



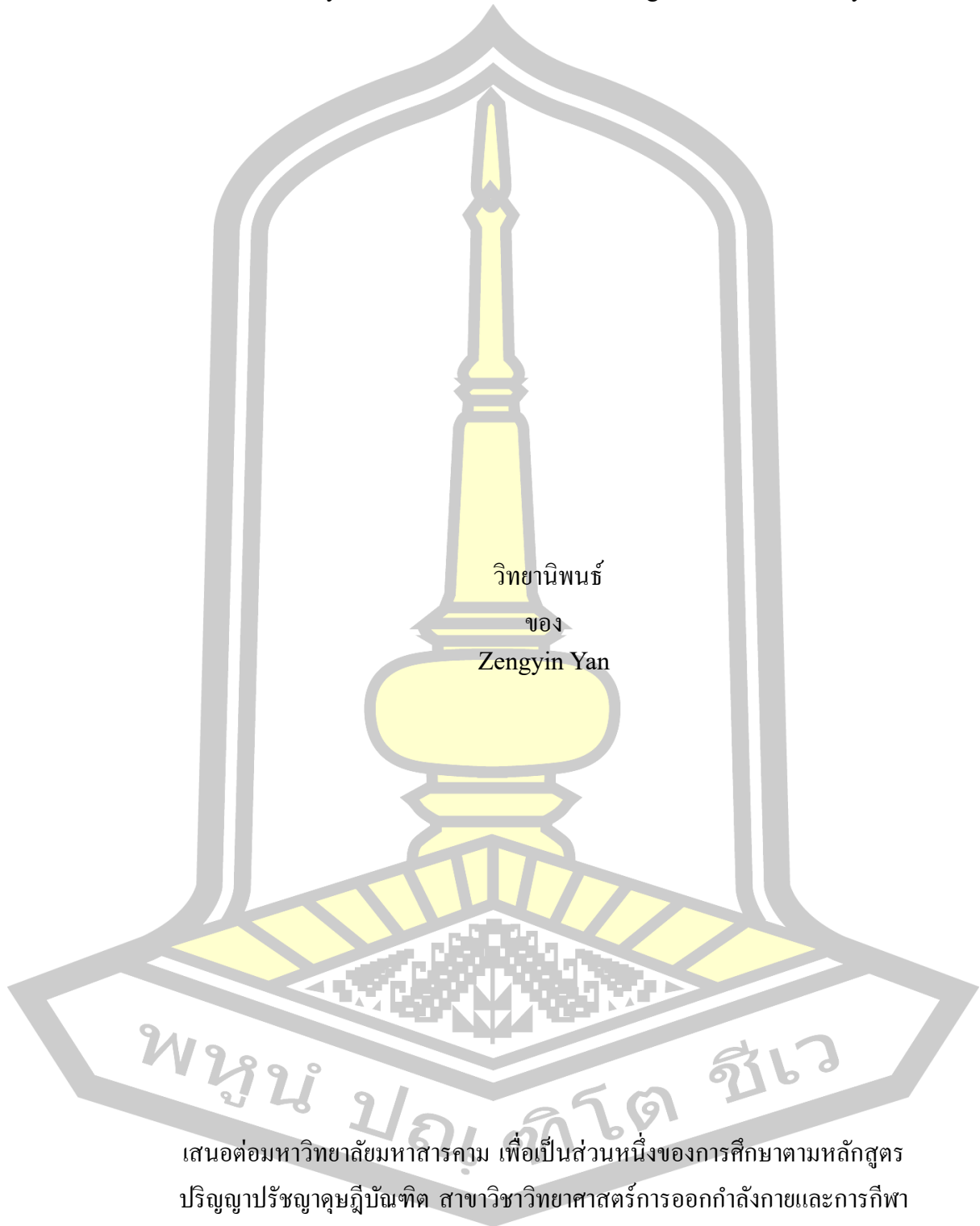
The Relationship and Prediction of University Sports Environment, Exercise Motivation, and Physical Exercise Behavior among Chinese University Students

Zengyin Yan

A Thesis Submitted in Partial Fulfillment of Requirements for
degree of Doctor of Philosophy in Exercise and Sport Science
December 2024

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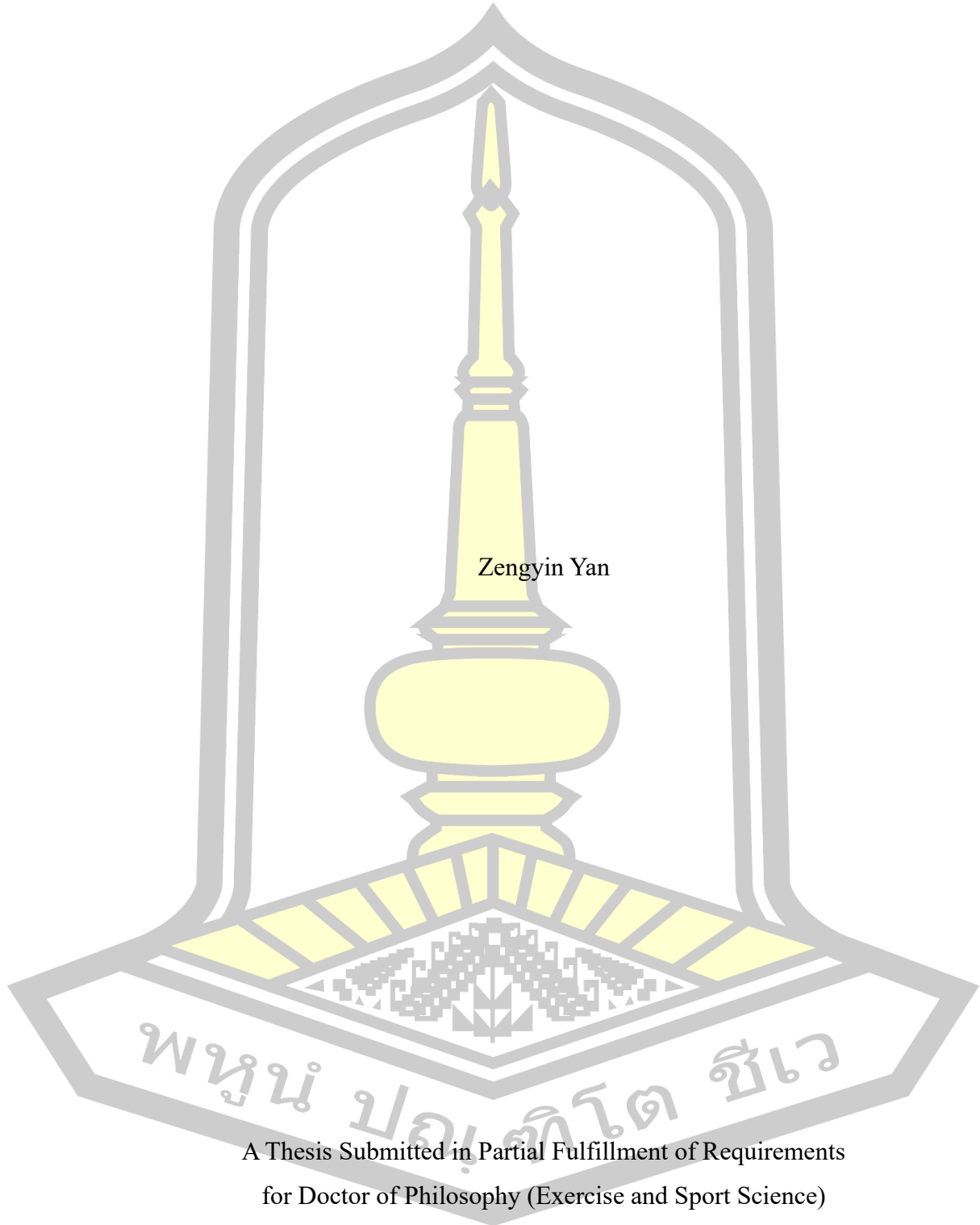


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ลิขสิทธิ์เป็นของมหาวิทยาลัยมหาสารคาม

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December 2024

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The examining committee has unanimously approved this Thesis, submitted by Mr. Zengyin Yan , as a partial fulfillment of the requirements for the Doctor of Philosophy Exercise and Sport Science at Maharakham University

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TITLE	The Relationship and Prediction of University Sports Environment, Exercise Motivation, and Physical Exercise Behavior among Chinese University Students		
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ABSTRACT

Physical exercise plays an important role in preventing diseases and promoting health. The university stage is a critical transition period from youth to adulthood, and it is also a critical period for forming good exercise behaviors and lifelong sports habits, which is of great significance to the future healthy life of university students. University students' exercise behavior is driven by multiple factors. The university sports environment is an important basis for promoting university students' exercise behavior. Exercise motivation is the psychological motivation that drives university students' exercise behavior.

This study explores the intrinsic relationship between the university sports environment, exercise motivation and exercise behavior, and provides theoretical reference and practical support for improving university students' exercise behavior. Therefore, the purposes of this study were five: To revise and validate the university sports environment questionnaire for Chinese university students; To determine the relationship between university sports environment and exercise motivation and exercise behavior as a whole and classified by gender and year level of study; To determine the relationship between exercise motivation and exercise behavior as a whole and classified by gender and year level of study; To create equations to predict physical exercise behavior for Chinese university students; To put forward strategies for promoting exercise behavior for Chinese university students.

The main conclusions are as follows:

The reliability and validity of the revised University Sports Environment Questionnaire reached acceptable standards ($IOC \geq 0.8$ and $ICC \geq 0.8$), providing strong evidence for the use of the University Sports Environment Questionnaire and providing theoretical and empirical basis for the future application of the scale among Chinese university students.

University students have gender-consistent characteristics in the university sports environment, and there was no significant difference ($P > 0.05$); there

were significant gender differences between male and female university students in the dimensions of health motivation, appearance motivation and identification motivation ($P < 0.05$), among which In terms of health motivation, male were significantly higher than female university students ($P < 0.05$); in terms of appearance motivation, female were significantly higher than male university students ($P < 0.05$); in terms of identification motivation, male were significantly higher than female university students ($P < 0.05$). There were significant gender differences in exercise behavior among university students ($P < 0.05$). Male were significantly higher than female university students in both higher vigorous and moderate exercise behavior. There were significant differences in university sports environment, exercise motivation and exercise behavior among university students ($P < 0.05$), and the lower grades were generally higher than the higher grades.

The correlation between university sports environment, exercise motivation and exercise behavior was from low to high, Pearson's r value was 0.359^{**} - 0.397^{**} , all at the significance level of 0.01. There was a significant positive correlation between university sports environment and exercise motivation. The sports social environment and sports policy environment had a significant positive influence and predictive power on exercise motivation. There was a positive correlation between university sports environment and university students' exercise behavior. University sports environment had a significant positive influence and predictive power on exercise behavior. Exercise motivation had a significant positive correlation with university students' exercise behavior, and exercise motivation had a significant positive influence and predictive power on university students' exercise behavior.

The structural equation model of the university sports environment, exercise motivation and exercise behavior of university students had a good fit, and the model had a good adaptability. The model path showed that university sports environment had a significant positive impact on exercise motivation and exercise behavior. Exercise motivation had a significant positive effect on university students' exercise behavior. At the same time, the mediating effect of the path between university sports environment-exercise motivation-exercise behavior was significant, and exercise motivation plays a partial mediating role in the impact of university sports environment on exercise behavior.

University sports environment and exercise motivation had a significant positive prediction effect on university students' exercise behavior. According to the results of the study, the corresponding strategies were put forward to improve the university students' exercise behavior by improving the university sports environment, stimulating the university students' exercise motivation, and promoting the development of university students' physical and mental health.

Keyword : University Sports Environment, Exercise Motivation, Exercise Behavior

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Zengyin Yan

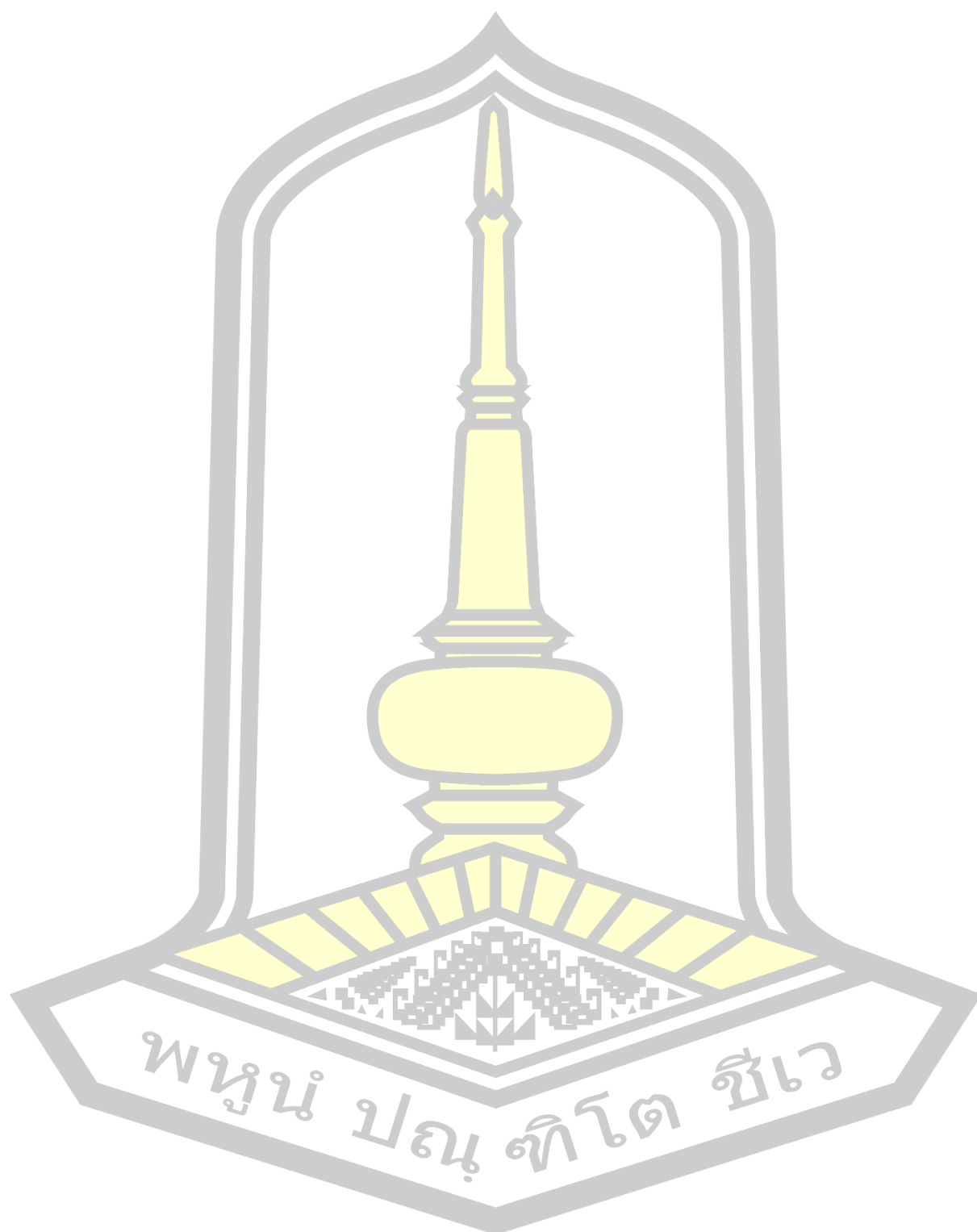
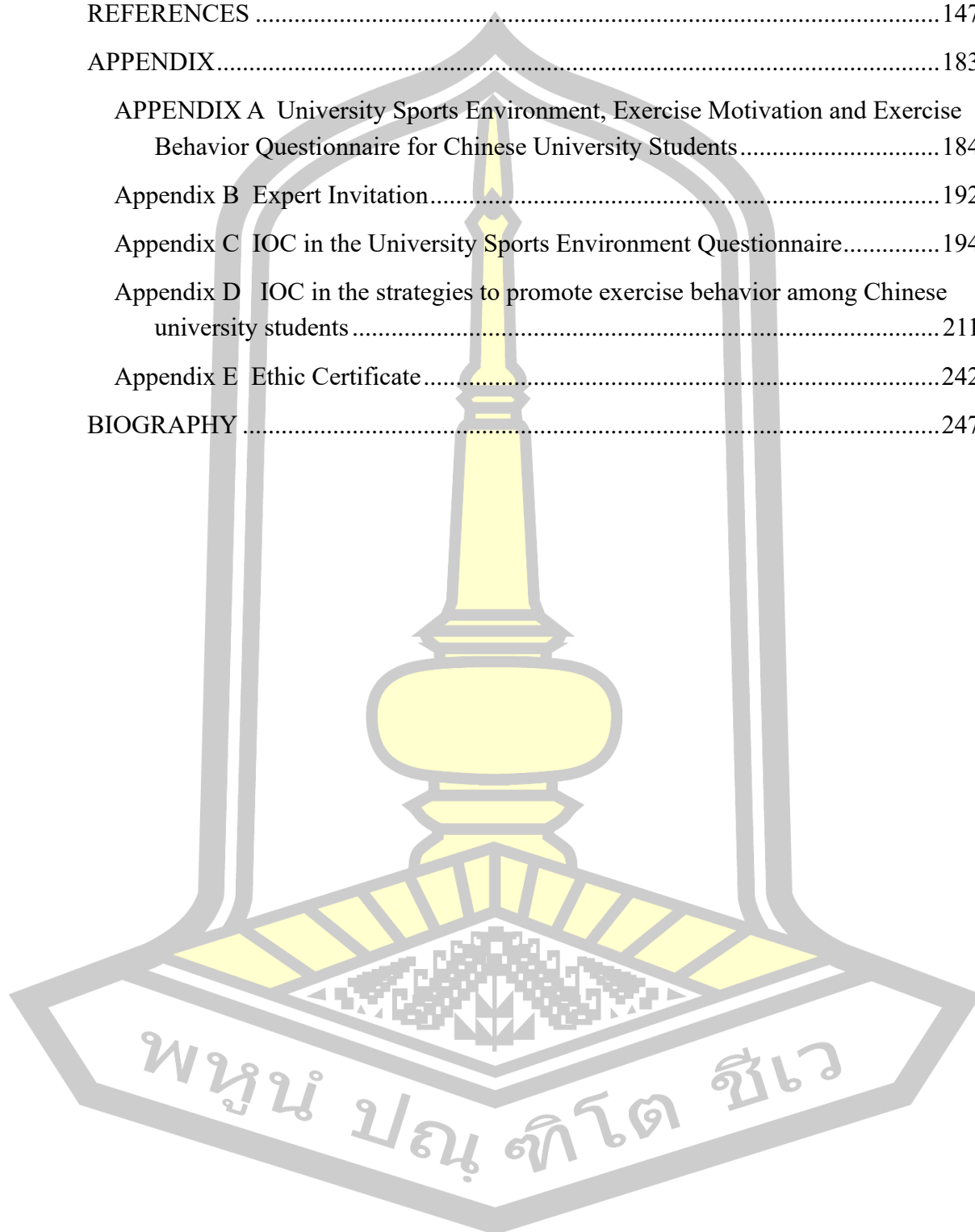


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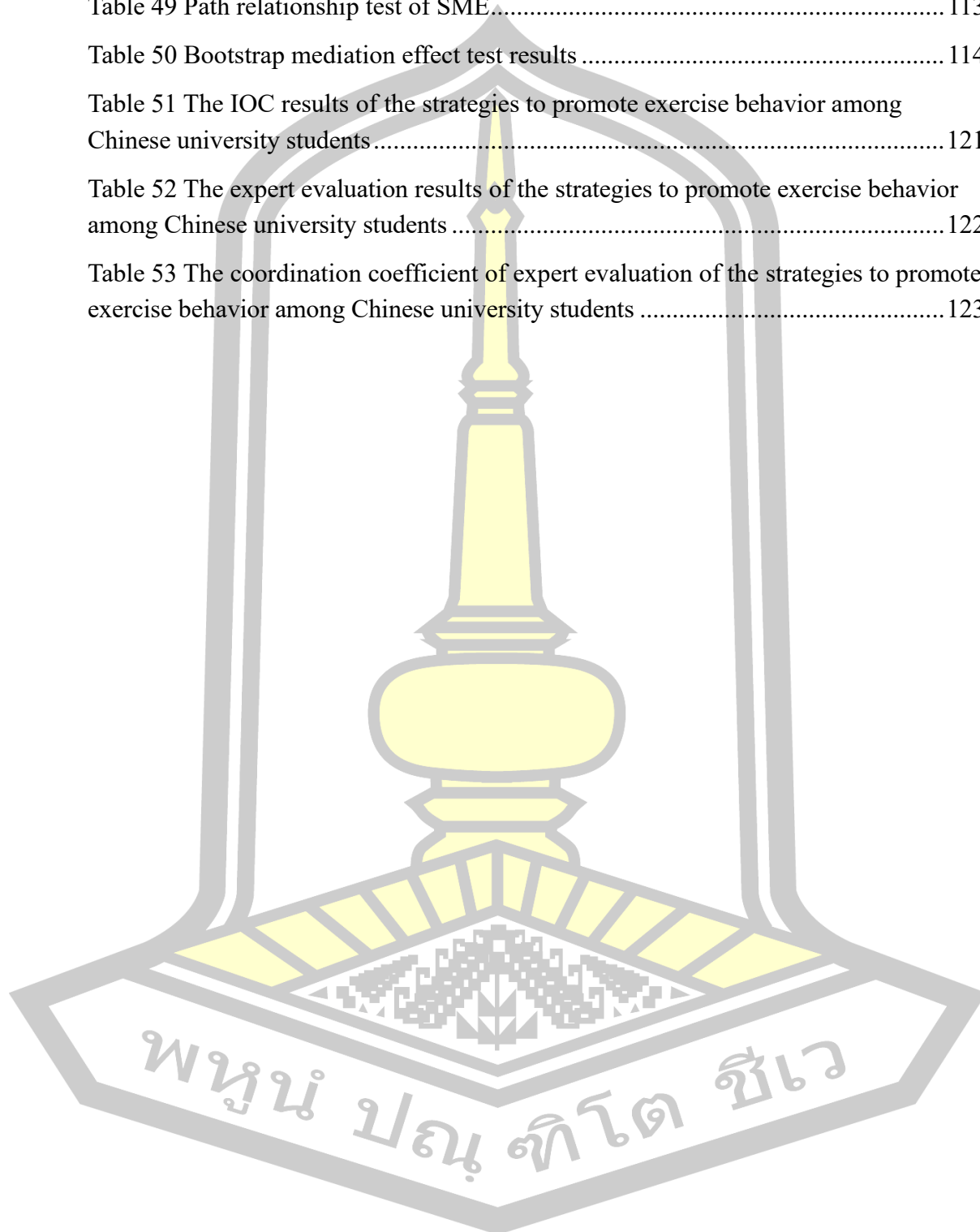


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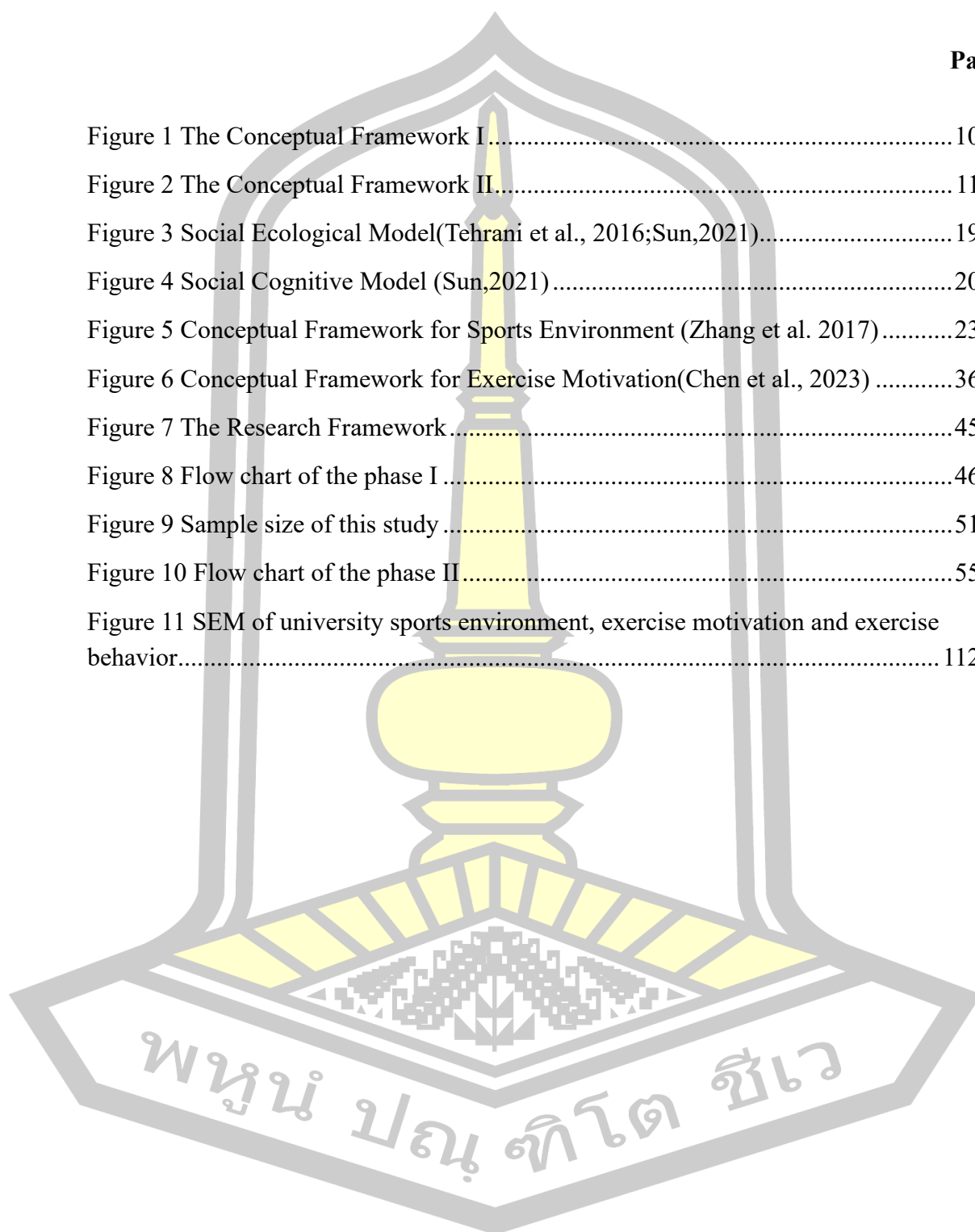
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CHAPTER I

INTRODUCTION

Background

With the on-going development of human society, and science and technology, many laborious manual tasks have gradually been taken by machines. The emergence of various intelligent appliances makes people's lives more relaxed and comfortable, and offers more convenience and freedom to the process of learning. However, it also brings certain risks to some extent to people's physical health. With the on-going development of human society, and science and technology, many laborious manual tasks have gradually been taken by machines. The emergence of various intelligent appliances makes people's lives more relaxed and comfortable, and offers more convenience and freedom to the process of learning. However, it also brings certain risks to some extent to people's physical and mental health. WHO pointed out in the Global Physical Activity Status Report 2022 that 81% of adolescents and 27.5% of adults fail to reach the physical activity level, Lack of physical activity not only leads to lost opportunities for children and adults to achieve better health, but also to an increasing burden of morbidity and mortality from non-communicable diseases, which affects not only individuals and their families throughout their lives, but also health services and society as a whole (WHO, 2022). Life is about exercise, and the traditional belief is that young people should be energetic, but nowadays young people are becoming more and more inactive and unhealthy. (Ward et al., 2006).

