

The Evolution of Urban Physical Education Development Model and Its Innovative Development Strategy

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<p>Article History</p> <p>Article Submission 12 August 2023</p> <p>Revised Submission 10 September 2023</p> <p>Article Accepted 6 October 2023</p>	<p style="text-align: center;">Abstract</p> <p>In China's urban environment, physical education has changed significantly during the last few decades. Physical education programs are in higher demand than ever, especially in colleges, as people's knowledge of health and fitness has grown. This study examines the effectiveness of an innovative physical education development and strategy, based on self-determination theory principles, in promoting physical activity and motivation among undergraduate students in Taiyuan, China. A total of 256 participants enrolled in fitness-based physical activity classes at a university in China were included in the study. Data was collected through self-reported measures of physical education, physical fitness, innovativeness, lifestyle behavior, and academic achievement. Statistical analyses were conducted using SPSS software. The findings suggest that the physical education development model and strategy may be effective in promoting physical education, physical fitness, innovativeness, and academic achievement among undergraduate students in China. Further research may be needed to explore the relationship between academic achievement and lifestyle behavior in more detail and to identify any other factors that may be influencing academic achievement.</p> <p>Keywords: Physical Education; Physical Fitness; Innovativeness; Academic Achievement; Lifestyle Behavior</p>
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Introduction

The development of novel strategies to encourage physical education among undergraduate students in Chinese institutions has received increasing attention in recent years (Mateo-Orcajada, González-Gálvez, Abenza-Cano, & Vaquero-Cristóbal, 2022). In order to address the demands of their students, colleges now see the development of physical education models and techniques as a vital issue. Since the beginning of time, when martial arts and other types of physical activity were an essential part of daily life, China has had a long history of physical education (Wang, He, Zhou, & Ren, 2022). Physical education has grown in importance in modern society, especially in universities where a focus is placed on encouraging undergraduate students to lead fit and healthy lifestyles. Physical education was heavily emphasized in the early years of the People's Republic of China with a focus on building strong, healthy troops to protect the nation (Lin, Wang, & Wu, 2022). However, as China started to transition towards a more market-oriented economy in the late 1970s, the emphasis on physical education switched to encouraging health and wellness among the broader public, including university students (Sanjar & Hayotxon, 2022). These strategies include integrating physical education with other academic fields, such as health science and nutrition, as well as using technology, such as wearables and smartphone apps, to track physical activity and give feedback to students. In China, university fitness-based physical exercise classes for undergraduate students have a long history and have seen major changes throughout the years (Henning, Dreiskämper, & Tietjens, 2022). There is a need for creative approaches to promote physical education and foster healthy lives among university students as the demand for fitness-based physical activity classes rises. Physical fitness is a state of health and well-being that enables someone to go about their daily tasks without experiencing undue fatigue and with enough energy to take part in leisure activities and react to emergencies (Zhai et al., 2022). It is typically characterized by a variety of traits, such as flexibility, body composition, muscular strength and endurance, and cardiovascular and respiratory endurance. While it can lower the risk of chronic diseases including heart disease, obesity, and diabetes, physical fitness is crucial for overall health and wellness. Regular exercise can also enhance cognitive performance, lower stress, and promote mental health (Hervás et al., 2018; Kholmiraevich, 2021).

The term “lifestyle behavior” describes the routines and routines that people follow in their daily lives, including their dietary habits, exercise routines, sleeping schedules, stress-reduction techniques, and substance use (Zhai et al., 2022). These behaviors significantly affect health and well-being and can affect the chance of developing chronic diseases like cancer, diabetes, and heart disease (Baena-Morales & González-Víllora, 2022). Although regular exercise can enhance cardiovascular health, develop muscle strength and endurance, and boost general wellness, physical activity is also an important part of lifestyle behavior. Adults should engage in at least 150 minutes of moderate-intensity aerobic exercise each week, as well as muscle-building activities at least twice a week, according to Frank et al. (2022).

Innovativeness is described as “the ability to develop and introduce original, valuable ideas, techniques, or goods” (Atasoy & Özden, 2022). It entails adopting a mindset that prioritizes innovation, risk-taking, and creativity to find fresh approaches to pressing issues or uncover untapped potential. Innovation is crucial for people, businesses, and society because it enables them to adapt to changing conditions, maintain their competitiveness, and promote development (Palamarchuk et al., 2020). Academic achievement is the degree to which students succeed in their academic endeavors, including grades, test scores, and general performance (McPherson, Mackay, Kunkel, & Duncan, 2018). It is frequently employed as a gauge of a student's aptitude and potential in the classroom as well as a predictor of their future success in both their academic and professional endeavors. Some variables, such as cognitive capacity, motivation, effort, and access to resources and assistance, have an impact on academic accomplishment (Clohessy, Whelan, & Paradis, 2021). Higher cognitive qualities, such as intelligence and problem-solving prowess, are generally associated with improved academic performance in students. As students who are driven and make an effort in their studies are more likely to succeed academically, motivation and effort are also major aspects.

By offering insights into these models' historical history, highlighting contemporary issues and trends, highlighting creative solutions, and outlining a successful development plan, this

study aims to enhance urban physical education development models. The ultimate objective is to encourage urban residents to lead active and healthy lifestyles, which will improve their physical and emotional well-being. The current study evolved the evolution of urban physical education development and its innovative development strategy in undergraduate students enrolled in university fitness-based physical activity classes in China, as well as the self-determination theory established. Self-determination theory refers to “the innate psychological needs that drive human behavior and their impact on individuals' motivation and well-being” (Gagné et al., 2022). People are more likely to feel independent and inspired to engage if they are offered a choice of physical activities and can select ones that fit with their unique interests and values.

