Big Data Analysis on Spatial Distribution Features of College Students' Physical Literacy

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Abstract
To effectively improve college students' physical literacy, it is required to conduct a thorough examination of the geographical distribution characteristics of their physical literacy. Only a few domestic researchers have examined the system for measuring and evaluating physical literacy, and they have been unable to develop a cohesive study framework. Additionally, little research has been conducted on the spatial distribution characteristics of college students' physical literacy. As a result, this article performs a large-scale analysis of the spatial distribution characteristics of college students' physical literacy. To begin, certain established evaluation indices for college students' physical literacy were enhanced using spatiotemporal data on college students' physical literacy, and an evaluation index system (EIS) for college students' physical literacy was built. Following that, the technique for ranking preferences according to their similarity to the ideal solution (TOPSIS) was used to compare college students' physical literacy, and the assessment flow was described. The analytic hierarchy process (AHP) was used with the entropy value approach to optimise the index weights. Following that, the authors discussed the process of spatial distribution analysis and its application to college students' physical literacy. The standard deviational ellipse was used to determine the spatial distribution direction of college students' physical literacy. The average nearest neighbour was used to assess the degree of concentration or dispersion of spatial points, and the kernel density tool was used to analyse both the global features of the distribution space of college students' physical literacy and the structural elements of the distribution space of each. Finally, distributions of physical literacy among college students in various locations were reported, demonstrating the scientific quality of our analysis approach.
Keywords: evaluation of college students' physical literacy; big spatiotemporal data; spatial distribution features

1. Introduction

China has implemented various incentive measures to encourage college students to engage in both indoor and outdoor physical activity. However, physical literacy among college students has not improved considerably (Kaiyan & Qin, 2018; Li, Yi, & Gu, 2021; Li, 2018; Li & Fan, 2021; Liu, Li, & Du, 2021; Tang & Wei, 2021; Yan & Zhang, 2017; YongKang & QianQian, 2022). To improve college students' physical literacy (Jiang & Xu, 2022), both their physical and mental health must be nurtured thoroughly (Li et al., 2013; Liu, 2014; Singh, Liang, & Bárdossy, 2012; Tang, Wang, & Shen, 2019; Wang, 2018; Wu & Zhang, 2021; Zhang, 2019). To effectively increase college students' physical literacy, each region must thoroughly examine the spatial distribution characteristics of college students' physical literacy and the underlying reasons for regional disparities in college students' physical literacy. Thus, a study into the spatial distribution characteristics of college students' physical literacy has the potential to increase the physical literacy of regional college students dramatically.

Che (2014) examined the value and purpose of daily physical exercise and suggested strategies for cultivating the daily physical ability of contemporary college students. It was established that daily physical activity is an effective strategy for college students to break negative habits, foster an awareness of the importance of lifelong exercise, and strengthen their will and ability to overcome obstacles, improving the whole person's overall quality. Physical activity benefits students' physical development, mental health, and personality development. Physical education (PE) aids pupils' self-esteem, communal consciousness, and willpower. According to Zhang, Cheng, and Liu (2013), the first step toward cultivating students' personalities is accurately identifying them. Otherwise, it would be impossible to continue guiding and promoting students' personality development, which is necessary for healthy growth. Ding (2013) developed an evaluation index system (EIS) for teenage athletic ability based on bio-resistance. Ding (2013) analysed operation models using impedance waveforms and movement stability using impedance waveform repeatability to apply various exercise training to rehabilitation and related fields. Prior study has established

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that college students are at a greater risk of abandoning physical activity. Thus, it is critical to promote sports to this demographic. Kettunen, Kari, and Critchley (2019) summarised essential experiences with sport and wellness technology digital coaches in college students with a low to a sedentary exercise level, emphasised the importance of these critical experiences to the overall user experience, and revealed their effects on how the digital coach improves exercise motivation.

Physical literacy study on college students began in foreign nations early on. Most foreign countries have recognised the numerous benefits of sports for college students through theoretical and practical examinations. In comparison, China lacks relevant research. However, China has implemented numerous regulations to improve college students' physical literacy, and the public has noticed. Domestic research on this subject currently has several challenges: most studies are theoretical rather than data-driven, and the few data-driven studies discuss nothing about the spatial characteristics of college students' physical literacy. Only a few domestic researchers have examined the method for measuring and evaluating physical literacy, establishing distinct measurement systems for various items and groups, but failing to develop a cohesive study framework. The majority of available research on the distribution of college students' physical literacy is theoretical rather than quantitative. Additionally, little research has been conducted on the spatial distribution characteristics of college students' physical literacy. To address the limitations of the prior study, this article uses big data to investigate the spatial distribution characteristics of college students' physical literacy.