University students are even more affected by academic burden, socialization, entertainment and other influences, resulting in increasing screen time and sedentary behavior, and gradually decreasing physical activity behavior (Dong, 2017), Previous studies have found that students' physical exercise behavior generally has an inverted phenomenon that "decreases with age"(Dong and Mao, 2021). Excessive screen time

and sedentary behavior have adverse effects on both physical and mental well-being of individuals (WHO, 2020); In addition, the development of take-out industry enables university students to enjoy their desired meals conveniently without going out (Lei et al., 2020; Liu et al., 2023), it leads to a decrease in daily physical activity. On the one hand, this leads to a decrease in the daily physical activity of university students, and on the other hand, they consume too much of various high-energy foods and beverages, resulting in a decrease in physical fitness (Lian and Li, 2019), overweight/obesity (Chan et al., 2017; Karabulut et al., 2018; Yuan et al., 2021; WHO, 2020), cardiovascular disease, type 2 diabetes (WHO., 2020), vision loss (Li et al., 2019; Karthikeyan et al., 2022), sleep quality problems (Aurea et al., 2022; Bai, 2022), anxiety (Ku et al., 2018; Stanczykiewicz et al. 2019; WHO, 2020), depression (Kim et al., 2010; Liu et al., 2016; WHO, 2020), and other health problems.

The Ministry of Education of China released the Eighth National Survey on Students' Constitution and Health in September 2021, revealing an overall improvement in the physical fitness and health status of Chinese students, but the problem of declining university physical fitness remains serious (Gong, 2021), and young people are obviously physically inactive (P.R.C. 2020). Insufficient physical activity is recognized as one of the risk factors that trigger and contribute to the risk of chronic diseases (WHO, 2022; Boutayeb, 2006), and the group of university students has become an invisible group of high prevalence of chronic diseases (Wang, 2021), which seriously jeopardizes the physical and mental health of university students. In China, physical education is one of the mandatory courses for university students and is closely related to graduation, but most university students participate in physical education courses only to fulfill academic requirements, with a low percentage of independent exercise and participation in sports clubs after class, a situation that is not conducive to the physical and mental health of university students (Li and Zhu, 2020; Chen, 2022; Hou, 2023).

The university stage is a key transitional period stage for the transition from adolescence to adulthood (Zhang and Li, 2022), and also a key period for forming good exercise behavior and lifelong sports habits (Liu et al., 2001), university sports is the final stage of students' physical education learning in the school system, and also a turning point for realizing the transition from school sports to lifelong sports, which has an important role in university students' future healthy life and work is of great significance (Liu et al., 2001; Xiao, 2015). The diversified value of physical activity has become a global consensus, and physical activity plays an indispensable role in disease prevention and health promotion (Liu, 2016). The health benefits of physical activity are demonstrated as early as childhood and adolescence, and this behavior continues into adulthood, where the health effects are more pronounced (Nichol et al., 2009). For every weekday of physical education that a normal-weight adolescent participates in, the odds of becoming an overweight adult decrease by 5% (Menschik et al., 2008). Taking time away from other subjects and adding a daily hour of physical activity to the school curriculum does not decrease students' academic performance in those subjects (Trudeau and Shephard, 2008); conversely, applying physical education time to other academic courses does not improve either students' performance in those subjects or their fitness (Marsh, 1992). The reason for this effect is that physical activity improves student learning (Story et al., 2009) and fosters better exercise behaviors and a greater willingness to participate in school activities (Mahar et al., 2006; Trudeau and Shephard, 2008). For this age group of university students, appropriate exercise can improve physical function, enhance physical fitness, and reduce obesity and the risk of disease (Ekelund et al., 2012 ; Li et al., 2015 ; Wang et al., 2018; WHO, 2022 ; Hou, 2023). University students' adherence to physical activity behaviors has a positive impact on learning, the development of healthy living habits, mental health, and social adaptability (Biddle et al., 2011; Singh et al., 2012 ; Wen, 2015; Li and Ji, 2016; Lu and Wang, 2019; Yan et al., 2019; Fang, 2020).

The environment, people, and their behavior are mutually causal, and environmental factors can strengthen human behavior (Gao, 1999), which is a key factor determining a person's behavior pattern (Zhang et al., 2017). The physical exercise behavior of university students is not driven by a single factor. Individual factors, environmental factors, and psychological factors may all have an impact (Zhang and Li, 2022; Hou, 2023). The impact of each factor on individual behavior is comprehensive, multi-level, and multidimensional (Dai and Chen, 2018). The school sports environment is an important place to promote student physical exercise and reduce sedentary behavior (Wechsler et al., 2000; Morton et al., 2016). At the same time, various activities that individuals participate in are related to motivation, which is the intrinsic role of initiating and maintaining individual activities and directing them towards a specific goal (Chen et al., 2008). Previous studies have conducted relevant studies on the relationship between environment and mental health, environment and exercise behavior, and mental health and exercise behavior, explaining or predicting exercise behavior from a certain level or aspect, although a correlation between the two can be obtained, However, such research can easily lose a systematic and holistic understanding of behavioral phenomena, lacking multi-dimensional and multifaceted research. Therefore, to truly grasp the intrinsic mechanism of sports behavior, it is necessary to conduct research from multiple levels and dimensions, including the environment, individual psychology, and behavior.

The generation of exercise behavior is easily influenced directly by the surrounding environment (Rezende et al., 2015; Humpel et al., 2002; Hong and Li, 2022). In early childhood, the family sports environment is the main focus, but as age increases, the school sports environment becomes increasingly important (Flores et al., 2019). The school sports environment guides students to actively participate in physical exercise, An important place to reduce sedentary behavior (Wechsler et al., 2000; Morton et al., 2016; Wei et al., 2019). Universities have sufficient sports venues, facilities, equipment, and physical education courses, which are important

foundations for supporting university students to better engage in physical exercise activities. They are also one of the important influencing factors for the formation and development of university students' physical exercise behavior (Wechsler et al., 2000; Birnbaum et al., 2005; Johnston et al., 2007; McKenzie and Kahan, 2008; Wang, 2023). In addition to holidays, university students, all students need to live and study in the environment of university, and the overall situation of the school sports environment has a profound impact on their exercise awareness and behavior, as well as their physical and mental health (Wang, 2023). The university sports environment, composed of many factors such as physical education teachers, students, campus sports system, sports facilities, sports culture, etc., is closely related to the learning, life, and sports activities of university students. As the place where students can engage in the most physical exercise, schools promote active participation of university students in physical exercise, enhance health, and strengthen physical exercise behavior, an important driving force for cultivating lifelong sports awareness and abilities (Mao, 2003; Zhang et al., 2017; Chai and LiN, 2018; Wang, 2022).

Exercise motivation refers to why individuals participate in exercise and what needs they need to meet through exercise. It is the psychological motivation for individuals to participate in and maintain exercise behavior (Chen et al., 2006; Chen et al., 2023), and it is also the direct reason for individuals to participate in exercise behavior (Chen et al., 2014). When individuals have a strong enough motivation to exercise, they can actively engage in physical exercise, thereby achieving the effect of physical fitness (Zhang and Li, 2022). Exercise motivation can stimulate students' desire to participate in physical exercise, promote students to choose their favorite sports activities, increase the "frequency", "time", and "intensity" of their exercise behavior, and to some extent help students develop the concept of lifelong sports The habit of actively participating in physical exercise (Wang, 2023). The generation of exercise behavior among university students comes from exercise needs and exercise motivation (Liu et al., 2001). Exercise motivation is the basic driving force for

university students to engage in physical exercise, which satisfies the physiological and psychological needs of university students caused by various intrinsic and extrinsic stimuli through physical exercise. University students' exercise behavior is driven by multiple motivations simultaneously, Exercise motivation is diverse (Liu et al., 2001; Chen et al., 2008). The exercise motivation of university students has multiplicity and complexity, and the same exercise behavior often implies multiple different motivations (Chen et al., 2023). The exercise motivation of university students has a positive impact on physical exercise behavior, and the effect is significant (Zhang and Li, 2022). Both intrinsic and extrinsic motivations have the effect of promoting university students' exercise behavior, improving the efficiency of university students' exercise behavior and the quality of physical learning (Chen et al., 2023; Wang, 2023). The stronger the exercise motivation, the longer the exercise behavior will last. If the exercise motivation no longer exists, the exercise behavior of university students will be difficult to generate and externalize. For university students who lack exercise motivation, their exercise time will be shortened, with each exercise time less than 30 minutes (Sun and Zhang, 2022; Wang, 2023). There is a significant positive correlation between exercise motivation and the subjective well-being of university students. Exercise motivation has a positive predictive effect on the subjective well-being of university students (Chen, 2022; He and Wang, 2023). At the same time, exercise motivation can positively predict the dimensions of confidence, will, and cooperation in exercise persistence and social development (Li et al., 2018).

In summary, the benefits of physical exercise on physical and mental health are widely recognized, but the proportion of people who frequently participate in physical exercise is relatively low. University students have heavy academic tasks, lack awareness and exercise behavior of active exercise, resulting in a lack of physical exercise or insufficient physical exercise, leading to a decline in physical health and physical fitness (Lu and Hui, 2020; Chen, 2022; Hou, 2023), an increase in the

incidence of overweight/obesity, and a series of non-communicable chronic diseases, Causing psychological health problems such as anxiety and depression (Kim et al., 2010; Wang et al., 2018). This state has received widespread attention from various sectors of society, and the sports field has conducted multi-dimensional and interdisciplinary research on this issue, aiming to understand the mechanism of the impact of physical exercise and seek effective sports intervention methods.

Guo (2019) reviewed the previous school sports environment and developed the "School Sports Environment Questionnaire for Middle School Students" based on the "three-level theory of cultural structure". Empirical research was conducted on middle school students, proving that the questionnaire has good reliability and validity, meets the requirements of psychometrics, and is a good tool for measuring school sports environment. But the university sports environment has more open, dynamic, and sustainable characteristics than the middle school sports environment, including natural environment, sports venues, sports facilities, sports courses, sports activities and competitions, etc. (Wang, 2022). Different research groups are located in different school sports environments, which are worth studying.

The physical exercise behavior of university students is influenced by various factors. This study will explore and analyze the relationship between the university sports environment, exercise motivation, and exercise behavior from a multidimensional perspective. It will propose optimization strategies for the relevant factors that affect the physical exercise behavior of university students, solve the practical dilemma of insufficient physical activity among university students, and improve their physical health level, Promote the development of physical and mental health among university students.

University students exhibit gender and stage differences in cognitive abilities, values, interpersonal needs, and behavioral characteristics. Different genders and stages of university students have different perceptions of the environment, academic

pressure, exercise motivation, and exercise behavior (Wang et al., 2009; Wang and Xiao, 2018; Dong and Mao, 2020). Different environmental perceptions, exercise motivations, and exercise behaviors can also be formed in physical exercise. There are significant differences in physical exercise behaviors and motivations between male and female university students (Chen et al., 2023; Wang, 2023). Most freshmen and sophomores in Chinese universities have physical education curriculum requirements, University students are required to participate in learning and complete assessments without special reasons (such as physical illness), which is somewhat mandatory. However, junior and senior university students generally do not have physical education curriculum requirements, which may lead to differences in their attitudes towards school sports environment, exercise motivation, and exercise behavior. Therefore, this study will also analyze and explore the differences between university students in terms of gender, academic stage, and school sports environment, exercise motivation Exploring the relationship between exercise motivation and exercise behavior.

Research Questions

1. Is the reliability and validity of the revised university sports environment questionnaire?
2. Is there a correlation between the university sports environment and exercise behavior and exercise motivation, as a whole and different dimensions, and is there a difference among different gender and year level of study?
3. Is there a correlation between overall and different dimensions of university students' exercise motivation and university students' exercise behavior, and is there variability across gender and year level of study?

4. Can the university sports environment predict university students' exercise behavior and motivation? Can the exercise motivation predict university students' exercise behavior?

5. Can strategies of promoting exercise behavior be put forwarded for university students?

Objectives of the study

The main objective of this research is:

1. To revise and validate the university sports environment questionnaire for Chinese university students.
2. To determine the relationship between university sports environment and exercise motivation and exercise behavior as a whole and classified by gender and year level of study.
3. To determine the relationship between exercise motivation and exercise behavior as a whole and classified by gender and year level of study.
4. To create equations to predict physical exercise behavior for Chinese university students.
5. To put forward strategies for promoting exercise behavior for Chinese university students.

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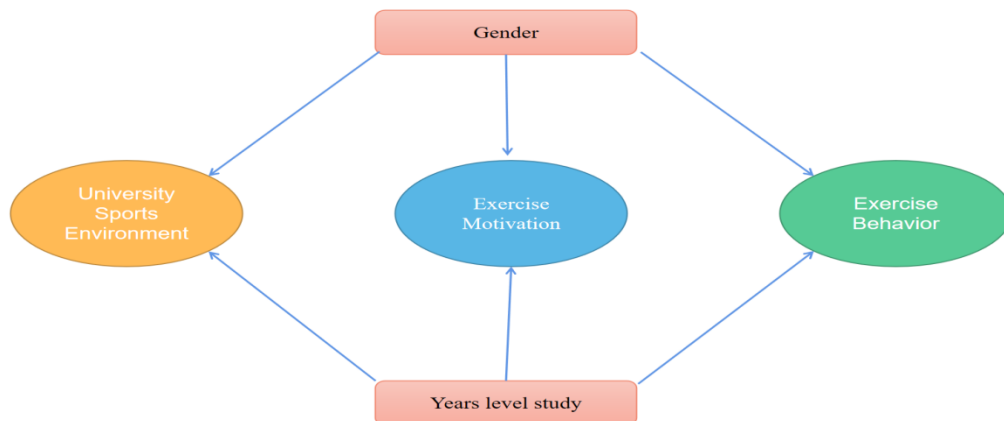


Figure 1 The Conceptual Framework I

Research Hypotheses

1. The University Sports Environment Questionnaire can apply with university students.
2. The university sports environment is positively related to exercise motivation and exercise behavior.
3. The exercise motivation is positively related to exercise behavior.
4. The university sports environment may predict university students' exercise behavior and exercise motivation; The exercise motivation may predict university students' exercise behavior.
5. Strategies for promoting exercise behavior can be used or suitable with university students.

พหุบัณฑิต ชีวะ

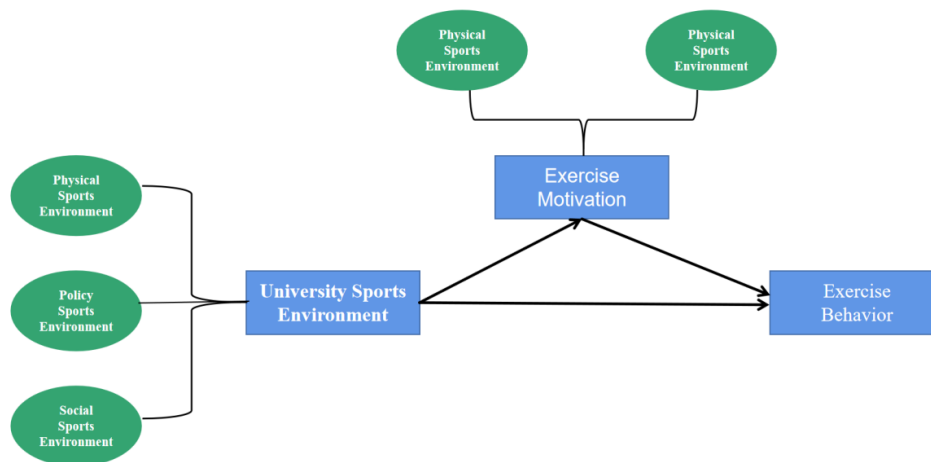


Figure 2 The Conceptual Framework II

Significant of study

1. From the perspective of concept cognition, it provides decision-making reference for university sports related departments and sports managers. Through the multi-dimensional analysis of the situation and relationship of university sports environment, exercise motivation and university students' exercise behavior, it is clear that the university sports environment is changeable. Strengthen the university sports environment construction to support and attach importance to university students' exercise motivation and exercise behavior.

2. Pay attention to the cultivation of university students' exercise behavior, improve their exercise motivation, and cultivate the value of "life lies in sports", so that university students can carry out physical exercise reasonably, scientifically and regularly according to their own conditions and the university sports environment, and develop the behavior habit of lifelong participation in physical exercise.

3. Enrich the university physical environment, exercise motivation and the theoretical research of university students' exercise behavior, solve the problems of the quantity and quality of university students' physical exercise participation, and provide ideas and suggestions for promoting university students' exercise behavior.

Definitions of Terms

University sports environment

The university sports environment such as physical education classes, physical education teachers, extracurricular exercises, sports equipment, school policies and regulations related to school sports. It is an integral part of the school education environment. The school sports environment is divided into social and psychological environments (classroom teaching atmosphere, sports tradition and atmosphere, interpersonal relationships, teachers, sports information, etc.) and physical environment (spatial and temporal elements, sports venues, sports equipment). The school sports environment includes the school sports social environment (teaching atmosphere, teacher-student relationship, classmate support, etc.), the school sports natural environment (field equipment, sports buildings, school buildings, etc.) and school sports normative environment (school system settings, etc.) (Han and Chen, 2010). Rao (2015) school sports environment refers to the sum of various factors centered on school sports development, and each factor complements and promotes each other. Influence the development of the school sports environment, and at the same time attach importance to the role of school culture, and divide it into spiritual environment, institutional environment, material environment and behavioral environment. Conduct research on the "whole school" sports environment, and divide the school sports environment into: physical environment, social environment and policy environment. (Morton et al., 2016). Guo (2019) defines the school sports environment as: the school-wide sports environment that affects children and adolescents to engage in physical activities. The school sports environment is placed in the school The cultural system is subject to the dual constraints of the educational environment and the sports environment, and has also formed its own unique cultural attributes. According to the "three-layer theory of cultural structure", the school sports environment is also divided into: the school physical environment, the school sports policy environment and the school sports social environment.

Combined with the research of various scholars, the definition of "sports environment" in this study is: the sum of sports environment factors affecting students' physical exercise (activity) in the "whole University". It mainly consists of three parts: physical environment, policy environment and social environment .

The sports physical environment mainly refers to the places equipment and equipment provided for students to participate in physical exercises (activities).

The sports policy environment mainly refers to the relevant policies systems and requirements that affect students' participation in physical exercise (activities).

The sports social environment mainly includes the school physical education course、 sports associations、 sports competitions teachers and peer support, etc.

Exercise motivation

Exercise motivation is an extension of motivation in the field of sports, which is the psychological impetus for individuals to participate in and maintain exercise behavior (Chen et al., 2006; Chen et al., 2014; Yang, 2016), the direct motive that prompts individuals to engage in physical exercise behavior, based on some kind of human need for physical exercise (driven by extrinsic stimuli or the individual's subjective initiative to exercise motivation) (Mao, 1997; Ma, 2008), through the influence of other factors such as the frequency and intensity of the individual's participation in exercise to achieve their exercise goals (Zhang, 1996; Song, 2022).

In this study, "exercise motivation" is defined as: university students' exercise motivation jointly generated by extrinsic incentives or stimuli and intrinsic driving forces. This motivation can maintain or inhibit students' behavior of doing physical exercise (Zhang et al., 2009). Therefore, exercise motivation is divided into two parts: intrinsic motivation and extrinsic motivation. intrinsic motivation is an inherent tendency of individuals to pursue novelty and challenges, develop and improve their

own abilities, and have the courage to explore and learn, and dare to explore and learn, is closely related to individual psychological factors such as interest, satisfaction, enjoyment, etc., participating in an activity is for behavior The satisfaction brought by itself is a highly autonomous type of motivation; The extrinsic motivation is that individuals are not motivated by interest, but are subjected to extrinsic pressure, rewards, and choose to participate in a certain activity in order to achieve a certain outcome (reward) , for example: in order to obtain better grades or avoid punishment, etc. (Ryan and Deci, 2000; Chen et al., 2006; Hou, 2023).

Intrinsic motivation includes five aspects: pleasure motivation, curiosity motivation, appearance motivation, health motivation and social motivation; extrinsic motivation includes four aspects: academic motivation, identification motivation, economic motivation and honor motivation. (Chen et al., 2023).