Literature Review

Self-Determination Theory

A practical conceptual foundation for analyzing physical education and physical fitness is offered by self-determination theory (Gagné et al., 2022). In Self - determination theory, it is presupposed that people are dynamic beings who are driven to develop, overcome obstacles, and incorporate new encounters into their identities (Gagné et al., 2022; Guay, 2022). Competence, autonomy, and relatedness are the three fundamental psychological requirements that motivate people. How well these three demands are met will impact how engaged people are in a certain environment. Also, it explains their general ability to work well and feel well-being. To comprehend how people can be encouraged to engage in physical activity and adopt a physically active lifestyle, self-determination theory (SDT) has been used in physical fitness and physical education situations (Kholmiraevich, 2021). Self-determination theory contends that when one's fundamental psychological demands for autonomy, competence, and relatedness are met, one is more likely to engage in physical exercise (Sanjar & Hayotxon, 2022). People are more likely to feel driven to keep up their physical exercise when they feel confident in their physical abilities and have the opportunity to develop such skills and talents. Teachers and coaches of physical education can use self-determination theory to build a welcoming environment that encourages motivation and participation in physical activity (Kholmiraevich, 2021). This may entail offering a variety of physical activities, emphasizing personal growth and development, and fostering opportunities for social interaction and connection through physical activity. Individuals might be inspired to start and sustain a physically active lifestyle by comprehending and using self-determination theory principles in physical education and fitness environments (Guay, 2022; Henning et al., 2022).

Physical education lessons can help students develop healthy lifestyle habits by encouraging student autonomy in decision-making, offering chances for skill development and improvement, and fostering a positive social atmosphere (Guay, 2022). Self-determination theory contends that individuals are more likely to exhibit innovative and creative behaviors if they are intrinsically driven, feel competent, and have a sense of autonomy (Pitafi, Kanwal, Ali, Khan, & Waqas Ameen, 2018). Physical education programs can encourage a feeling of invention and creativity in children by giving them the chance to explore and experiment with various physical activities as well as by emphasizing personal growth and improvement (Sibley, Hancock, & Bergman, 2013).

Physical Education and Academic Achievement

Physical education, a particular kind of educational program, is to help pupils become more physically fit, coordinated, and sportsmanlike (Baena-Morales & González-Víllora, 2022). Team sports, individual sports, fitness activities, and health education may all be included in this program, which is commonly given in elementary and secondary schools (Pitafi et al., 2018). Although the objectives of physical education programs can vary, they often seek to advance socializing, teamwork, and overall academic success (Atasoy & Özden, 2022; Zhai et al., 2022). Students may have the opportunity to enhance their leadership and personal responsibility in physical education programs. Programs for physical education can be very helpful in encouraging healthy lives and lowering the risk of chronic illnesses including obesity, diabetes, and heart disease (Frank et al., 2022). Physical education programs can assist children in forming enduring habits that support general health and well-being by giving those opportunities to engage in physical exercise and learn about appropriate eating and nutrition (Lin et al., 2022).

According to Mateo-Orcajada et al. (2022), students who participate in physical education programs typically achieve higher grades and score better on standardized tests than students who do not participate. According to Pitafi et al. (2018); Wang et al. (2022), primary school pupils who participated in physical education programs did better on reading and math benchmark examinations than those who did not. According to Frank et al. (2022) and Zacher, Heusner, Schmitz, Zwierzanska, and Frese (2010), high school students who took part in a physical education course that emphasized fitness and health had higher GPAs and were more likely to complete their high school education than their non-participating peers. According to Sibley et al. (2013), middle school students who took part in a physical education program that included a lesson on nutrition and healthy living in the classroom scored higher in science and social studies than their non-participating peers (Atasoy & Özden, 2022).

H1: Physical education positively and significantly impacts academic achievement.

Physical Fitness and Academic Achievement

A growing body of research indicates that academic achievement and physical fitness are positively correlated (Baena-Morales & González-Víllora, 2022). Regular physical activity has been linked to enhancements in cognitive function, memory, attention span, and academic achievement, according to research. According to studies, students who engage in regular physical activity typically perform better academically, earn higher grades, and are more likely to complete high school and pursue higher education (Hervás et al., 2018). This could be a result of the fact that exercise helps to lower tension and anxiety, which can enhance attention and concentration (Dauenhauer & Keating, 2011). Moreover, increased blood flow to the brain and the production of neurotrophic factors, which encourage the creation of new brain cells and enhance cognitive function, are associated with physical fitness and enhanced brain function (Habyarimana, Tugirimukiza, & Zhou, 2022; Stevens, To, Stevenson, & Lochbaum, 2008). Exercise may also aid in enhancing executive functioning abilities, which are crucial for academic performance and include working memory, concentration, and self-control (Mateo-Orcajada et al., 2022).

Academic achievement depends on cognitive ability and brain development, both of which have been related to physical fitness (Kholmiraevich, 2021; Sanjar & Hayotxon, 2022). Exercise improves memory, attention, and concentration by increasing blood flow and oxygen to the brain. Also, it promotes the release of hormones and growth factors, which help the brain's ability to create new synaptic connections and generate new brain cells (Habyarimana et al., 2022). Stress and anxiety have been demonstrated to be reduced by physical activity, which can improve academic performance. Exercise can lower levels of cortisol, a stress hormone that can impair cognitive function, as well as endorphins, which are natural mood enhancers (McPherson et al., 2018). In addition to these direct benefits, being physically fit can also boost academic performance indirectly by encouraging healthy habits and lowering the risk of chronic illnesses (Baena-Morales & González-Víllora, 2022). Schools should place a high priority on physical activity as part of a comprehensive approach to education because physical fitness and intellectual achievement are closely related (Hervás et al., 2018). Schools can assist academic success by promoting cognitive growth, lowering stress levels, and enhancing general health and well-being by encouraging children to participate in regular physical activity (Atasoy & Özden, 2022).

H2: Physical fitness positively and significantly impacts academic achievement.