The following are the primary contents: (1) Using spatiotemporal data on college students' physical literacy, several standard evaluation indices for college students' physical literacy were improved, and an EIS for college students' physical literacy was built. (2) To completely evaluate college students' physical literacy, the approach for order of preference by similarity to ideal solution (TOPSIS) was used, and the evaluation flow was described. (3) To improve the weights of the indices, the analytic hierarchy process (AHP) was used with the entropy value approach. (4) The flow of spatial distribution analysis was clarified to improve the physical literacy of college students. (5) Using ArcGIS, the standard deviational ellipse was used to determine the spatial distribution direction of college students' physical literacy. The average nearest neighbour was used to determine the degree of concentration or dispersion of spatial points. The kernel density tool was used to analyse the global features of the distribution space of college students' physical literacy and the structural features of the distribution space. Finally, distributions of physical literacy among college students in various locations were reported, demonstrating the scientific quality of our analysis approach.

2. Evaluation of College Students' Physical Literacy

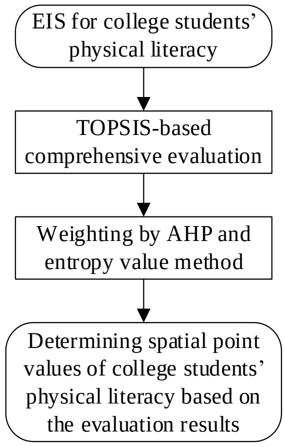

Figure 1. The flow of TOPSIS-based comprehensive evaluation of college students' physical literacy

Since the 1980s, advancements in information and communication technologies have transformed college students' lifestyles and increased the storage, exchange, and computation of data regarding sports participation. College students leave a large amount of data on physical literacy when they use the Internet. This sort of data is rising in popularity and can be used to investigate the spatial distribution characteristics of college students' physical literacy.

Many physical literacy statistics in the age of big data incorporate spatial information, providing a foundation for examining the spatial distribution characteristics of college students' physical literacy from novel perspectives and using novel approaches.

Using EIS principles, several standard indicators of college students' physical literacy were improved using spatiotemporal data on college students' physical literacy. Thus, an EIS for college students' physical literacy was developed, consisting of 15 secondary and five primary indices. The EIS is detailed as follows:

Primary indices:

$SL=\{SL_1, SL_2, SL_3, SL_4, SL_5\}$={sports knowledge, sports techniques and skills, sports behaviour, sports psychology, physical level};

Secondary indices:

$SL_1=\{SL_{11}, SL_{12}\}$={physical health care knowledge, basic knowledge of physical exercise};

SL_2={SL_{21}, SL_{22}}={sports techniques, sports skills};
SL_3={SL_{31}, SL_{32}, SL_{33}, SL_{34}}={sports exercise behaviour, sports entertainment behaviour, sports information acquisition behaviour, sports consumption behaviour};
SL_4={SL_{41}, SL_{42}, SL_{43}, SL_{44}}={sports motivation, sports emotion, sports ethics, sports awareness};
SL_5={SL_{51}, SL_{52}, SL_{53}}={ body shape, body function, body fitness}.

This paper comprehensively evaluates college students' physical literacy by TOPSIS. The evaluation flow is shown in Figure 1. Let n and m be the number of evaluation schemes and indices for college students' physical literacy, respectively. Then, the specific steps of the TOPSIS-based comprehensive evaluation can be expressed as follows:

The normalised decision matrix in assessing college students' physical literacy is obtained by vector normalisation. Let $K=\{k_{ij}\}$ be the decision matrix; $H=\{h_{ij}\}$ be the normalised decision matrix. If an index is positive, then:

$$h_{ij} = \frac{\max(k_{ij}) - k_{ij}}{\max(k_{ij}) - \min(k_{ij})} \tag{1}$$

If an index is negative, then:

$$h_{ij} = \frac{k_{ij} - \min(k_{ij})}{\max(\mathrm{k_{ij}}) - \min(\mathrm{k_{ij}})} \tag{2}$$

Let ω_j be the weight of index i. Then, the weighted normalised matrix $O=\{o_{ij}\}$ can be expressed as:

$$o_{ij} = \omega_j \times h_{ij}, i = 1,2,\ldots,n; j = 1,2,\ldots,m \tag{3}$$

The next is to determine the positive ideal solution k^* and negative ideal solution k_0. Let k^*_j and k^0_j be the j-th attribute of the best solution k^*, and the worst solution k^0, respectively. If an index is positive, then:

$$k_j^* = \min_i(o_{ij}) \tag{4}$$

$$k_j^0 = \max_i(o_{ij}) \tag{5}$$

If an index is negative, then:

$$k_j^0 = \max_i(o_{ij}) \tag{6}$$

$$k_j^0 = \min_i(o_{ij}) \tag{7}$$

After that, the distances from each evaluation scheme to the positive and negative ideal solutions are calculated. The distance to the perfect positive answer can be calculated by:

$$\delta_i^1 = \sqrt{\sum_{j=1}^{m}\left(k_{ij} - k_j^*\right)^2}, i = 1,2,\ldots,n \tag{8}$$

The distance to the negative ideal solution can be calculated by:

$$\delta_i^2 = \sqrt{\sum_{j=1}^{m}\left(k_{ij} - k_j^0\right)^2}, i = 1,2,\ldots,n \tag{9}$$

