The effect of physical education teaching style on exercise habits of college students

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Abstract

Purpose – The purpose of this study is that the teaching style of college physical education (PE) teachers affects the establishment of college students' exercise habits.

Design/methodology/approach – This study uses the teaching style scale for 32 PE teachers and the autonomic motivation and exercise habits scale for 320 college students in the form of self-report.

Findings – Chinese college PE teachers mainly use the teacher-centered reproduction style, and the practice style is the most frequently used; The overall teaching style of college PE teachers was significantly negatively correlated with autonomous motivation and exercise habits. PE teachers' teaching style can negatively affect college students' autonomous motivation, and college students' autonomous motivation can positively affect their exercise habits.

Originality/value – There is a significant negative correlation between the teaching style of college PE teachers and the exercise habits of college students. However, it cannot directly affect the establishment of college students' exercise habits, but is achieved through the mediating role of college students' autonomous motivation.

Keywords Teaching style, Exercise habits, Autonomous motivation, Spectrum theory

Paper type Research paper

Introduction

In recent years, more and more attention has been paid to the low level of youth participation in physical activity. A sedentary lifestyle, such as an unhealthy diet, is an important risk factor for chronic disease, obesity, depression and anxiety, leading to psychological, physical and emotional problems (González *et al.*, 2017; Standal and Aggerholm, 2016). Based on a comparison of Chinese college students' physical fitness data from 1985 to 2014, physical-related qualities of speed, explosive power, strength and endurance generally decreased (Jian and Yuan, 2019). Although PE courses in colleges are mandatory for 4 semesters and provide for enhancing physical fitness and developing a sense of sports participation among college students as training goals, the results are concerning. Chinese Ministry of Education's (MOE) *Guideline for Physical Education and Health Teaching Reform (Trial)*, introduced in June 2021, calls for scientific and standardized PE courses to improve classroom quality. The aim is to influence the level of exercise and improve the quality of physical health of university students from the perspective of physical education teachers. The study pointed out that although physical exercise behavior was prevalent among Chinese college students, the stability of physical exercise habits was only at moderate intensity, that is, individual physical exercise behavior did not fully develop into physical exercise habits (Wang *et al.*, 2022). Habits serve to facilitate the cycle of an activity and provide sustained motivation (Rebar *et al.*, 2020), such as exercise habits, which drive individuals to participate in regular

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physical activity on a daily basis. Exercise habits vary based on factors such as preferences, choices, capabilities, abilities, etc., and the time and intensity of physical activity is highly necessary in daily physical activity (Endozo, 2019). It is important to note that once habits are established, they have some persistence (Swartz, 2002), and such persistence has beneficial effects on college students who establish exercise habits now and later. However, there is still a gap in the relationship between the teaching style of college physical education teachers and exercise habits, therefore, it is necessary to understand the relationship between the two to demonstrate the quality of college physical education courses.

Teaching methods or teaching styles play a central role in influencing students' PE experience (Invernizzi *et al.*, 2019). According to Mosston and Ashworth, Spectrum is composed of a continuum of 11 landmark styles, through the gradual transition of teaching roles between teachers and students, to determine the teaching styles on this decision-making continuum (Mosston and Ashworth, 2008). It includes: command (A), practice (B), reciprocal (C), self-check (D), inclusion (E), guided discovery (F), convergent discovery (G), divergent production (H), individual program (I), learner-initiated (J) and self-teaching (K). Among them, A-E are teacher-centered production styles and F-K are student-centered production styles (Mosston and Ashworth, 2008). Reproduction styles represent students copying known knowledge, replicating models and practical skills; Production styles are teachers guiding students to discover and produce knowledge (Syrmpas *et al.*, 2019). Mandelbaum believes that teaching style is an important factor affecting teaching effectiveness (Mandelbaum, 2013). It can also affect students' learning adaptability (Desak, 2017), including learning achievement (González *et al.*, 2018), learning beliefs (Syrmpas and Digelidis, 2014) and teacher emotions (Heydarnejad *et al.*, 2017), etc., indirectly or/and directly affect the beliefs of college students participating in sports, including the cultivation of sports habits.

Hagger *et al.* define a habit as a specific behavioral response that co-occurs with environmental cues or situational features (Hagger, 2019), that is, a habit is a specific behavior. The formation of college students' exercise habits is a behavioral construction, and developing beneficial habits can make students take valuable behaviors as their default choices (Fiorella, 2020). Barnett *et al.* claim that the college years are a critical time for establishing and developing healthy behaviors (Barnett *et al.*, 2014). Therefore, the generation of exercise habit intention in college is mainly related to the PE environment, especially the teaching style of PE teachers. Gardner *et al.* proposed the habit-intention relationship hypothesis, and reviewed 52 studies on the effect of intention on behavior with varying degrees of habit intensity, and under the premise of self-control levels, intention and habit have an interactive effect (Gardner *et al.*, 2020). According to self-determination theory, an individual's intentions arise from their own motivations (Ryan and Deci, 2017), and motivations can provide a clue for habit formation. According to the research of Gardner and Lally, after obtaining a cue, an individual will trigger and perform an action and obtain a learned reflection (Gardner and Lally, 2018), which is called a habit.

Exercise habits can be understood as positive, stable, automatic behaviors and thought patterns formed by repeated exercise practice in specific situations, which are mainly characterized by repetitive and automatic, effortless and unconscious (Rebar *et al.*, 2020). Studies have pointed out that the individual's sense of self-efficiency (Freene *et al.*, 2014), parents' own exercise habits (Sukys *et al.*, 2014) and support (Zecevic *et al.*, 2010) influence the formation of exercise habits. However, the process of exercise habit formation, proposed by Lally *et al.*, the concept of *context-dependent repetition*, that is, by preparing and starting exercises frequently and reliably in the same situation (Lally *et al.*, 2010). Repetition of context is a necessary factor in the formation of exercise habits. The current stage of research on the formation of exercise habits in university students has focused more on the repetition of the context by the individual's own factors (Endozo, 2019; Eichorn *et al.*, 2018). However, there is no research formulation on PE courses, especially on the teaching style of PE teachers.