Mediating Role of Lifestyle Behaviors

Academic achievement depends on having enough sleep, which has been related to increased memory consolidation, concentration, and cognitive flexibility (Clohessy et al., 2021). Similar to this, a well-balanced diet that emphasizes healthy foods while limiting sugary, processed food intake can deliver vital nutrients that enhance brain function and raise academic achievement (Palamarchuk et al., 2020; Zhai et al., 2022). Obesity has been connected to many health problems, including poor diet, which can have a negative effect on academic performance. Additionally, adopting good living habits like frequent exercise and nutritious eating can enhance general physical fitness, which has a positive effect on academic performance (Frank et al., 2022; Zacher et al., 2010). Better cognitive function, memory, and attention span all crucial for academic success have been related to improved physical fitness. The relationship between physical education, physical fitness, and academic achievement can be mediated by lifestyle choices (Pitafi

et al., 2018; Wang et al., 2022). Healthy habits can enhance mental acuity, boost physical fitness, and have a good effect on academic success. To encourage academic performance, schools should place a priority on healthy lifestyle behaviors in addition to physical education and exercise initiatives (Lin et al., 2022).

Higher levels of physical exercise were linked to greater academic achievement, according to research on 279 primary school kids, and this association was mediated by healthier lifestyle behaviors like healthy eating and getting enough sleep (Sibley et al., 2013; Zhai et al., 2022). Participation in physical education courses was linked to greater academic performance, according to a study of 88 college students. This relationship was mediated by healthy lifestyle behaviors like increased physical activity and improved sleep patterns (Frank et al., 2022). In a study of numerous studies, it was discovered that lifestyle factors including nutrition and sleep patterns may influence the link between physical exercise and academic achievement. According to the review, adopting good living habits may strengthen the connection between physical activity and academic success (Henning et al., 2022).

H3: Lifestyle behaviors positively mediate the relationship between Physical education and academic achievement.

H4: Lifestyle behaviors positively mediate the relationship between Physical fitness and academic achievement.

Moderating Role of Innovativeness

Innovativeness is the capacity and willingness to use novel concepts, strategies, and technologies. According to Mateo-Orcajada et al. (2022), more creative students may be better able to adjust to shifting academic requirements and make use of new tools and technology to improve their learning. According to research, creative students may be more inclined to practice good lifestyle behaviors including frequent exercise and a balanced diet. These actions could be viewed as creative methods for improving academic performance (Kholmiraevich, 2021). For instance, they might be more willing to try novel forms of exercise that have been shown to improve cognitive function and academic performance, like yoga or mindfulness meditation (Habyarimana et al., 2022). Also, creative students might be more likely to use technology to promote their healthy living choices. For instance, they could track their physical activity or look up healthy recipes using online resources or fitness apps (Arufe-Giráldez, Sanmiguel-Rodríguez, Ramos-Álvarez, & Navarro-Patón, 2023). In general, the relationship between lifestyle choices and academic achievement may be strengthened by the capacity for innovation. Innovative students may be better able to adopt healthy lifestyle practices and benefit from these practices' advantages for academic success. Schools should think about encouraging innovation as a component of a comprehensive strategy for fostering healthy lifestyle behaviors and academic achievement (McPherson et al., 2018).

Research has shown that more innovative students may be more likely to engage in healthy lifestyle behaviors, such as regular physical activity and healthy eating habits (Clohessy et al., 2021; Lambourne et al., 2013; Zhai et al., 2022). For example, a study of 256 undergraduate students found that those who scored higher on a measure of innovativeness also reported engaging in more physical activity and eating more fruits and vegetables (Zhai et al., 2022). According to a survey of 256 college students, individuals who scored higher on an innovativeness test also said they exercised more and ate more fruits and vegetables. Moreover, improved academic success was linked to innovativeness levels (Clohessy et al., 2021). Intrinsic motivation acted as a mediating factor in this association, making inventive pupils more likely to be driven by personal interest and delight in these behaviors (Hervás et al., 2018). Moreover, innovative students may be better able to adapt to changing academic demands and leverage new tools and technologies to enhance their learning. The ability to be innovative may also enhance the relationship between lifestyle behaviors and academic achievement (Baena-Morales & González-Víllora, 2022). Innovative students may be better equipped to take advantage of the benefits of healthy lifestyle behaviors, such as improved cognitive function and academic performance. The framework we developed using the previous factors is shown in Figure 1.

H5: Innovativeness moderates the relationship between lifestyle behaviors and academic achievement.