The composite evaluation index of each evaluation scheme can be calculated by:

$$f_i = \frac{\delta_i^2}{\delta_i^2 + \delta_i^1} \tag{10}$$

Then, the AHP and entropy value method are combined to weigh each index and optimise index weights. Let θ^1_i and θ^2_i be the weights determined by the AHP and entropy value method, respectively. Then, we have:

$$\theta_B = \phi\theta_i^k + \gamma\theta_j^2 (B = 1,2,\ldots,m) \tag{11}$$

The composite weight coefficients φ and γ can be respectively calculated by:

$$\phi = \frac{\theta_i^1}{\theta_i^1 + \theta_j^2} \tag{12}$$

$$\gamma = \frac{\theta_i^2}{\theta_i^1 + \theta_j^2} \tag{13}$$

Since the final composite weight satisfies $\Sigma^m_{B=1}\theta^*_B=1$, weight θ_B is normalised to combine the merits of subjective and objective weighting:

$$\theta_{best}^* = \frac{\phi\theta_i^1 + \gamma\theta_j^2}{\sum_{i=1}^{m}\sum_{j=1}^{m}\left(\phi\theta_i^1 + \gamma\theta_j^2\right)} \tag{14}$$

3. Spatial Distribution Analysis

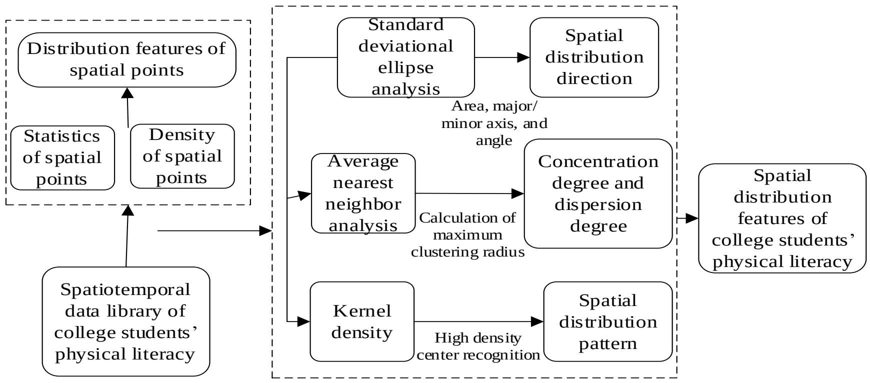

Figure 2. The flow of spatial distribution analysis on college students' physical literacy

Before investigating the distribution of geographical points for college students' physical literacy, the authors developed a spatiotemporal data library of college students' physical literacy. The standard deviational ellipse was used to determine the spatial distribution direction of college students' physical literacy. The average nearest neighbour was used to assess the degree of concentration or dispersion of spatial points, and the kernel density tool was used to analyse both the global features of the distribution space of college students' physical literacy and the structural elements of the distribution space of each. Figure 2 depicts the technical flow.

This article determines the spatial distribution direction of college students' physical literacy through standard deviational ellipse analysis. The formed ellipse has the mean centre, area, major and minor axes, and angle. The mean centre is defined by the coordinates A and B; the major and minor axes denote the distribution direction and range of spatial points in college students' physical literacy, and the corner is the angle formed by the main and minor axes clockwise away from the vertex. The area of the ellipse, the axial length, the angle, and the mean centre may all be computed using the following formulas:

$$C = \sum_{i=1}^{m}(a_i\bar{a})\sum_{i=1}^{m}(b_i\bar{b}) \quad (15)$$

$$r = \sum_{i=1}^{m}(a_i\bar{a})^2\sum_{i=1}^{m}(b_i\bar{b})^2 \quad (16)$$

$$\tan\alpha = \frac{X+\sqrt{X^2+4C^2}}{2C} \quad (17)$$

$$\varepsilon_a = \sqrt{\sum_{i=1}^{m}\left[(a_i-\bar{a})\cos\alpha-(b_i-\bar{b})\sin\alpha\right]^2/m} \quad (18)$$

$$\varepsilon_b = \sqrt{\sum_{i=1}^{m}\left[(a_i-\bar{a})\cos\alpha-(b_i-\bar{b})\cos\alpha\right]^2/m} \quad (19)$$

Besides, the average nearest neighbour was selected to evaluate spatial points' concentration or dispersion degree. Let S be the most immediate neighbour index. If $S \leq 1$, the spatial points are concentrated; if $S \geq 1$, the spatial issues tend to be uniformly distributed; if $S=1$, the spatial points are randomly distributed; if $S=0$, the spatial points are perfectly concentrated. Let W and M be the mean distance between and the number of spatial points for college students' physical literacy; X be the region's area. Then, we have:

$$S = W/\left(\frac{X}{8M}+\frac{1}{2}\sqrt{\frac{X}{M}}\right) \quad (20)$$

Let δ be the distance; m be the number of evaluation factors for college students' physical literacy; X be the region's total area; $l_{i,j}$ be the weight. Then, the K function can be expressed as:

$$K(\delta) = \sqrt{\frac{X\sum_{i=1}^{m}\sum_{j=1,j\neq i}^{m}l_{i,j}}{\pi m(m-1)}} \quad (21)$$