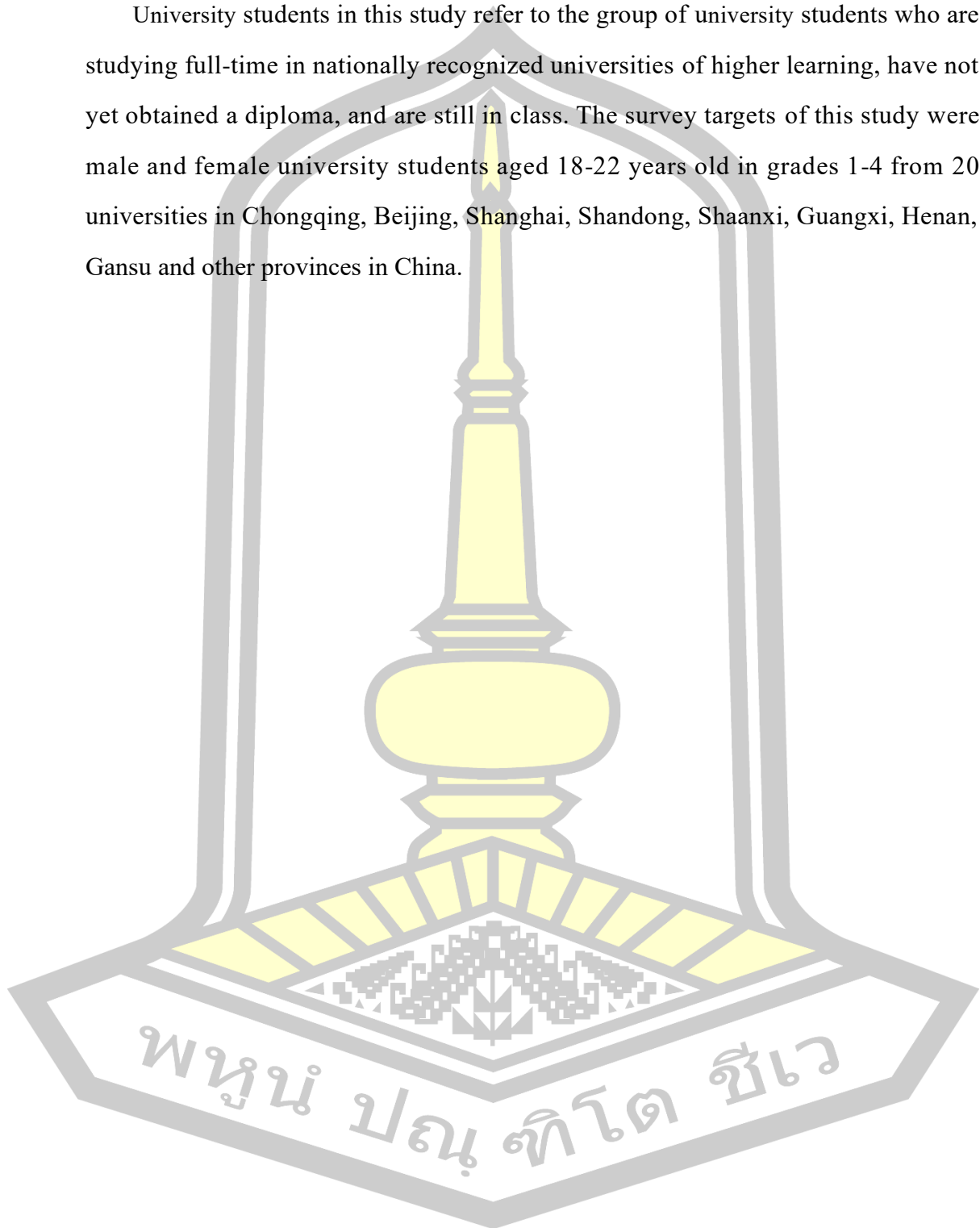
Exercise behavior

Exercise behavior refers to the response of body changes generated in sports participation with sports as the carrier or path. Exercise behavior indicators include sports participation, exercise tendency and sports character (Yu et al., 012). It is mainly refers to the extrinsic representation of individuals engaging in specific physical activities (Wang, 2023). Exercise behavior refers to a behavior that people slowly form to transform themselves during activities (Wang and Du, 2006).

Exercise behavior is an important extrinsic appearance to promote students' physical health, with the purpose of enhancing physical fitness, improving health, enriching life, and cultivating exercise habits. In this study, The exercise behavior questionnaire of this study used “the physical activity rating scale-3, PARS-3”(Liang, et al., 1994) . the physical exercise behavior of participants in the last month. The questionnaire mainly examines physical exercise behavior in three aspects: exercise intensity, exercise time, and exercise frequency.

University Students

University students in this study refer to the group of university students who are studying full-time in nationally recognized universities of higher learning, have not yet obtained a diploma, and are still in class. The survey targets of this study were male and female university students aged 18-22 years old in grades 1-4 from 20 universities in Chongqing, Beijing, Shanghai, Shandong, Shaanxi, Guangxi, Henan, Gansu and other provinces in China.



CHAPTER II

LITERATURE REVIEW

The focus of this study is the relationship between university sports environment, exercise motivation and exercise behavior. Therefore, in terms of literature collection, based on relevant theoretical foundations and university sports environment, exercise motivation and exercise behavior clues, the previous relevant theoretical foundations, literature, books, policy documents and other materials were collected, summarized and sorted out. The theoretical model construction of the study, the selection of initial indicators such as questionnaires, and the analysis and discussion of the research results provide important theoretical support. According to the purpose of the research, this chapter will discuss the following important issues: the relationship between school sports environment and exercise behavior; the relationship between school sports environment and exercise motivation; the relationship between exercise motivation and exercise behavior.

Theoretical Framework

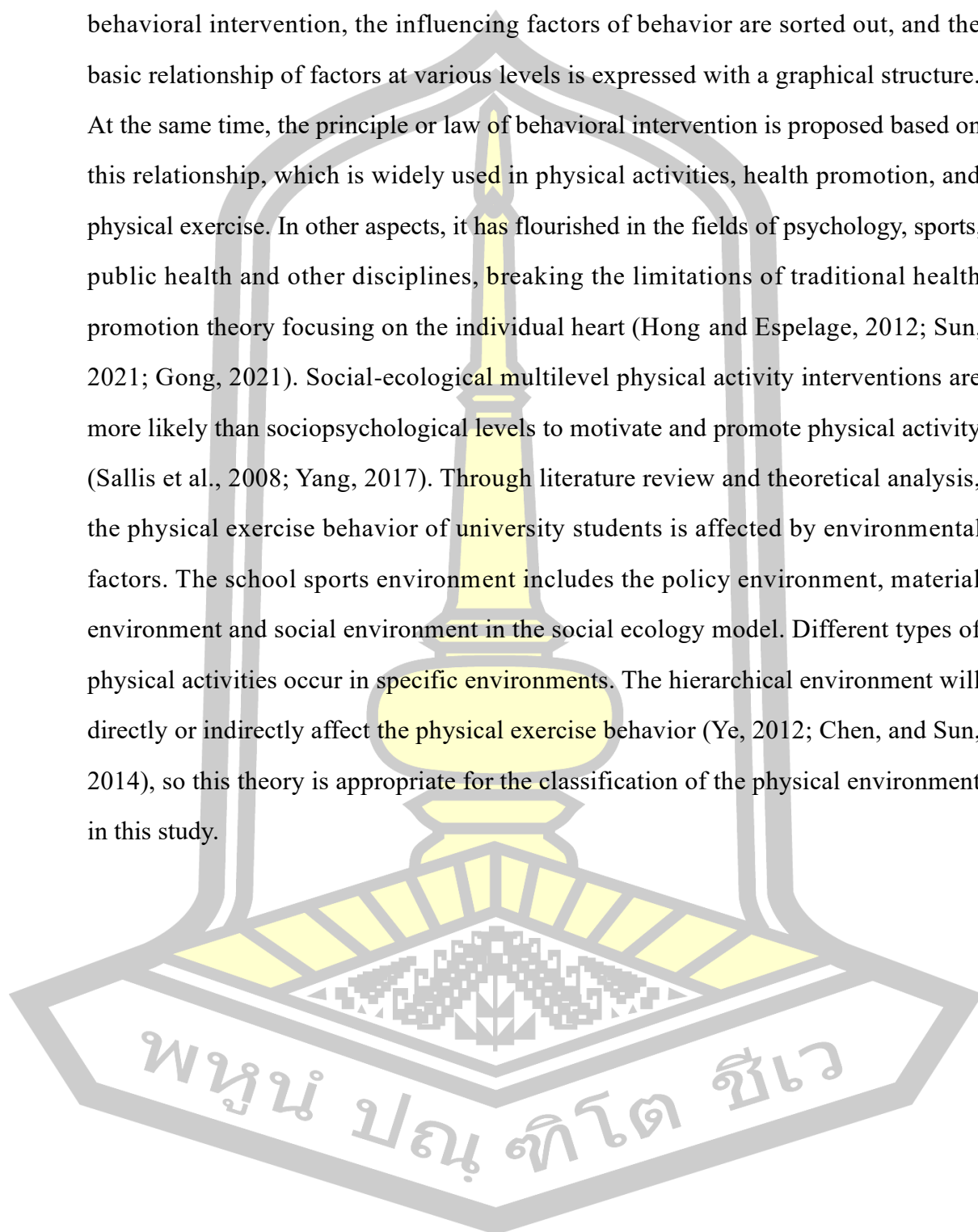
The social ecological theory (SET)

Social ecology is a scientific theory that integrates biological and social methods to study the law of interaction between human beings, the natural environment and the artificial environment (Ding, 1987). There are three main research directions: From the perspective of sociology, study the relationship between social culture and ecological environment; from the perspective of sociobiology, study the social behavior of organisms; from the perspective of the relationship between man and nature, study the interaction between society and nature (Qin, 2022). Ecological theory holds that human development is influenced by a series of interacting factors that may support or hinder human development (Elder et al. 2007).

The social ecological model (SEM) originated from the ecological theory proposed by American psychologist Urie Bronfenbrenner in 1970 (Tehrani et al., 2016), and according to the The closeness of the relationship between individuals divides the environmental factors of the ecosystem in which individuals live into four different levels: microsystem, mesosystem, exosystem and macrosystem, emphasizing that the ecological environment has a significant impact on human behavior; McLeroy (1988) based on the theory of social ecology to build a health behavior model at five levels, including individual level, interpersonal level, organizational level, community level and policy level. Its core idea is to explore the impact of multiple levels on individual behavior (Glanz et al., 2008; Dai and Chen, 2018). In research and application, scholars will show differences in the expression of models according to specific situations on the premise of ensuring that the theoretical connotation of the model remains unchanged. Welk (1999) constructed a socio-ecological model to promote adolescent physical activity from the dimensions of individual factors, sociocultural factors, and sports environment factors. These factors are relatively direct predictors of individual physical exercise (Ahn et al., 2015). The rapid promotion of physical activity or physical exercise in children and adolescents, the research agrees that personal psychology, interpersonal support and environment are the key factors for children and adolescents to participate in physical activity (Casey et al., 2009; Eime et al., 2015), and the sports environment is the key to promoting children's physical activity. Material Guarantee of Physical Exercise for Adolescents (Guo and Yang, 2020; Dong and Mao, 2021; Hong and Li, 2022).

The individual and the environment are determinants of behavior (Bronfenbrenner, 1979), and the environment largely controls or sets limits on the behavior that occurs (Green et al., 1996). The socio-ecological model focuses on the nature of communication between people and the social environment, material environment, and policy environment at different levels, and provides a multidimensional interaction framework for understanding the factors affecting

physical activity (Tehrani et al., 2016; Sun, 2021) (Figure 3). From the perspective of behavioral intervention, the influencing factors of behavior are sorted out, and the basic relationship of factors at various levels is expressed with a graphical structure. At the same time, the principle or law of behavioral intervention is proposed based on this relationship, which is widely used in physical activities, health promotion, and physical exercise. In other aspects, it has flourished in the fields of psychology, sports, public health and other disciplines, breaking the limitations of traditional health promotion theory focusing on the individual heart (Hong and Espelage, 2012; Sun, 2021; Gong, 2021). Social-ecological multilevel physical activity interventions are more likely than sociopsychological levels to motivate and promote physical activity (Sallis et al., 2008; Yang, 2017). Through literature review and theoretical analysis, the physical exercise behavior of university students is affected by environmental factors. The school sports environment includes the policy environment, material environment and social environment in the social ecology model. Different types of physical activities occur in specific environments. The hierarchical environment will directly or indirectly affect the physical exercise behavior (Ye, 2012; Chen, and Sun, 2014), so this theory is appropriate for the classification of the physical environment in this study.



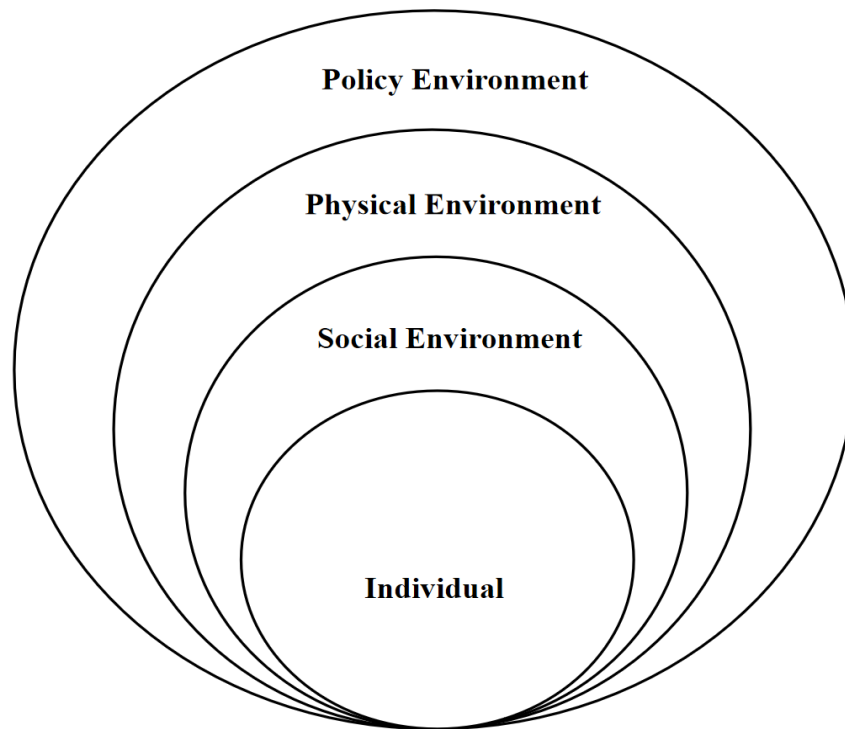


Figure 3 Social Ecological Model(Tehrani et al., 2016;Sun,2021)

The social cognitive theory (SCT)

In 1986, on the basis of social learning theory, Bandura proposed the social cognitive theory (SCT), which refers to how individuals choose, interpret, memorize and use social information to make judgments and decisions. It describes that individual factors, environmental factors, and behaviors are independent and interact with each other, so it is also called ternary interaction theory or Reciprocal Determinism theory (Figure 4) (Sun, 2021; Chen and Huang, 2023). Reciprocal Determinism theory emphasizes the interaction between people and the environment. The environment is not only the cause of individual behavior, but may also be the result of human behavior (Bandura, 1978). Behavior is affected by the interaction of individual, environment and other factors. influence, and these factors are dynamic and constantly interact. For example, the environment may limit or promote behavior, but behavior can also change the environment (Bandura, 1986), and individuals can actively participate in self-development and achieve goals through their own actions

(Bandura, 2004). Individual factors mainly refer to ascribed factors such as gender and grade, as well as intrinsic factors such as cognition and motivation. Environmental factors mainly refer to the natural environment and social environment. Behavior refers to the actions taken by individuals (Lin, 2022; Chen and Huang, 2023). "Triple interactive determinism" focuses on the study of people's psychological activities and daily behaviors from the dynamic interaction between people, environment and behavior, and is widely used in social management, education, physical exercise and other fields, and can achieve good results (Liu et al., 2020; Yin, 2022).

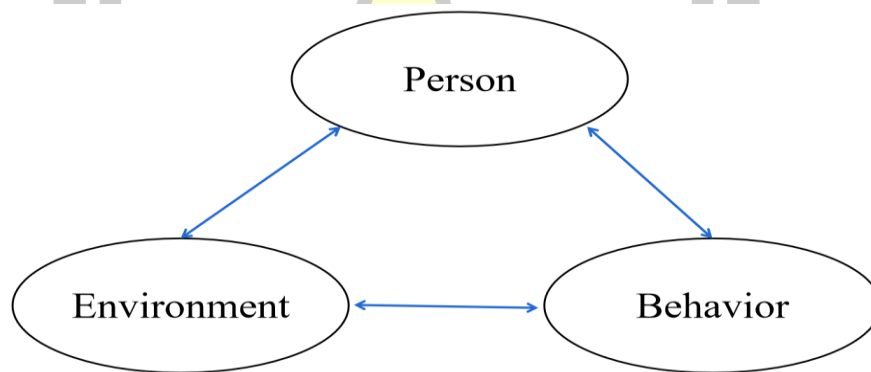


Figure 4 Social Cognitive Model (Sun,2021)

The environment is a potential factor that determines behavior. The interaction between the individual and the environment determines behavior, and behavior is the result of the interaction of the three (Shi, 2020). Changes in the social environment will have an impact on the individual, and the support of the individual is also essential for environmental changes, and both individual and environmental factors need to be addressed in the health promotion process. Individual, behavioral, and environmental factors are positively correlated with all dimensions of middle school students' physical education classroom learning input, and the school environment is more positively predictive of behavioral factors affecting middle school students' physical education classroom than the off-campus environment (Lin, 2022). Among

the school factors related to physical exercise behavior of children and adolescents, the school environment (such as: physical environment, interpersonal environment, etc.) may have an impact on physical exercise behavior by affecting adolescents' individual psychological characteristics (such as cognition, belief, motivation, etc.) , at the same time, physical exercise behavior may also negatively affect the school environment (Dong, 2021). Liang (2017) studied the physical exercise behavior of university teachers based on interactive decision theory, and the results showed that there is a certain correlation between the individual, behavioral and social environmental factors of university teachers' physical exercise behavior, and they jointly affect the university teachers' physical exercise behavior. Exercise motivation and exercise effect play a role, and then affect their exercise behavior. University students' physical exercise behavior interacts with personal factors and environmental factors. It is not only affected by the subjective factors of university students' individual psychology (exercise motivation), but also by the school sports environment. Therefore, this theoretical model is suitable for this study and can be done. Theoretical framework for this study.

Research on school sports environment and physical exercise

Physical exercise is not only affected by individual physiological and psychological factors, but also by environmental factors (Tucker et al., 2009). Creating an environment that encourages and supports exercise offers the greatest potential for a more active nation (Scottish Government, 2009). The behavior of individuals participating in physical exercise is closely related to the surrounding environment. People's perception of the surrounding environment will directly affect the exercise behavior and the persistence of the exercise behavior (Hong and Li, 2022). Environmental changes promote increased exercise, leading to a healthier lifestyle and can be an effective strategy to address inactivity. (Powell, 2005).

The sports environment is one of many environmental types, which refers to the sum of all natural and social conditions that are interrelated and affect each other with sports (Xiong, 2003). The sum of all intrinsic and extrinsic environments, including sports venues, sports facilities, physical exercise arrangements, people participating in sports activities around, etc. (Wei et al., 2019). "Sports Dictionary" defines the sports environment as: the natural environment and social environment that affect the development of sports. The natural environment includes factors such as geography, climate, facilities, and equipment, and the social environment includes factors such as folk culture, social relations, and interpersonal relationships (Chen and Chen, 2000). Due to different research perspectives and audience groups, there are also differences in the composition and classification of the concept of sports environment. For example, according to the basic nature, the sports environment can be divided into hard environment and soft environment; according to the way of influence, the sports environment can be divided into extrinsic Environment and intrinsic environment; according to the division of scope, the sports environment is divided into macro environment, meso environment and micro environment; according to the daily life space, the sports environment can be divided into school sports environment, family sports environment and community sports environment (Hao et al., 2021 ; Zhang et al. 2017; Hong,2022; Zhang,2023; Guo 2019) (Figure 5). The sports environment of this study is divided according to the daily life space of university students, and they live in schools most of the time, so this study focuses on the school sports environment.

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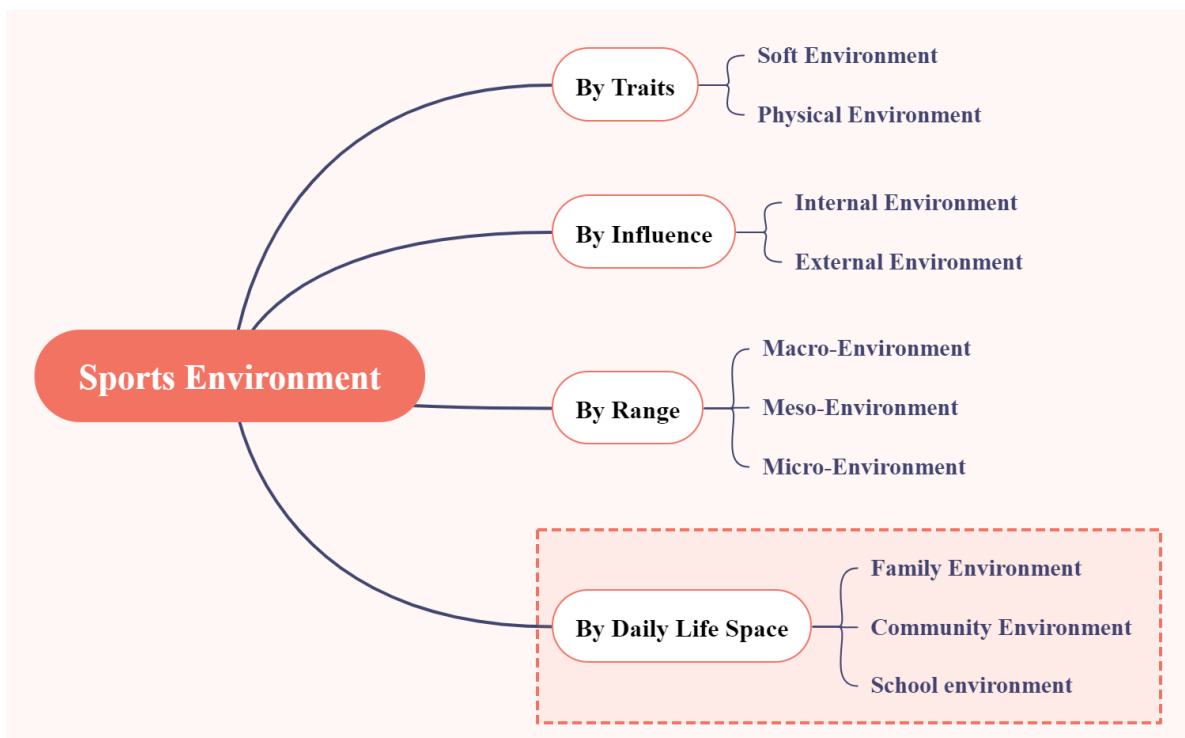


Figure 5 Conceptual Framework for Sports Environment (Zhang et al. 2017)

The construction of the school sports environment is a branch of the construction of campus culture. It is placed in the school culture system and is subject to the dual constraints of the educational environment and the sports environment (Guo, 2019). Schools are an important place to impart sports skills and culture, and also an important platform to shape students' lifelong exercise behaviors. Young people spend most of their time in schools. Schools can encourage students by creating or improving favorable sports environments, facilities and policies. Regularly participate in sports activities (Durant et al., 2009) to help students fight against overweight and obesity (Story et al., 2009), and developing good exercise behaviors is also an important guarantee for university students' personality health (Yang et al., 2013), it is also an effective measure to prevent and reduce invisible chronic diseases (Huang, 2017). For university students, as long as they are provided with the opportunity to participate in physical exercise and the necessary physical exercise conditions, they can maintain good exercise behavior. (Chen et al., 2023). University physical

education is the last stage of school physical education and a critical period for the transition from school sports to social sports. Cultivating university students to develop good exercise habits will help their physical and mental health in the future (Liu et al., 2001; Zhang and Li, 2022). A good school sports environment can encourage students to participate in physical exercise and develop good sports habits (Rao, 2015).

University students' exercise behavior is affected by factors such as health cognition, sports cognition, personal investment, social support, exercise atmosphere, venue equipment, exercise motivation, and exercise persistence (Wang, 2021). Schools can provide students with more opportunities to participate in physical exercise, mainly including: physical education courses, extracurricular sports activities, sports clubs, and access to school gymnasiums, playgrounds, gymnasiums and other sports venues, and have professional learning to provide students with a teacher or coach who directs professional exercise (Wechsler et al., 2000). In this study, "university sports environment" refers to the total number of sports environment factors that affect students' physical exercise (activities) within the entire school. Therefore, it mainly consists of three parts: the sports physical environment, the sports policy environment, and the sports social environment.

Through the classification and sorting of the existing literature in the early stage, the research objects of the school sports environment on exercise behavior are mostly children and adolescents. Considering the research of other groups, it may have a reference effect for the group of university students. Therefore, the entire social group was included in the review of previous literature. And make a literature review on the school sports environment from the following parts.

Sports policy and physical exercise

Despite being at the farthest end of the ecological model, institutions and policies have a profound impact on exercise behavior, with the WHO launching a worldwide

strategy to enhance fitness for all, encouraging the promotion of exercise among children and adolescents (Guo, 2019). At the same time, governments have introduced policies for public health promotion, which cover a wide range of areas such as environmental support, exercise-related health education, and physical education in schools. Improve the supportive environment for promoting people's exercise, provide more supportive conditions, strengthen the construction of pavements, bicycle paths, and health trails, and encourage green travelling. Increase the construction of facilities for the promotion of exercise such as sports, fitness, recreation areas, and parks (P.R.C. 2020). Practical national health promotion policies and the environments created with them have a clear role in guiding and safeguarding the physical, mental and socially adapted behaviors of adolescents (Hao et al., 2021).