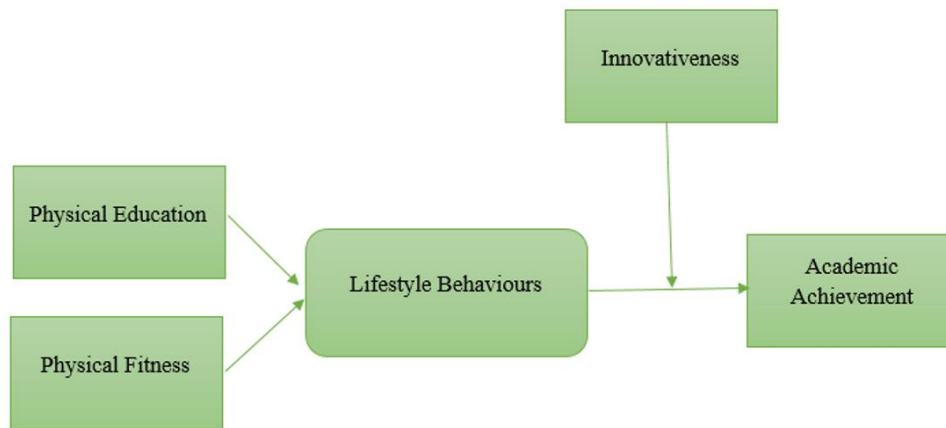


Figure 1. Conceptual model

Methodology

To test the conceptual model related to the evolution of urban physical education development and its innovative development strategy, the questionnaire method was used to predict the associations among the variables. This survey based on the adapted questionnaire was conducted in China where students were asked about the different questions related to variables in the context of academic achievement. This study was quantitative which is why Likert scale-based items were used where respondents were given closed options on a specific scale to respond. For an understanding of the study, it was explained to all the respondents so that they could give true opinions on the basis of what they have experienced and what was asked in the adapted questionnaire. Data was collected once from the respondents which is why cross-sectional approach was used for data collection (Sandra Marcelline et al., 2022). Under non-probability sampling, the method we adopted was convenience sampling. As the population was unknown and the researcher was not aware of the whole population. When conducting a convenient sample, the researcher chooses individuals who are easy to reach or readily available in a given setting, period of time, or set of circumstances. When the researcher needs a quick and simple way to collect data or when access to the target population is constrained, this sampling technique is frequently used. An effective indicator of internal consistency reliability is Cronbach's Alpha. It determines how closely connected a group of items on a scale or questionnaire are to one another. A higher Cronbach's Alpha score denotes a more reliable measurement. This method was suitable according to the situation which is why it was used for gathering the data. A total 300 number of questionnaires were distributed among the employees in China. Out of 300 questionnaires, 256 properly filled were received and their percentage was more than 85 percent. Which was the appropriate respondent rate for further data analysis? Out of which 53% were girls and 47% were boys. SPSS 22 was used for data analysis, where all the statistical tests were performed to test the hypotheses. During data analysis, direct and indirect relationships were tested along with the presence of mediating and moderating variables. For mediation and moderation analysis, Hayes (2012) was used to find out the results. The structural equation modeling (SEM) method was recommended by Hayes (2012) for such types of research models where mediation and moderation both are required to measure.

Measures

A total of five variables were included in the conceptual model of the study, where physical education and physical fitness were the independent variables, lifestyle behaviors were the mediating variable, Innovativeness was the moderating variable, and academic achievement was the dependent variable. Four items were adapted from Clohessy et al., (2021) against physical education, three items were adapted against physical fitness from Zhai et al., (2022) and a total of five items were adapted from McPherson et al., (2018) for the mediating variable lifestyle behaviors. For the moderating variable total of four items were adapted from Palamarchuk et al., (2020), and for the dependent variable academic achievement, four items were adapted from

(Zhai et al., 2022). All the items were adapted and after that used to measure the conceptual framework on five point Likert scale. The degree to which respondents agree or disagree with a statement or question is measured using a 5-point Likert scale, which is frequently employed in survey research. It has five alternatives for responding, usually from “strongly agree” to “strongly disagree”, with a neutral option in the middle. In the first section of the instrument demographic questions were asked and in the second section, adapted items were used to ask questions regarding the study. These items were tested for reliability analysis to find out whether these items are reliable for this study or not. During the pilot study, it was analyzed that the items were reliable and their value was more than 0.70 (Hayes, 2012).

Results

The present study evolved the evolution of urban physical education development and its innovative development strategy in undergraduate students enrolled in university fitness-based physical activity classes in China, as well as the self-determination theory established.

Demographics

The present study shows the impact of self-determination theory on the evolution of urban physical education development and its innovative development strategy in undergraduate students enrolled in university fitness-based physical activity classes in China, which are presented in Table 1 together with demographic data. Student's gender, age, physical education, and physical fitness activity were shown to be the most important characteristics for students of physical activity classes in China. Table 1 presents a demographic profile.

Table 1. Demographic profile

Demography	Description	No. of Responses	%
Gender	Girls	136	53
	Boys	120	47
Age	20-30	110	43
	30-40	56	22
	Above 40	90	35
Physical Education	1 st Grade	90	35
	2 nd Grade	80	32
	3 rd Grade	86	33
Physical Fitness Activity	Aerobic Activity	130	51
	Exercise (20 min)	70	27
	Sports Team/League	56	22

In Table 1, the gender of girls special students of physical activity classes in China was 53% and boys were 47%. The age of students in physical activity classes in China 20-30 was 43%, 30-40 was 22%, and above 40 was 35%. The physical education of students of physical activity classes in China 1st grade was 35%, 2nd grade was 32% and 3rd grade was 33%. The physical fitness aerobic activity of students of physical activity classes in China was 51%, students of physical exercise activity classes in China were 27% and students of physical sports team/league activity classes in China were 22%.

Descriptive Statistics

By adding up every value in the dataset and dividing by the total number of values, the mean, sometimes referred to as the average, is determined. It is a measurement of the data's central tendency. The dispersion or variability of the data is measured by the standard deviation (Hayes, 2012; Hayes, Montoya, & Rockwood, 2017). It is determined by multiplying the square root of the number of values less than one by the total of the squared deviations between each value and the mean. When a dataset is sorted from smallest to greatest, the median is the midway value. It is a measure of the central tendency that, in contrast to the mean, is less sensitive to extreme values. The descriptive statistics for the study variables are displayed in Table 2. The mean of physical fitness was 3.68, physical education was 3.97, lifestyle behavior was 3.69, innovativeness was 3.71

and academic achievement was 3.71.

Table 2. Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation
PE	256	1.25	5.00	3.9736	.73800
PF	256	1.00	5.00	3.6862	1.05494
LSB	256	1.00	5.00	3.6953	.85917
INO	256	1.50	5.00	3.7178	.76804
AA	256	1.00	5.00	3.7187	1.05858
Valid N (listwise)	256				

Data Normality Test

Data normality refers to the distribution of data points in a dataset. A normal distribution, also known as a Gaussian distribution or a bell curve, is a symmetric distribution in which the majority of the data points are clustered around the mean, with fewer data points in the tails of the distribution (Hayes et al., 2017). Normality is important because many statistical tests assume that the data are normally distributed. If the data are not normally distributed, it can affect the validity of the results of the statistical analysis.