Without boundary correction, if the distance between spatial points i and j is smaller than δ, the weight will be one; if the distance is greater than δ, the weight will be zero. In addition, the kernel density tool was called to analyse the global features of the distribution space of college students' physical literacy and the structural elements of the distribution space of each kind of physical literacy. Let $F(s)E(r)$ be the kernel density function; LK is kernel density radius threshold; nm is the number of points, and L is spatial weight. Then, an analytical formula can be given:

$$E(r) = \sum_{i=1}^{m}\frac{1}{K^2}l\left(\frac{r-x_i}{K}\right) \quad (22)$$

Kernel density analysis is not closely associated with spatial weight, but is closely related to selecting the density radius threshold. Formula (22) shows that the kernel density peaks at each core spatial point and increases with the distance from any other spatial point to the core point.

This paper investigates the degree of geographical concentration of college students' physical literacy in a region, using the locational Gini and concentration indices. Let a_i and a_j be the number of college students with qualified physical literacy in cities i and j, respectively; a' be the mean of variable A; m be the number of cities; $H \in [0, 1]$ be the locational Gini index. Then, the locational Gini index can be calculated by:

$$H = \frac{1}{2m^2a'}\sum_{i=1}^{m}\sum_{j=1}^{m}\left|a_i-a_j\right| \quad (23)$$

Formula (23) shows that the greater the locational Gini index H, the higher the degree of geographical concentration of college students' physical literacy in a region. The concentration index can be calculated by:

$$JZ_m = \sum_{i=1}^{m}r_i \quad (24)$$

Considering the number of college students with qualified physical literacy in the city i as a proportion of that in all cities in the region, this paper focuses on the top h cities in terms of concentration index. The greater the concentration index, the more concentrated the college students with qualified physical literacy are in the region.

This paper examines the global and local spatial autocorrelations of college students' physical literacy through exploratory spatial data analysis. Global Moran's I was introduced to measure the correlation and concentration of spatial points for college students' physical literacy. Let m be the number of cities; a_i be the number of college students with qualified physical literacy in city i; ω_{ij} be the normalised spatial weight coefficient. Then, global Moran's I can be calculated by:

$$I = \frac{m\sum_{i=1}^{m}\sum_{j=1}^{m}\omega_{ij}(a_i-\bar{a})(a_j-\bar{a})}{\sum_{i=1}^{m}\sum_{j=1}^{m}\omega_{ij}\quad\sum_{i=1}^{m}(a_i-\bar{a})^2} \tag{25}$$

The greater the global Moran's I, the higher the autocorrelation between the spatial points for college students' physical literacy. Local Moran's, I can measure the local spatial autocorrelation:

$$I_i = \frac{a_i-\bar{a}}{R^2}\sum_{j=1}^{m}\omega_{ij}\left(a_j-\bar{a}\right), R^2 = \frac{1}{m}\sum_{i=1}^{m}(a_i-\bar{a})^2 \tag{26}$$

4. Experiments and Results Analysis

Table 1

Results of primary indices

Primary index	Sports knowledge	Sports technology and skills	Sports behaviour	Sports psychology	Physical level
Eigenvector	0.625	1.074	1.302	0.825	1.305
Weight	14.268%	22.157%	26.025%	15.326%	22.224%
Maximum eigenvalue			4		

Numerous scholars developed a preliminary questionnaire regarding the objects and challenges at hand. In contrast to conventional evaluation approaches, this article uses a combination of the AHP and the entropy value method to optimise the weight of each index. Table 1 summarises the results of the examination of the primary index. To begin, the primary indices' mean values were determined to be 1.633, 3.107, 3.269, 2.256, and 3.427. The judgment matrix was then calculated by dividing the mean values by two. As indicated in Table 1, the major indices have eigenvectors of 0.625, 1.074, 1.302, 0.825, and 1.305, with corresponding weights of 14.268 percent and 22.157 26.025 percent, 15.326 percent, and 22.224 percent.

Figure 3 depicts spatial statistics on the physical literacy of several types of college students. As can be seen, regions 1 and 3 dominated in terms of college students with qualified sports knowledge, technology, and abilities; regions 2, 4, and 5 lagged behind regions 1 and 3. The primary reason for this is because the physical literacy needed of college students in each location correlates strongly with the distribution of college students' physical literacy. Among the five regions, regions 1 and 3 are critical for developing college students' physical literacy because they have the most college students. Additionally, it was discovered that there were relatively few college students with superior athletic abilities in any region. College students have not paid sufficient attention to sports behaviour and psychology in sports.

