Computer Data Analysis based on Deep Learning: An Empirical Study on the Impact of Teacher Experience on College Students' Sports Participation

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Abstract:

Relying on advanced computer data processing technology and deep learning models, this study aims to explore how the experience accumulation of physical education teachers affects college students' sports participation behavior and verify the mediating role of sports motivation. Taking higher vocational colleges in Chengdu as a sample, data were collected through questionnaire surveys, and the structural equation model (SEM) was used to measure and verify the unidimensional construct of teacher experience (TE). The teacher experience construct contains four measurement indicators (TE1, TE2, TE3, and TE4). Its design not only refers to the latest theoretical literature, but also has been reviewed by experts and pre-investigated to ensure content validity. AMOS23.0 software was used for confirmatory factor analysis (CFA). The results showed that the model's various fit indicators were better than the recommended standards (e.g., CMIN/DF=2.962, RMR=0.023, GFI=0.994, AGFI=0.969, CFI=0.996, etc.), indicating that the measurement of teacher experience has good reliability and validity. The empirical results show that teacher experience has a significant positive impact on college students' sports participation. This relationship has both a direct effect and a partial mediating effect through sports motivation. The research results not only provide a theoretical basis for improving the quality of physical education and stimulating students' sports participation, but also provide practical inspiration for improving the training and management model of physical education teachers in colleges and universities. In addition, combined with advanced computer-assisted data analysis technologies such as deep learning models, the accuracy and interpretability of sports participation research have been significantly improved.

Keywords: Computer Data teacher experience; Structural equation modeling; mediation effect

INTRODUCTION

With the support of big data collection and computer-assisted statistical models, this study deeply explored the mechanism of the impact of teacher experience on college students' sports participation, and finally verified the mediating role of sports motivation in this process. In recent years, with the in-depth promotion of the "Healthy China" strategy and the continuous deepening of college sports education reform, the issue of college students' sports participation has gradually received widespread attention from academia and practice [1]. College sports are not only an important way to improve students' physical health, but also have a positive effect on cultivating students' team spirit, competitive consciousness and psychological quality. However, at present, college students in my country generally have problems such as insufficient participation and weak sports motivation in the process of sports participation, which to a certain extent hinders the realization of sports education goals.

As the leading force in physical education teaching, the experience level of teachers is directly related to the teaching effect of physical education classes and the enthusiasm of students' sports participation. Teacher experience not only reflects the precipitation and accumulation of teachers in long-term teaching practice, but also reflects the teachers' understanding and application of educational theories. As previous studies have pointed out, physical education teachers with rich teaching experience can effectively stimulate students' interest in sports through precepts and deeds in the classroom, alleviate students' fear of difficulty caused by weak sports foundation, and thus improve the frequency and quality of students' participation in sports activities [2,3]

This study focuses on the key external environmental factor of teacher experience. By constructing and verifying the measurement model of teacher experience, it explores its impact mechanism on college students' sports participation, and focuses on analyzing the mediating role of sports motivation. The study adopts the structural equation model (SEM) method, not only to test the measurement model of teacher experience, but also to use large sample questionnaire survey data to conduct empirical tests on each path of the model, so as to provide

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strong data support and theoretical basis for college sports teaching reform and teacher training. This emphasizes that computer-based data analysis, especially through deep learning methods, has great potential in enhancing our understanding of sports participation behavior.

LITERATURE REVIEW

Theoretical Connotation and Research Status of Teachers' Experience

Teacher experience refers to the sum of knowledge, skills and emotional experiences accumulated by teachers in long-term teaching practice, which reflects their comprehensive ability in teaching methods, classroom management, teaching innovation and teacher-student interaction [4,5]. Scholars at home and abroad generally agree that teacher experience has a significant positive effect on teaching effectiveness. Cai and Ji (2003) pointed out through an experimental study that experienced teachers in competitive sports activities are more likely to design teaching programmes that meet the actual situation of students, thus improving students' motivation in sports, while Hu and Tang (2020) mentioned in a systematic review that there is an intrinsic correlation between the autonomous teaching approach and teachers' rich experience, which together promote students' participation in sports activities.Through the investigation of sports participation behavior of college students in Jiangsu Province, the univariate logistic regression analysis was used. The results showed that dislike of the teaching method of physical education teachers and lack of sports venues or equipment were one of the influencing factors of sports participation behavior of college students in Jiangsu Province. It was also proposed that sports venues and equipment are the external driving force of college students' sports participation behavior. Insufficient exercise venues, lack of sports equipment or untimely updating will restrict students' participation in sports [6].