Table 3. Tests of normality

	Kolmogorov-Smirnov^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
AA	.113	256	.0001	.928	256	.0001
PE	.150	256	.0001	.915	256	.0001
PF	.140	256	.0001	.919	256	.0001
LSB	.088	256	.0001	.965	256	.0001
INO	.077	256	.001	.970	256	.0001

Reliability Test

A reliability test is a statistical method used to determine the consistency and stability of a measure or test. It is an important tool in social science research, especially in fields such as psychology and education, where measurements of attitudes, opinions, and other psychological constructs are common (Nawaz, Su, & Nasir, 2021). There are several measures of reliability, but the most commonly used one is Cronbach's alpha coefficient. This coefficient measures the internal consistency of a set of items in a scale or questionnaire, and it ranges from 0 to 1, with higher values indicating greater reliability. In Table 4, Cronbach's alpha value is .872 which means very good reliability.

Table 4. Reliability statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.872	.872	20

Correlation Test

A correlation test is a statistical method used to determine the strength and direction of the relationship between two variables. It is used to determine whether there is a significant association between two variables, and if so, whether the association is positive or negative (Rovai, Baker, & Ponton, 2013). There are several types of correlation tests, but the most commonly used one is the Pearson correlation coefficient, which measures the linear relationship between two continuous variables. The Pearson correlation coefficient ranges from -1 to +1, with -1 indicating a perfect negative correlation, 0 indicating no correlation, and +1 indicating a perfect positive correlation.

Table 5. Correlations

		PE	PF	LSB	INO	AA
PE	Pearson Correlation	1	.550**	.286**	.515**	.581**
	Sig. (2-tailed)		.0001	.0001	.0001	.0001
	N	256	256	256	256	256
PF	Pearson Correlation	.550**	1	.310**	.364**	.534**
	Sig. (2-tailed)	.0001		.0001	.0001	.0001
	N	256	256	256	256	256
LSB	Pearson Correlation	.286**	.310**	1	.382**	.179**
	Sig. (2-tailed)	.0001	.0001		.0001	.004
	N	256	256	256	256	256
INO	Pearson Correlation	.515**	.364**	.382**	1	.608**
	Sig. (2-tailed)	.0001	.0001	.0001		.0001
	N	256	256	256	256	256
AA	Pearson Correlation	.581**	.534**	.179**	.608**	1
	Sig. (2-tailed)	.0001	.0001	.004	.0001	
	N	256	256	256	256	256

KMO and Bartlett's Test

KMO (Kaiser-Meyer-Olkin) and Bartlett's Test are two statistical tests that are commonly used to assess the suitability of data for factor analysis. Factor analysis is a statistical technique used to identify the underlying dimensions or factors in a set of observed variables (Yong & Pearce, 2013). The KMO test measures the adequacy of the sample size and the strength of the correlations between the variables. It produces a value between 0 and 1, with values closer to 1 indicating that the data are suitable for factor analysis. Bartlett's test of sphericity is used to test the null hypothesis that the correlation matrix of the variables is an identity matrix, indicating that the variables are uncorrelated (Rahim, Rashid, & Hamed, 2016). A significant result ($p < 0.05$) indicates that the correlation matrix is not an identity matrix, and therefore the variables are correlated and suitable for factor analysis. In Table 6, the value of KMO is 0.736 which means closer to 1 indicating that the data are suitable for factor analysis and Bartlett's test should be significant.

Table 6. KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.736
Bartlett's Test of Sphericity	Approx. Chi-Square	413.973
	df	10
	Sig.	.0001

Regression Test (Indirect Hypothesis)

Regression analysis is a statistical method used to examine the relationship between a dependent variable and one or more independent variables. It is used to predict the value of the dependent variable based on the values of the independent variables (Allen, Bennett, & Heritage, 2014; Samuels, 2017). There are several types of regression analysis, but the most commonly used one is linear regression. Linear regression is used to model the relationship between a dependent variable and one or more independent variables using a straight line. In Table 7 and Figure 2, the direct relationship shows significance, which physical education positively and significantly impacts academic achievement and physical fitness positively and significantly impacts academic achievement.

Table 7. Direct relation

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.236	.283		.833	.406

	PE	.590	.083	.411	7.072	.0001
	PF	.309	.058	.308	5.291	.0001

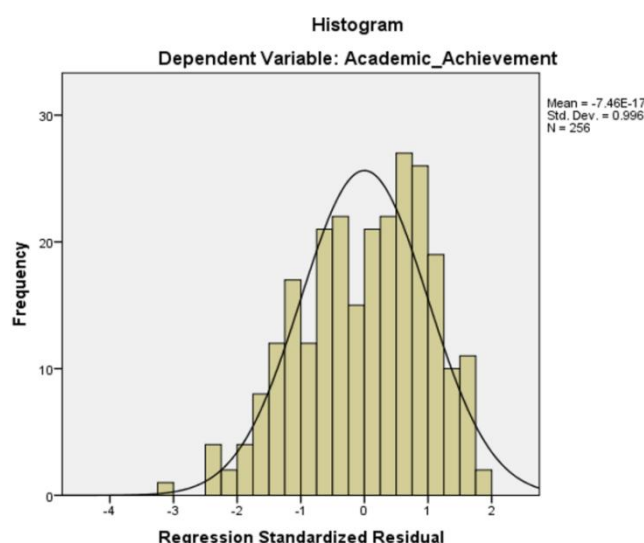


Figure 2. Regression analysis

Test Mediation Analysis

A statistical method called mediation analysis is used to look at how an independent variable may have an indirect impact on a dependent variable through one or more mediators. A statistical approach known as mediation is used to examine the indirect impact of an independent variable on a dependent variable through one or more mediating variables (Salmani, Norozi, Moodi, & Zeinali, 2020; Yong & Pearce, 2013). The fundamental tenet of mediation is that the independent variable influences the mediator variable, and the mediator variable influences the dependent variable. To investigate Hypotheses 3–4, a basic mediation analysis was performed. The findings are shown in Tables 3 and 4. The first hypothesis holds that academic achievement is favorably correlated with a focus on physical education. Similar to Hypothesis 2, emphasis on physical health is correlated favorably with academic success. According to Hypothesis 3, the association between physical education and academic achievement is moderated by a focus on lifestyle behavior. Table 8 lower section demonstrates that all confidence intervals had a 95% degree of assurance. Mathematically speaking, academic achievement and physical fitness have a positive association. In Table 8, lifestyle behaviors positively mediate the relationship between Physical education and academic achievement.