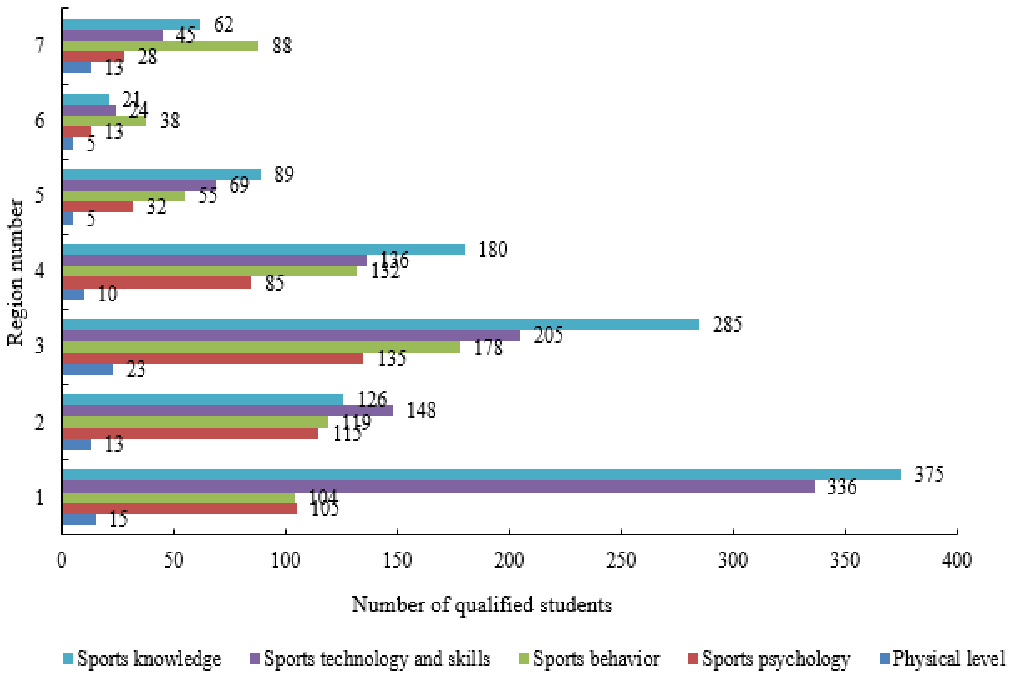

Figure 3. Spatial statistics on each kind of college students' physical literacy

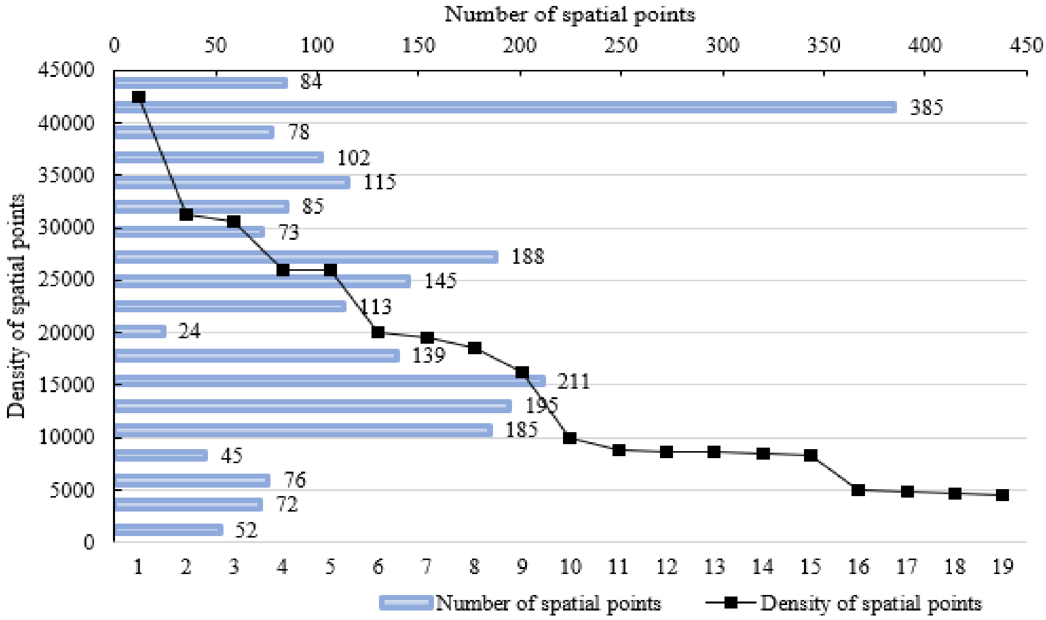

Figure 4. Spatial point statistics on college students' physical literacy in each region

The distribution density of college students in each region was compared to the distribution of spatial locations for physical literacy in that region to identify and summarise the statistical distribution features of the two variables. The spatial point statistics on college students' physical literacy in each location are depicted in Figure 4. It may be deduced that the density of college students gradually decreased as they moved from the centre to the periphery. Regions 1 and 2 had a disproportionately high concentration of college students. By comparing the density of college students to the thickness of spatial points for physical literacy, it becomes obvious that places with a high density of college students are not necessarily those with a high density of spatial points for physical literacy.

A comparative experiment was conducted to determine the relationship between the amount of time college students spend participating in sports and their physical literacy development. The time distribution of college students' participation in sports activities by grade is depicted in Figure 5. It can be shown that college students of all grades in the research region preferred to participate in sports activities between 6:00 and 8:00 a.m. and 6:00-9:00 p.m. They were less likely to exercise between 8:00-11:00 a.m., 11:00-1:00 p.m., 1:00-4:00 p.m., or 4:00-6:00 p.m., in the morning, noon, or afternoon. At noon, the valley's probability of participating in athletic activities increased.

