sports people at present and put forward “sports ideology and politics” as the focus of the integration of sports education^[3,4]. Tang and Cai (2019) constructed the evaluation index system of youth sports morality, including sportsmanship, sports character, and sportsmanship behavior^[5]. Yu et al. (2020) and Wang et al. (2021) developed an information, intelligent and digital student

physical fitness evaluation system based on big data and constructed ways to improve students' physical health by value-added evaluation to practice the "sports person" system^[6, 7]. Diversified research perspectives can enrich the path of practicing "Educate people through physical education." However, the research on youth sports morality can not be separated from the social relationship environment background. Emirbayer and Goodwin(1994) believe that sociological interpretation from the perspective of social relations is superior to interpretation from the perspective of individual attributes and that "network theory builds interpretation on the relationship model."^[8] Scott (2011) elaborated on the application of social network analysis in the field of adolescent health intervention. He discussed the great value of social network analysis based on "social integration" and "behavioral dynamics principle."^[9] Pouwels et al. (2018) demonstrated the predictive function of social network structure for destructive behaviors by studying the social network structure and the development trajectory of aggressive behaviors in adolescents^[10]. Sha(2020) used the social network analysis method to explore adolescent social network relationships' influence on academic engagement and achievement^[11]. Therefore, the network effect plays an essential role in forming and developing adolescents' ideas and behaviors. Sports morality refers to the moral and behavioral norms displayed by athletes or students in sports classrooms or fields. It involves the influence of organizational behavior and psychology. Social network analysis has achieved rich research results in mental health and behavioral intervention. Christakis and Fowler(2007) found that if a person's friends were obese over a certain period, his or her chances of becoming obese (body mass index >30) a 57 percent increase^[12]. Christakis and Fowler(2008) reported that smoking cessation by a spouse could reduce a person's chance of smoking by 67%^[13]. The reason why social network analysis is so helpful in the field of mental health is that social network relationships are not only used in the short term for our cognition and behavior but also have long-term and lasting effects on our mental health, ideas, and behaviors (such as the study of friendship network and bullying behavior)^[14]. Based on this inspiration, this research uses the social network analysis method to conduct the intervention experiment research on sports morality in the physical education classroom.

2. Participants

China's vast territory and middle-level development of the city can represent the current status of compulsory education development. In order to improve the research efficiency, this study adopts the typical case sampling method in the purposive sampling method^[15]. Primary and secondary schools in Yueyang City, a third-tier city, were selected as the research objects. A total of 204 students, including 102 boys and 100 girls, were selected from two Grade four classes in a primary school and two in a junior middle school in Yueyang City. The status quo of sports morality and the social preference network of sports classrooms were investigated.

3. Definition of Terms

Social network: A "social network" is a collection of social agents and their relationships as nodes^[16]. In this study, nodes represent students in a physical education class. Relationships represent the title directions of different questions among students. Social network analysis uses graph theory and matrix algebra to analyze relationships based on quantized data.

Social preference: "Social preference" is a peer nomination based on "most liked" and "least liked," indicating the degree to which a teenager is liked or disliked by peers^[17]. This study defined social preference as liking or disliking the peers with whom primary and middle school students attended PE classes.

Betweenness Centrality: In a sense, Betweenness is a measure of the impact of a node on the

dissemination of information through the network^[18]. This study represents the measure of the influence of students in the social preference network in the physical education classroom.

Network Centralization: “Network Centralization” indicates the degree to which a graph shows the tendency to centralize to a certain point^[19]. This study indicates that in the social preference network of physical education classrooms, the preference relationship points to the central tendency of a particular student. The strength of this central tendency determines the influence of a particular student in the physical education classroom in the network structure.

4. Method

The study aimed to accelerate the dissemination of information or behavior related to the morality intervention based on social network analysis. Like Valente and Davis (1999), in public health research, we could select the central object in the treatment group as the “change agent” (e.g., the individual targeted by the intervention)^[20]. This study hypothesized that intervention on a spatially important point (student) attribute (sports mortality) would not affect the attribute similarity of adjacent points. We hypothesized that the central subjects had authority, credibility, or connections and could spread the concept of sportsmanship and influence behavior more widely in the group than the random subjects.