Table 8. Mediation analysis (hypothesis 3)

Outcome Variable: Academic Achievement		
Model 4	T-Value	P-Value
Physical Fitness	-2.3297	0.0206
Lifestyle Behavior	9.0408	0.0001
The direct effect of X on Y		
	T-Value	P-Value
	-2.3297	0.0206
Level of confidence for all confidence intervals in the output:		
95.0000		

To investigate Hypotheses 3–4, a basic mediation analysis was performed. The findings are shown in Tables 3 and 4. The first hypothesis holds that academic achievement is favorably correlated with a focus on physical education. Similar to Hypothesis 2, emphasis on physical health is correlated favorably with academic success. According to Hypothesis 3, the association between physical education and academic achievement is moderated by a focus on lifestyle behavior. Table 9 lower section demonstrates that all confidence intervals had a 95% degree of

assurance. Mathematically speaking, academic achievement and physical education have a positive association. Table 9 shows Lifestyle behaviors positively mediate the relationship between Physical fitness and academic achievement.

Table 9. Mediation analysis (hypothesis 4)

Outcome Variable: Academic Achievement		
Model 4	T-Value	P-Value
Physical Education	7.7230	0.0001
Lifestyle Behavior	4.3788	0.0001
The direct effect of X on Y		
	T-Value	P-Value
	7.7230	0.0001
Level of confidence for all confidence intervals in the output:		
95.0000		

Test Moderation Analysis

A statistical method called moderation analysis is used to determine whether the connection between two variables changes as a function of the value of a third variable. The moderator is the name given to the third variable (Hadi, Abdullah, & Sentosa, 2016). The fundamental tenet of moderation is that the degree to which one variable influences another can influence the direction or strength of a relationship between two variables. Researchers can use moderation analysis to examine if the impact of one variable on another differs depending on the degree of the moderator variable. This method is frequently employed in social science research to assist in determining the circumstances in which a relationship between two variables is more or less significant. To investigate Hypotheses 5, a basic moderation analysis was performed. The findings are shown in Table 5. According to Hypothesis 5, the association between lifestyle behavior and academic achievement is moderated by innovativeness. Table 10 and Figure 3 show academic achievement and lifestyle behavior have an insignificant association.

Table 10. Moderation analysis (hypothesis 5)

Outcome Variable: Academic achievement		
Model 1	T-Value	P-Value
Lifestyle Behavior * Innovativeness	-1.1528	0.2501

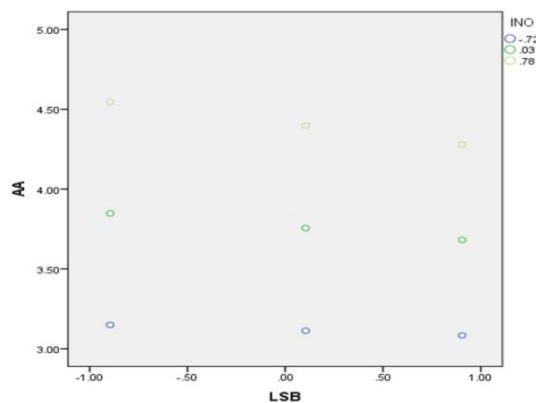


Figure 3. Moderation

Discussion

The findings of the study reveal that the evolution of the urban physical education development and its innovative development strategy has a positive impact on the physical fitness, innovativeness, and academic achievement of undergraduate students enrolled in university fitness-based physical activity classes in China. The study also found that physical education plays a critical role in promoting healthy lifestyle behavior among students, which further contributes to

their academic achievement. The self-determination theory established in the study provides a comprehensive framework for understanding the relationships between physical education, physical fitness, innovativeness, lifestyle behavior, and academic achievement. The theory proposes that individuals are motivated by three basic psychological needs, namely autonomy, competence, and relatedness (Baena-Morales & González-Víllora, 2022). The study found that the fulfillment of these psychological needs in the context of physical education contributes to the development of innovativeness and promotes academic achievement.

There are various ways that physical education might boost academic achievement. First of all, exercise has been linked to better brain health and greater blood flow to the brain, both of which can help cognitive functions like learning and problem-solving. Regular exercise encourages a healthy lifestyle, which can improve physical and mental health and help students focus and pay attention more intently when studying. The study's results highlight the importance of incorporating physical education into the university curriculum and promoting a healthy lifestyle among students. The study's findings can be used to inform policy and practice in promoting physical education in higher education institutions in China and other countries (Wang et al., 2022). The study also provides insight into the role of physical education in promoting academic achievement and the development of innovativeness among students. In conclusion, the present study contributes to our understanding of the evolution of the urban physical education development model and its innovative development strategy in undergraduate students enrolled in university fitness-based physical activity classes in China.

The study provides evidence for the positive impact of physical education on physical fitness, innovativeness, lifestyle behavior, and academic achievement. The association between academic achievement and lifestyle behavior is found to be insignificant, which means that there is no significant linear relationship between the two variables. This could mean that lifestyle behavior has little to no impact on academic achievement, or that there are other factors that are more influential in determining academic achievement. It is important to note that a lack of significant association does not necessarily mean that there is no relationship between the two variables. Physical health, emotional health, and overall quality of life have all been linked to regular physical activity. Students are given the chance to participate in organized exercise, sports, and recreational activities by including physical education in their university experience, encouraging a more active and healthy lifestyle.