School sport policies create a favourable school sports environment that emphasises the importance of sport, indirectly influences physical exercise, and creates a wider sporting culture within the school campus (Morton et al., 2016). School policies, incentives, and role modelling provide psychosocial support for student exercise (Wechsler et al., 2000). School exercise policies are emphasised through the development of school exercise health programmes, the provision of high quality physical education curricula, and increased opportunities for students to participate in physical exercise (Story et al., 2009). School physical education policies mainly include policies related to physical fitness testing, physical education curriculum, school physical education teacher staffing, physical education field setup and configuration, extracurricular physical education activities and large classroom physical education activities arrangement, etc. School physical education policies have indirect and direct effects on students' physical exercise participation (Chen, 2014), which can effectively enhance university students' exercise behavior (Zhang, 2011). Open physical education policies have a positive effect on students' participation in physical exercise (Baueret et al., 2004), and too much supervision can have a negative impact on exercise (Hyndman et al., 2012), which may affect

children's chances of MVPA exercise levels, (Bocarro et al., 2012). Meanwhile, Policies that allow exemptions for PE may be an additional barrier to learning and participation in PE (Booth, et al., 2008 and Booth, et al., 2008) . Sport administration enforcement and policy resource security factors are huge drivers of exercise behaviors in adolescents (Su et al., 2017). Effectively strengthen the investment of school sports funds, the implementation of work policies, teacher policies and funding policies, formulate sports venues, equipment management and service systems, actively promote public sports venues and facilities to provide services for school sports, create good policies and systems for school sports, and further promote the development of school sports (Xu , 2019)

Table 1 Research on sports policy environment and physical exercise

Author (Publish time)	Research Population	Variables	Findings
Hong, J.J. (2022)	Junior high school students	School sports Environment, Family sports Environment, Community sports Environment, Exercise Behavior	The total amount of exercise had a positive and statistically significant relationship with the school sports environment ($r=0.461$, $P<0.01$) and the school sports policies environment ($r=0.447$, $P<0.01$). The better the institutional environment of school sports, the better the total amount of exercise and the adherence to exercise of junior high school students. The policy and institutional environment provides a favorable guarantee for the creation and maintenance of junior high school students' exercise behavior.
Sun, H. (2022)	University students	School Sports Environment, Physical exercise	The "education policy" in the school sports policies environment has gender consistency characteristics ($p>0.05$), while the "policy implementation" has a certain gender difference ($p<0.05$). The "education policy" and "policy implementation" of the school sports policies environment There was a significant positive correlation with the amount of exercise of university students ($p<0.01$).

Ge, T. (2022)	Senior high school students	School Sports Environment, Physical exercise	There are significant positive correlations between the indicators of the school physical education policies environment and the seven indicators of exercise. In education policy and policy implementation, the impact of education policy on physical exercise is slightly higher than that of policy implementation.
Gao, W.T. (2021)	University students	School Sports Environment, Physical exercise	There is no statistical significance between the university sports policies environment and the VPA of university students ($p>0.05$), but there is a certain positive impact on the time of MPA and LPA of university students, and there is statistical significance ($p<0.01$). It can be speculated that the environment of the university sports policy will affect the level of physical exercise of university students, indicating that the improvement of the environment of the university sports policy can promote the behavior of middle and low-intensity physical exercise of university students.
Lv, R.H. (2021)	Junior high school students	School sports Environment, Exercise Behavior, Self-Efficacy	There is a positive correlation ($P<0.05$) between exercise behavior and the education policies dimension in the school sports policy environment, and there is a low degree of correlation. The higher the education policy, the higher the exercise behavior of students, and the policy implementation dimension does not reach a significant state.
Su, et al., (2017)	Junior and senior high school students	The social ecological theory, Exercise Behavior,	The degree of government's support to the promotion of physical education and the authenticity of the school's implementation of physical education policy are important factors affecting the exercise behavior of teenagers. The implementation of sports administration and the guarantee of policy resources have a macroscopic guiding effect on teenagers' exercise behavior, which can promote and promote the sustainable development of teenagers' exercise behavior

Physical environment and physical exercise

Access to facilities and opportunities to exercise are consistent predictors of exercise in children and adolescents. (Tucker et al., 2009). The school sports environment affects the physical exercise of adolescents (Sallis et al., 2001), and larger schoolyards, buildings, and playgrounds are associated with greater participation in physical exercise (Stratton and Mullan, 2005). The availability of physical exercise resources (venues, facilities, equipment, etc.) improves the

operability, accessibility, and difficulty of performing exercise behaviors and makes exercise behaviors possible (Dong and Mao, 2021). Factors such as the number, layout, and convenience of exercise venues affect individual exercise behavior (Hong and Li, 2022), and the adequacy of exercise conditions (e.g., whether or not venues and facilities can satisfy the demand for exercise) is one of the most important factors affecting adherence to exercise (Chen et al., 2005). The physical conditions of school sports are the material conditions and guarantees of students' practice of physical exercise, which is an important factor for adherence to exercise behavior and the establishment of physical exercise. exogenous factors for adhering to exercise behavior and establishing exercise habits (Chen et al., 2006; Van Cauwenberg et al., 2018).

Universities have sports facilities, equipment and venues, which is an important foundation to support university students to better devote themselves to physical exercise, and is also one of the important influencing factors for the formation and development of university students' exercise behavior (Wang, 2023), and schools with sufficient sports facilities, such as sports fields and gymnasiums, can effectively promote the participation of young people in physical exercise (Fernandes et al., 2010), and at the same time, can provide better opportunities for students to engage in healthy physical exercise after school (Wechsler et al., 2000). There is a correlation between the number of school sports facilities, the number of playing fields and the availability of swimming pools and participation in physical education classes, while the school sports environment also plays an important role in leisure sports, and the number of sports facilities is more important than the availability of physical education classes Schools with good sports facilities and supervision policies are more likely to stimulate students to exercise (Sallis et al., 2001). Lack of relevant infrastructure in schools means that more opportunities for physical exercise are not available (Dagkas et al., 2007), and students have nothing to do outside of school hours (Hohepa et al., 2007), and similarly, poor facilities weaken the intrinsic

motivation of students to participate in physical exercise, (Ntoumani et al., 2004). Thus, lack of (poor quality) sports equipment is a major barrier to student participation in physical exercise (Morton et al., 2016). The school physical environment, the number of sports facilities was positively associated with student MVPA at school (Button et al., 2013; Fein et al., 2004; Nichol et al., 2009; Haug et al., 2010). Students attending schools with sports grounds have good physical fitness indicators, having a gym in the school helps to improve the physical fitness of both boys and girls, girls in schools with gymnasiums have higher flexibility than girls in schools without gymnasiums, and facilities such as playgrounds, multipurpose halls, gymnasiums, and auditoriums are easily accessible to the students before, during, and after school and on weekends, which have a significant impact on the level of physical exercise and health of the adolescents, and by Improving the school sports environment and after-school physical exercise interventions can be effective in promoting adolescents' physical fitness and health status (Lo et al., 2017).

Table 2 Research on physical environment and physical exercise

Author (Publish time)	Research Population	Variables	Findings
Zhang, Y. (2023)	Junior high school students	School sports environment, sports interest	In the physical environment of school sports, the more sports facilities can meet the needs of students, the higher the students' interest in sports. When the school sports facilities can fully meet the needs of students, the number of people who like physical exercise is also the largest.
Gong, et al., (2021)	University students	School Sports Environment, Sports Participation, Sports Gains	There is a significant positive correlation between university students' sports environment perception and its dimensions and university students' sports participation and its dimensions ($P < 0.01$), and university students' sports environment perception has a direct positive impact on sports participation.

Hong,J.J. (2022)	Junior high school students	School sports Environment, Family sports Environment, Community sports Environment, Exercise Behavior	The total amount of exercise has a positive correlation with the school sports environment ($r=0.461$, $P<0.01$) and the physical environment of school sports ($r=0.437$, $P<0.01$), which is statistically significant. The better the school physical environment, the better the total amount of exercise and exercise persistence of junior high school students. The physical environment of school sports creates good conditions for the continuous occurrence of exercise behavior of junior high school students.
Sun,H. (2022)	University students	School Sports Environment, Physical exercise	There are gender differences in all dimensions of the physical environment of school sports ("temporal and spatial characteristics", "field equipment funding") ($p<0.05$). There is a significant positive correlation ($p<0.01$) between the physical environment of school physical education, "field equipment expenses", "spatial and temporal characteristics" and the amount of physical exercise of University students.
Dong et al., (2021)	Junior and senior high school students	School physical environment, interpersonal environment, physical exercise	School physical environment is the causal variable of adolescent physical exercise and school interpersonal environment. A complete school gymnasium, facilities, equipment and other natural environment can provide opportunities and conditions for youth physical exercise, which is beneficial to improve the operability and accessibility of behaviors, reduce the difficulty of execution, and make it possible to generate exercise behaviors. The natural environment of the school is the material guarantee to improve the amount of physical exercise of young people and stimulate exercise behavior.
Ferrari et al., (2021)	Adolescents	School physical environment, physical exercise	The school sports environment is related to the increase of youth physical exercise, more sports venues (≥ 3), the physical environment such as swimming pools and track and field tracks under the available conditions are positively correlated with the total amount of physical exercise of teenagers (≥ 60 minutes per day), the school sports environment has a positive effect on promoting youth physical exercise is very important.
Chu et al., (2020)	Children in grades 4-5	School Sports Environment, Basic psychological needs satisfaction	The physical environment of the school directly and positively predicts students' physical exercise. The physical environment of school sports contributes more to sports than the social environment of school sports, and while strengthening the social environment of school sports is important, prioritizing improvements in sports facilities and equipment may result in a better school sports environment and basic psychological needs satisfaction (BPNS) for Hispanic children.

Hobin et al., (2012)	Senior high school students	School environment, physical exercise	The characteristics of the physical environment in which students attend schools are related to their physical exercise. There are indoor sports rooms in schools, and male and female students have more time for physical exercise. Schools should consider providing flexible activity plans for female students and improving daily physical exercise for senior male students. class.
Young et al., (2007)	The Trial of Activity for Adolescent Girls (TAAG)	School Sports Environment and Policies, Physical exercise, Exercise Opportunities	The number of days of physical exercise and the accessibility of school venues and sports facilities after school are positively correlated with the overall physical exercise of adolescents (semipartial correlation coefficients = .236 and .186, respectively), improving the school sports environment and policies is the key to promoting physical exercise core strategy.

Physical education and physical exercise

The implementation of physical education programmes and extracurricular physical exercises is an important indicator element in evaluating the comprehensive school environment (Guo, 2019). School physical education programme is an important factor in school education and is the most dominant form of daily physical exercise for students ((Hills et al.,2015), providing a platform for students to participate in physical exercise. Physical education programmes are irreplaceable in the promotion of students' physical fitness and health, affecting the level of physical exercise and the development of physical behavior (Guo, 2019). Physical education, physical exercise, and sports in schools are all associated with better physical fitness among students (Story et al., 2009). Intramural sports create an atmosphere of lively and enjoyable exercise, and students who are reluctant to participate in physical exercise can be encouraged to do so by articulating the value of physical exercise (MacQuarrie et al., 2008). The atmosphere of the PE class and the 'competitive' element of PE can motivate students to be active, but at the same time, over-competitiveness can diminish the enjoyment of PE (Smith et al., 2009), with students

focusing on competition more than participation and enjoyment (Booth et al., 2008), and only the elite of the sport receiving attention. elite athletes get the attention, while other students struggle to feel a sense of belonging and accomplishment (MacQuarrie et al., 2008), which in turn decreases students' exercise motivation. Students want more options for physical exercise and a greater sense of participation (Azzarito et al., 2006 ; Ntoumanis et al., 2004). Evaluations that focus on the process of effort are more likely to increase students' participation and effort in physical exercise than physical education course evaluations that focus on skills alone (Constantinou et al., 2009). Creating a positive sports environment stimulates and encourages students to participate in regular physical exercise and physical exercise can be added to the school curriculum without academic consequences and also can offer physical, emotional and social benefits. (Story et al., 2009).

Interpersonal support and physical exercise

Interpersonal support on campus is closely related to adolescent physical exercise (Dai and Chen, 2019), and interpersonal support stimulates exercise identity and facilitates the formation and maintenance of exercise behaviors (Sun and Ji, 2010). Adolescents' exercise behavior effectively predicts their interpersonal relationships, and is an effective intervention for adolescents to develop interpersonal relationships. students who are physically exercise tend to be more readily accepted by their peers and those with the same activity expectations (teachers), which is conducive to the promotion of friendship and acceptance with those around them, which in turn leads to the establishment of a broader social network and more interpersonal support (Zhang, 2014; Wang and Cao, 2019). University campus is the home of university students' study and life, and it is also the "second classroom" for students' social development, whose interpersonal support mainly includes: teachers' support and peer support and other interpersonal support, understanding and help (Jia et al., 2009).

University students are in the developmental stage of social adaptation, and tend to imitate the intentions and behaviors of high-authority people (teachers). In a good interpersonal supportive atmosphere, students can form corresponding psychological characteristics and behavioral patterns (Baer et al., 2010), and the behaviors of teachers can promote the motivation of students' participation in physical exercise and sports activities (Morton et al., 2009; Smith et al., 2009). Physical education teachers are the implementers of physical education teaching and the organisers of extracurricular physical exercises, teachers' support for students' participation in physical exercise is conducive to stimulating students' motivation for physical exercise, improving exercise behavior, and providing students with a good sport environment (Liu, 2021), teachers' support is positively correlated with students' physical exercise (Morton et al., 2016), and students' perceived The higher the level of affective support, the easier it is to mobilise students' positive psychological resources, thus enhancing exercise adherence and promoting healthy behaviors (Chen and Zhu, 2022). Teacher support can provide students with a basis for imitation, learning, and standardisation of physical exercise, which can help students form sports cognition, establish a sense of identity, build up a sense of rules, and avoid deviant behaviors, etc., which is conducive to adolescents' establishment of correct values of sports, the development of good exercise behaviors, and the formation of healthy lifestyles (Fan et al., 2019 ; Dong and Mao, 2021).

Peer support can provide extrinsic motivation for adolescents to maintain exercise behaviors, which is conducive to adolescents' living and exercising together, improving physical function and enjoying the joy of exercising, and at the same time, enhancing students' social adaptability and alleviating stress and loneliness (Hsu et al., 2011). Adolescents' cognition and behaviors will develop towards group congruence under the influence of interpersonal relationships (Zhao et al., 2017), adolescents' likelihood of engaging in physical exercise is higher in the company of their peers or peers (Salvy et al.,2008), and there is a positive relationship between peer

encouragement and adolescents' physical exercise (Kunesh et al., 1992). Peer relationships that are unique to adolescents' social and emotional growth are irreplaceable in adults, and the smaller age gap and equality and parallelism among university students not only affects motor skills and motivation to be physically exercise when interacting with their peers, but also alters participation in exercise behaviors (Bukowski et al., 1994; Zhou et al., 2015 ; Liu ,2021). Students' regular participation in physical exercise not only strengthens their physique and regulates their emotions, but also enables them to share joy and exchange ideas with peers with similar interests or abilities in competition and cooperation, and achieve interpersonal relationship development. Compared with low-activity adolescents, adolescents who enjoy and regularly participate in physical exercise tend to obtain a high level of peer support, and build a broad interpersonal network. Physical exercise creates a social interaction between students platform, which is an important way to build and develop interpersonal relationships (Chen and Yu, 2015 ; Dong and Mao ,2021).

Table 3 Research on social environment and physical exercise

Author (Publish time)	Research Population	Variables	Findings
Sun, H. (2022)	University students	School Sports Environment, Physical exercise	In the social environment of school physical education ("physical education class", "exercise opportunities", "physical education teachers", "interpersonal support", "social norms"), except for "physical education teachers" which have gender-consistent characteristics, there are gender in several other dimensions Difference ($p < 0.05$). "Physical education classes", "exercise opportunities", "interpersonal support", "physical education teachers" and "social norms" of the school's sports social environment showed a significant positive correlation with the amount of physical exercise of university students ($p < 0.01$).
Hong, J.J. (2022)	Junior high school students	School sports Environment, Family sports Environment, Community sports Environment, Exercise Behavior	The total amount of exercise has a positive correlation with the school sports environment ($r = 0.461$, $P < 0.01$) and the school sports social environment ($r = 0.459$, $P < 0.01$), which is statistically significant. The better the school sports social environment, the better the total amount of exercise and exercise persistence of junior high school students. A good school social sports environment plays an irreplaceable role in promoting junior high school students' participation in physical exercise and maintaining high exercise persistence.
Zhang, Y., and Zhang, C., (2022)	University students	Exercise Behavior, Social support, Self-efficacy	The influence of social support on university students' physical exercise is as follows: school support (0.444), peer support (0.312), family support (0.145), and school support has the greatest impact on university students' physical exercise. The encouragement and

			companionship of friends can best reflect university students' needs for peer support, and peer support has a significant positive impact on university students' exercise behavior.
Dong et al., (2021)	Junior and senior high school students	School physical environment, interpersonal environment, Physical exercise	The interpersonal environment in school is the result variable of physical exercise for adolescents. Regular participation in physical exercise can not only strengthen the body and regulate emotions, but also share happiness and exchange ideas with like-minded or similarly capable peers in competition and cooperation, and realize the development of interpersonal relationships. Physical exercise is an important way to promote social and interpersonal relationships among adolescents, and to establish and consolidate exercise groups.
Zhang, R. (2019)	University students,	School sports Environment, Exercise Behavior	All school factors are significantly correlated with the total amount of physical exercise of university students, and the correlation coefficient is small to medium. Among the factors of school physical education environment, physical education curriculum, school conditions, physical education teachers and exercise opportunities can significantly affect the physical exercise behavior of university students, among which physical education curriculum provides the greatest contribution, followed by school conditions.
Wei et al. (2019)	Elementary, Junior and senior high school students	Sports Environment, Physical Education Attitudes, and Exercise Behavior	There is a medium-strength correlation between the teacher-student sports atmosphere and the students' exercise times from Monday to Friday (0.340, P=0.002), indicating that the campus environment will have a certain impact on students' school sports behavior.

Sports Environment and Motivation Exercise

The motivation for physical exercise among university students is generated by the combination of extrinsic incentives or stimuli and intrinsic driving forces. This motivation can maintain or inhibit students' behavior of engaging in physical exercise (Zhang et al., 2009). Therefore, this study divides exercise motivation into two parts: intrinsic motivation and extrinsic motivation (Figure 6). Intrinsic motivation includes five aspects: pleasure motivation, curiosity motivation, appearance motivation, health motivation and social motivation; extrinsic motivation includes four aspects: academic motivation, identification motivation, economic motivation and honor motivation. (Chen et al., 2023).

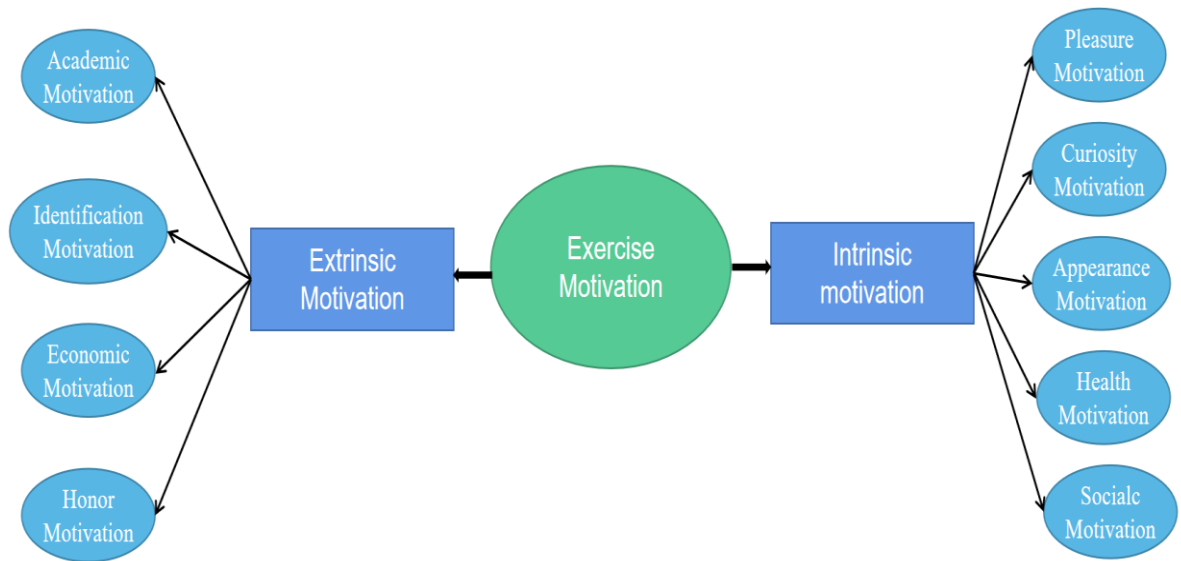


Figure 6 Conceptual Framework for Exercise Motivation(Chen et al., 2023)

Discussion on the relationship between university sports environment and individual psychological factors is also an aspect that this research should focus on. The research results show that most of the school sports environment factors can positively affect the students' exercise behavior, that is to say, there is a positive correlation between the school sports environment and the students' exercise behavior. The extrinsic environment often exerts its effect through near faults (motivation, intention, etc.). Motivation may play a mediating role between the school sports environment and physical exercise ((Ye, 2012 ; Chen and Zhu, 2022). Basic psychological needs and motivation are extrinsic factors. The environment plays an important role in physical exercise. (Sun, 2021). Sports psychology believes that the formation and development of the dynamic system of physical exercise participation (including exercise interest, exercise motivation, exercise attitude, etc.) is in the natural environment and social environment There is a two-way interaction between environmental factors and subject factors (Guo, 2019). Individuals' attitudes and degrees of participation in physical exercise largely depend on their environment (Hong and Li, 2022). The environment will have an effect on the individual's

psychology (Cai et al., 2018), and the degree of satisfaction of the individual's basic psychological needs determines the motivation status in the environment (Sun, 2021). "Interest is the best teacher", a good sports environment can enhance students' interest in physical exercise (Hao, 2022; Xu, 2022). Similarly, the environment can also promote or block the formation and development of an individual's positive behavior and healthy psychology, emphasizing the organic interaction between the individual and the environment Importance. (Sun, 2021).

The various activities that individuals participate in are related to motivation, and motivation is based on needs (Chen et al. 2008), and the stimulation of the extrinsic environment will cause students to have psychological needs (Chen and Cui, 2015), and the needs can only be awakened Only then will the individual behavior be driven, and it is the motivation of the individual that awakens the demand (Chen et al. 2008). Satisfaction of basic psychological needs is the source of motivation (Deci et al., 2000). When the subject perceives the information stimulation of the extrinsic physical environment, the corresponding psychological environment (intrinsic motivation) will be generated through the brain information processing system, thereby guiding behavior (Bastons et al. 2016; Chen and Zhu, 2022). Exercise motivation is generally based on the organization and guidance of school sports, and the relationship between peers/classmates during school (Chen and Zhu, 2022). university students live in the sports environment of the university, and the perception of the university environment and the information they acquire will stimulate or change behavior motivation and decision-making (Giles-Corti, and Donovan, 2003; Wang, 2023; Peng, 2015). Group identity is formed in the comparison, and the motivation, intention, decision-making and behavior of behavior are influenced by the identity (Zhang and Zuo, 2006; Chen and Cui, 2015). These potential extrinsic resources can internalize intrinsic motivation, (Dai and Chen, 2018). A good sports environment can help stimulate adolescents' exercise motivation, thereby increasing the amount of physical exercise (Yang, 2017).

From the analysis of the existing literature, it can be seen that the school sports environment has a positive impact on students' exercise motivation. However, although previous studies have confirmed that the school sports environment has a positive correlation with students' exercise motivation, this only proves that there is an overall correlation between the two, whether there are other correlations between the two (such as: school The intrinsic relationship between the influence of sports environment on different motivations), whether there are gender or school-level differences, but it is unknown? The insufficiency of previous studies has also become a problem that this study needs to pay attention to.

Table 4 Research on sports environment and motivation exercise

Author (Publish time)	Research Population	Variables	Findings
Bai, J.H. (2022)	university students	Exercise Motivation Exercise Behavior Physical Education Class Satisfaction	There is a significant positive correlation between physical education learning satisfaction and exercise motivation ($P<0.01$). The higher the student satisfaction in physical education learning, the higher their level of exercise motivation, and the correlation between venue equipment and exercise motivation highest coefficient.
Chen et al., (2022)	adolescents	Community sport environment, Intrinsic motivation	The community sports environment has a positive impact on the intrinsic motivation of adolescents ($P<0.01$), and suitable community sports venues and equipment can provide conditions and environmental protection for teenagers to practice exercise.
Chu et al., (2020)	Children in grades 4-5	School Sports Environment, Basic psychological needs satisfaction	The school sports environment plays a crucial role in the motivational processes of Hispanic children, which in turn affects physical and cognitive outcomes in sports. Physical environment significantly predicted children's sports autonomous motivation through autonomy, and social environment significantly predicted children's sports autonomous motivation through autonomy and ability

Exercise motivation and exercise behavior

Because the research on the relationship between exercise motivation and exercise behavior in different social groups may be of reference to this group of university students. Therefore, the entire social group was included in the review of previous literature.