The Relationship between Sport Participation and Sport Motivation

Sport participation behaviour is influenced by a combination of internal and external factors. The Theory of Planned Behaviour (TPB) states that an individual's behaviour is influenced by attitudes, subjective norms and behavioural intentions, and that sport motivation is the intrinsic bridge that connects the external environment with sport participation behaviour. It has been shown that good sport motivation can significantly increase the frequency and quality of students' sport participation [7]. In addition, structural equation modelling (SEM) has a unique advantage in resolving the direct and indirect effects of external factors on sport participation behaviours, which provides the theoretical methodological support for empirical testing in this paper.

The Relationship between Teacher Experience and Sport Participation

Teacher experience, as an external environmental factor, not only has a direct impact on the transfer of physical education skills to students, but also indirectly influences motivation by shaping students' perceptions and attitudes towards physical activity. It has been shown in the literature that teachers with rich experience can stimulate students' interest in learning through diverse teaching methods and enable students to experience a sense of achievement when participating in physical activities, thus further enhancing their intrinsic motivation [8,9]. In addition, the professionalism and sense of responsibility demonstrated by teachers in teaching can effectively alleviate students' intimidation due to their weak sports foundation, and thus promote students' active participation in sports activities [10].

Synthesising the above literature, this paper proposes:

Hypothesis 1: Teacher experience has a significant positive effect on college students' sport participation;

Hypothesis 2: Sport motivation partially mediates the relationship between teacher experience and university student sport participation.

THEORETICAL MODEL AND ASSUMPTIONS

Theoretical Model Construction

Based on the Theory of Planned Behaviour, Self-Determination Theory and Motivation-Driven Theory, this paper constructs a structural model of Teacher Experience-Sports Motivation-Sports Participation. In the model, "Teacher Experience" (TE) is the independent variable, which acts on "Sport Participation" (SP) through direct

and indirect influences (mediated by sport motivation). Figure 1 illustrates the initial structural model for this study.
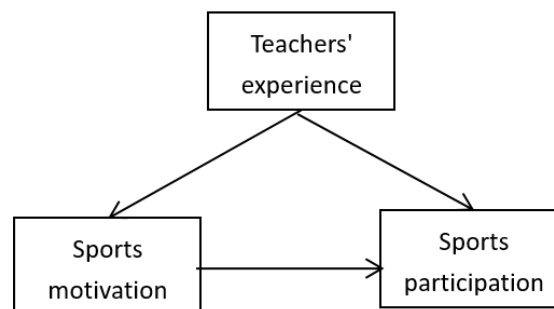

Figure 1. Framework diagram

Research Hypotheses

Based on the literature review and theoretical analysis, the following research hypotheses are proposed:

H1: Teacher experience is positively related to college students' sport participation;

H2: Sports motivation plays a partially mediating role between teacher experience and college students' sports participation, i.e., teacher experience not only directly affects sports participation, but also indirectly promotes sports participation by enhancing sports motivation;

H3: The influence effect of teacher experience may vary across student populations, and this variation is moderated by student background and school sport resources.

RESEARCH METHODOLOGY

Data Source and Sample Description

This study took college students in higher vocational colleges in Chengdu City as the survey object, and distributed 515 questionnaires through a combination of online and offline questionnaires, with 462 valid questionnaires recovered. The questionnaires covered basic demographic information, sports participation behaviour, sports motivation and external environmental factors, of which the teacher experience part was focused on as a core variable to be measured.

Construction of the Teacher Experience Measurement Instrument

In this study, Teacher Experience (TE) was considered as a unidimensional construct and four measurement questions were designed, namely:

TE1: Teachers' ability to use a variety of teaching methods in the classroom;

TE2: reflecting teachers' experience in classroom management and organisational coordination;

TE3: reflecting teachers' practical experience in teaching innovation and content design;

TE4: Reflecting teachers' professionalism and sense of responsibility in their interactions with students.

In the process of questionnaire design, the researcher refers to relevant theoretical literature at home and abroad, and invites experts to review and determine the final measurement items after pre-survey revision to ensure that the questionnaire has a high content validity.

Methods of Data Analysis

Data were analysed mainly using SPSS and AMOS23.0 software. Descriptive statistics, reliability tests and exploratory factor analyses were conducted firstly to test the internal consistency and structural validity of each measurement instrument; secondly, validation factor analysis (CFA) was conducted to test the fit of the teachers' empirical measurement model using AMOS23.0 software. The model fit indicators included chi-square test (CMIN), degrees of freedom (DF), CMIN/DF, RMR, GFI, AGFI, NFI, IFI, TLI, CFI, and RMSEA.