Based on the nature of the PE curriculum in Chinese universities, the continuous participation of college students in PE courses can be considered as a repetitive context, and therefore, it is reasonable to believe that there is a correlation between PE teaching style and college students' exercise habits.

However, the importance of motivation cannot be denied in the actual study. Studies point out that motivation is one of the most important aspects of forming physical activity habits or adherence to physical activity (Kim and Cho, 2013), and people with strong exercise habits also have a strong will to exercise or self-determined motivation (Gardner and Lally, 2013; Radel *et al.*, 2017; Rebar *et al.*, 2016). According to self-determination theory, autonomous motivation refers to volitional actions taken out of enjoyment, personal utility, or consistency of personal values, rather than actions taken because of rewards, social pressure, etc (Ryan and Deci, 2017). This may provide an implication that the level of individual autonomy determines one's habitual state, as autonomously motivated behavior is self-determined and comes from one's internal execution of will (Arnautovska *et al.*, 2019). This self-determined motivation plays an important role in promoting healthy behavior (Ntoumanis *et al.*, 2021) and frequent physical activity behavior became habitual (Gardner and Lally, 2013). For example, forcing individuals to stop their daily habit of walking after meals for some reason, the individual's autonomous will feels extremely uncomfortable. Although few studies at this stage directly point out the relationship between autonomous motivation and exercise habits, Wang *et al.* noted in their study that physical exercise behavior can develop into physical exercise habits through a direct path, a single mediator of need or satisfaction, or a chain mediator of need to satisfaction (Wang *et al.*, 2022). Among these, autonomous motivation plays a mediating effect in the realization of exercise behavior (Sylvester *et al.*, 2014). Therefore, it is essential to understand the relationship between autonomous motivation and exercise habits.

In fact, individuals can be influenced by the surrounding social environment through two completely different interpersonal styles (control style and autonomy support) (Ryan and Deci, 2020). Research proves that the autonomy-supportive teaching style of teachers has an effect on students' autonomous motivation in sports (Behzadnia *et al.*, 2019). High school teachers' productive styles such as "sensitive student-centered" are mainly related to teachers' intrinsic motivation, reproductive styles such as "big conference" are mainly related to teachers' extrinsic motivation types (Mahmoodi *et al.*, 2021). It has been pointed out that the opportunity to promote autonomy towards activities in the educational environment is transferred to the external environment and increases the autonomous motivation for related activities (Hagger and Chatzisarantis, 2012). According to Gardner *et al.*'s explanation of habituation, habituation is a process that, when encountered with a cue, triggers an impulse to perform an action that, through learning, becomes a learned response to that cue (Gardner and Lally, 2018). The autonomous motivation (teaching style) that PE teachers transfer to facilitate activities in the classroom may be the cue that triggers habituation to occur. However, previous studies have reported the relationship between different teaching styles and student motivation (Sheikh and Mahmood, 2014; Murto, 2019; Razmaite and Grajauskas, 2021), but the relationship between teaching styles, autonomous motivation and exercise habits has not been analyzed so far in the particular context of colleges and universities, especially the issue of the relationship between teaching styles and exercise habits.

Therefore, based on the above analysis and research objectives, this study used an empirical research method to analyses the correlations between the variables in a quantitative way by collecting the teaching styles of physical education teachers and the levels of autonomous motivation and exercise habits of university students. This study hypothesized a mediating effect of autonomous motivation between teaching style and exercise habits for the effect of college physical education teachers' teaching style on the establishment of exercise habits among college students. From a practical point of view, PE

teachers are more likely to want college students to establish their own exercise habits and to establish this new level by influencing college students' original autonomous motivation status. Accordingly, the following hypotheses have been tested.

H1. Students' autonomous motivation is positively related to exercise habits and has a positive predictive effect.

H2. PE teachers' teaching style was negatively related to college students' autonomous motivation and had a negative predictive effect.

H3. Teaching style of PE teachers is negatively related to exercise habits of college students and has a negative predictive effect.

Methods

Participants and data collection

The research subjects of this study are from public PE teaching and general college students (except PE majors) in a general undergraduate comprehensive university in eastern China. All public PE teachers (n = 32) and students (n = 320) at the university. In order to make the research more random and universal, the sampling method chosen in this study is stratified sampling. First, all public PE teachers participated in this research; secondly, 10 college students were randomly selected from each PE teacher's teaching class for investigation. The way to fill in the questionnaire is to fill in on-site, and at the same time, conduct on-site inspection. If there is any problem with the filled-in questionnaire (logical error, omission, etc.), it is required to re-fill until it meets the standards. It should be pointed out that all teachers and students participated in this research voluntarily, and the sample of college students came from the 1st to 4th semester (when college students enter the 5th semester, the school does not set up PE courses).

Instruments

PE teacher' teaching style: The teaching style of PE teachers in this study uses the teaching style of Mosston and Ashworth for PE teachers (Mosston and Ashworth, 2008), the questionnaire method is the 4-question-dimension questionnaire used by Kulinna and Cothran in their research (Kulinna and Cothran, 2003). The scale contains four questions: (1) I have used this way to teach PE, (2) I think this way of teaching would make class fun for my students, (3) I think this way of teaching would help students learn skills and concepts, and (4) I think this way of teaching would motivate students to learn. The scale is an assessment of teachers' different perceptions of student learning in PE classes through teachers' subjective feelings. The scale contains two research aspects: teachers' experiences (question a) and teachers' perceptions (questions b-d). Where questions (b-d) represent teachers' perceptions of the benefits to students, denoting fun, learning and motivation, respectively and are the data used in the data analysis of this study.