The temporal distribution of college students' participation in sports activities at various consumption levels is depicted in Figure 6. As can be observed, college students with varying levels of consumption did not differ significantly in their preferred periods for sports activities, except that those with a consumption level of >1500 were somewhat more inclined to exercise in the afternoon. Regardless of their consumption level, college students prefer to exercise between 6:00 and 9:00 p.m. and 6:00-8:00 a.m. Only a small percentage of people would exercise during other times. Additionally, it was discovered that college students with varying consumption levels differed greatly in their likelihood of exercising between 6:00 and 8:00 a.m. but modestly in their probability of exercising between 6:00 and 9:00 p.m.

Another comparative experiment was conducted to determine the relationship between the sports locations chosen by college students and their physical literacy development. The venue performance of college students participating in sports events at various grades is depicted in Figure 7. As can be observed, college students in any grade of the research region, e.g., those in areas I, II, IV, and VI, were not fond of outdoor recreational sports activities. Additionally, it was revealed that college students with high grades were more likely to engage in indoor sports activities.

Figure 8 depicts the distribution of physical literacy among college students in the research region. The research region's buffer zones for college students' physical literacy distribution were drawn around each college stadium. The spatial sites for college sports facilities in the buffer zones were rather numerous surrounding college stadiums and focused in the region's southeast or southwest.

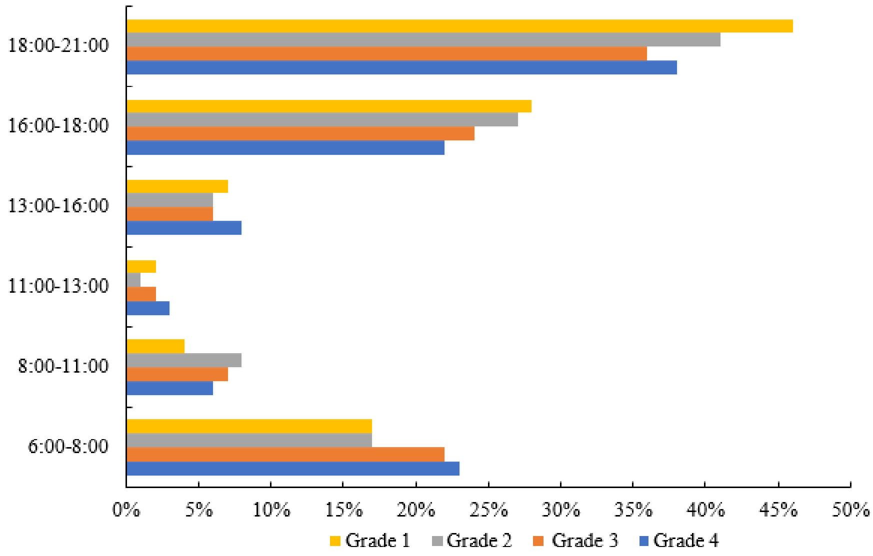

Figure 5. Time distribution of college students' participation in sports activities in different grades

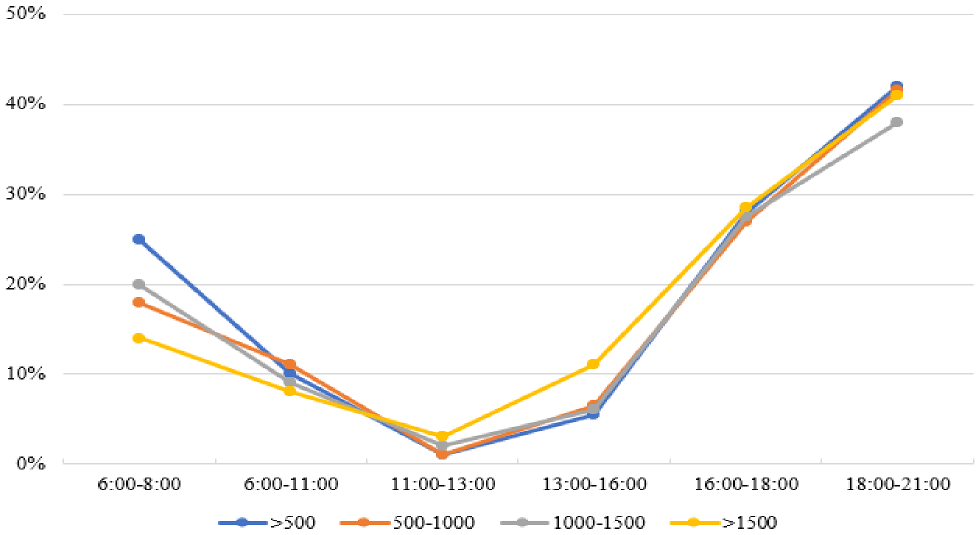

Figure 6. Time distribution of college students' participation in sports activities at different consumption levels