In this study, UCINET6.5 was used to transform the collected “relational data” into 2- mode. Then, the Betweenness Centrality index of network structure characteristics was analyzed. After this, Netdraw is used to draw the visual network relationship diagram according to the betweenness centrality and determine the intervention target based on this. Finally, the intervention experiment on sports morality was carried out using different methods. The difference in sports morality evaluation produced by different intervention methods was compared.

Firstly, the network investigated by the relationship data in the study is the Social preference network of primary and secondary school students^[17]. The reason for choosing this network is that social preference indicators could capture the trait of peer ecology and organizational belonging in the classroom and are closely related to organizational behavior^[21]. The survey was conducted by the Name Generator Questionnaire^[22](Which three students do you like to take PE class within PE class? Then the students will give their names in turn.) The researchers were asked to fill in the numbers corresponding to their favorite students according to the class name and number comparison table. Students are their friends and are not allowed to name themselves. Based on the results of social preference nominations in PE classes, the adjacency matrix was constructed to represent all the nominated data in each PE class:For any position (I, j) in the adjacency matrix, when J is nominated as a good friend by a classmate numbered as I in the physical education class, its value in the adjacency matrix is 1; Otherwise, it's 0.The research index of relational data is Betweenness Centrality. Compared with the influence measure of local network characteristics of Degree Centrality, Betweenness Centrality can provide better results for the measurement of global network characteristics^[23].

Secondly, the sports morality questionnaire in the study investigated the status quo of sports morality based on the evaluation index system of youth sports morality by Tang and CAI (2019)^[5]. The self-evaluation questionnaire was designed and scored on a five-scale Likert. Finally, the total score was calculated according to the weight of the youth sports morality.The Cronbach α coefficient of the sports morality questionnaire was 0.91, the KMO was 0.93, and the Bartlett spherical test was $P < 0.01$, indicating that the sports morality questionnaire has good reliability and validity. Finally, the experimental design method of Vander Weele (2013) was adopted in this study^[24]. As shown in Fig.1, the longitudinal research method is adopted for the physical morality of primary and secondary school students. At the end of the first term of the 2020-2021 academic

year, the sports morality of each class was evaluated. Meanwhile, primary schools were divided into control group (P1) and intervention group (P2), and middle schools were divided into control group (M1) and intervention group (M2). After routine physical education activities, 10% of the students in the control group were randomly given physical education and moral education treatment, and the rest were untreated groups (UNTP1, UNTM1). After routine physical education activities, 10% of the students in the control group were randomly given physical education and moral education treatment, and the rest were untreated groups (UNTP1, UNTM1). The “sportsmanship” of each class will be assessed at the end of the next semester of 2021-2022. Then, the difference in mean outcomes between subjects in the central subject intervention group who did not receive the intervention and students in the usual treatment group who did not receive the intervention can be viewed as an experimental estimate of peer effects, indicating the presence of a central intervention effect.

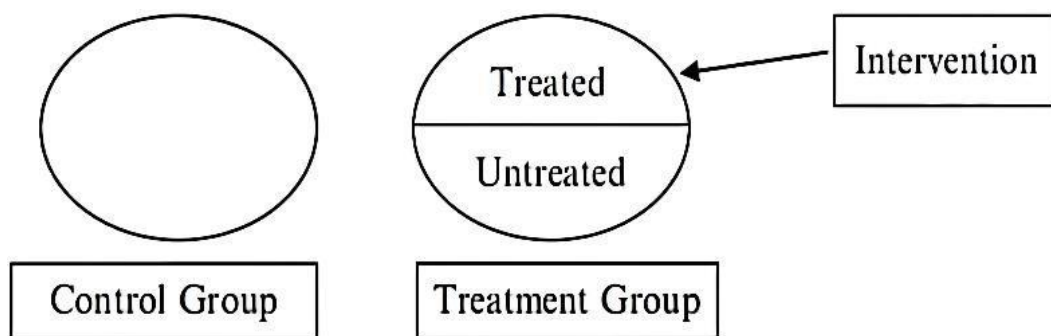


Figure 1: Experimental Design

5. Results

5.1 Social Preference Network Characteristics of Primary and Secondary School Students

In this study, the “Name generation questionnaire” was conducted among 202 primary and secondary school students in Yueyang city on their social preferences in physical education class (M1, M2, P1, P2). A total of 202 valid questionnaires were collected, with an effective recovery rate of 100%. There were 576 valid candidates, with a rate of 95%. Four social preference networks with precise edges were constructed respectively.