Physical exercise has been linked to improved cognitive function, better academic results, and more focused attention. Students may gain these cognitive advantages from physical education lessons, which could enhance learning outcomes and academic success. Physical education gives pupils a place to practice important life skills. Students can develop skills like teamwork, leadership, communication, and problem-solving by taking part in team sports or fitness activities. These abilities might be useful assets in upcoming personal and professional endeavors because they are transportable. The study also emphasizes the potential value of physical education in fostering wholesome attitudes and conduct. Universities may make a substantial contribution to establishing lifetime healthy habits by exposing students to a variety of physical activities and teaching them about the value of exercise, nutrition, and overall well-being. When developed throughout the university years, these behaviors have the potential to have a long-term effect on students' health and well-being (Kholmiraevich, 2021).

Conclusion

The results of this study have theoretical and practical implications that can be helpful to undergraduate students enrolled in university fitness-based physical activity classes in China as well as existing and future academics. The findings of this study may be very helpful to decision-makers, administrators, and policymakers. In particular, the self-determination theory is impacted by the growth of the urban physical education development model and its novel development approach among undergraduate students in university fitness-based physical activity programs in China. Practically speaking, the creation of a new physical education model and approach could enhance the standard of physical education for Chinese undergraduate students. The new model can support the promotion of physical activity and general health among

university students by embracing cutting-edge ideas and strategies, such as a fitness-based physical activity program. The new approach may also have an impact on Chinese policy and practice in physical education. If the concept is successful in enhancing student involvement and outcomes, other universities may adopt it, and it may even be included in national physical education regulations. The new model's theoretical application of self-determination theory can assist in clarifying the significance of autonomy and motivation in promoting physical activity and exercise habits. The approach can be viewed as a self-determination theory application in the context of fitness-based physical activity and physical education. The approach may be able to address some of the major difficulties in encouraging physical activity and exercise behavior, such as lack of motivation and adherence to exercise programs, by fostering autonomy and intrinsic motivation through the use of self-determination theory concepts. As a result, there is evidence to suggest a beneficial correlation between academic success and physical education, despite variances and complexities within the relationship. Physical education classes can encourage regular physical activity, which has cognitive, social, and emotional advantages that can help students do better in school. Schools may foster an environment that supports students' holistic development and improves their overall academic attainment by recognizing and promoting the benefits of physical education.

Limitations

One limitation is the generalizability of the findings. The study was conducted in a specific context and with a specific population (undergraduate students in China), so the results may not be applicable to other contexts or populations. Future research could examine the effectiveness of the model and strategy with different populations, such as younger or older individuals, or individuals with different cultural backgrounds. Another limitation is the potential for self-report bias. The study relied on self-reported data from participants, which may be subject to biases or inaccuracies. Future research could incorporate objective measures of physical activity, such as activity trackers, to provide more accurate data. Additionally, the study did not include a control group. Without a control group, it is difficult to determine whether the observed changes in physical activity and motivation were due to the intervention or other factors.

Future Recommendation

Future research could incorporate a control group to better understand the effectiveness of the model and strategy. As for analysis through SPSS, the software can be used to conduct various statistical analyses to explore the data, such as descriptive statistics, correlation analyses, and regression analyses. These analyses can help examine the relationship between variables and identify potential predictors of physical education, fitness, and academic achievement. However, it is important to ensure that the appropriate statistical tests are used and that the assumptions of the tests are met to ensure the validity of the results. Future research could also consider using other statistical software or approaches to provide additional insights into the data.

References

- Allen, P., Bennett, K., & Heritage, B. (2014). *SPSS statistics version 22: A practical guide*. Sydney, Australia: Cengage Learning Australia.
- Arufe-Giráldez, V., Sanmiguel-Rodríguez, A., Ramos-Álvarez, O., & Navarro-Patón, R. (2023). News of the pedagogical models in physical education—A quick review. *International Journal of Environmental Research and Public Health*, 20(3), 2586.
- Atasoy, R., & Özden, C. (2022). Effect of instructional leadership, organizational innovativeness, and school hindering on teachers' satisfaction at Bilsems. *Education Reform Journal*, 7(2), 57-75.
- Baena-Morales, S., & González-Víllora, S. (2023). Physical education for sustainable development goals: Reflections and comments for contribution in the educational framework. *Sport, Education and Society*, 28(6), 697-713.
- Clohessy, T., Whelan, E., & Paradis, K. F. (2021). Does passion for physical activity spillover into performance at work? Examining the direct and indirect effects of passion and life satisfaction on organisational performance and innovativeness. *International Journal of Sport and Exercise Psychology*, 19(5), 794-814.
- Dauenhauer, B. D., & Keating, X. D. (2011). The influence of physical education on physical activity levels of urban elementary students. *Research Quarterly for Exercise and Sport*, 82(3), 512-520.
- Frank, L. D., Adhikari, B., White, K. R., Dummer, T., Sandhu, J., Demlow, E., . . . Van den Bosch, M. (2022). Chronic disease and where you live: Built and natural environment relationships with physical activity, obesity, and diabetes. *Environment International*, 158, 106959.
- Gagné, M., Parker, S. K., Griffin, M. A., Dunlop, P. D., Knight, C., Klonek, F. E., & Parent-Rocheleau, X. (2022). Understanding and shaping the future of work with self-determination theory. *Nature Reviews Psychology*, 1(7), 378-392.
- Guay, F. (2022). Applying self-determination theory to education: Regulations types, psychological needs, and autonomy supporting behaviors. *Canadian Journal of School Psychology*, 37(1), 75-92.
- Habyarimana, J. de D., Tugirumukiza, E., & Zhou, K. (2022). Physical education and sports: A backbone of the entire community in the twenty-first century. *International Journal of Environmental Research and Public Health*, 19(12). <https://doi.org/10.3390/ijerph19127296>
- Hadi, N. U., Abdullah, N., & Sentosa, I. (2016). An easy approach to exploratory factor analysis: Marketing perspective. *Journal of Educational and Social Research*, 6(1), 215.
- Hayes, A. F. (2012). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: Guilford Publications.
- Hayes, A. F., Montoya, A. K., & Rockwood, N. J. (2017). The analysis of mechanisms and their contingencies: PROCESS versus structural equation modeling. *Australasian Marketing Journal*, 25(1), 76-81.
- Henning, L., Dreiskämper, D., & Tietjens, M. (2022). The interplay of actual and perceived physical fitness in children: Effects on motivation and physical activity. *Psychology of Sport and Exercise*, 58. <https://doi.org/10.1016/j.psychsport.2021.102055>
- Hervás, G., Ruiz-Litago, F., Irazusta, J., Fernández-Atutxa, A., Fraile-Bermúdez, A. B., & Zarrasquin, I. (2018). Physical activity, physical fitness, body composition, and nutrition are associated with bone status in university students. *Nutrients*, 10(1). <https://doi.org/10.3390/nu10010061>
- Kholmiraevich, A. J. (2021). Innovations in fitness works and physical education. *Texas Journal of Medical Science*, 2, 4-5.
- Lambourne, K., Hansen, D. M., Szabo, A. N., Lee, J., Herrmann, S. D., & Donnelly, J. E. (2013). Indirect and direct relations between aerobic fitness, physical activity, and academic achievement in elementary school students. *Mental Health and Physical Activity*, 6(3), 165-171.