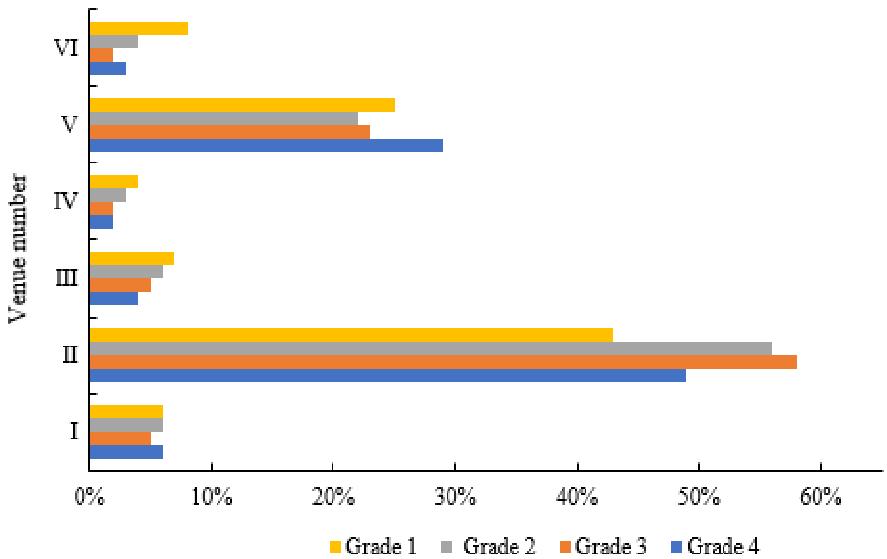

Figure 7. Venue performance of college students' participation in sports activities in different grades

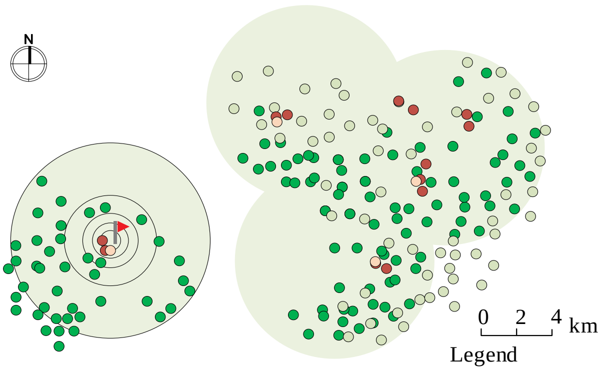

Figure 8. Distribution of college students' physical literacy in the research region

Several recommendations were made in the initial analysis to increase the physical literacy of college students in the region: (1) Strengthen the government's credibility by implementing necessary policies; (2) Increase governmental support for the sports culture industry and foster a more relaxed atmosphere for the sports health industry's development; (3) Promote physical education model innovation and encourage society to value talents and creativity.

5. Conclusions

This article examines the spatial distribution characteristics of college students' physical literacy using big data. To begin, spatiotemporal data on college students' physical literacy were collected, and traditional indices of college students' physical literacy were refined, resulting in an EIS for college students' physical literacy. Following that, the TOPSIS was extensively used to evaluate college students' physical literacy, and the evaluation flow was described. Additionally, the AHP was used with the entropy value approach to optimise the index weights. After defining the flow of spatial distribution analysis for college students' physical literacy, several ArcGIS tools were used for a more detailed analysis. The standard deviational ellipse was used to determine the spatial distribution direction of college students' physical literacy. The average nearest neighbour was used to determine spatial points' concentration or dispersion degree, and the kernel density tool was used to analyse global features. The authors calculated the weights for the primary indices, plotted the spatial statistics on each type of college students' physical literacy, and drew the spatial point statistics on college students' physical literacy in each region, concluding that regions with a high density of college students are not necessarily those with a high density of physical literacy spatial points.

Additionally, comparative experiments were conducted to determine the relationship between the time spent by college students participating in sports and the development of their physical literacy and the relationship between the sports venues chosen by college students and the development of their physical literacy. The pertinent data were analysed. Finally, a sketch map depicted the distribution of college students' physical literacy across the research region.

The purpose of this article is to examine the overall distribution of physical literacy among regional college students and the data for evaluation indices for sports knowledge, sports techniques and abilities, sports behaviour, sports psychology, and physical level. However, the causes affecting each indicator should be investigated in greater detail. Additionally, new important and effective optimisation strategies for each influencing component are anticipated.

6. Research Implications

This study has not only theoretical but also practical consequences for ensuring the physical literacy of college students. In this light, this study reveals the critical significance of psychological management and free time in helping students develop their creativity. Additionally, this study addresses the spatial distribution characteristics of college students' physical literacy as an essential component of the students' living standards. This study says that proper methods must exist and that these tactics must be used successfully to assure productivity. In this manner, college students can participate in extracurricular activities and improve their physical literacy.

7. Future Directions

To begin, this study sought to elucidate the critical function of spatial distribution characteristics in college students' physical literacy. However, reviewing the prior literature makes it clear that various other elements also contribute to college students' physical literacy. Future research should explore the effect of students' behaviour, extracurricular activities, and cognitive approach to these aspects to better comprehend them.