Autonomic motivation scale. This study integrated the revised Perceived Locus of Causality (PLOC-R) scale of Vlachopoulos *et al.* and the combined version of Vlachopoulos *et al.* (2011), Wilson *et al.* (2006). The scale starts with "I take part in PE . . . ", which measures amotivation, external regulation, introjected regulation, identified regulation, integrated regulation and intrinsic motivation 6 factors and 22 items. Use the Self-Determination Index (SDI) formula: 3 × intrinsic motivation, 2 × integrated regulation,1 × identified regulation, −1 × introjected regulation, −2 × external regulation and −3 × amotivation. A numerical value is finally obtained that facilitates the quantification of the level of autonomic motivation (Heryanto *et al.*, 2020).

Exercise habits scale. The research tool used in this study is the Self-Report Behavioral Automaticity Index (SRBAI) scale proposed by Gardner (2012), Gardner *et al.* (2012), which is

modified from The Self-Report Habit Index (SRHI) scale of Verplanken and Orbell (2003). The scale contains 4 dimensions and measures people's habitual behavior in a self-evaluation manner. The title of the scale is, "When I exercise . . . " which was then followed by four items on the scale: "I do it without having to consciously remember", "I do it automatically", "I do it without thinking" and "I start before I realize I am doing it".

In the three scales used in this study, the questions were answered in the form of self-reports, and all questions were investigated according to a 5-point Likert scale (from strongly disagree to strongly agree). Two main research collectives were included in this study: the first was the PE teachers, who completed the Teaching Style Inventory, a self-reported scale containing 11 teaching styles, each with a detailed explanation, based on their own understanding of the teaching style. However, it is important to note that the question "a" in the teaching style was changed to from never to always (1 = never and 5 = always), which is different from the other questions; the second one was completed by college students, in the form of self-reported autonomous motivation and exercise habits scales, which were independent from each other, although college students submitted them together at the time of completion. It should be noted, however, that the data on autonomous motivation were obtained computationally and data collection was based on the revised Perceived Locus of Causality (PLOC-R) scale, therefore, autonomous motivation was not directly represented in the questionnaire.

In this study, related language translation questions were involved, including 11 teaching styles and questions in other questionnaires. In order to ensure the accuracy of the translation, two translators engaged in PE were hired to compare the translated content in detail. All teachers and students who participated in the questionnaire were faced with the Chinese language. In addition, some demographic information for each participant was collected before beginning to fill out the Teaching Style, PLOC-R and SRBAI scales. The demographic information of PE teachers is gender, teaching years and profession title, and the demographic information of college students is gender, profession category and average idle time per day (hours).

Data analysis

The first stage is mainly to analyze the construct validity and internal consistency of the scale. SPSS 26 was used to calculate the consistency between Cronbach's alpha (Tavakol and Dennick, 2011) assessment scales, and confirmatory factor analysis (CFA) was performed with Amos 20 (Arbuckle, 2011) software, which was mainly used to test the autonomic motivation scale. Goodness-of-fit of the CFA model was evaluated using multiple recommended indices of good-fit: the Chi-square ratio of degrees of freedom (χ^2/df), Root Mean Squared Error of Approximation (RMSEA), the Root Mean Square Residual (RMR), the Comparative Fit Index (CFI), the Incremental Fit Index (IFI), the Normed Fit Index (NFI), the Average Variance Extraction (AVE) and the Combined Reliability (CR) (Kulinna and Cothran, 2003; Jaakkola and Watt, 2011; Vlachopoulos *et al.*, 2011).

By using the Smart-PLS model to evaluate the corresponding fit index by building a structural equation, previous studies have pointed out that good results have been achieved even with small sample sizes (Wixom and Watson, 2001; Zhang *et al.*, 1991). Multicollinearity Variance Inflation Factor (VIF) < 3; R2 values for autonomic motivation and exercise habits (small = 0.02, medium = 0.13, large = 0.26); Convergent validity of the structural model was also calculated (CR > 0.7 and AVE>0.5) and discriminant validity (HTMT<0.85) (Clark and Watson, 2016).

In the second phase of the analysis, the use of teaching styles was first assessed. By analyzing the values of teachers' experiences (M > 3.5) and perceptions (M > 10.5) style (Hein *et al.*, 2012) in the PE teacher's teaching style scale, the teaching style preference of PE

teachers was studied and the analysis of each variable in demographics. Second, using the calculation of the Pearson product-moment correlation coefficient, the correlation between PE teachers' teaching style and college students' autonomous motivation and exercise habits is evaluated. Finally, by using the Smart-PLS software to establish a structural equation model, the impact of college PE teachers' teaching styles on college students' exercise habits is predicted. It should be noted that the teaching style data used in the correlation and structural equation modeling are derived from the average of the terms "b", "c" and "d" in the questions of teachers' perceptions.