- Lin, T., Wang, L., & Wu, J. (2022). Environmental regulations, green technology innovation, and high-quality economic development in China: Application of mediation and threshold effects. *Sustainability (Switzerland)*, 14(11). <https://doi.org/10.3390/su14116882>
- Mateo-Orcajada, A., González-Gálvez, N., Abenza-Cano, L., & Vaquero-Cristóbal, R. (2022). Differences in physical fitness and body composition between active and sedentary adolescents: A systematic review and meta-analysis. *Journal of Youth and Adolescence*, 51(2), 177-192.
- McPherson, A., Mackay, L., Kunkel, J., & Duncan, S. (2018). Physical activity, cognition and academic performance: An analysis of mediating and confounding relationships in primary school children. *BMC Public Health*, 18(1), 1-9.
- Nawaz, A., Su, X., & Nasir, I. M. (2021). BIM Adoption and its impact on planning and scheduling influencing mega plan projects-(CPEC-) quantitative approach. *Complexity*, 2021, 1-9.
- Palamarchuk, O., Gurevych, R., Maksymchuk, B., Gerasymova, I., Fushtey, O., Logutina, N., . . . Maksymchuk, I. (2020). Studying innovation as the factor in professional self-development of specialists in physical education and sport. *Revista Romaneasca Pentru Educatie Multidimensionala*, 12(4), 118-136.
- Pitafi, A. H., Kanwal, S., Ali, A., Khan, A. N., & Waqas Ameen, M. (2018). Moderating roles of IT competency and work cooperation on employee work performance in an ESM environment. *Technology in Society*, 55, 199-208.
- Rahim, S. H. A., Rashid, R. A., & Hamed, A. B. (2016). Islamic financial literacy and its determinants among university students: An exploratory factor analysis. *International Journal of Economics and Financial Issues*, 6(7), 32-35.
- Rovai, A. P., Baker, J. D., & Ponton, M. K. (2013). *Social science research design and statistics: A practitioner's guide to research methods and IBM SPSS*. Chesapeake, VA: Watertree Press LLC.
- Salmani, F., Norozi, E., Moodi, M., & Zeinali, T. (2020). Assessment of attitudes toward functional foods based on theory of planned behavior: Validation of a questionnaire. *Nutrition Journal*, 19(1), 1-9.
- Samuels, P. (2017). *Advice on exploratory factor analysis*. Retrieved from <https://www.open-access.bcu.ac.uk/6076/>
- Sandra Marcelline, T. R., Chengang, Y., Ralison Ny Avotra, A. A., Hussain, Z., Zonia, J. E., & Nawaz, A. (2022). Impact of Green Construction Procurement on Achieving Sustainable Economic Growth Influencing Green Logistic Services Management and Innovation Practices. *Frontiers in Environmental Science*, 9. <https://doi.org/10.3389/fenvs.2021.815928>
- Sanjar, U., & Hayotxon, A. (2022). Content of physical education of children of different ages and ways of its organization (for example of children aged 4-6). *International Journal Of Social Science & Interdisciplinary Research*, 11(06), 1-5.
- Sibley, B. A., Hancock, L., & Bergman, S. M. (2013). University students' exercise behavioral regulation, motives, and physical fitness. *Perceptual and Motor Skills*, 116(1), 322-339.
- Stevens, T., To, Y., Stevenson, S., & Lochbaum, M. (2008). The importance of physical activity and physical education in the prediction of academic achievement. *Journal of Sport Behavior*, 31(4), 368-389.
- Wang, M., He, Y., Zhou, J., & Ren, K. (2022). Evaluating the effect of chinese environmental regulation on corporate sustainability performance: The mediating role of green technology innovation. *International Journal of Environmental Research and Public Health*, 19(11). <https://doi.org/10.3390/ijerph19116882>
- Yong, A. G., & Pearce, S. (2013). A beginner's guide to factor analysis: Focusing on exploratory factor analysis. *Tutorials in Quantitative Methods for Psychology*, 9(2), 79-94.
- Zacher, H., Heusner, S., Schmitz, M., Zwierzanska, M. M., & Frese, M. (2010). Focus on opportunities as a mediator of the relationships between age, job complexity, and work performance. *Journal of Vocational Behavior*, 76(3), 374-386.
- Zhai, X., Ye, M., Gu, Q., Huang, T., Wang, K., Chen, Z., & Fan, X. (2022). The relationship between physical fitness and academic performance among Chinese college students. *Journal of American College Health*, 70(2), 395-403.