"Sports Research" pointed out: "In order to achieve the effect of sports, we must move their subjective, promote their consciousness of sports." When an individual develops the desire or necessity to participate in an exercise, an intrinsic drive is created that motivates him or her to act (Qiu et al., 2011; Hong and Li, 2022). The choice of sport participation depends more on the individual's knowledge of sport, exercise motivation, the level of sport skill mastery, and leisure time (Song, 2013). Exercise motivation refers to why people participate in physical exercise and to satisfy a certain personal need through physical exercise, and is the psychological impetus for individuals to participate in and maintain exercise behavior (Chen et al., 2008). Exercise motivation is a key determinant of exercise behavior (Standage et al., 2008; Barbeau et al., 2010), predicts exercise behavior, and influences exercise intention and mood (Ding and Mao, 2014). Motivation is the basic driving force for engaging in physical exercise, and only after the formation of motivation can exercise behavior be generated, Exercise motivation can effectively promote students' active participation in the process of physical exercise, affecting students' exercise behavior, and after motivation is strengthened, it is conducive to the maintenance of exercise behavior, and the stronger the motivation is, the longer the exercise behavior is (Wang, 2023). Reluctance to engage in or difficulty in persisting in physical exercise for a long time is a manifestation of insufficient motivation (Sun, 2021)

Students' exercise motivation refers to the satisfaction of students' physiological and psychological needs through physical exercise due to a variety of intrinsic and extrinsic stimuli, and the needs are diversified, and a student's participation in

physical exercise is driven by a variety of motivations at the same time. Due to the differences in students' personal and social environments and exercise needs, exercise motivation varies, and students not only have multiple exercise motivations, but also vary in the intensity of their exercise motivation (Chen et al., 2008). Teaching practices in the school environment have a strong developmental impact on students' motivation and beliefs (Eccles and Roeser, 2011), students with strong exercise motivation have higher self-efficacy, which effectively promotes students' participation in physical exercise, and the stronger the exercise motivation, the higher the enthusiasm and self-confidence in physical exercise (Luo, 2022). University students' exercise motivation is significantly related to exercise intention and exercise effort (Standage et al., 2012). When the basic psychological needs of an individual are met, the individual generates strong autonomous motivation, which effectively improves exercise behaviors (Fu and Xian, 2013 ; Dong et al., 2014). Individuals who voluntarily engage in physical exercise have a longer duration of exercise behavior than those who are passively supervised to engage in physical exercise (Zhang et al., 2002). University students' exercise motivation affects the formation of exercise behavior, and lack of exercise motivation is one of the main reasons why university students do not actively participate in physical exercise (Cao and Jiang, 2013).

Table 5 Research on exercise motivation and exercise behavior

Author (Publish time)	Research Population	Variables	Findings
Chen et al., (2023)	University students	exercise motivation. Exercise Behavior. Sports Misbehavior	University students with different motivation types have differences in physical exercise time ($p < 0.001$), physical exercise frequency ($p < 0.001$), physical exercise intensity ($p < 0.05$) and physical exercise items ($p < 0.001$), active type \approx Enjoyment type $>$ profit-seeking type $>$ depression type.
Sun et al., (2022)	University students	Exercise Motivation Exercise Behavior	University students who lack exercise motivation will shorten their exercise time, each exercise time is less than 30 minutes, choose lower exercise intensity during exercise, and their participation in exercise frequency is low.

Zhang et al., (2022)	University students	Exercise Motivation Exercise Behavior Extrinsic Pressure Peer effects	There is a significant positive correlation between exercise motivation, extrinsic pressure, peer effect and exercise behavior. University students' exercise motivation positively affects exercise behavior, and the effect is significant; extrinsic motivation has a significant impact on exercise behavior.
Chen,L. (2022)	University students	Extracurricular physical exercise, Exercise motivation, subjective well-being	There is a significant positive correlation between extracurricular physical exercise and all dimensions of exercise motivation among university students in Chongqing. University students with a large amount of extracurricular physical exercise have the strongest health motivation, social motivation, fun motivation, and ability motivation. University students with a moderate amount of extracurricular physical exercise have the strongest motivation for appearance. most intense.
Bai,J.H. (2022)	University students	Exercise Motivation Exercise Behavior Physical Education Class Satisfaction	There is a very significant positive correlation between exercise motivation and its various dimensions and exercise behavior ($p<0.01$). The higher the level of exercise motivation of students, the higher their exercise behavior.
Song,M.K. (2022)	University students	Exercise motivation, exercise behavior, self-efficacy	There is a significant positive correlation between the five dimensions of exercise behavior and the seven dimensions of exercise motivation ($P<0.01$). The stronger the intrinsic motivation and extrinsic motivation of university students participating in physical exercise, the higher the time, frequency, and intensity of university students participating in physical exercise. , The stronger the number of items and the persistence of exercise. Intrinsic motivation has the greatest impact on university students' exercise behavior
Yang et al. (2015)	junior high school students	Exercise Motivation, Exercise Behavior, Fitness	Exercise behavior (score of physical exercise load) was significantly correlated with each dimension of aerobic fitness and motivation ($P<0.01$). All dimensions of exercise motivation can significantly and positively predict exercise behavior and aerobic fitness, and intrinsic motivation is more predictive of exercise behavior than extrinsic motivation.
Chen et al., (2008)	University students	exercise motivation. Exercise Behavior	The intensity of intrinsic exercise motivation has a strong positive correlation with the frequency, time and intensity of exercise.

In summary, the previous relevant research results provide an important research foundation for the establishment of the relationship between variables and the construction of structural equation modeling in this study.

The previous research mostly focuses on the correlation between two variables, such as: the influence of extrinsic environmental factors on exercise behavior, or the influence of individual psychological factors on exercise behavior, or the influence of extrinsic environmental factors on individual psychological factors. From a certain level or a certain side to explain or predict the exercise behavior, although you can get the correlation between the two, but such a study is very easy to lose the systematic and holistic grasp and understanding of the behavioral phenomenon. Exercise behavior is affected by a variety of factors, not only by individual psychological factors but also by the extrinsic social environment and natural environment. Therefore, in order to truly grasp the intrinsic mechanism of exercise behavior, it is necessary to study from the environment, individual psychology and other levels. In addition, the previous research mainly focuses on children and adolescents, while university students are in a school sports environment different from that of children and adolescents, so it is necessary to carry out a specialized research on this group. Therefore, this study takes university students as the object of investigation, and integrates the relationship between school sports environment, exercise motivation and exercise behavior to explore, respectively, to explore the relationship between the school sports environment and university exercise motivation; the relationship between the school sports environment and university students' exercise behavior; the relationship between university students' exercise motivation and exercise behavior; and the relationship between the interaction between the school sports environment and exercise motivation and exercise behavior.

The occurrence of exercise behavior is easily and directly influenced by the surrounding environment (Humpel et al., 2002; Hong and Li, 2022). The school sports

environment is the sum of sports environmental factors that affect students' physical exercise (activities) in the "whole school". It is mainly composed of three dimensions: the physical environment, the policy environment and the social environment. Some studies have proved the relationship between school sports environment and exercise behavior, but there must be a strong or weak difference in the influence of different school sports environment factors on university students' exercise behavior, in the end, what is the degree of influence of each environmental factor on university students' exercise behavior? Which school sports environment factors have a strong influence on university students' exercise behavior, which school sports environment has a small influence on university students' exercise behavior, or which school sports environment has no influence on university students' exercise behavior, these aspects are the concerns of this study, and they are also the questions that will be investigated in this study. Therefore, this study to explore the effects of different school sport environment dimensions on university exercise behavior.

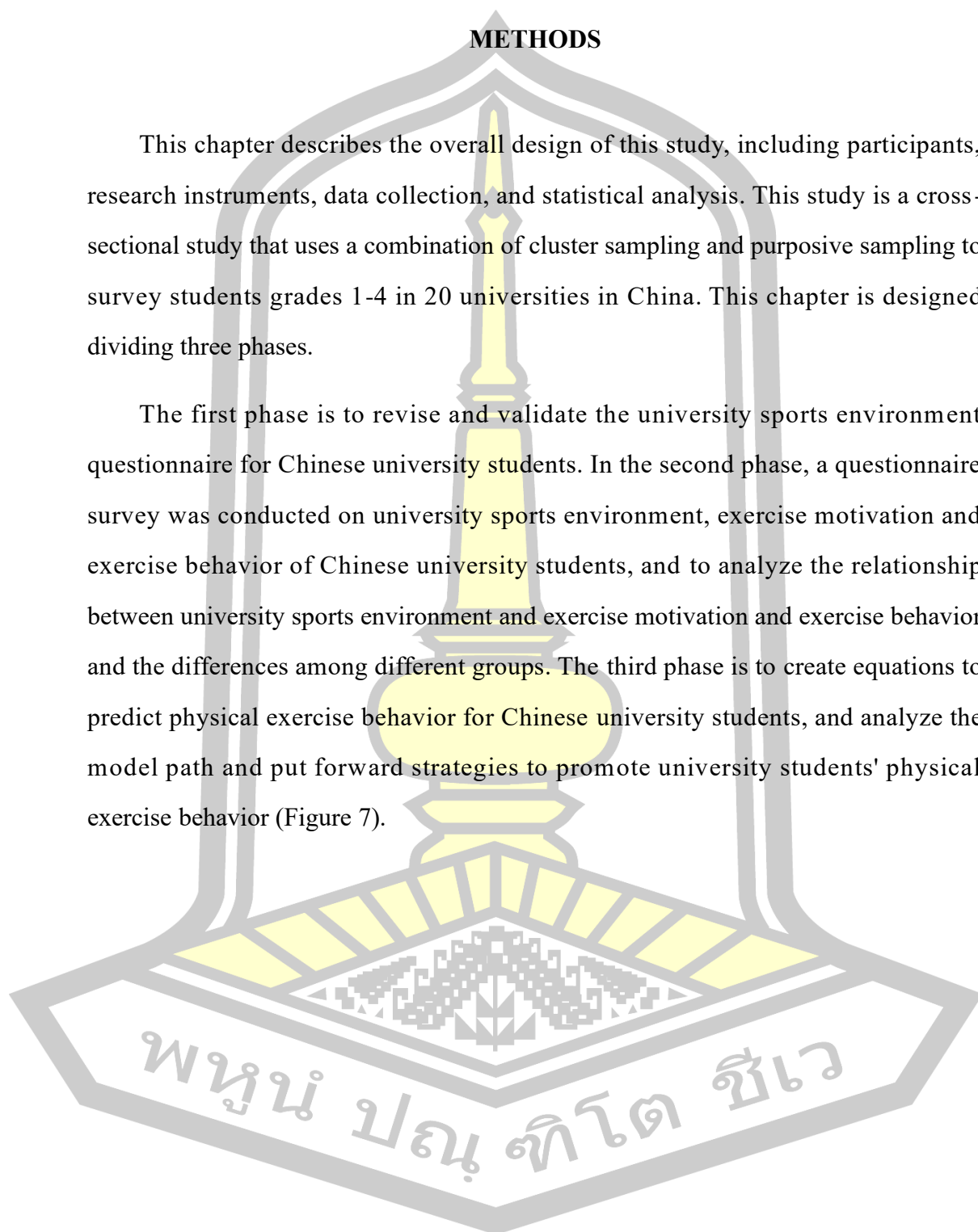
Influenced by individual gender perceptions, university students have formed gender schemas about physical exercise and will engage in exercise in the same way as the majority of their peers of the same gender, coupled with the different exercise preferences of male and female adolescents (Sukys et al., 2014 ; Dong and Mao, 2021). Are there differences in motivation and exercise behavior among university students with different gender roles? University students' environmental perception, exercise motivation, and exercise behavior may differ by gender and academic period due to gender perceptions, study tasks, etc. (Wang and Wang, 2017). In China, it is common for freshman, sophomore university students to have physical education course requirements, while junior and senior students do not have physical education course requirements; are there differences in university students' motivation and exercise behaviors in this environmental context? Based on this, this study tries to explore the intrinsic mechanism of the three.

CHAPTER III

METHODS

This chapter describes the overall design of this study, including participants, research instruments, data collection, and statistical analysis. This study is a cross-sectional study that uses a combination of cluster sampling and purposive sampling to survey students grades 1-4 in 20 universities in China. This chapter is designed dividing three phases.

The first phase is to revise and validate the university sports environment questionnaire for Chinese university students. In the second phase, a questionnaire survey was conducted on university sports environment, exercise motivation and exercise behavior of Chinese university students, and to analyze the relationship between university sports environment and exercise motivation and exercise behavior and the differences among different groups. The third phase is to create equations to predict physical exercise behavior for Chinese university students, and analyze the model path and put forward strategies to promote university students' physical exercise behavior (Figure 7).



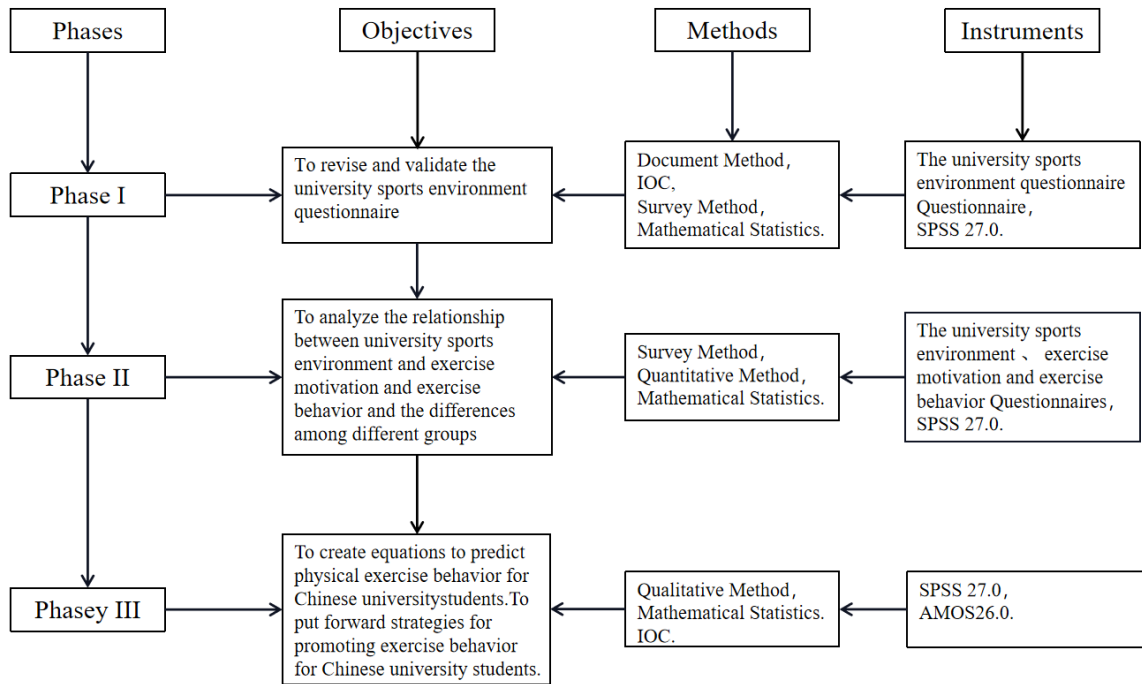
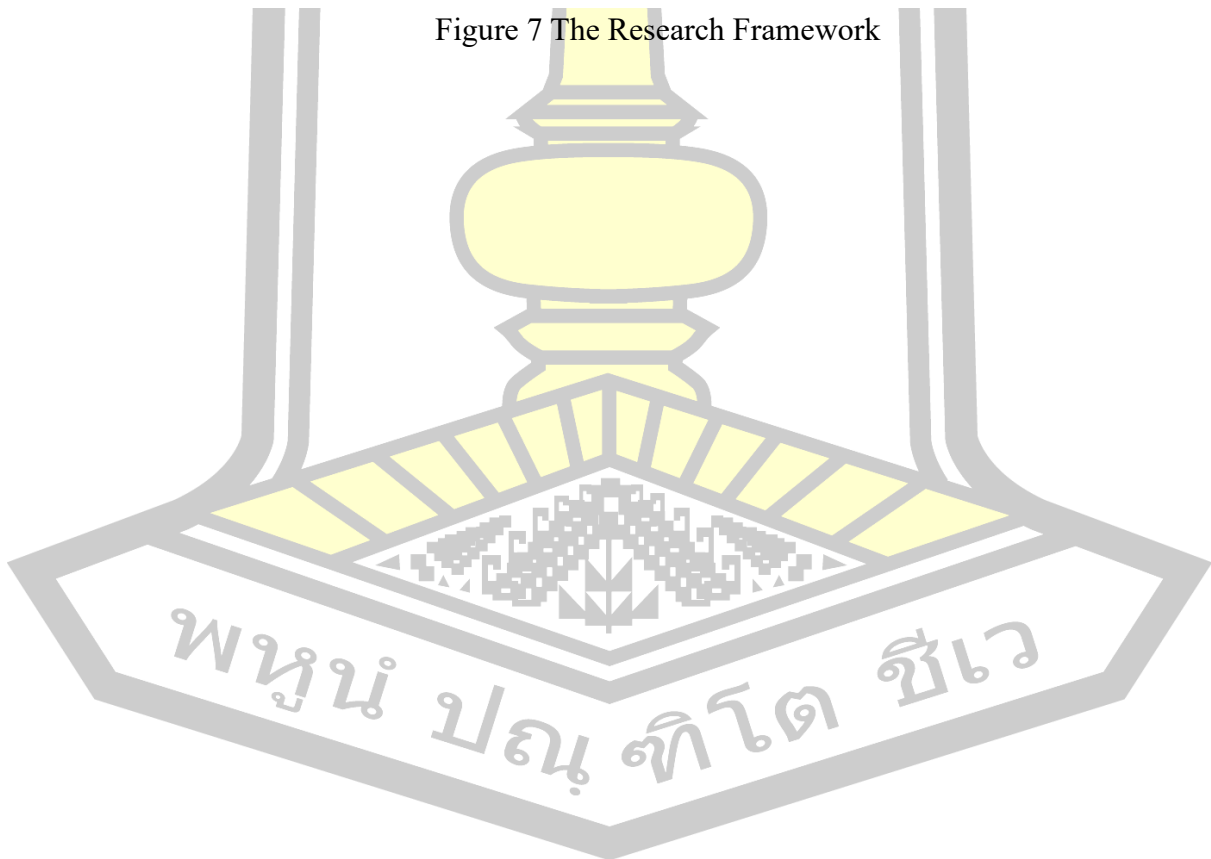


Figure 7 The Research Framework



Phase I: To revise and validate the university sports environment questionnaire for Chinese university students.

1. Objective

To revise and validate the university sports environment questionnaire for Chinese university students.

2. Research Questions

Is the reliability and validity of the revised university sports environment questionnaire?

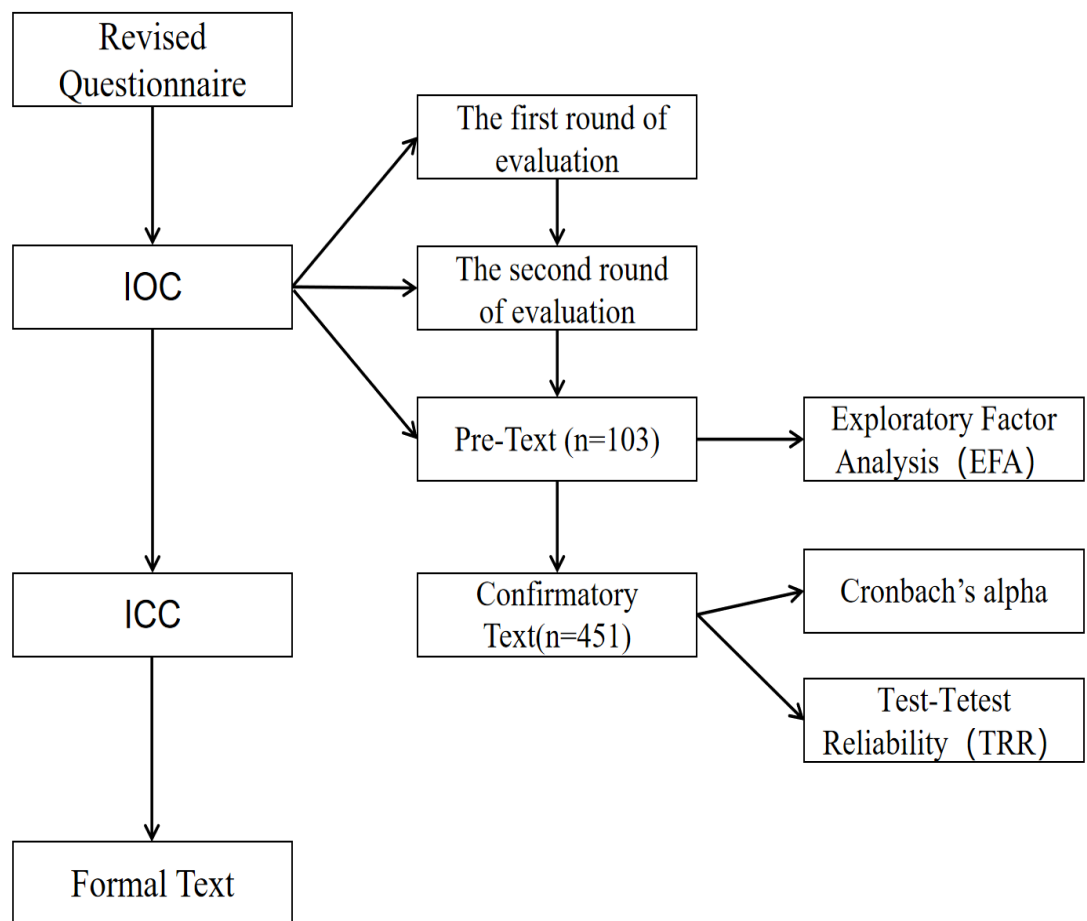


Figure 8 Flow chart of the phase I

3. Instrument

3.1. Sociodemographic characteristic

According to the research objective, will collect the basic information of the study participants, such as gender(male or female), age, school, grade, student number (second phase) basic sociological indicators.

3.2 The university sports environment questionnaire

The first phase of the research instrument is the university sports environment questionnaire, which is a revision of Guo (2019) "school sports environment questionnaire for middle school students" according to the instrument of this study. In order to make the questionnaire more suitable for university students', the questions were revised, and the words or sentences that were unclear, ambiguous, and incompatible with the university sports environment were revised. The university sports environment questionnaire still uses three subscales: sports physical environment, sports policy environment, and sports social environment.

3.2.1 The sports physical environment subscale

The sports physical environment refers to the sports venues, the number and accessibility of sports equipment, the suitability of the campus environment, and the adequacy of exercise time that affect students' participation in physical activities. The sports physical environment in this study included 2 dimensions: : sports venue and equipment and sports space and guidelines, with a total of 6 items. The evaluation questions use a 5-level Likert scale, ranging from "strongly disagree" to "strongly agree" (table 6).

Table 6 The sports physical environment dimensions

Dimension	Items	Score range	Scoring method
Sports venue and equipment	Q4、 Q5、 Q6	[1,5]	Divided into 1-5 levels, each scoring 1-5 points
Sports space and guidelines	Q1、 Q2、 Q3	[1,5]	Divided into 1-5 levels, each scoring 1-5 points

3.2.2 The sports policy environment subscale

The school sports policy environment mainly refers to the publicity and implementation of relevant policies, norms, etc. that affect students' participation in physical exercise. The sports policy environment has two dimensions: education policy and policy implementation, with a total of 7 items. The evaluation questions use a 5-level Likert scale, ranging from "strongly disagree" to "strongly agree" (table7).

Table 7 The sports policy environment dimensions

Dimension	Items	Score range	Scoring method
Education Policy	Q7、 Q8、 Q9	[1,5]	Divided into 1-5 levels, each scoring 1-5 points
Policy Implementation	Q10、 Q11、 Q12、 Q13	[1,5]	Divided into 1-5 levels, each scoring 1-5 points

3.2.2 The sports social environment subscale

The sports social environment refers to the physical education curriculum (specifically physical education classes, extracurricular sports activities), exercise opportunities (mainly including whether the school has various sports organizations, sports activities organized by the school, and exercise time arrangements) that affect students' physical activities, and interpersonal support for school sports (specifically teachers, peers or friends). This study has five dimensions for the sports social environment: physical education, exercise opportunities, teacher support, friends or peer support, and social norms, with a total of 21 items. The evaluation questions use a 5-level Likert scale, ranging from "strongly disagree" to "strongly agree" (table 8).