Results

Validity and reliability

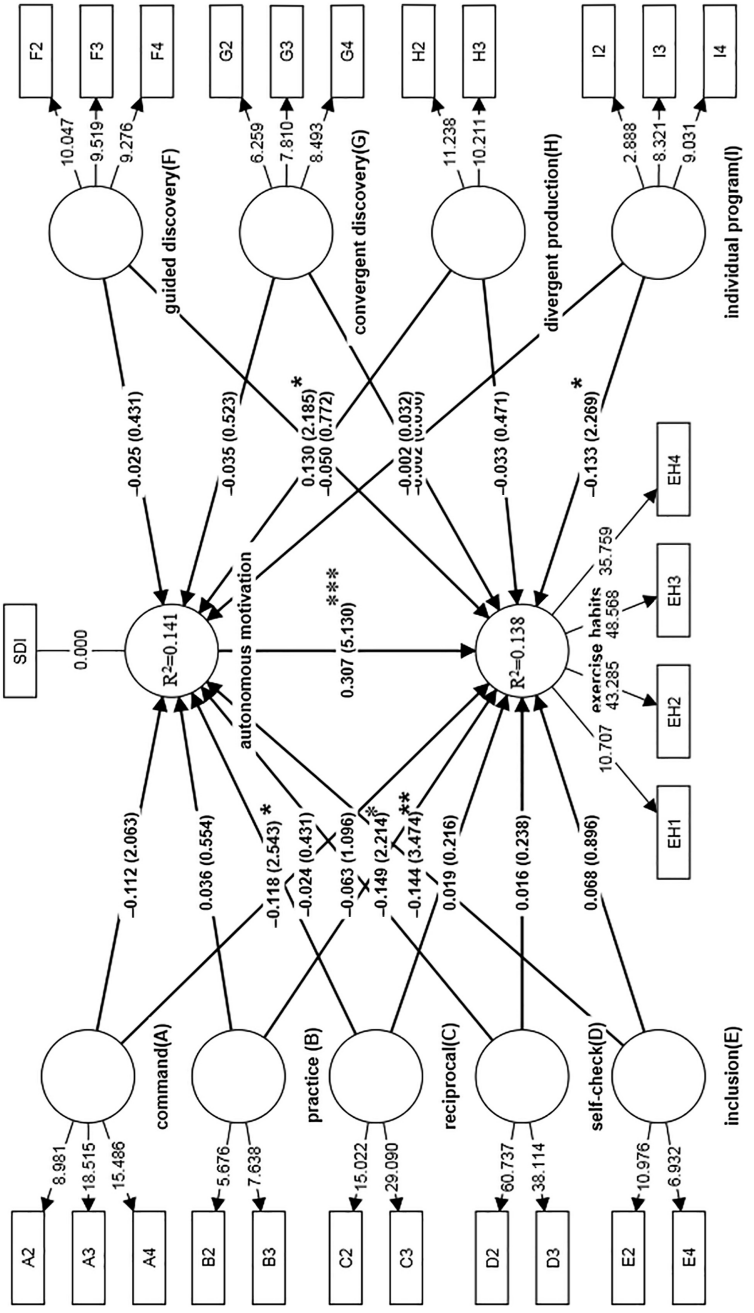
The reliability (Cronbach's alpha) of the perceptions of the PE teachers' teaching style scale is all greater than 0.87, and the overall teaching style confidence is 0.878; the reliability (Cronbach's alpha) of the college students' autonomous motivation scale is all greater than 0.85. The reliability of the exercise habit scale (Cronbach's alpha) was all greater than 0.75. χ^2/df = 2.696, RMSEA = 0.072, RMR = 0.046, CFI = 0.949, NFI = 0.921, IFI = 0.949 in confirmatory factor analysis of the Autonomic Motivation Scale, while AVE>0.5, CR > 0.8 for all dimensions. All goodness-of-fit indices meet acceptable levels (Marsh *et al.*, 2004). Therefore, the validity and reliability evaluation of the scales used concluded that the PE teaching style questionnaire used in Kulinna *et al.*'s study is also applicable to PE teachers in Chinese universities (Kulinna and Cothran, 2003).

In the overall fit evaluation of the model, by using the PLS Algorithm algorithm for operations, the hypothetical predictive relational model shows the following fit indices (Figures 1 and 2): Multicollinearity Variance Inflation Factor (VIF) < 3; Autonomic Motivation and Exercise Habit R2>0.13; At the same time, the minimum value of convergent validity CR of the structural model was calculated to be 0.891 > 0.7, the minimum value of AVE is 0.674 > 0.5, and the maximum value of discriminant validity HTMT is 0.621 < 0.85. Therefore, the model has good validity.

Teachers' experiences and perceptions style

In this study, the preferred teaching styles of PE teachers were first screened based on the assessment criteria of teaching style preference. It can be seen from Table 1 that the teaching styles preferred by PE teachers are practice, reciprocal, inclusion and guided discovery styles. The practice style is the most frequently used teaching style by PE teachers, however, PE teachers rarely use learner-initiated and self-teaching styles in their classrooms (Kulinna and Cothran, 2003; Syrmpas and Digelidis, 2014; SueSee *et al.*, 2018). The average values of other teaching styles in experiences and perceptions are only greater than 3 and 9, indicating that PE teachers have experience in teaching, but they are not high-frequency teaching styles. Generally speaking, Chinese college PE teachers mainly use the teacher-centered (reproduction style) teaching style to carry out classroom teaching.

Repeated measures ANOVA results indicated that differences were present among teachers' experiences styles ($F(10, 22) = 8.921$, $p < 0.001$) and teachers' perceptions styles ($F(10, 22) = 6.582$, $p < 0.001$). The results of the MANOVAs alone show that, except for gender ($F(11, 20) = 2.711$ $p < 0.05$) which is significant in perceptions styles (SueSee and Barker, 2019; Jaakkola and Watt, 2011), teaching years and profession title have no significant differences in teachers' experiences and perceptions styles. The between-subject effect test on gender shows that command style ($F(1) = 10.421$ $p < 0.01$), practice style ($F(1) = 5.984$ $p < 0.05$), reciprocal style ($F(1) = 5.959$ $p < 0.05$) and self-check style ($F(1) = 6.880$ $p < 0.05$) were significant, and the remaining teaching styles were not.