References

Che, Y. L. (2014). A Study on Training of Contemporary College Student Everyday Sports Ability. In *Advanced Materials Research* (Vol. 971, pp. 2509-2512). Trans Tech Publ. https://www.scientific.net/AMR.971-973.2509

Ding, W. (2013). Training the students' sports ability and developing their personality in physical education. In *2013 Fifth International Conference on Measuring Technology and Mechatronics Automation* (pp. 1275-1279). IEEE. https://doi.org/10.1109/ICMTMA.2013.313

Jiang, Y., & Xu, G. (2022). Research on the cultivation path of teenagers' sports health literacy under the background of healthy China. *Journal of healthcare engineering, 2022*. https://doi.org/10.1155/2022/3031475

Kaiyan, H., & Qin, W. (2018). The development and popularisation of network platform of college sports venues in intelligent manufacturing. *International Journal of Reasoning-Based Intelligent Systems, 10*(1), 20-25. https://doi.org/10.1504/IJRIS.2018.091126

Kettunen, E., Kari, T., & Critchley, W. (2019). Critical Experiences with Sport and Wellness Technology Digital Coach: A Study among University Students with Low Levels of Physical Activity. In *Pacific Asia Conference on Information Systems*. Association for Information Systems. https://jyx.jyu.fi/handle/123456789/69198

Li, D., Yi, C., & Gu, Y. (2021). Research on college physical education and sports training based on virtual reality technology. *Mathematical Problems in Engineering, 2021*. https://doi.org/10.1155/2021/6625529

Li, H.-Y., Tian, L., Wu, Y.-n., & Xie, M. (2013). Improvement of mid-to long-term runoff forecasting based on physical causes: application in Nenjiang basin, China. *Hydrological sciences journal, 58*(7), 1414-1422. https://doi.org/10.1080/02626667.2013.833664

Li, T. (2018). Sports mental behaviours of college students based on cluster analysis. *Journal of Discrete Mathematical Sciences and Cryptography, 21*(6), 1299-1304. https://doi.org/10.1080/09720529.2018.1526405

Li, W., & Fan, X. (2021). Construction of network multimedia teaching platform system of college sports. *Mathematical Problems in Engineering, 2021*. https://doi.org/10.1155/2021/6304703

Liu, C., Li, Z., & Du, X. (2021). The effect of musical stimulation in sports on sports fatigue of college students. *Journal of Internet Technology, 22*(1), 187-195. https://jit.ndhu.edu.tw/article/view/2472

Liu, H. S. (2014). Research on the college students' physique test based on artificial neural network and support vector machines approach. In *Advanced Materials Research* (Vol. 945, pp. 3558-3561). Trans Tech Publ. https://doi.org/10.4028/www.scientific.net/AMR.945-949.3558

Singh, S. K., Liang, J., & Bárdossy, A. (2012). Improving the calibration strategy of the physically-based model WaSiM-ETH using critical events. *Hydrological sciences journal, 57*(8), 1487-1505. https://doi.org/10.1080/02626667.2012.727091

Tang, M., & Wei, D. (2021). Cultivation Strategies for Scientific Research and Innovation Ability of College Students Majoring in Sports. *International Journal of Emerging Technologies in Learning, 16*(6). https://web.s.ebscohost.com/abstract?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=18630383&AN=149578509&h=

Tang, P., Wang, Y., & Shen, N. (2019). Prediction of college students' physique based on support vector regression. In *2019 Chinese Automation Congress (CAC)* (pp. 2439-2443). IEEE. https://doi.org/10.1109/CAC48633.2019.8997443

Wang, H. (2018). Design of college students' physique monitoring and service platform based on computer and network. *International Journal of Reasoning-based Intelligent Systems, 10*(2), 134-138. https://doi.org/10.1504/IJRIS.2018.092217

Wu, Y., & Zhang, F. (2021). Research on the influence of sports and nutrition matching on improving students' physique based on intelligent sensor. *Computational Intelligence and Neuroscience, 2021*. https://doi.org/10.1155/2021/3556131

Yan, W., & Zhang, Y. (2017). College sports fitness teaching model based on constructivism. *Agro Food Industry Hi-Tech, 28*(1), 1642-1645.

YongKang, W., & QianQian, F. (2022). The Chinese Assessment of physical literacy: Based on Grounded Theory Paradigm for children in grades 3-6. *medRxiv*. https://doi.org/10.1101/2022.01.12.22269057

Zhang, T. (2019). Index And Analysis Of College Students' Physique Health Ability Based On Ordered Causality Test. In *2019 International Conference on Robots & Intelligent System (ICRIS)* (pp. 356-360). IEEE. https://doi.org/10.1109/ICRIS.2019.00096

Zhang, X., Cheng, T., & Liu, Y. (2013). An Adolescent Physical Exercise Ability Evaluation Method in Sports Training. In *Proceedings of the 2nd International Conference on Green Communications and Networks 2012 (GCN 2012): Volume 4* (pp. 341-348). Springer. https://doi.org/10.1007/978-3-642-35440-3_44