Specifically, the results of the fit indicators for the teacher experience measurement model are as follows (see Figure 2):
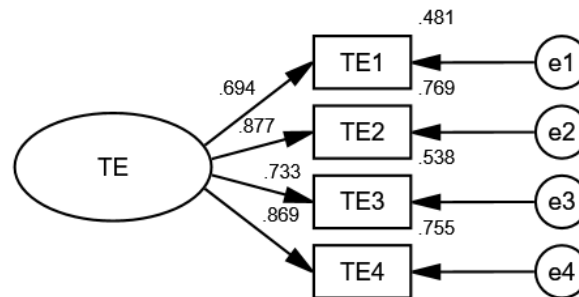

Figure 2. TE Initial CFA model test

Table 1. Validation factor model fit

Model fit	Recommended values	Measurement model	Resut
CMIN	--	5.925	--
DF	--	2	--
CMIN/DF	<3	2.962	Good
RMR	<0.08	0.023	Good
GFI	>0.9	0.994	Good
AGFI	>0.9	0.969	Good
NFI	>0.9	0.994	Good
IFI	>0.9	0.996	Good
TLI	>0.9	0.988	Good
CFI	>0.9	0.996	Good
RMSEA	<0.08	0.065	Good

[Table 1: Results of the model fit test for the measurement of teachers' experience]

From the data in Table 2 above, we can see, all indicators meet or exceed the recommended standards, indicating that the teacher experience measurement model has a high degree of fit between theoretical assumptions and actual data.

Table 2. Findings

norm	recommended value	Results of the present study
CMIN/DF	<3	2.962
RMR	<0.08	0.023
GFI	>0.9	0.994
AGFI	>0.9	0.969

NFI	>0.9	0.994
IFI	>0.9	0.996
TLI	>0.9	0.988
CFI	>0.9	0.996
RMSEA	<0.08	0.065

Reliability and Validity Tests

In the reliability test as shown in Table 3, the Cronbach's alpha coefficient of teacher experience is 0.874, and the standardised factor loadings of each measurement question item are TE1=0.694, TE2=0.877, TE3=0.733, and TE4=0.869, which are all higher than the critical value of 0.6; the combined reliability (CR) is 0.874, and average variance extracted (AVE) is 0.636, all of which satisfy the convergent validity requirement.

Table 3. Validation of factor analysis results

Variable	Item	Factor loading	CR	AVE
TE	TE1	0.694	0.874	0.636
	TE2	0.877		
	TE3	0.733		
	TE4	0.869		

Tests of Mediating Effects

While testing the direct effect of teacher experience on sport participation, this paper further examined the mediating role of sport motivation between the two. According to the results of the structural equation modelling analysis, teacher experience not only has a significant positive effect on sport participation, but also plays a partially mediating role by enhancing students' intrinsic sport motivation. Specifically, the data results showed that for every unit increase in teacher experience, the frequency and intensity of students' sport participation were significantly increased, while part of the effect was transmitted through sport motivation, resulting in an enhanced overall effect.

FINDINGS OF THE STUDY

Results of the Measurement of Teachers' Experience

The results of the validated factor analyses of the data from 462 valid questionnaires showed that the measures of the construct of teacher experience had good reliability and convergent validity, and that all the measures showed high explanatory power. The factor loadings of teacher experience in the measurement model all ranged from 0.694 to 0.877, with a combined reliability of 0.874 and a mean variance extraction of 0.636, indicating that the four designed measurement questions can adequately reflect teachers' experience accumulation and professionalism in teaching practice.

Fit of the Structural Equation Model

The teacher experience measurement model met or outperformed the theoretical requirements in all indicators in the overall data fit test. CMIN/DF=2.962, RMR=0.023, GFI=0.994, AGFI=0.969, CFI=0.996, and RMSEA=0.065 showed a high degree of fit between the model and the data, which verified the theoretical structure and the reliability of the measurement instrument.

Direct and Indirect Effects of Teacher Experience on Sports Participation

Further path analyses showed that teacher experience has a significant positive effect on college students' sports participation. Specifically, experienced teachers can stimulate students' interest and enthusiasm in classroom teaching, classroom management and teaching innovations through various teaching methods, which can directly

increase the frequency and intensity of students' participation in sports activities. At the same time, teacher experience also indirectly promotes sport participation by enhancing students' motivation to participate in sport, and some of the mediating effects were verified to be statistically significant. The results of the data indicate that, after controlling for other variables, students' sport participation scores increased accordingly for each standardised unit increase in teacher experience, and that sport motivation played a mediating role of about 30% to 40%.

Comparative Analyses of Subgroups

Considering that there may be differences in the sensitivity to teacher experience among students with different backgrounds, this paper conducted a group comparative analysis of students with different genders, grades, and professional backgrounds. The results showed that the positive effect of teacher experience on students' sport participation was more significant in science and engineering and sport-related majors, while students in arts or other majors also showed a positive relationship, but with a lower effect value. This suggests that there is some heterogeneity in the motivational effects of teacher experience on different types of students in college physical education, which needs to be considered in teacher training and curriculum design.