Note(s): 2, 3, 4 represent b, c, d items respectively; $*p < 0.05$, $**p < 0.01$

Source(s): Author's own creation/work

Figure 1.
Hypothetical teaching styles model

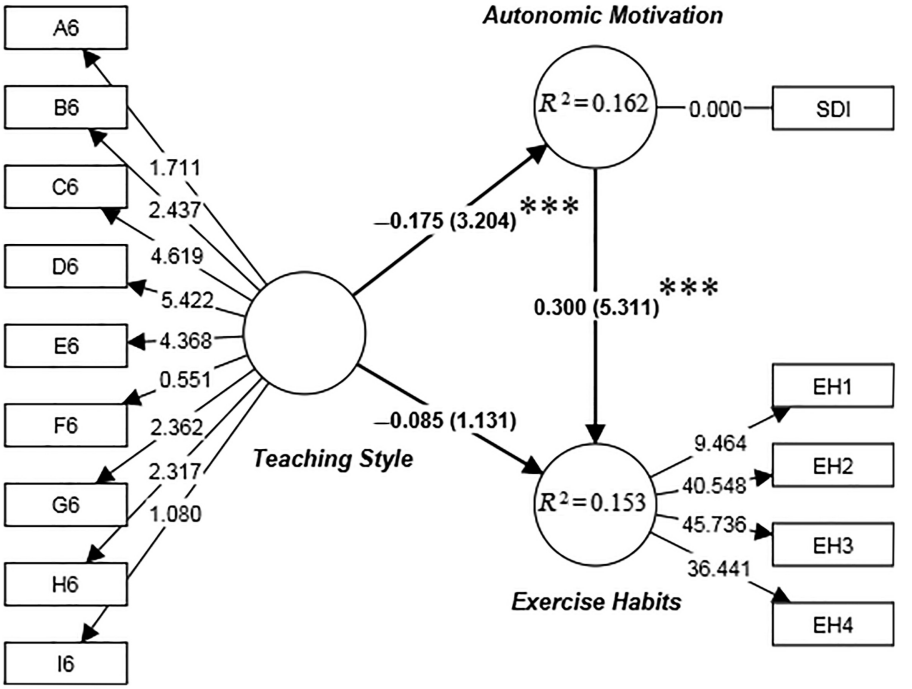


Figure 2.
Hypothetical overall teaching styles model

Note(s): 6 represent b, c, d items average value; A-I represent Mostton's teaching styles; ***$p < 0.001$

Source(s): Author's own creation/work

Table 1.
Means and standard deviations for teachers' experiences and perceptions

Style	Experiences mean(SD)	Perceptions mean(SD)
Command Style	3.22 (1.313)	8.81 (3.23)
Practice Style	4.28 (0.729)	11.59 (2.42)
Reciprocal Style	3.75 (1.047)	11.19 (3.42)
Self-Check Style	3.09 (1.254)	8.44 (4.09)
Inclusion Style	3.81 (1.401)	11.22 (3.33)
Guided Discovery Style	3.78 (1.070)	10.54 (2.92)
Convergent Discovery Style	3.44 (1.134)	10.09 (2.93)
Divergent Production Style	3.63 (1.070)	10.43 (3.06)
Individual Program Style	3.37 (1.385)	11.06 (2.61)
Learner-Initiated Style	2.75 (1.320)	9.03 (3.81)
Self-Teaching Style	1.97 (1.282)	7 (3.50)

Source(s): Author's own creation/work

Autonomic motivation and exercise habits

Autonomy is considered to be the origin and regulator of one's own behavior (Ryan and Deci, 2017), while habit is considered to be a specific reflection of behavior (Hagger, 2019). Levels of autonomy and habit indirectly reflect the degree to which individuals are under conscious control. It can be seen from Table 2 that 85.2% of college students have a certain degree of

autonomy (M = 9.23, SD = 6.92), can independently restrain their own sense of autonomy and are rarely influenced by the outside world; 64.4% of college students already have exercise habits (M = 3.55, SD = 0.77), have an attitude of recognition of exercise habits and can carry out regular physical exercise. Univariate analysis of variance showed that there was no significant difference between college students' autonomous motivation and gender, average idle time per day (hours) and profession category; However, exercise habits are affected by college students' average idle time per day (hours) ($F(2) = 3.318\ p < 0.05$). Post hoc polynomial contrasts showed that the daily idle time of college students was "<1" hour and "1–2 h" ($p < 0.05$) and ">2 h" ($p < 0.05$), respectively.

The preliminary correlation analysis

In this study, Pearson correlation analysis was performed on each variable by using SPSS software. Table 3 shows the correlation between the 11 teaching styles of Mostton's Spectrum theory, the three research variables of college students' autonomous motivation and exercise habits. In the correlation analysis, the overall teaching style of college PE teachers was significantly negatively correlated with autonomous motivation ($r = -0.503\ p < 0.01$) and exercise habits ($r = -0.377\ p < 0.05$). Among them, there is a significant negative correlation between command, practice, reciprocal, self-check, inclusion and convergent discover style and autonomous motivation; Practice, self-check, divergent production, individual program style showed a significant negative correlation with college students' exercise habits, while guided discovery style showed a significant positive correlation with college students' exercise habits; Overall teaching style (TS) was significantly negatively correlated with autonomous motivation and exercise habits; There is a significant positive correlation between the autonomous motivation level and exercise habits of college students. The level of autonomous motivation of college students showed a significant positive correlation with exercise habits (Poon, 2018).