Table 8 The sports social environment dimensions

Dimension	Items	Score range	Scoring method
Physical education	Q14, Q15, Q16	[1,5]	Divided into 1-5 levels, each scoring 1-5 points
Exercise opportunities	Q17, Q18, Q19	[1,5]	Divided into 1-5 levels, each scoring 1-5 points
Teacher support	Q20, Q21, Q22, Q23, Q24	[1,5]	Divided into 1-5 levels, each scoring 1-5 points
Friend/Peer Support	Q25, Q26, Q27, Q28	[1,5]	Divided into 1-5 levels, each scoring 1-5 points
Social norms	Q29, Q30, Q31, Q32, Q33, Q34	[1,5]	Divided into 1-5 levels, each scoring 1-5 points

3.3 Item-Objective Congruence (IOC)

IOC is a method used to assess the alignment between test items and their intended measurement objectives. Introduced by Rovinelli and Hambleton in 1977, the IOC method ensures through quantitative analysis that each test item accurately measures the intended content, thus enhancing the test's content validity. The core principle of IOC involves expert evaluation to determine the degree of alignment between each test item and its intended objective. These experts are usually scholars or professionals with a deep understanding of the test content and objectives. The IOC method's key feature is its ability to transform subjective evaluations into quantitative indicators, facilitating the analysis and refinement of test items. Typically, 3 to 5 experts are invited to rate the relevance of each test item to its measurement objective on a scale from 0 to 1, where 0 indicates irrelevance and 1 indicates complete relevance. The IOC index for each item is then calculated based on these ratings. The specific calculation method is as follows:

$$IOC = \frac{\sum_{i=1}^n S_i}{n}$$

In this context, (S_i) denotes the relevance score assigned by the (i)th expert to a specific item, while (n) represents the total number of experts. The suitability of each item is assessed based on the IOC index value; generally, a higher IOC index indicates a stronger alignment between the item and its intended measurement objective.

The validity of the questionnaire was assessed using the Indexes of Item-Objective Congruence (IOC) by a five-member expert panel in this study. Five experts from different research fields evaluated the interview outline and made suggestions from different perspectives, Modifications were made based on expert opinions and a second round of IOC expert evaluation was conducted. The list of experts is as follows (Table 9):

Table 9 List of Evaluation Experts

Expert	Area	University	Professional Title
A	Sport Event; Sport Management	Chongqing University of Posts and Telecommunications	Professor Dean
B	Sport Psychology; Physical Education	Lanzhou University	Associate Professor
C	Sport Psychology; Physical Education	Nanyang Normal University	Associate Professor
D	Physical Education and Sports Training	Sichuan University	Professor
E	Physical Education and Sports Training	Chongqing University of Posts and Telecommunications	Associate Professor

The expert group assessed the consistency between the research purpose and the question design at this stage. In the evaluation form, “-1” means the question is inconsistent with the purpose, “0” means uncertain, and the score “1” means the question design is consistent with the research purpose(Appendix C). Scored by five

experts, after calculation, when the value of IOC is greater than or equal to 0.5 (≥ 0.5), the project is valid (Turner and Carlson, 2003; Fouzul Kareema and Bt Zubairi, 2021).

4. Participants

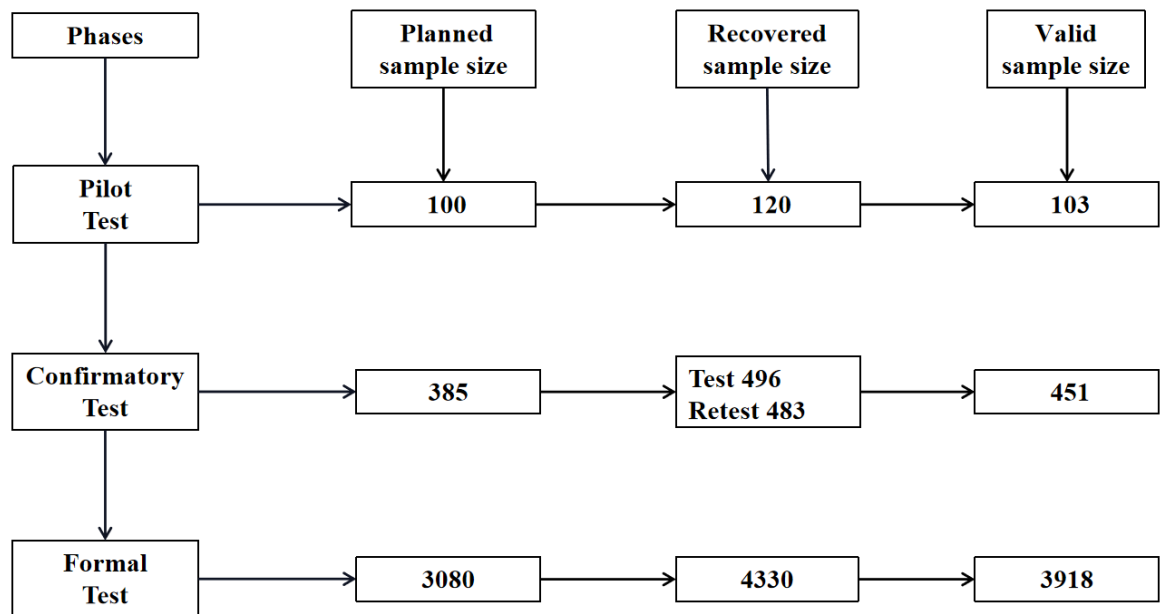


Figure 9 Sample size of this study

4.1 Pilot Test

The purposive sampling ensure that those who can provide the most information (Creswell, 2013; Lewis, 2015). Purposive sampling method was used in this phase. After the university sports environment questionnaire was revised and passed the IOC, a questionnaire survey was conducted on students of different genders in grades 1-4 of Chongqing University of Posts and Telecommunications. It is expected that 100 university sports environment questionnaires will be distributed (50 online and 50 paper). In this phase, 120 questionnaires were actually distributed and 120 were collected (60 online and 60 paper). After eliminating invalid data, a total of 103 valid sample data were obtained (48 online and 55 paper).

Table 10 Sample size of sampling survey

Author (Year)	Suggested sample size selection
Krejcie and Morgan (1970)	The article "Determining sample size for research activities" provides the basis for the sample size taken when the population is between 10-50000000, When the total number of survey objects is more than 500000, the sample size is 384.
Ollerenshaw and Creswell (2002)	The sample size of the formal sample is defined from the attributes of the questionnaire survey. It is thought that the sample size of the formal sample should be more than 350 in the general questionnaire survey.
Wu (2010)	$n \geq \frac{N}{\left(\frac{\alpha}{k}\right)^2 \times \frac{N-1}{P(1-P)} + 1} = \frac{500000}{\left(\frac{0.05}{1.96}\right)^2 \times \frac{500000-1}{0.50 \times (1-0.50)} + 1} = 384.18 \approx 385$

4.2 Confirmatory test

This phase uses cluster sampling and purposive sampling methods to survey university students of different genders in grades 1-4 at Chongqing University of Posts and Telecommunications and Chongqing Medical University, and retests them two weeks later (14 days). According to the sample size calculation results of Wu (2010) sampling survey the sample size for this phase is 385 (table 10). In order to ensure the recovery rate and validity of the two questionnaires, the effective questionnaire rate is preset to 80%, so it is expected that 482 questionnaires will be distributed in this phase (241 online and 241 paper). In the first test of this phase, 496 questionnaires were actually distributed and 496 were collected (250 online and 246 paper); in the retest, 483 questionnaires were actually distributed and 483 were collected (246 online and 237 paper); after eliminating invalid data, a total of 451 valid sample data were obtained (221 online and 230 paper).

Inclusion criteria:

- (1) Chinese university students aged 18-22 years, both male and female.
- (2) University students who are studying in grades 1-4.
- (3) Interested in this study and sign informed consent.
- (4) Understand the purpose and requirements of this study.
- (5) The volunteer is healthy and able to complete the questionnaire independently.

Exclusion criteria:

- (6) The volunteers can't complete the questionnaire independently.
- (7) Physical deformities or psychiatric disorders that can't read or understand the questionnaire.

5. Data Collection Procedure

This study conducted a pilot test and confirmatory test before the normal data collection. The purpose of pilot test is to ensure the validity of the questionnaire, revise and adjust the questions in the research instrument (Bernard, 2000; Bryman, 2016).

This phase of university sports environment questionnaire survey adopts the combination of online questionnaire (Questionnaire Star, a professional online questionnaire survey platform in China) and paper questionnaire. Links and two-dimensional codes were set up in the online questionnaire, and all questions were required to be answered by scanning the code through wechat or QQ. If there were any missing options, the submission could not be completed, so as to improve the completion rate of the questionnaire. Freshman and sophomore students paper questionnaire or online questionnaire survey all the start or end in physical education class, interpretation by the university physical education teachers, and then university students to fill in; The junior and senior university students were organized by their class teachers, and the university physical education teachers or trained research investigators were present to explain, distribute and collect the questionnaires.

In the first phase, the Pilot Test was conducted anonymously. In the second phase of the test and retest, the paired data of the two tests are needed, so, the questionnaire survey was conducted in the form of student numbers.

Data elimination:

- (1). Data with omissions, multiple selections, or consistent answers in the paper questionnaire will be eliminated.
- (2) Since the online questionnaire is set to be a mandatory form, there are no omissions or multiple selections in the questionnaire, and only sample data with consistent answers will be eliminated.
- (3) In the second phase of the test, If the sample data lacks test or retest data, it will be eliminated.

6. Data Analysis

The study used SPSS 27.0 data statistics software to analyse the valid samples. (1) Descriptive statistics were used to analyse the participants' Sociodemographic characteristic and IOC score statistics. (2) Exploratory factor analysis (EFA) was used to analyse the validity of the university sport environment questionnaire. The construct validity is the degree to which a questionnaire can measure the degree to which it is theoretically constructed or to which it can measure psychological traits, and is the most rigorous validity test method. (3) ICC analysis, this study uses test-retest reliability and Cronbach's alpha for ICC. to analyse the reliability of the university sport environment questionnaire.

พหุ ประถมศึกษา

Phase II: To analyze the relationship between university sports environment and exercise motivation and exercise behavior and the differences among different groups.

1. Objective

To analyze the relationship between university sports environment and exercise motivation and exercise behavior and the differences among different groups.

2. Research Questions

Is there a correlation between the school sports environment and exercise behavior and exercise motivation, as a whole and different dimensions, and is there a difference among different gender and year level of study?

Is there a correlation between overall and different dimensions of university students' exercise motivation and university students' exercise behavior, and is there variability across gender and year level of study?

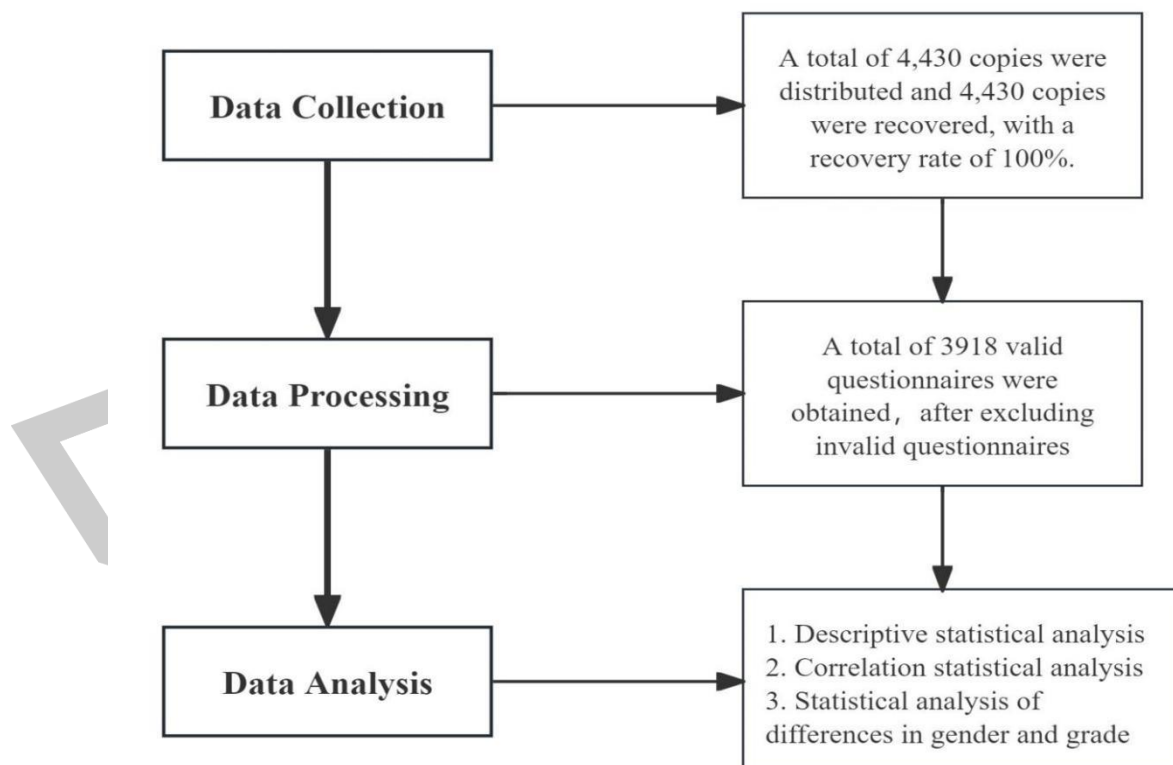


Figure 10 Flow chart of the phase II

3. Instrument

3.1. Sociodemographic characteristic

According to the research objective, will collect the basic information of the study participants, such as gender (male or female), age, school, grade, basic sociological indicators.

3.2 The university sports environment questionnaire

The university sport environment questionnaire includes three subscales: sport physical environment, sport policy environment, and sport social environment, with a total of 34 items. The evaluation questions use a 5-level Likert scale, ranging from "strongly disagree" to "strongly agree" (table 11).

Table 11 The university sports environment subscales

Subscale	Items	Score range	Scoring method
sport physical environment	Q1-Q6	[1,5]	Divided into 1-5 levels, each scoring 1-5 points
sport policy environment	Q7-Q13	[1,5]	Divided into 1-5 levels, each scoring 1-5 points
sport social environment	Q14-Q34	[1,5]	Divided into 1-5 levels, each scoring 1-5 points

3.3 The exercise motivation questionnaire

The exercise motivation to questionnaire in this study used the physical activity motivation measurement Scale (MPAM-R) and the physical activity extrinsic motivation scale (Chen, et al., 2023). The scales are widely used in China, have good reliability, and have been studied several times in Chinese university student populations (Chen, et al., 2006, Chen, et al., 2008, Chen, et al., 2023).

3.3.1 The intrinsic motivation subscale

The simplified scale of motivation for exercise and physical activity measurement scale (MPAM-R) was developed by Chen, et al. (2013) based on the full version of the 30-item scale developed by Ryan, et al. (1997), and then streamlined into the Chinese version of the MPAM-R. The English version of the MPAM-R is used in research with university students, and the translated Chinese version is also used in research with university students, so this questionnaire was used in this study. The simplified Chinese version of the MPAM-R maintains the theoretical structure of the original motivation for physical activity scale, which is still divided into five dimensions (pleasure motivation, health motivation, appearance motivation, Curiosity motivation, and social motivation), with a total of 15 items. The evaluation questions use a 5-level Likert scale, ranging from "strongly disagree" to "strongly agree" (table 12).

Table 12 The intrinsic motivation dimensions

Dimension	Items	Score range	Scoring method
Health Motivation	M1、 M2、 M3	[1,5]	Divided into 1-5 levels, each scoring 1-5 points
Appearance Motivation	M4、 M5、 M6	[1,5]	Divided into 1-5 levels, each scoring 1-5 points
Pleasure Motivation	M7、 M8、 M9	[1,5]	Divided into 1-5 levels, each scoring 1-5 points
Curiosity Motivation	M10、 M11、 M12	[1,5]	Divided into 1-5 levels, each scoring 1-5 points
Social Motivation	M13、 M14、 M15	[1,5]	Divided into 1-5 levels, each scoring 1-5 points

3.3.2 The extrinsic motivation subscale

Table 13 The extrinsic motivation dimensions

Dimension	Items	Score range	Scoring method
Academic Motivation	M16, M17, M18	[1,5]	Divided into 1-5 levels, each scoring 1-5 points
Identification Motivation	M19, M20, M21	[1,5]	Divided into 1-5 levels, each scoring 1-5 points
Economic Motivation	M22, M23, M24	[1,5]	Divided into 1-5 levels, each scoring 1-5 points
Honor Motivation	M25, M26, M27	[1,5]	Divided into 1-5 levels, each scoring 1-5 points

The external motivation scale for sports exercise is a revised version of the extrinsic motivation Scale (Chen, et al., 2008). The scale contains four dimensions (academic motivation, identification motivation, economic motivation, and honor motivation), with a total of 12 items. The evaluation questions use a 5-level Likert scale, ranging from "strongly disagree" to "strongly agree" (table 13).

3.3.3 Internal Consistency Coefficient and Test-retest Reliability of the exercise motivation

Reliability refers to the stability and consistency of the results obtained from a measurement tool. Higher reliability indicates a smaller standard error of measurement. In social sciences, especially when using Likert scales, Cronbach's alpha coefficient (Cronbach α) is commonly employed for reliability testing. This method was introduced by Cronbach in 1951. The formula is:

$$\alpha = \frac{K}{K-1} \left(1 - \frac{\sum S_i^2}{S^2} \right)$$

Where K represents the total number of items included in the scale;

Where $\sum S_i^2$ is the sum of the variances of the items in the scale and S^2 is the variance of the sum of the items in the scale.

Reliability is divided into two categories: external reliability and internal reliability. External reliability usually refers to the degree of consistency of the measurement tool when measured at different times. Test-retest reliability is the most commonly used test method for external reliability. Internal reliability refers to whether each scale measures a single concept, and at the same time, the degree of internal consistency of the items that make up the scale. The most commonly used method is Cronbach's alpha coefficient. Therefore, this study uses test-retest reliability and Cronbach's alpha for ICC verification.

Test-retest reliability refers to the use of the same scale to test the same group of subjects twice, and the product-difference correlation coefficient is calculated based on the scores of the subjects in the two tests. This coefficient is called the test-retest reliability coefficient. Since test-retest reliability assumes that the test scores obtained by the subjects on the scale or test remain consistent or stable after a short period of time, test-retest reliability is also called the coefficient of stability, which can reflect the stability and consistency of the scale. If the interval is too short, the subject may remember the previous response, thus compromising the accuracy of the test results. However, if the interval time is too long, the test results may be unstable and the status of the subjects may change, which will also affect the reliability of the test results. Base on previous study and reference, the interval between test-retest reliability is most common within one to two weeks. Therefore, the test-retest reliability interval of this study is two weeks.

Table 14 Cronbach's alpha evaluation criteria

Cronbach's alpha	Evaluation results
$\alpha \geq 0.900$	excellent
$0.800 \leq \alpha < 0.899$	very good
$0.700 \leq \alpha < 0.799$	good
$0.600 \leq \alpha < 0.699$	acceptable
$0.500 \leq \alpha < 0.599$	Poor
$\alpha < 0.500$	Unacceptable

The value of α ranges between 0 and 1, with the probability of extreme values (0 or 1) being very low. In the field of social sciences, there has been considerable discussion regarding the minimum acceptable α coefficient. Many scholars have expressed their views on this matter. Henson (2001) suggests that if the purpose is to develop a pilot questionnaire or measure a construct, an α coefficient between 0.50 and 0.60 is sufficient. However, for basic research purposes, the α coefficient should ideally be above 0.80. Nunnally (1978) posits that The alpha coefficient value of 0.70 is considered to be an acceptable scale boundary value. Wu (2010), after synthesizing the views of several scholars, provided a summary judgment on the α coefficient indicator (Table 14).

Table 15 ICC and Test-retest Reliability Results of the exercise motivation

Scale	Dimensions	Number of Items	Cronbach's alpha		r
			T1	T2	
Exercise Motivation	Intrinsic	15	0.839	0.835	.920**
	Extrinsic	12	0.835	0.829	.903**
Extrinsic Motivation	HM	3	0.821	0.819	.863**
	AM	3	0.820	0.823	.825**
	PM	3	0.815	0.815	.829**
	CM	3	0.815	0.818	.830**
	SM	3	0.826	0.817	.832**
Intrinsic Motivation	AVM	3	0.817	0.822	.853**

	IDM	3	0.830	0.810	.828**
	ECM	3	0.825	0.825	.850**
	HOM	3	0.819	0.820	.818**

Note:Intrinsic=Intrinsic Motivation,Extrinsic=Extrinsic Motivation,HM=Health Motivation, AM=Appearance Motivation, PM=Pleasure Motivation, CM=Curiosity Motivation, SM=Social Motivation,ACM=Academic Motivation, IDM=Identification Motivation, ECM=Economic Motivation, HOM=Honor Motivation, EB=Exercise Behavior.

**** Correlation is significant at the 0.01 level**

As can be seen from the table 15, the Cronbach's α of the intrinsic motivation subscales is 0.839 (T1) and 0.835 (T2), the test-retest reliability $r = 0.920$ ($P < 0.001$); the Cronbach's α of the extrinsic motivation subscales is 0.835(T1) and 0.829(T2),the test-retest reliability $r = 0.903$ ($P < 0.001$); Cronbach's α of all subscales is greater than 0.8(table 15), and test-retest reliability r values is greater than 0.8, It proves that the two subscales of the exercise motivation have high reliability, the questionnaire has passed the reliability test (Nunnally and Bernstein, 1994; Cohen,2013;Koo and Li,2016).

The Cronbach's α coefficients of the five dimensions of the intrinsic motivation subscale ranged from 0.815 to 0.826, and the test-retest reliability r values ranged from 0.825 to 0.863; the Cronbach's α coefficients of the four dimensions of the extrinsic motivation subscale ranged from 0.810 to 0.830, and the test-retest reliability r values ranged from 0.818 to 0.853.The Cronbach's α coefficient of each dimension of the two subscales was greater than 0.8(table 15), and the test-retest reliability r values was greater than 0.8, which proved that each dimension of the three scales had high reliability and met the requirements of psychometrics (Nunnally and Bernstein, 1994; Cohen,2013;Koo and Li,2016).

3.4 The exercise behavior questionnaire

The exercise behavior questionnaire of this study used “the physical activity rating scale-3,PARS-3”(Liang,et al.,1994) and the physical exercise behavior measurement(Chen,et al.,2010) to investigate the physical exercise behavior of participants in the last month. The questionnaire mainly examines physical exercise behavior in three aspects: exercise intensity, exercise time, and exercise frequency. The Likert 5-point scoring method is used, in which intensity and frequency are calculated from 1 to 5 points, time is calculated from 0 to 4 points, exercise behavior = intensity * frequency * time, the highest score is 100 points, and the lowest score is 0 points. Evaluation criteria: scored 19 points or less for the small amount of exercise of exercise behavior; Score between 20 ~ 42 points for moderate intensity exercise behavior; The score ≥ 43 points is the exercise behavior of large amount of exercise (Shen,2011; Lu,2012; Feng,2015). This study of exercise behavior test-retest reliability is 0.902, Therefore, it proved that the exercise behavior questionnaire of high stability, scale reliability is very good.

4. Participants

In this phase, the cluster sampling method and purposive sampling method were used to select students from grade 1-4 from 20 universities in Chongqing, Beijing, Shanghai, Shandong, Shaanxi, Guangxi, Henan and Gansu provinces of China. Try to keep the number of grade and gender uniform. It is expected that a total of 3080 questionnaires will be distributed (1540 online and 1540 paper), and are pre-issued to establish a data basis for the empirical research and quantitative demonstration of this research. In this phase,4430 questionnaires were actually distributed and 4430 were collected (2241 online and 2189 paper). After eliminating invalid data, a total of 3918 valid sample data were obtained (1820 online and 2098 paper).

Inclusion criteria were:

- (1) Chinese university students from Chongqing, Beijing, Shanghai, Shandong, Shaanxi, Guangxi, Henan, Gansu.
- (2) Age 18-22 years, both male and female.
- (3) University students who are studying in grades 1-4.
- (4) Interested in this study and sign informed consent.
- (5) Understand the purpose and requirements of this study.
- (6) The volunteer is healthy and able to complete the questionnaire independently.