Table 1: Characteristics of Class Social Preference Network Mediation Centrality

Class	Betweenness				
	Mean	Std.Dev	Sum	Min	Max
P1	121.73	146.16	6330	0	583.1
P2	147.32	174.76	7366	0	737.17
M1	195.04	221.92	9752	0	763.05
M2	201.42	211.30	10071	0	955.86

Table 2: Characteristics of Normalized Betweenness Centrality of Class Social Preference Network

Class	nBetweenness					
	Mean	Std.Dev	Sum	Min	Max	Centralization
P1	4.77	5.73	248.24	0	22.87	18.45%
P2	6.26	7.43	313.18	0	31.34	25.59%
M1	8.29	9.44	414.62	0	32.4	24.64%
M2	8.56	8.98	428.19	0	40.64	32.73%

Tables 1 and 2 show the Betweenness Centrality of the social preference network of each P.E. class analyzed by UCINET. As can be seen from Table 1, the average intermediary centrality of

primary school students is lower than that of middle school students, with average values of 4.77, 6.26, 8.29, and 8.56, respectively. At the same time, the standard deviation of each group is also tiny, indicating that the distribution difference of the mediating centrality value of the social preference network in primary school is smaller than that in junior high school. The total value of intermediary centrality of all nodes in the network is lower than that in the middle school network. The maximum intermediary centrality of primary schools (583.1 and 737.17) was lower than that of secondary schools (763.05 and 955.86). Table 2 shows that the normalized betweenness centrality parameter is also consistent with the unnormalized size relationship. The results show that the influence difference of each pupil is slight; In middle school students, individual students will have a significant influence. Meanwhile, there will be more marginalized middle school students with little influence in the class. Specific students who are in the center of the network in middle school can control and influence the whole network. From Table 2, it can also be seen that the network centrality of middle school students is more concentrated than that of primary schools, which further indicates that in the whole network structure, individual actors in middle schools have more prominent control advantages.

On the selection of intervention target in social preference network, taking Class 2 of primary school as an example: Fig. 2 is the visualization diagram composed by assigning the value of mediation centrality as a point attribute in the social preference network of Class P2 by using NETDRAW software in UCINET. As shown in Figure 2, in the structure diagram of the social preference network of Class P2, the red triangle nodes represent the five members with the highest mediation centrality in the class, which are P2-3, P2-4, P2-25, P2-27, and P2-36. The larger the triangle, the higher the mediating centrality. We can find that P2-3 is the member with the highest mediating centrality in the class. In the intervention group, the triangle is the target intervention member, a total of 5 people; The circle is the students who did not implement the intervention, the UNTP2 group, a total of 45 people. The intervention group M2 also adopted the same method as P2. We randomly selected the treated students for the control group, and the untreated students were UNTP1 and UNTM1.

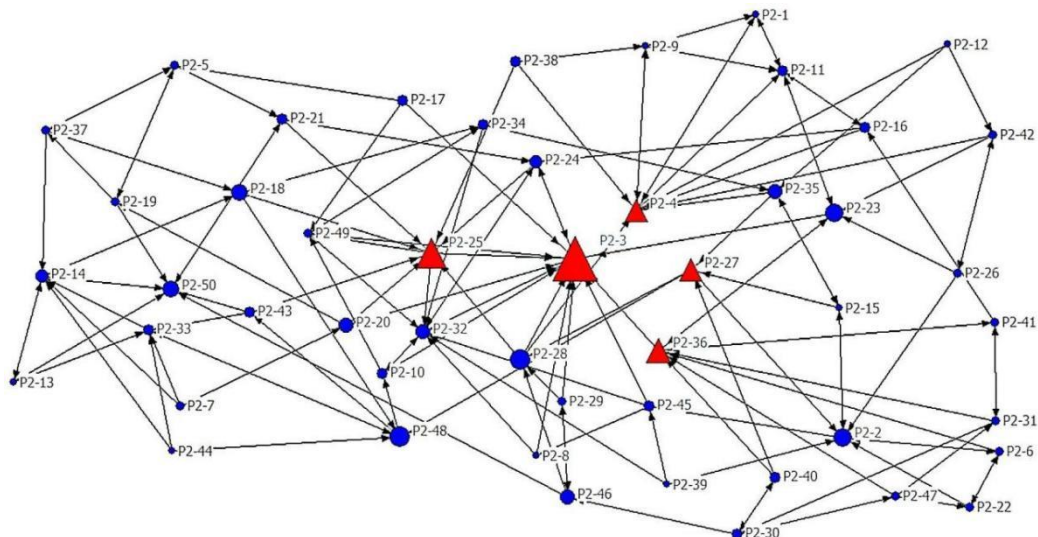


Figure 2: The Betweenness Centrality Diagram of the Social Preference Network in Class P2