Structural equations modelling analysis

The results of correlation analysis show that there are 9 teaching styles that are related to exercise habits and autonomous motivation. By using Smart-PLS software to build a structural equation model (Figures 1 and 2), and using the Bootstrapping algorithm to perform 5,000 operations on the model, the results of the structural model were obtained. It should be noted that in the test of model validity, some dimensions with high multicollinearity in the outer model are excluded. As can be seen from Figure 1, reciprocal ($t = 2.543$, $p < 0.05$) and inclusion style ($t = 3.474$, $p < 0.01$) have negative effects on college students' autonomous motivation; practice ($t = 2.214$, $p < 0.05$) and individual program style ($t = 2.269$, $p < 0.05$) had a negative impact on college students' exercise habits; However, guided discovery style ($t = 2.185$, $p < 0.05$) had a positive effect on college students' exercise habits. Among them, college students' autonomous motivation can significantly affect their own exercise habits ($t = 5.130$, $p < 0.001$).

Variables	Mean(SD)	>0(%)	>3(%)
Self-determination Index	9.23 (6.92)	85.2%	–
Exercise Habits	3.55 (0.77)	–	64.4%

Note(s): Self-determination index is obtained by calculation, scores for it ranged from-24 to 24 and exercise habit from 1 to 5; "–" means not participating in the project $n = 320$ students
Source(s): Author's own creation/work

Table 2. Means and standard deviations for autonomic motivation (SDI) and exercise habits

Table 3.
Correlations between all variables

	A	B	C	D	E	F	G	H	I	J	K	TS	AM	EH
A	1													
B	0.318	1												
C	−0.013	0.449*	1											
D	0.220	0.371*	0.441*	1										
E	0.183	0.340	0.577**	0.388*	1									
F	0.018	−0.080	−0.193	0.004	−0.114	1								
G	−0.080	0.160	0.477**	0.443*	0.252	0.244	1							
H	−0.220	0.149	0.513**	0.266	0.249	−0.035	0.342	1						
I	0.040	−0.271	0.042	0.137	0.092	−0.108	0.201	0.269	1					
J	−0.005	0.236	0.242	0.028	0.140	−0.024	0.155	0.280	−0.205	1				
K	0.114	0.153	0.035	0.034	0.206	0.228	0.188	0.205	−0.215	0.677**	1			
TS	0.293	0.519**	0.675**	0.644**	0.63**	0.161	0.625**	0.561**	0.152**	0.508**	0.52**	1		
AM	−0.464**	−0.362*	−0.369*	−0.366*	−0.370*	−0.173	−0.399*	−0.173	−0.064	0.077	−0.088	−0.503**	1	
EH	−0.321	−0.369*	−0.212	−0.377*	−0.115	0.353*	−0.105	−0.459**	−0.463**	−0.017	−0.010	−0.377*	0.223**	1

Note(s): The abbreviations in the table represent EH = exercise habit, AM = Autonomic Motivation, TS = teaching style, and the remaining letters A-K are the abbreviations for the corresponding 11 teaching styles in the Mostton's Spectrum theory. ** means $p < 0.01$, * means $p < 0.05$

Source(s): Author's own creation/work

However, in actual PE, PE teachers do not use a single teaching style, but a combination of multiple styles. Therefore, this study counted 9 educational styles that were correlated with autonomous motivation and exercise habits. The dimension of teaching style was changed to the average of the three items "b", "c" and "d" (Figure 2). The analysis results show that the teaching style of PE teachers has a negative effect on college students' autonomous motivation ($t = 3.204$, $p < 0.001$), but there is no significant difference between it and exercise habits ($t = 1.131$, $p > 0.05$). College students' autonomous motivation positively affects exercise habits ($t = 5.311$, $p < 0.001$). Autonomous motivation positively influences exercise habits among college students ($t = 5.311$, $p < 0.001$) (Poon, 2018).

Discussion

The Mosston Spectrum Theory is aimed at the teaching style of PE teachers. This theory is generally applicable to the research on the teaching style of PE teachers in many countries, such as Greek (Syrmpas and Digelidis, 2014), Finnish (Jaakkola and Watt, 2011), Swedish (SueSee and Barker, 2019) and other countries. This study uses the Spectrum theory to evaluate the perceptions of college PE teachers about it in the context of Chinese education. The results of the current study show that various teaching styles have been used in the context of PE in China. Statistics show that, except for the learner-initiated ($M = 2.75$, $SD = 1.32$) and self-teaching ($M = 1.97$, $SD = 1.282$) the average frequency of use of other teaching styles is greater than 3, indicating that Chinese college PE teachers use multiple styles in the teaching process, but there are differences in the frequency of use of each style. Previous studies have confirmed the findings of this study (Hewitt, 2015; Hewitt *et al.*, 2016; Syrmpas *et al.*, 2016; Cothran *et al.*, 2005). Therefore, the mixed use of various teaching styles is a means of PE in colleges and universities, and only using a single teaching style in teaching will reduce the quality of teaching.

In this study, the preferred teaching styles of PE teachers were practice, reciprocal, inclusion and guided discovery styles. Among them, practice style ($M = 4.28$, $SD = 0.729$) is the most frequently used teaching style by PE teachers. SueSee *et al.*'s research from multiple perspectives shows that PE teachers, regardless of gender or years of teaching experience, show that practice style is the most frequently used (SueSee and Barker, 2019). Not only that, American PE teachers use command, practice styles most frequently, while learner-initiated and self-teaching styles are rarely used (Kulinna and Cothran, 2003). Similarly, in a self-reported study of Australian high school PE teachers, the use of learner-initiated and self-teaching styles was 8 and 6, respectively, in a sample of 110 surveyed (SueSee *et al.*, 2018), similar to the results of this study. However, in a video lesson study of Turkish secondary PE teachers, data collected by using the IFITS scale showed that teachers spent about 50% of the total teaching time using command ($x = 54.64$, $SD = 22.68$), about 9% of the time was taught using practice ($x = 9.46$, $SD = 16.81$) (Parsak and Saraç, 2019). Similarly, some studies have pointed out that command, practice, reciprocal, convergent discovery and learner initiated style are often used when teaching PE to primary school students through an audio-visual online model (Suherman *et al.*, 2019). The reasons for this phenomenon may be highly related to the setting of research objects, evaluation criteria and teaching modes. For example, the research on the style of Turkish PE teachers is more objective through non-autonomous evaluation methods.