Exclusion criteria were:

- (1) The volunteers can't complete the questionnaire independently.
- (2) Physical deformities or psychiatric disorders that can't read or understand the questionnaire.

5. Data Collection Procedure

Since the dimensions and contents involved in the questionnaire of this study are relatively comprehensive, and the number of survey items is relatively large, it brings certain difficulties to the research work. In order to ensure the quantity and quality of questionnaire distribution and collection, the questionnaire survey adopts a combination of online questionnaires (Wenjuanxing, a professional online questionnaire survey platform in China) and paper questionnaires. Online questionnaires can effectively communicate with the target population (Jones, 1998). Secondly, online surveys reduce the cost of data collection and improve the time efficiency of the data collection process (Bachmann et al., 1996). The online questionnaire for this study sets a link and a QR code, which can be filled in by scanning the code through WeChat or QQ. All questions are required to answer, that is, if there is an omission, the submission cannot be completed, thereby improving the completion rate of the questionnaire.

Before collecting data, the university physical education teachers or trained research investigators informed the university students participating in the survey of the relevant content and purpose of the research and asked the respondents to agree and sign a written informed consent form. Then the questionnaires were distributed and collected. The survey of freshman and sophomore students was conducted at the beginning or the end of the physical education class. After the university physical education teacher explained the content and purpose of this survey, the university students filled it out. Junior and senior university students were organized by their class teachers, and the university physical education teachers or trained research investigators gave on-site explanations before distributing and collecting questionnaires. They could withdraw from the study at any time. To protect the privacy of research participants, data collection and analysis were anonymous.

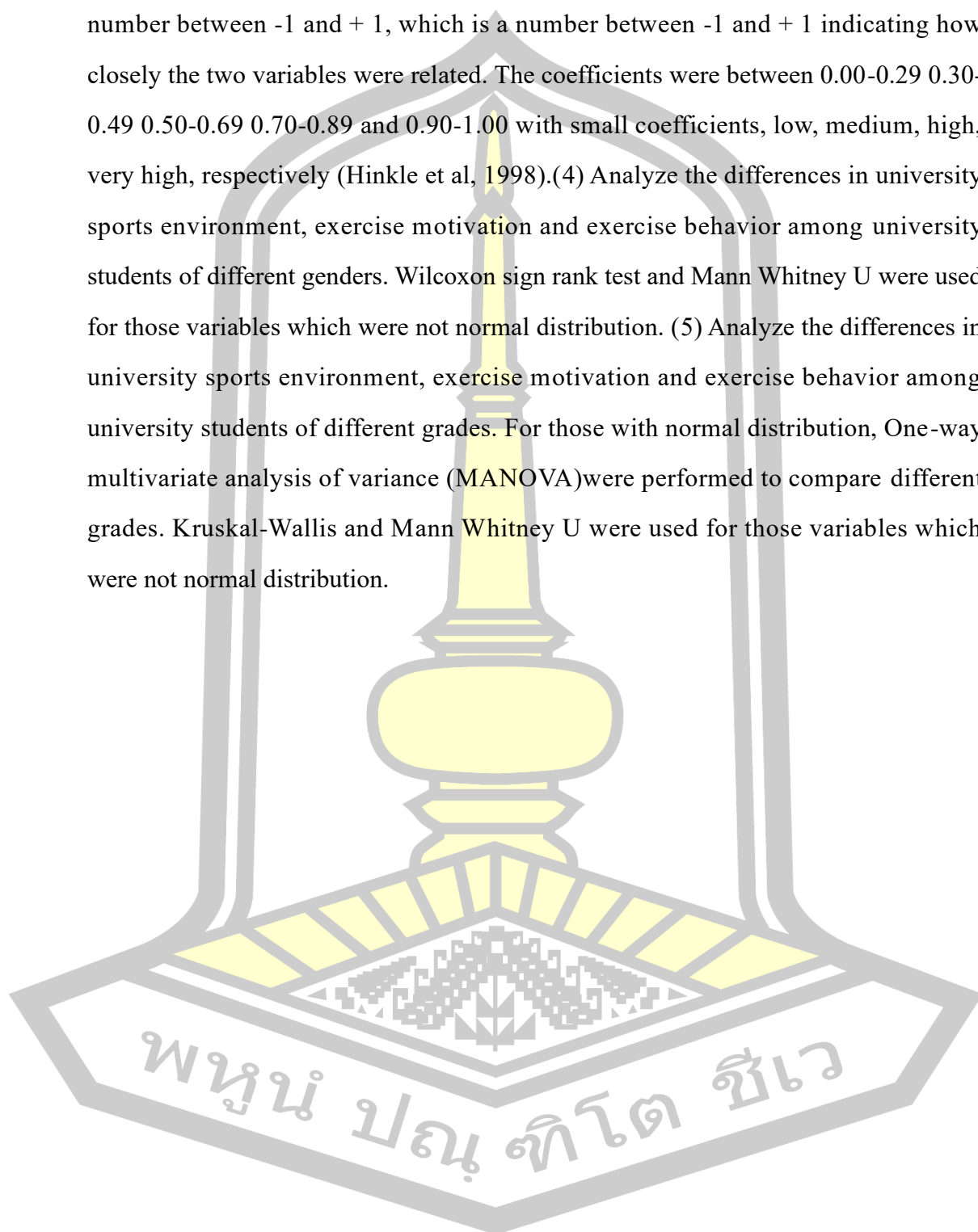
Data elimination:

- (1) Data with omissions, multiple selections, or consistent answers in the paper questionnaire will be eliminated.
- (2) Since the online questionnaire is set to be a mandatory form, there are no omissions or multiple selections in the questionnaire, and only sample data with consistent answers will be eliminated.

6. Data Analysis

This study used SPSS 27.0 statistical software to analyze the valid samples. (1) Normal distribution of all variables were assessed before choosing statistical analysis. According to Kline (1998), if the absolute value of skewness is within 3 and the absolute value of kurtosis is within 8, the data can be considered to approximately meet the normal distribution requirements. (2) Descriptive statistics were used to analyze the mean, standard deviation, percentage, chi-square, etc. (3) Correlation analysis was used to analyze the relationship between university sports environment,

exercise motivation and exercise behavior. Pearson correlation coefficient which is a number between -1 and + 1, which is a number between -1 and + 1 indicating how closely the two variables were related. The coefficients were between 0.00-0.29 0.30-0.49 0.50-0.69 0.70-0.89 and 0.90-1.00 with small coefficients, low, medium, high, very high, respectively (Hinkle et al, 1998). (4) Analyze the differences in university sports environment, exercise motivation and exercise behavior among university students of different genders. Wilcoxon sign rank test and Mann Whitney U were used for those variables which were not normal distribution. (5) Analyze the differences in university sports environment, exercise motivation and exercise behavior among university students of different grades. For those with normal distribution, One-way multivariate analysis of variance (MANOVA) were performed to compare different grades. Kruskal-Wallis and Mann Whitney U were used for those variables which were not normal distribution.



Phase III: To create equations to predict physical exercise behavior for Chinese university students, and to put forward strategies for promoting exercise behavior for Chinese university students.

1.Objective

To create equations to predict physical exercise behavior for Chinese university students.

To put forward strategies for promoting exercise behavior for Chinese university students.

2.Research Questions

Can the school sports environment predict university students' exercise behavior and motivation? Can exercise motivation predict university students' exercise behavior?

Can strategies of promoting exercise behavior be put forwarded for university students?

3. Instrument

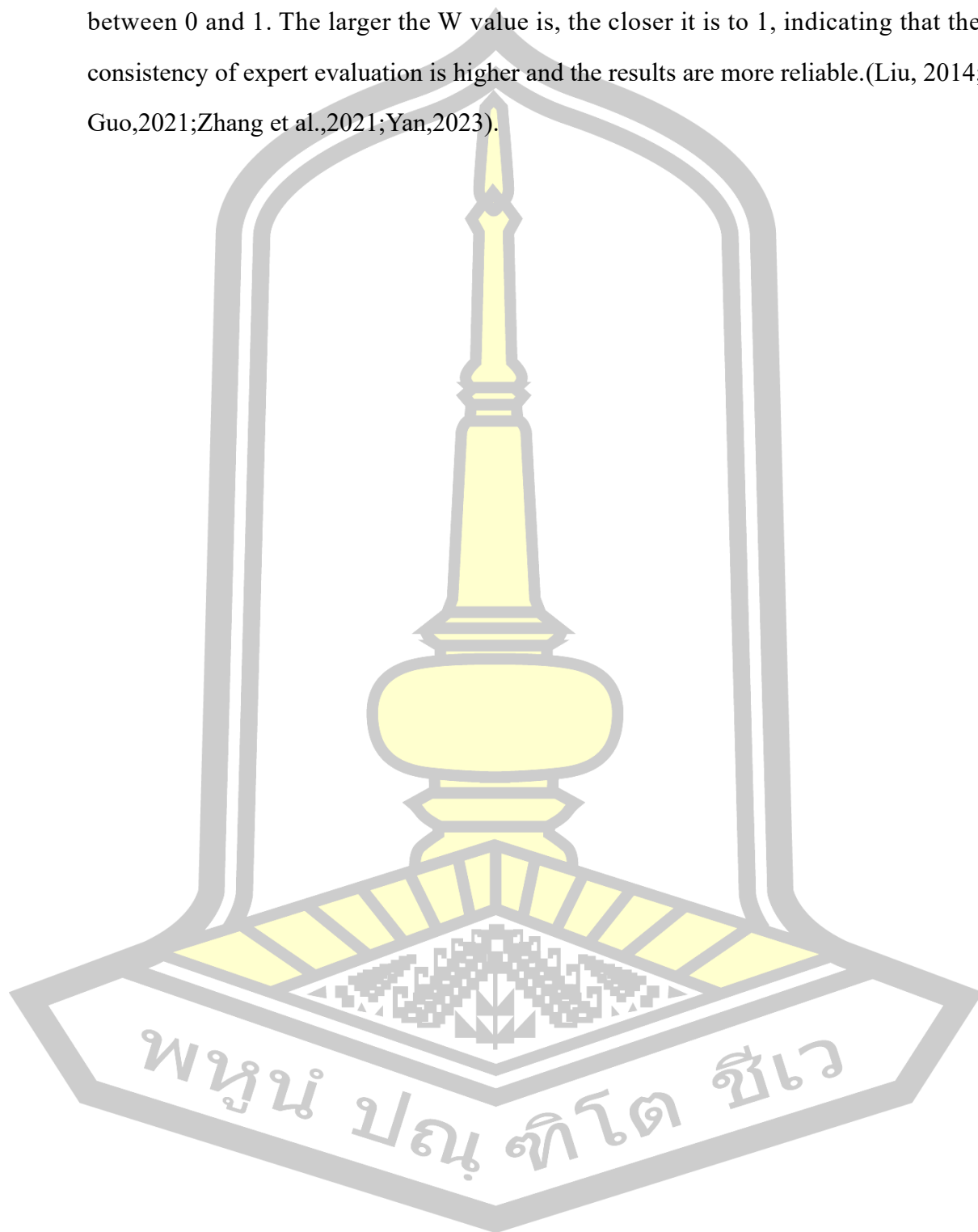
At this phase, this study uses cross-sectional survey data to build a structural equation model to analyze the influencing mechanism, path and predictive power of university sports environment, exercise motivation and exercise behavior, and puts forward relevant strategies according to the research results. Expert evaluation and IOC (Appendix D) were used to evaluate the strategies of university sports environment and exercise motivation for Chinese university students' exercise behavior. The expert evaluation Questionnaire use a 5-level Likert scale, 1=Strongly Unreasonable, 2=Unreasonable, 3=Neutral, 4=Reasonable, 5=Strongly Reasonable (Zhang,2020).

4. Data Analysis

This study used SPSS 27.0 statistical software to analyze the valid samples. (1) Multiple regression analysis was used to analyze the predictive power between university sports environment, exercise motivation and exercise behavior. Tolerance(TOL) is between 0 and 1. If the TOL value is too small, it indicates that there is a collinearity problem between this variable and other independent variables; Variance inflation factor(VIF) : The smaller the value of VIF is, the less obvious the collinearity between the independent variables; if the value is greater than 10, the problem of linear coincidence may occur between the independent variables; R-squared is an important statistical index in regression analysis, which is used to measure the degree of fit of the model to the data. The r-squared value ranges from 0 to 1 and represents the proportion of the variability explained by the model to the total variability(Wu,2010).(2) AMOS 26.0 software was used to construct the model, analyze the model fit and path(Wu,2009) , and put forward strategies to promote exercise behavior among Chinese university students based on the research results.(3)Based on the results of the study, descriptive statistics were used for strategic analysis, Including IOC Value mean, standard deviation, CV value and Kendall coefficient.

The degree of coordination of expert evaluation reflects the convergence of experts' evaluation of indicators and is usually expressed by the coefficient of variation (CV) and the Kendall coordination coefficient (Kendall's W). CV is an important indicator used to measure the consistency of expert evaluation opinions. $CV=S/M$, S is the standard deviation, M is the mean. The larger the CV value, the greater the difference in expert evaluation opinions. The smaller the CV value, the higher the consistency of expert evaluation opinions. It is generally believed that a coefficient of variation of less than 0.25 indicates that the consistency between experts is good.(Qu,2012;Xie, 2020; Zhang, 2020; Wu,2020;Zhang et al.,2021;Li et al.,2021; Guo,2021;Yan,2023).The Kendall coordination coefficient (Kendall's W) used to

evaluate the degree of consistency of expert evaluation opinions. The W value is between 0 and 1. The larger the W value is, the closer it is to 1, indicating that the consistency of expert evaluation is higher and the results are more reliable.(Liu, 2014; Guo,2021;Zhang et al.,2021;Yan,2023).



CHAPTER IV

RESEARCH RESULTS

This study is a cross-sectional study. A sample survey of Chinese university students in grades 1-4. This research data comes from 20 universities in Chongqing, Beijing, Shanghai, Shandong Province, Shaanxi Province, Guangxi Province, Henan Province, and Gansu Province. The data analysis results were divided into 3 studies.

Phase I:

Analyze the university sports environment questionnaire. The validity of the questionnaire on physical environment, policy environment and social environment of university sports was analyzed by IOC and exploratory factor analysis (EFA). Through test-retest reliability (TRR) and Cronbach's alpha coefficient, the reliability of physical environment, policy environment and social environment of university sports were analyzed.

Phase II:

Analyze the relationship between the university's sports environment, exercise motivation, and exercise behavior, and further analyze different gender and year level of study.

Phase III:

To create equations to predict physical exercise behavior for Chinese university students. and to put forward strategies for promoting exercise behavior for Chinese university students.

Phase I: Analyze the university sports environment questionnaire. The validity of the questionnaire on physical environment, policy environment and social environment of university sports was analyzed by IOC and exploratory factor analysis (EFA). Through test-retest reliability (TRR) and Cronbach's alpha coefficient, the reliability of physical environment, policy environment and social environment of university sports were analyzed.

This three-dimensional university sports environment questionnaire targets the university sports physical environment, the university sports policy environment, and the university sports social environment. Questions 1-6 focus on the sports physical environment, with the following objectives: to explore the factors affecting the sports physical environment. Questions 7-13 focus on the university sports policy environment, with the goal of exploring the factors affecting the university sports policy environment. Questions 14-34 focus on the sports social environment, with the goal of exploring the factors affecting university sports social environment.

Item-Objective Congruence (IOC)

Table 16 The IOC results of the questionnaire of the first round of evaluation

Item	Proposed revisions	Results
Q6	The maintenance and updating of sports venues and equipment is more intuitive for university students	0.4
Q2、 Q3、 Q30、 Q34	Q2:The sports facilities are complete, which encourages me to exercise. Q3:Delete (Spatiotemporal characteristics). Q30:Classmates are very enthusiastic about participating in physical exercise. Q34:Modify the syntax	0.6
Q1、 Q4、 Q5、 Q8、 Q9、 Q10、 Q14、 Q15、 Q21、 Q22、 Q23、 Q24、 Q26、 Q29、 Q31	Q1、 Q8、 Q9、 Q10、 Q14、 Q22、 Q26、 Q29: Modify the expression of individual words For example:Q26:My friends→Most of my good friends	0.8

Q7、Q11、Q12、Q13、Q16
、Q17、Q18、Q19、Q20、
Q25、Q27、Q28、Q32、Q33

In the first evaluation round, the scores of Q6 were only 0.4, which did not meet the requirements of item validity, experts have proposed revisions. the scores of Q2、Q3、Q30 and Q34 were 0.6, the scores of Q1、Q8、Q9、Q10、Q14、Q22、Q26、Q29 were 0.8, These scores are more significant than 0.5, but experts still proposed revisions (Table 16). According to the suggestion of the expert group, the questionnaire was redesigned and revised. After the revision, the second round of evaluation was carried out on the questionnaire.

Table 17 The IOC results of the questionnaire of the final evaluation

No.	Item	Results
Q1	My university's green environment and sports activity space design attract me to participate in physical exercise.	1.0
Q2	My university has complete sports venues and facilities, which enable me to participate in physical exercise for at least 1 hour every day.	1.0
Q3	My university has plenty of time for extracurricular sports activities.	0.8
Q4	My university sports equipment can meet my physical exercise needs.	0.8
Q5	I can easily use my university's sports equipment for physical exercise.	1.0
Q6	My university regularly maintains and updates sports venues and sports equipment.	0.8
Q7	The regular physical fitness tests conducted by my university prompted me to take part in physical exercise.	1.0
Q8	My university physical education examination prompted me to take part in physical exercise.	1.0
Q9	My university did not cancel some dangerous sports (such as long-distance running, throwing, etc.) due to concerns about sports accidents.	1.0
Q10	My university publicized and strictly implemented the sports policy.	1.0
Q11	My university organizes at least one school sports meeting every year.	1.0
Q12	My university has relevant extracurricular physical exercise policies (such as running clock-in, physical exercise clock-in, etc.).	1.0
Q13	My university arranges physical education courses according to policy requirements and conducts them normally.	1.0
Q14	Physical education classes have played a positive role in cultivating my interest in sports	1.0
Q15	The form and content of extracurricular sports activities are attractive to me.	0.8
Q16	My university sports curriculum is rich in content, and you can choose your favorite sports.	1.0
Q17	My university has a variety of sports organizations (such as sports clubs, sports associations, sports associations, class/school sports teams, etc.).	1.0
Q18	My university often organizes sports activities (such as class and department sports competitions, sports meetings, sports recreation activities, sports and	1.0

	cultural festivals, etc.).	
Q19	I often take part in sports activities organized by my university.	1.0
Q20	My physical education teacher is conscientious and responsible in his work	1.0
Q21	My teacher often takes part in physical exercise with his/her students.	0.8
Q22	The number of physical education teachers in my university can meet the needs of physical education work	1.0
Q23	I like my physical education teacher very much.	0.8
Q24	Other teachers (such as counselors, class mentors, etc.) actively support me to participate in physical exercise.	1.0
Q25	Most of my good friends/companions like to take part in physical exercise.	1.0
Q26	Most of my good friends/companions often encourage me to take part in physical exercise.	1.0
Q27	My friends/companions often take part in sports exercises with me.	1.0
Q28	I prefer to take part in physical exercise with friends/companions.	1.0
Q29	I often see other professional teachers (non-PE teachers) in my university participating in physical exercises	1.0
Q30	The students in the class are very enthusiastic about participating in physical exercise, and most of them like to participate in physical exercise very much.	0.8
Q31	Our principals, deans and other leaders like to take part in physical exercise.	0.8
Q32	The members of my university's sports team set a good example for me to take part in physical exercise.	1.0
Q33	There is a strong atmosphere of physical exercise in my university.	1.0
Q34	The attitude of teachers and students towards students with good physical education and students with good academic performance is exactly the same.	0.8

After further revision of the items, in the second round of IOC evaluation, the IOC value of each item was greater than or equal to 0.8 (≥ 0.8), forming the final IOC evaluation table (Table 17), indicating that the item content validity was reasonable.

1. Exploratory factor analysis (EFA)

The revised questionnaire (University sports Environment Questionnaire) has been reviewed by sports experts and teachers for its content and textual expression, and then pre-tested among university students of different gender and year level of study, and the construct validity of the questionnaire was tested through exploratory factor analysis (EFA). Construct validity is the degree to which a questionnaire can measure the degree to which it is theoretically constructed or to which it can measure psychological traits and is the most rigorous validity test method.

Table 18 Descriptive statistics of demographic characteristics of EFA

Variables	Numbers	Percentage (%)	Mean(SD)
Gender			
Male	55	53.4	
Female	48	46.6	
Total	103	100	
Year level of study			
Freshman	29	28.2	
Sophomore	26	25.2	
Junior	25	24.3	
Senior	23	22.3	
Age (year old)			
18	14	13.6	
19	24	23.3	
20	23	22.3	20.08±1.311
21	24	23.3	
22	18	17.5	

The university sports environment questionnaire in this study was revised with reference to the questionnaire compiled by Guo. The questionnaire is clearly divided into three levels (Sports physical environment, sports policy environment and sports social environment). The sub-dimensions and items included in each level are clearly defined, and the revised university sports environment questionnaire has been tested by experts. Therefore, this study adopts the factor analysis method of different levels, that is, according to the various levels of the questionnaire, the factors of the items included in the level are analyzed separately. In this phase, a total of 120 questionnaires were distributed, 120 were collected, invalid questionnaires were eliminated, and 103 valid questionnaires were obtained (Table 18).

2.1 Sports Physical Questionnaire

The results showed that the KMO value of the Sports Physical Questionnaire was 0.751, which was greater than 0.7; the chi-square value of the Bartlett sphericity

test was 154.787 (df=15), and reached a significant level ($p < 0.001$), indicating that factor analysis was appropriate. Combined with the scree plot, it was found that when two factors were selected, the questionnaire structure and item distribution were most reasonable. The university sports physical environment questionnaire obtained two factors with eigenvalues greater than 1, explaining 66.832% of the total variance, which exceeded 60%, indicating that the questionnaire had high construct validity.

The sports physical environment of university refers to the sports venues, the quantity and availability of sports equipment, the suitability of campus environment, and the sufficient time for physical exercise that affect university students' participation in physical activities. According to EFA results (Table 19), the sports physical environment of university consists of 6 items, which are divided into 2 dimensions: 1. Sports Venue and Equipment, including Q1, Q2 and Q3; 2. Sports Space and Guidelines, including Q4, Q5 and Q6.

Table 19 EFA of the Sports Physical Environment Dimension Scale

Items	Dimensions		Commonality
	1	2	
Q6	.855		.731
Q4	.810		.699
Q5	.765		.634
Q2		.846	.717
Q1		.760	.619
Q3		.726	.612
Dimension value	2.099	1.910	
Explained variance (%)	34.991	31.841	
Cumulative explained variation (%)	34.991	66.832	

2.2 Sports Policy Questionnaire

The results show that the KMO value of the Sports Policy Environment questionnaire is 0.728, which is greater than 0.7; the chi-square value of the Bartlett sphericity test is 185.230 (df=21), and it has reached a significant level ($p < 0.001$), indicating that factor analysis is suitable. Combined with the scree plot, it is found

that when two factors are selected, the questionnaire structure and item distribution are most reasonable. The university sports policy environment questionnaire obtained two factors with eigenvalues greater than 1, explaining 62.333% of the total variance, which is more than 60%, indicating that the questionnaire has a high construct validity.

The sports policy environment of university refers to the publicity and implementation of relevant policies and systems that affect university students' participation in physical exercise (activities). According to EFA results (Table 20), the sports policy environment of university consists of 6 items, which can be divided into 2 dimensions: 1.Education Policy, including Q7, Q8 and Q9; 2.Policy Implementation, including Q10, Q11, Q12 and Q13.

Table 20 EFA of the Sports Policy Environment Dimension Scale

Items	Dimensions		Commonality
	1	2	
Q13	.869		.758
Q11	.817		.675
Q12	.749		.561
Q10	.736		.569
Q7		.826	.692
Q9		.755	.575
Q8		.721	.533
Dimension value	2.553	1.811	
Explained variance (%)	36.465	25.868	
Cumulative explained variation (%)	36.465	62.333	

2.3 Sports Social Questionnaire

The results showed that the KMO value of the university sports social environment questionnaire was 0.816, which was greater than 0.7; the chi-square value of the Bartlett sphericity test was 1280.867 (df=210) and reached a significant level ($p < 0.001$), indicating that factor analysis was appropriate. Combined with the

scree plot, it was found that when two factors were selected, the questionnaire structure and item distribution were most reasonable. The university sports social environment questionnaire obtained five factors with eigenvalues greater than 1, explaining 71.555% of the total variance, which exceeded 60%, indicating that the questionnaire had high construct validity .