5.2 Sports Character Characteristics and Independent Sample t-Test of Untreated Middle and Primary School Students after Intervention

As shown in Table 3, at the end of the second semester of the 2021-2022 school year, the total

number of non-treatment students in the control and non-treatment part of the intervention group was 45. The average score of UNTP1 was 79.04, and the standard deviation was 6.13. The average score of UNTP2 was 82.02, and the standard deviation was 5.43. The results showed that the average score of physical morality of non-treatment students in the primary school group using the center intervention group was higher than that in the random intervention group. The intra-group differentiation was lower than that in the random intervention group. Combined with Table 4, the *Sig* of P1-P2 equal variance test for the non-treatment part was .227, indicating that the samples met the equal variance test. On this premise, our two data groups' independent sample *t*-test results were: *t* was -2.438, and *Sig* was .017 < .05.

Table 3: Analysis Table of Sports Morality Scores of Untreated Students after Intervention

Group	N	Mean	Std.Deviation	Std.Error Mean
UNTP1	45	79.04	6.13	0.91
UNTP2	45	82.02	5.43	0.81
UNTM1	46	82.74	5.49	0.81
UNTM2	46	85.22	3.53	0.52

Meanwhile, as shown in Table 3, at the end of the second semester of the 2021-2022 school year, after the implementation of sports morality teaching, there were 46 non-treatment students in the middle school control group and 46 non-treatment students in the intervention group, with an average score of 82.74 and a standard deviation of 5.49 in UNTM1. The average score of UNTM2 was 85.22, and the standard deviation was 3.53. The results showed that the average score of physical morality of non-treated middle school students in the central intervention group was higher, and the difference within the group was smaller. Combined with Table 4, the *Sig* of M1-M2 equal variance test for the non-treatment part was .011, indicating that the samples met the equal variance test. On this premise, our two data groups' independent sample *t*-test results were: *t* was -2.573, and *Sig* was .012 < .05. So, in statistical significance, UNTM2 performs better than UNTPM1 in overall Sports morality, which is significant.

Table 4: Independent Sample t-Test of Physical Morality Characteristics of Untreated Middle and Primary School Students after Intervention

Untreated Group	Independent Samples Test						
	Levene's Test for Equality of Variances				t-test for Equality of Means		
		F	Sig.	t	df	Sig.(2-tailed)	Mean Difference
P1-P2	Equal variances assumed	1.478	.227	-2.438	88	.017	-2.978
	Equal variances not assumed			-2.438	86.747	.017	-2.978
M1-M2	Equal variances assumed	6.739	.011	-2.573	90	.012	-2.478
	Equal variances not assumed			-2.573	76.891	.012	-2.478

In conclusion, with the purpose of testing the impact of different intervention programs on the physical morality of primary school students, the study adopted two programs of central treatment and random treatment, respectively, to implement the physical morality intervention on the research subjects and then carried out independent sample t-test analysis on the data of the two groups of the non-treatment group. The results showed that the scores of UNTP2 and UNTM2 were better than those of UNTP1 and UNTM1. There were statistically significant differences between the two groups, indicating that the social preference network of the two P.E. classrooms had network effects after implementing the central intervention program of P2 and M2. The central intervention program of the two groups was better than the random treatment program. It indicates that the central subjects have authority, credibility, or connection and can spread the concept of sportsmanship and conduct influence in the group more widely than the random subjects. The

network effect of the social preference network in the P.E. classroom can accelerate the dissemination of information or behavior related to sports morality intervention.