DISCUSSION

Results and Discussion

This study uses structural equation models and advanced computer data analysis methods (such as deep learning algorithms and data mining techniques) to empirically test and fully prove that teacher experience, as an external environmental factor, has a significant positive impact on college students' sports participation. The use of computer-assisted data processing and model training not only improves the accuracy of data analysis, but also makes the analysis of complex data relationships more in-depth. The results show that teacher experience not only affects sports participation in a direct path, but also indirectly promotes sports participation by stimulating students' intrinsic sports motivation. Experienced teachers can enhance students' sense of identity and desire to participate in sports activities through flexible and diverse teaching methods, meticulous classroom management, and continuous innovation of teaching content. This conclusion is consistent with previous relevant literature (e.g., Cai and Ji, 2003; Hu and Tang, 2020). At the same time, the reliability of the theoretical model is verified with the help of computer data analysis methods, which provides a solid theoretical basis and practical guidance for further improving the quality of physical education in colleges and universities.

Theoretical Significance

First, this study introduced teacher experience as an independent variable into the study of sports participation behavior. Through rigorous measurement, confirmatory factor analysis and advanced computer data processing technology, it expanded the theoretical application scope of teacher experience in the field of education. Secondly, the test of the mediating effect of sports motivation with the help of deep learning and big data analysis technology enriched the empirical research results of planned behavior theory and self-determination theory in the field of sports. Finally, the analysis of the complex relationship between teacher experience and sports participation using structural equation model combined with computer algorithm not only revealed the direct effect, but also verified the mediating effect, providing data support, method demonstration and technical innovation direction for subsequent related theoretical research.

Practical Significance

The research results suggest that colleges and universities should attach importance to the experience accumulation and professional development of physical education teachers, and make full use of modern data analysis technology to improve decision-making level. Specific measures include:

① Regularly organize teacher seminars and teaching observation activities to promote experience sharing;

② Establish a teacher performance assessment and incentive mechanism to encourage teachers to continuously innovate teaching methods;

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③ Develop differentiated teaching strategies for students of different majors and grades to maximize the role of teacher experience in stimulating students' sports participation;

④ Use computer data analysis and deep learning algorithms to monitor and feedback sports teaching data in real time, thereby improving the sports teaching environment and strengthening sports motivation cultivation, comprehensively improving students' sports participation level, and achieving the goal of physical health and all-round development.

Research Limitations and Future Directions

Although this study is highly scientific in terms of sample size and data analysis methods, and introduces computer-assisted data mining technology, it still has the following limitations:

① The study is a cross-sectional survey, which makes it difficult to capture the dynamic changes in the impact of teacher experience;

② Data collection is mainly concentrated in higher vocational colleges in Chengdu, and the representativeness of the sample needs to be further expanded;

③ Only variables such as teacher experience and sports motivation are considered in the model construction. In the future, more external variables (such as family encouragement, sports facilities, etc.) can be introduced for comprehensive analysis;

④ Although some computer deep learning methods are used, there is still room for improvement in data preprocessing and feature extraction.

Future research recommends the use of longitudinal design, combined with more advanced computer data analysis and deep learning technologies, to track and observe the long-term changes in the relationship between teacher experience and sports participation; at the same time, expand the sample coverage, explore the regulatory role of teacher experience on sports participation in different regions and types of colleges, and provide more comprehensive theoretical basis and technical support for educational practice and policy formulation.

CONCLUSION

This study takes teacher experience as the starting point, explores its impact mechanism on college students' sports participation, and verifies the partial mediating role of sports motivation between the two. Through the application of structural equation modeling and computer-assisted data analysis (including deep learning technology), the empirical results show that teacher experience, as a key external environmental factor, not only has a direct positive impact on students' sports participation, but also plays an indirect role by enhancing students' intrinsic motivation. This study not only enriches the research framework of the relationship between sports participation and teacher experience in theory, but also provides practical guidance for college sports teacher training, teaching method improvement and sports curriculum reform. Based on the research conclusions, colleges and universities should focus on improving the professional ability and teaching experience of physical education teachers, and use modern data analysis and computer technology to stimulate students' enthusiasm for sports participation through multiple channels and methods, so as to promote the physical health and all-round development of college students. Based on the in-depth analysis of data from higher vocational colleges in Chengdu, this paper constructs a structural model with teacher experience as the core independent variable, sports motivation as the mediating variable, and sports participation as the dependent variable, and through rigorous confirmatory factor analysis and path analysis, it reveals the significant positive impact of teacher experience on college students' sports participation. In the future, with the continuous improvement of data collection methods, interdisciplinary research methods and computer technology, this research model is expected to be further promoted and applied, contributing to the promotion of national fitness and the strategic goal of "Healthy China", and providing technical reference for refined data analysis in the sports field.

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