The results of this study show that the teacher-centered teaching style (reproduction style) is the most widely used style in PE classrooms. This was confirmed in previous research by Cothran *et al.*, teachers in almost all countries use a teacher-centred teaching style in their teaching (Cothran *et al.*, 2005). Especially in science teaching in schools, teacher-centred teaching results are better (Al-Balushi *et al.*, 2020). Likewise, in the reform of higher education in Eritrea, even though the education sector requires the use of a student-centred teaching

style, in practice teaching is still teacher-centred (Abdella and Fataar, 2021). It should be noted that while PE teachers generally use reproduction styles for teaching, PE teachers always tend to use a certain style, such as the practice style in this study. In a meta-analysis study, the practice, command and inclusion styles were found to be the most popular styles among teachers over the past 16 years (Rhodes and Rebar, 2018). Therefore, there is sufficient evidence to suggest that PE teachers in this study prefer the outcome of a teacher-centred teaching style.

It is worth noting that PE teachers' perceptions styles showed differences in teachers' gender ($F(11, 20) = 2.711\ p < 0.05$) specially the reproduction styles preferred by PE teachers. Some studies have pointed out that this gender effect depends on the environment. Although teachers may have personal preferences for a certain teaching method, when influenced by external stimuli, the teaching style status will adapt to the changes of the outside world (Nelson Laird *et al.*, 2011). Women in high warmth teaching styles increased perceived warmth but also decreased perceived ability (Burnell *et al.*, 2018), and women were more sensitive to behavioral disengagement and social support (Popa-Velea *et al.*, 2021). It shows that female teachers are more easily affected by the external environment, especially when teaching with a teacher-centered teaching style, their subjective will is more easily changed than that of men. This also explains the findings of this study, teachers show differences in command ($F(1) = 10.421\ p < 0.01$), practice ($F(1) = 5.984\ p < 0.05$), reciprocal ($F(1) = 5.959\ p < 0.05$) and self-check ($F(1) = 6.880\ p < 0.05$) style.Instead, there were no differences in student-centred (production style) teaching styles.

Exercise habits often align with a person's needs and wants. The survey found that 64.4% of college students have formed exercise habits, and college students as a whole are more willing to form exercise habits ($M = 3.55$), and the establishment of exercise habits is significantly related to the average idle time per day (hours) ($F(2) = 3.318\ p < 0.05$) of college students. People with strong exercise habits also tend to have a strong desire to exercise or self-determination motivation (Gardner *et al.*, 2011; Gardner and Lally, 2013; Radel *et al.*, 2017; Rebar *et al.*, 2016). There are 85.2% of college students with complete autonomous motivation ability, and the level of autonomous motivation of college students ($M = 9.23$) is generally high. The results show that college students' autonomous motivation not only has a strong positive correlation with exercise habits, but also positively affects exercise habits ($t = 5.311$, $p < 0.001$). Gardner and Lally define a habit as a process that, when encountering a cue, triggers an impulse to perform an action, which, through learning, becomes a learned response to the cue (Gardner and Lally, 2018). Therefore, habit formation is not an accidental process. Compared to other forms of autoregulation (Rebar, 2017), habit formation relies more on learning from past experience. At any point, people are likely to engage in one of many different behaviors, but only those reinforced by rewards and punishments persist over time (Rebar *et al.*, 2020). In summary, hypothesis one proposed in this study holds true. That is, college students' autonomous motivation is positively related to exercise habits and has a positive predictive effect.

Habit formation requires access to many introspective processes, often targeted exercise interventions such as goals and programs, as these can help increase motivation and the ability to act on motivation when opportunities arise (Verplanken, 2010). Effective external intervention measures can change the original motivation level of college students. Murto pointed out that teaching style has a certain impact on students' learning motivation (Murto, 2019). If such intervention goes against the inherent thinking, it becomes a painful process. The results of this study showed that the overall teaching style of PE teachers in teaching negatively predicted the level of autonomous motivation of college students ($t = 3.204$, $p < 0.001$). However, for single styles, only reciprocal style ($t = 2.543$, $p < 0.05$) and inclusion style ($t = 3.474$, $p < 0.01$) negatively predicted the level of autonomous motivation of college students. Previous studies have also confirmed the finding of a strong correlation between

teaching style and autonomous motivation (Mahmoodi *et al.*, 2021; Hein *et al.*, 2012), however, no further regressions were conducted to analyze the relationship. Therefore, hypothesis two proposed in this study holds that PE teachers' teaching style is not only negatively related to college students' autonomous motivation, but also has a negative predictive effect. This finding is also consistent with Deci and Ryan's self-determination theory hypothesis (Ryan and Deci, 2017).