6. Discussion and Suggestions

As an essential carrier to carry out the policy of “double reduction,” the physical education classroom takes “Cultivate people through sports” as the goal to promote the strategy of building moral education and realizing sports power. The experimental study of “sports morality” provides a scientific, quantified, and operable scheme for cultivating people by virtue and educating people scientifically.

First, in terms of the social preference network of physical education class, the study found that compared with primary school students, middle school students are more likely to have the phenomenon that individual students have a significant influence on the network, which is consistent with previous studies. Cillessen and Mayeux(2007) found in their study that the association between social function and popularity changes with age and is moderated by gender and peer status^[25]. The reasons leading to this phenomenon are complex and dynamic. Compared with primary school students, middle school students have stronger ability to maintain social preference relationships (such as mental, physical appearance, athletic ability, and social ability), which is why the influence of middle school social preference network is more concentrated than that of primary school students. In addition, Kim (2018) also confirmed that age was negatively correlated with social behavior (aggressive behavior)^[26]. Based on this, we can also consider whether adolescents are better at using individual characteristics (such as athletic ability, physical appearance, and social ability) to gain or strive for influence in class or peer network structure as they age? After studying the behavior patterns of Indonesian adolescents, researchers found that social preferences were positively correlated with academic performance, negatively correlated with aggression, and popularity was positively correlated with aggression and smoking^[27]. This conclusion can also show that education can impact the network structure between adolescents and children, which provides more scientific references for future research on the relationship between adolescents.

Secondly, after a school year of physical education, the class with the central intervention method has a better overall physical character score than the class with the random intervention. The network effect of sports morality intervention based on the social preference network of primary and middle school students is noticeable. This conclusion is a piece of strong evidence for the successful application of peer effect in the field of education, which is consistent with the research conclusion of Valente et al. (2003), who also found that group intervention is more effective when using natural peer groups than when randomly assigned or assigned by the teacher^[28]. This conclusion was also confirmed in the field of earlier weight loss interventions, where Wing and Jeffery(1999) found that subjects who were recruited and enrolled in a weight loss program with their friends were more likely to complete the program and lose more weight than those who were recruited and enrolled alone^[29]. This conclusion can be explained by the Group socialization Theory proposed by Harris (1995), who points out that the student peer Group is the most crucial motivation and environment for the socialization of teenagers and children outside the family environment^[30]. Children are more likely to identify with a group, so they will show similar standards of motivation, behavior, ideas, and so on and fit into the group accordingly. Therefore, in the social preference network of physical education classrooms, we should focus on implementing sports morality intervention for influential students, who can accelerate the transmission of rules and culture among classmates and make peers have similar sports morality, behavior and attitude.

To sum up, this study has the following: First of all, the “double reduce” policy for the

compulsory education stage of strengthening and promotion of physical education injected a strong heart, physical education class is a vital position to realize moral and all-round development, the importance of physical education class should start from the implementation of the existing policy. Take physical education as the breakthrough point, unswervingly break this “longer than wisdom, neglecting morality, weak than physical beauty, lack of labor” five educational imbalance situation. Further through physical education to realize “sports ethics,” “sports wisdom,” “sports beauty,” and “sports labor” to achieve the real sense of the five education at the same time. Secondly, the evaluation and assessment of the physical education curriculum should play a fundamental role in guiding society, schools, and students to realize the importance of physical education. Both the selection of the weight of each subject in the entrance examination and the perfection of the talent evaluation need in-depth reform. Finally, the promotion of education work cannot be separated from the social attributes of people, and education work from the perspective of social relations can have unexpected effects. The premise of education work is to have a deep understanding of the peer structure of adolescents so that we can have a deeper understanding of the mechanism of the change in adolescents' consciousness and behavior.

In addition, this study only uses the central node in the social network data to implement the central intervention. The network structure can also be intervened in future research. An (2011) has found through the study of smoking behavior that changing the network structure can not only change the smoking behavior but also consolidate the changes in the network^[31]. In addition, gender could also be included in subsequent experimental studies because in studies of status and perceived popularity. Vaillancourt and Hymel (2006) found significant gender differences in the valuation of social status. In addition, boys' perception of power was more closely related to perceived popularity than social measures of liking^[32]. There is still a lack of research in the field of education based on social network analysis in China. From this perspective, the research on “Cultivating people through sports” will surely provide more scientific, systematic, and operable results for the education front to carry out the new development concept and construct the new development pattern in the new era.

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