Studies have pointed out that a certain teaching style of sports environment can predict healthy eating habits of adolescents, and at the same time pointed out that autonomous motivation can positively predict such healthy eating habits (Trigueros *et al.*, 2019). In this study, however, hypothesis three partially held and there was only a correlation between the two. The results showed a significant negative correlation between overall teaching style and exercise habits, yet after regression analysis, no effect on exercise habits was shown ($p > 0.05$). It may be related to the selective use of teaching styles in the teaching process of teachers. After all, PE teachers will use more of their preferred teaching styles in actual teaching, and the corresponding use of other styles will also be reduced. However, the effects of practice and guided discovery style on exercise habits were contradictory in the teaching preferred by college PE teachers, while the remaining teaching styles did not show significance. In this study, the teacher's style of PE teachers realizes the influence on exercise habits through autonomous motivation, and the individual's autonomous motivation has a key mediating role. An individual's intrinsic reward may play a key catalytic role at every stage of habit formation, and individuals who are intrinsically motivated to actively participate in physical activity tend to be more likely to act on their own motives, to maintain their behavior and to have stronger exercise habits (Gardner and Lally, 2013; Kaushal and Rhodes, 2015; Radel *et al.*, 2017). In other words, exercise habits are enhanced as long as external influences are applied that increase this intrinsic motivation.

There are several factors that influence habit formation, by increasing or maintaining motivation to actively exercise, by helping to convert motivation into repetitive actions, or by reinforcing the value of reinforcement formed by each repetition to cued behavioral associations (Lally and Gardner, 2013). Although motivational factors are important, there is still a need for certain external stimuli to facilitate habit formation. The results showed that practice and individual program style negatively affected college students' exercise habits, while guided discovery style had a positive effect. Spectrum theory believes that guided discovery style is a transitional style from teacher-centered to student-centered (Mosston and Ashworth, 2008), which is the key to the transformation of students' learning thinking (Pill *et al.*, 2021). In a study comparing command and guided discovery styles on the problem of handstand acquisition, the guided discovery style teaching model appeared to be better at producing handstand memory (El Khouri *et al.*, 2020). It may be related to the sudden improvement of students' autonomy in the guided discovery style, which positively motivates the establishment of students' exercise habits. On the contrary, the practice style is more restrictive, and the individual program style is too laissez-faire, which leads to the emergence of students' rebellious emotions. Although the practice style can promote the improvement of motor skills (Proios, 2018; Argantos, 2015), the disadvantage of the practice style is that it is too mechanized and procedural, which can easily lead to the reverse state of the learner and reduce the enthusiasm of the students. Similarly, the individual program style needs to deliberately emphasize its independence in teaching (Mosston and Ashworth, 2008), the level of autonomous motivation is limited, and the self-motivation effect is poor.

Conclusion

Overall, this study is the first to study the impact of the teaching style of PE teachers in Chinese colleges and universities on the establishment of college students' exercise habits.

Firstly, it was determined that the teaching style preferred by PE teachers in general colleges and universities was teacher-centered reproduction style, including practice, reciprocal, inclusion and guided discovery styles, and practice style was the most frequently used teaching style by PE teachers. It cannot be denied that in order to improve the quality of teaching in the teaching process, teachers are based on the assistance of multiple styles, not just the use of one or several styles. Secondly, it was verified that there was a relationship between the teaching styles of PE teachers and the exercise habits of college students in general universities. There was a significant negative relationship between the teaching style of college PE teachers and college students' exercise habits, but it could not directly influence the establishment of college students' exercise habits. It can only influence the establishment of exercise habits through the mediating role of college students' autonomous motivation.

The use of PE teachers' styles influenced college students' levels of autonomous motivation and exercise habits. The results of the study provide a practical reference for the classroom teaching of PE teachers in Chinese universities. The development of exercise habits by college students in PE classrooms indirectly stems from the influence of PE teachers' teaching styles. However, PE teachers only focused on the implementation of teachers' teaching progress in the actual teaching process and did not pay attention to college students' initiative, innovation and effectiveness in the classroom and overall ignored the changes in college students' autonomy in classroom participation. In addition, PE teachers' preferred reproduction style shows that PE teachers focus more on teacher-centered style in their daily teaching. PE teachers should integrate the use of multiple teacher styles together and select the best teaching style in the face of different initiatives of college students; PE teachers' focus should not simply focus on the formality of the classroom, but should focus on the development of college students' motivation to exercise; at the same time, PE teachers should seek innovative teaching methods from themselves to extend and enrich students' practical learning and invest in the use of a wider range of teaching styles. Not only that, PE teachers must attend the necessary innovation/practice seminars to improve the effectiveness and innovation of teachers' teaching styles and ensure the accurate implementation of PE goals.

Limitations and future research

These limitations should be acknowledged. The number of teachers participating in the questionnaire survey is relatively small: the main reason is that the number of teachers participating in public PE courses in ordinary colleges and universities surveyed is relatively small, which cannot reflect the universality well, which may lead to inaccurate use of teachers' teaching styles; The schools studied are relatively simple: the research schools are located in ordinary colleges and universities in the east and lack many schools with professional categories, such as vocational schools, engineering schools and liberal arts schools. Therefore, this study is not applicable to higher vocational colleges, professional schools and higher-level universities; Scope of students participating in the study: The research object is only for college students who participate in PE courses, and there is no survey for college students in the 5th to 8th semesters who have no courses. Therefore, the scope of students is not broad enough, but the current situation is only studied, and there is no continuous follow-up to observe the impact of PE teachers' teaching styles on college students' exercise habits.

In future research, in order to obtain more accurate findings, the findings should be made more general. The number and variety of college and PE teachers should be increased, and the research scope and number of college students should be increased to make the research results more general and wider. At the same time, it should also be clearly recognized that this study only demonstrated and obtained the suggestion that the teaching style of college PE teachers indirectly affects the exercise habits of college students, but did not discuss the

mechanism too much. It is recommended to conduct further in-depth research to obtain accurate results.

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