Table 21 EFA of the Sports Social Environment Dimension Scale

Items	Dimensions					Commonality
	1	2	3	4	5	
Q31	.861					.843
Q33	.798					.763
Q30	.758					.736
Q34	.753					.628
Q32	.740					.751
Q29	.717					.598
Q26		.897				.853
Q27		.837				.790
Q25		.748				.656
Q28		.742				.629
Q21			.859			.755
Q20			.788			.663
Q23			.732			.660
Q22			.711			.583
Q24			.672			.544
Q14				.870		.794
Q15				.866		.809
Q16				.774		.716
Q18					.907	.877
Q17					.891	.847
Q19					.635	.530
Dimension value	4.038	3.354	3.056	2.364	2.215	
Explained variance (%)	19.231	15.970	14.553	11.255	10.546	
Cumulative explained variation (%)	19.231	35.201	49.754	61.009	71.555	

The sports social environment of university refers to the physical education curriculum (specifically, physical education course, extracurricular sports activities), exercise opportunities (mainly including whether the university has various sports organizations, sports activities

organized by the university, and exercise time arrangement), and interpersonal support for university sports (specifically, teachers, peers or friends). According to EFA results (Table 21), the sports social environment of university has a total of 21 items, which are divided into 5 dimensions: 1. Physical education, including Q14, Q15 and Q16; 2. Exercise opportunities, including Q17, Q18 and Q19; 3. Teacher support, including Q20, Q21, Q22, Q23 and Q24; 4. Friend/Peer Support, including Q25, Q26, Q27 and Q28; 5. Social norms, including Q29, Q30, Q31, Q32, Q33 and Q34.

2. Intraclass Correlation Coefficient (ICC)

Table 22 Descriptive statistics of demographic characteristics of ICC

Variables	Numbers	Percentage (%)	Mean(SD)
Gender			
Male	240	53.2	
Female	211	46.8	
Total	451	100	
Year level of study			
Freshman	123	27.3	
Sophomore	119	26.4	
Junior	106	23.5	
Senior	103	22.8	
Age (year old)			
18	78	17.3	
19	104	23.1	
20	92	20.4	20.02±1.387
21	86	19.1	
22	91	20.2	

This study selected 9 classes of physical education courses through cluster sampling method. After physical education class, unified questionnaires were

distributed and collected for freshmen, sophomores and juniors. Four senior classes were selected and unified questionnaires were distributed and collected for seniors at class meetings. All questionnaires were filled out and collected on the spot. A total of 496 questionnaires were distributed for the first time, and 496 were collected, with a recovery rate of 100%. Two weeks later, the same students were distributed and collected again. Due to the absence of university students, a total of 483 questionnaires were distributed and 483 were collected, with a recovery rate of 100%. The two returned questionnaires were classified, and the missing pairing of the two questionnaires, incomplete data, questionnaires that did not meet the requirements of the questions (such as: multiple choice for single-choice questions), the same answer was selected for the entire questionnaire, and the answer time was too short. A total of 451 valid questionnaires were obtained (Table 22).

Table 23 Internal Consistency Coefficient and Test-Retest Reliability Results of the University Sports Environment scales

Scale	Dimensions	Number of Items	Cronbach's alpha		r
			T1	T2	
University Sports Environment	Physical	6	0.849	0.822	.913**
	Policy	7	0.831	0.833	.878**
	Social	21	0.935	0.931	.944**
Physical	SSG	3	0.810	0.819	.901**
	SVE	3	0.805	0.802	.855**
Policy	EP	3	0.823	0.826	.852**
	PI	4	0.808	0.808	.823**
Social	PE	3	0.819	0.828	.887**
	EO	3	0.815	0.808	.866**
	TS	5	0.822	0.813	.865**
	F/PS	4	0.830	0.825	.868**
	SN	6	0.828	0.826	.857**

Note:T1 = 1st test, T2 = 2nd test, Physical=Sports physical environment, Policy=Sports policy environment,Social=Sports social environment, SSG=Sports Space and Guidelines;SVE=Sports Venue and Equipment, EP=Education Policy,PI=Policy Implementation,PE=Physical Education, EO=Exercise Opportunities,TS=Teacher Support,F/PS=Friends or Peer Support, SN=Social Norms.

**** Correlation is significant at the 0.01 level**

As can be seen from the table 23, the Cronbach's α of the sports physical environment subscales is 0.849 (T1) and 0.822 (T2), the test-retest reliability $r= 0.913$ ($P<0.001$); the Cronbach's α of the sports policy environment subscales is 0.831(T1) and 0.833 (T2),the test-retest reliability $r= 0.878$ ($P<0.001$); the Cronbach's α of the sports social environment subscales is 0.935 (T1) and 0.931 (T2),the test-retest reliability $r= 0.944$ ($P<0.001$); Cronbach's α of all subscales is greater than 0.8, and test-retest reliability r values is greater than 0.8, It proves that the three subscales of the university sports environment have high reliability, the questionnaire has passed the reliability test.

The Cronbach's α coefficients of the two dimensions of the sports physical environment subscale ranged from 0.802 to 0.819, and the test-retest reliability r values ranged from 0.855 to 0.901; the Cronbach's α coefficients of the two dimensions of the sports policy environment subscale ranged from 0.808 to 0.826, and the test-retest reliability r values ranged from 0.823 to 0.852; the Cronbach's α coefficients of the five dimensions of the sports social environment subscale ranged from 0.808 to 0.830, and the test-retest reliability r values ranged from 0.857 to 0.887.The Cronbach's α coefficient of each dimension of the three subscales was greater than 0.8, and the test-retest reliability r values was greater than 0.8, which proved that each dimension of the three scales had high reliability and met the requirements of psychometrics.

Phase II: Analyze the relationship between the university's sports environment, exercise motivation, and exercise behavior, and further analyze different gender and year level of study.

In this study, 4430 questionnaires were distributed to students from 20 universities in Chongqing, Beijing, Shanghai, Shandong, Shaanxi, Guangxi, Henan and Gansu provinces in China. 4430 questionnaires were recovered, with a recovery rate of 100%. The collected questionnaires were classified, and incomplete data, answers that were not consistent with the requirements of the question (such as single choice questions and multiple choices), the whole questionnaire selected the same answer questionnaire, and the answer time was too short were excluded. A total of 3918 valid questionnaires were obtained (Table 24).

Table 24 Descriptive statistics of demographic characteristics

Variables	Numbers	Percentage (%)	Mean(SD)
Gender			
Male	1978	50.5	
Female	1940	49.5	
Total	3918	100	
Year level of study			
Freshman	1018	26	
Sophomore	997	25.4	
Junior	979	25	
Senior	924	23.6	
Age (year old)			
18	776	19.8	
19	786	20.1	
20	778	19.9	19.99 (1.39)
21	871	22.2	
22	707	18	

According to the table 24, the sample size included 1978 males (50.5%) and 1940 females (49.5%), with a total of 3918. 1018 first-year students (26%), 997

(25.4%), a sophomore, junior, 979 (25%), senior in 924 (23.6%); Ranging in age from 18 to 22 years old, with an average of 19.99 (1.39).

1. University Sports Environment Data Analysis

1.1 Descriptive and Correlation Analysis of University Sports Environment

Table 25 Descriptive Statistics Analysis of University Sports Environment

Items	Min	Max	M	SD	Skewness	Kurtosis
Q1	1	5	4.11	0.89	-0.785	0.216
Q2	1	5	3.61	1.10	-0.362	-0.718
Q3	1	5	3.91	0.95	-0.585	-0.244
Q4	1	5	4.08	0.91	-0.993	0.914
Q5	1	5	4.11	0.86	-0.837	0.507
Q6	1	5	3.94	0.95	-0.616	-0.082
Q7	1	5	4.34	0.81	-1.19	1.205
Q8	1	5	4.20	0.84	-1.011	1.047
Q9	1	5	3.92	1.02	-0.785	0.129
Q10	1	5	4.13	0.79	-0.692	0.37
Q11	1	5	4.39	0.85	-1.37	1.441
Q12	1	5	4.28	0.81	-0.874	0.192
Q13	1	5	4.43	0.72	-1.126	1.016
Q14	1	5	4.22	0.84	-0.915	0.58
Q15	1	5	4.15	0.84	-0.749	0.267
Q16	1	5	4.12	0.88	-0.811	0.415
Q17	1	5	4.17	0.80	-0.789	0.489
Q18	1	5	4.01	0.84	-0.518	-0.152
Q19	1	5	3.66	0.96	-0.367	-0.198
Q20	1	5	4.55	0.64	-1.265	1.237
Q21	1	5	4.20	0.82	-0.688	-0.168
Q22	1	5	4.40	0.69	-0.914	0.56

Q23	1	5	4.48	0.69	-1.128	0.765
Q24	1	5	4.23	0.80	-0.766	0.089
Q25	1	5	4.16	0.88	-0.788	0.09
Q26	1	5	4.19	0.87	-0.886	0.37
Q27	1	5	4.20	0.87	-0.932	0.444
Q28	1	5	4.38	0.80	-1.224	1.265
Q29	1	5	3.96	0.86	-0.488	-0.094
Q30	1	5	4.00	0.88	-0.602	-0.003
Q31	1	5	3.89	0.88	-0.404	-0.154
Q32	1	5	4.03	0.84	-0.518	-0.115
Q33	1	5	4.13	0.80	-0.601	-0.01
Q34	1	5	4.13	0.79	-0.564	-0.057

Analysis results showed that the data skewness range was -1.37~-0.362, and the kurtosis range was -0.718~1.441(Table 25). The normal distribution of the data is judged by checking the kurtosis and skewness of the data before data and model analysis. The common standard for evaluating data normality is that the skewness value is between ± 3 and the kurtosis value is between ± 8 . When the data is not higher or lower than this range, it means that the data conforms to the normal distribution and passes the normal test. Therefore, all items in the university sports environment questionnaire meet the requirements of approximate normal distribution, this data is suitable to analysis in this study.

Table 26 Descriptive Statistics and Correlation Analysis of overall USE

Variables	Mean(SD)	Physical	Policy	Social
Physical	3.95(0.72)			
Policy	4.24(0.54)	.592**		
Social	4.15(0.57)	.704**	.674**	
USE	4.13(0.54)	.825**	.793**	.968**

Note:Physical=Sports physical environment, Policy=Sports policy environment, Social=Sports social environment,USE=University Sports Environment.

**** Correlation is significant at the 0.01 level**

According to the table 26, the Mean (SD) and correlation of the university sports environment questionnaire and the individual subscales. The university sports environment questionnaire contains three scales: sports physical environment, sports policy environment and sports social environment. The overall Mean(SD) of the university sports environment questionnaire was 4.13(0.54), and the three subscales were 3.95(0.72), 4.24(0.54) and 4.15(0.57), respectively. The correlation of the university sports environment questionnaire and its three subscales ranged from low to high, Pearson's r values ranging from 0.592** - 0.968**, all at a significant level of 0.01. Among them, the relationship between the university sports environment questionnaire and sports physical environment ($r=0.825^{**}$), sports policy environment ($r=0.793^{**}$) and social sports environment ($r=0.968^{**}$) was significant at 0.01, reaching a high level of positive correlation. The relationship between physical environment and policy environment ($r=0.592^{**}$), policy environment and social environment ($r=0.674^{**}$) and social environment and physical environment ($r=0.704^{**}$) was significant at 0.01, reaching a medium level of positive correlation.

Table 27 Descriptive Statistics and Correlation Analysis of sports physical environment

Variables	Mean(SD)	Q1	Q2	Q3	Q4	Q5	Q6	SSG	SVE
Q1	4.11(0.88)								
Q2	3.61(1.09)	.553**							
Q3	3.91(0.94)	.459**	.586**						
Q4	4.08(0.91)	.576**	.376**	.421**					
Q5	4.11(0.85)	.602**	.436**	.379**	.648**				
Q6	3.94(0.95)	.523**	.458**	.456**	.577**	.591**			

SSG	3.87(0.81)	.791**	.878**	.818**	.542**	.562**	.573**		
SVE	4.04(0.77)	.659**	.494**	.489**	.864**	.861**	.850**	.652**	
Physical	3.95(0.72)	.799**	.760**	.723**	.770**	.779**	.779**	.913**	.905**

Note:SSG =Sports Space and Guidelines,SVE=Sports Venue and Equipment,Physical=Sports physical environment.

**** Correlation is significant at the 0.01 level**

According to the table 27, the Mean (SD) and correlation of the sports physical environment subscale, the two dimensions, and each item. sports physical environment includes the sports space and guidelines (Q1 - Q3) and sports venue and equipment (Q4 - Q6) two dimensions. The correlations between the sports physical environment subscale and the two dimensions and each item ranged from low to high, Pearson's r value ranging from 0.376**-.913**, all at a significant level of 0.01. The relationship between physical environment and SSG was the most significant ($r=0.913^{**}$), reaching a very high level of positive correlation, and the relationship between Q4 and Q2 was the lowest ($r=0.376^{**}$), reaching a low level of positive correlation.

Table 28 Descriptive Statistics and Correlation Analysis of sports policy environment

Variables	Mean(SD)	Q7	Q8	Q9	Q10	Q11	Q12	Q13	EP	PI
Q7	4.34(0.80)									
Q8	4.2(0.42)	.609**								
Q9	3.92(1.01)	.405**	.443**							
Q10	4.13(0.79)	.429**	.543**	.461**						
Q11	4.39(0.85)	-0.003	-0.017	-.041*	.071**					
Q12	4.28(0.80)	.294**	.421**	.345**	.581**	.153**				
Q13	4.43(0.71)	.336**	.345**	.273**	.501**	.241**	.562**			
EP	4.15(0.71)	.804**	.828**	.796**	.590**	-0.027	.437**	.389**		

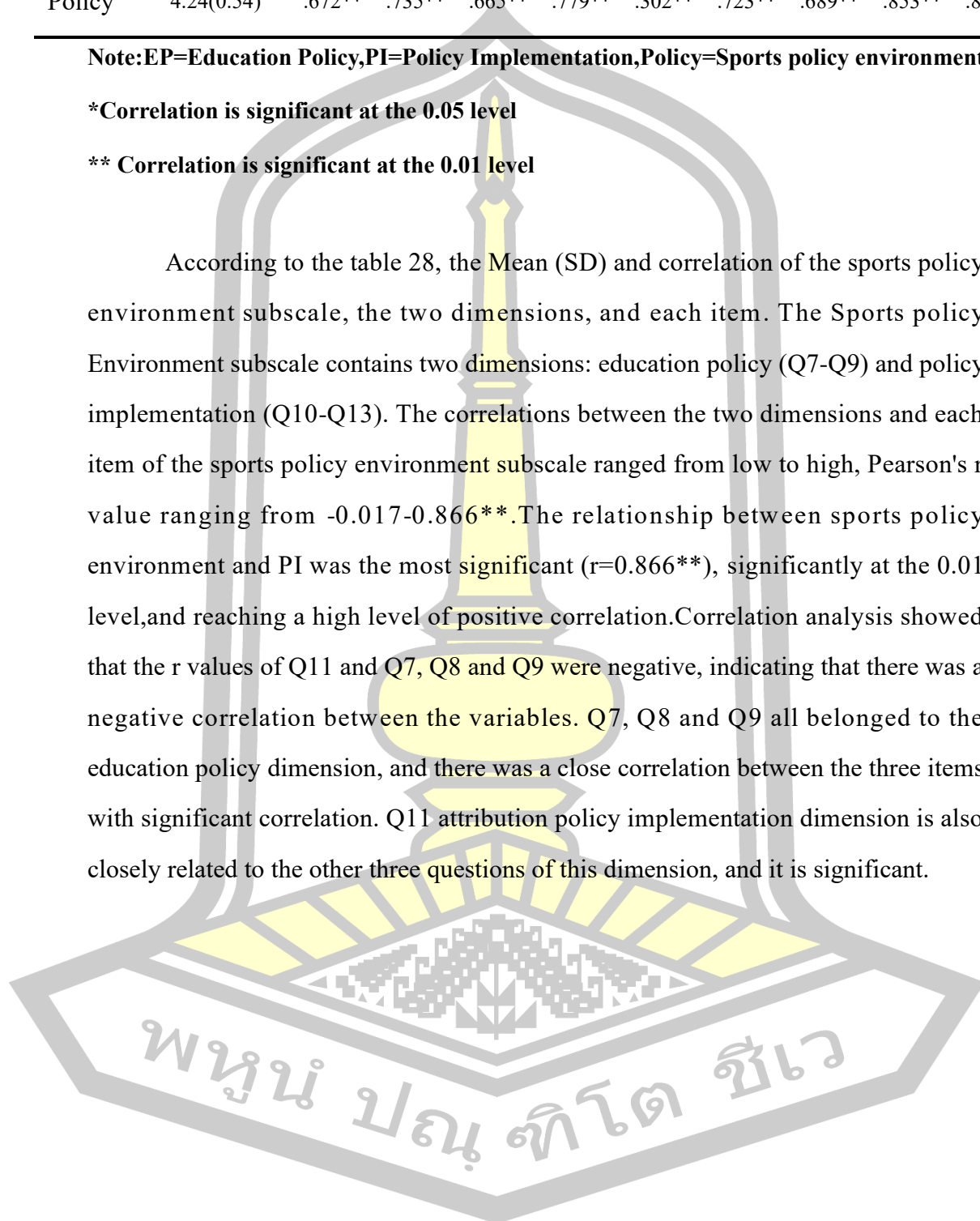
PI	4.30(0.56)	.362**	.445**	.357**	.746**	.534**	.799**	.786**	.478**	
Policy	4.24(0.54)	.672**	.735**	.665**	.779**	.302**	.723**	.689**	.853**	.866**

Note:EP=Education Policy,PI=Policy Implementation,Policy=Sports policy environment

*Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

According to the table 28, the Mean (SD) and correlation of the sports policy environment subscale, the two dimensions, and each item. The Sports policy Environment subscale contains two dimensions: education policy (Q7-Q9) and policy implementation (Q10-Q13). The correlations between the two dimensions and each item of the sports policy environment subscale ranged from low to high, Pearson's r value ranging from -0.017-0.866**. The relationship between sports policy environment and PI was the most significant ($r=0.866^{**}$), significantly at the 0.01 level, and reaching a high level of positive correlation. Correlation analysis showed that the r values of Q11 and Q7, Q8 and Q9 were negative, indicating that there was a negative correlation between the variables. Q7, Q8 and Q9 all belonged to the education policy dimension, and there was a close correlation between the three items with significant correlation. Q11 attribution policy implementation dimension is also closely related to the other three questions of this dimension, and it is significant.



Q29	3.96 (0.86)	.509**	.539**	.501**	.290**	.334**	.353**	.328**	.400**	.333**	.531**	.508**	.501**	.459**	.381**	
Q30	4.00 (0.88)	.573**	.519**	.371**	.349**	.478**	.368**	.442**	.473**	.354**	.502**	.643**	.571**	.545**	.528**	
Q31	3.89 (0.88)	.538**	.588**	.556**	.275**	.318**	.390**	.307**	.516**	.386**	.291**	.522**	.540**	.505**	.397**	
Q32	4.03 (0.83)	.533**	.557**	.529**	.363**	.411**	.451**	.362**	.474**	.448**	.357**	.491**	.572**	.504**	.471**	
Q33	4.13 (0.79)	.536**	.552**	.536**	.414**	.440**	.456**	.464**	.499**	.516**	.457**	.520**	.564**	.501**	.489**	
Q34	4.13 (0.78)	.426**	.468**	.465**	.290**	.391**	.343**	.381**	.529**	.408**	.414**	.469**	.474**	.420**	.377**	
PE	4.16 (0.77)	.909**	.923**	.889**	.438**	.462**	.500**	.487**	.592**	.567**	.442**	.637**	.642**	.630**	.586**	
EO	3.94 (0.69)	.524**	.521**	.542**	.796**	.827**	.787**	.473**	.452**	.519**	.409**	.486**	.477**	.415**	.394**	
TS	4.37 (0.58)	.609**	.630**	.615**	.497**	.494**	.413**	.800**	.818**	.850**	.756**	.812**	.549**	.514**	.469**	
F/PS	4.23 (0.73)	.653**	.651**	.596**	.328**	.333**	.516**	.384**	.521**	.501**	.399**	.584**	.861**	.899**	.892**	
SN	4.02 (0.67)	.648**	.681**	.645**	.415**	.463**	.513**	.457**	.619**	.545**	.630**	.682**	.632**	.593**	.548**	
Social	4.15 (0.57)	.784**	.802**	.770**	.557**	.584**	.626**	.612**	.720**	.705**	.752**	.772**	.744**	.706**	.683**	
															.772**	
																.743**
																.666**
																.865**
																.841**
																.736**
																.907**

Note: PE=Physical Education,EO=Exercise Opportunities,TS=Teacher Support,F/PS=Friends or Peer Support,SN=Social Norms,Social = Sports Social Environment

** Correlation is significant at the 0.01 level

According to the table 29, the Mean (SD) and correlation of the sports social environment subscale, the five dimensions, and each item. The sports social environment subscale contains five dimensions: physical education (Q14-Q16), exercise opportunities (Q17-Q19), teacher support (Q20-Q24), friend/peer support (Q25-Q28) and social norms (Q29-Q34). The correlations between the sports social environment subscale and the five dimensions and each item ranged from low to high, Pearson's r value ranging from 0.242** - 0.909**, all at a significant level of 0.01. The relationship between PE and Q14 was the most significant ($r=0.909$ **), reaching a very high level of positive correlation, and the relationship between Q18 and Q27 was the lowest ($r=0.242$ **), reaching a small coefficients level of positive correlation.

1.2 Analysis of differences in demographic characteristics of university sports environments

Table 30 Gender descriptive and difference analysis

Variables	Gender	N	M	SD	t	P
Physical	Male	1978	3.95	0.73	-0.569	0.569
	Female	1940	3.97	0.72		
Policy	Male	1978	4.24	0.56	-0.588	0.557
	Female	1940	4.25	0.53		
Social	Male	1978	4.16	0.59	0.058	0.954
	Female	1940	4.15	0.56		
SSG	Male	1978	3.87	0.83	-0.482	0.63
	Female	1940	3.88	0.80		
SVE	Male	1978	4.04	0.78	-0.554	0.579
	Female	1940	4.05	0.78		
EP	Male	1978	4.16	0.73	0.521	0.603
	Female	1940	4.15	0.71		
PI	Male	1978	4.29	0.57	-1.489	0.137
	Female	1940	4.32	0.56		

PE	Male	1978	4.16	0.76	-0.419	0.675
	Female	1940	4.17	0.78		
EO	Male	1978	3.93	0.72	-1.026	0.305
	Female	1940	3.96	0.67		
TS	Male	1978	4.37	0.60	-0.352	0.725
	Female	1940	4.38	0.58		
F/PS	Male	1978	4.25	0.74	1.281	0.200
	Female	1940	4.22	0.73		
SN	Male	1978	4.03	0.69	0.264	0.792
	Female	1940	4.02	0.66		

Note: Physical=Sports physical environment, Policy=Sports policy environment, Social=Sports social environment, SSG=Sports Space and Guidelines; SVE=Sports Venue and Equipment, EP=Education Policy, PI=Policy Implementation, PE=Physical Education, EO=Exercise Opportunities, TS=Teacher Support, F/PS=Friends or Peer Support, SN=Social Norms.

According to the table 30: The t values of Physical, Policy, Social, SSG, SVE, EP, PI, PE, EO, TS, F/PS, and SN are -0.569, -0.588, 0.058, -0.482, -0.554, 0.521, -1.489, -0.419, -1.026, -0.352, 1.281, 0.264, which did not reach the significant level ($P > 0.05$), These results indicated that all variables of the university sports environment had gender consistency characteristics, There were no significant of university sports environment between gender ($p > 0.05$).

Table 31 Year level of study descriptive and difference analysis

Variable	Year level of study	N	M	SD	F	P
Physical	Freshman	1018	4.03	0.79	9.981	<0.001**
	Sophomore	997	3.89	0.75		
	Junior	979	3.91	0.66		
	Senior	924	4.01	0.67		
Policy	Freshman	1018	4.32	0.56	16.096	<0.001**
	Sophomore	997	4.27	0.52		

	Junior	979	4.22	0.53		
	Senior	924	4.16	0.54		
Social	Freshman	1018	4.25	0.60	16.251	<0.001**
	Sophomore	997	4.10	0.61		
	Junior	979	4.10	0.53		
	Senior	924	4.18	0.55		
SSG	Freshman	1018	4.03	0.83	35.645	<0.001**
	Sophomore	997	3.82	0.82		
	Junior	979	3.69	0.81		
	Senior	924	3.96	0.75		
SVE	Freshman	1018	4.03	0.87	8.075	<0.001**
	Sophomore	997	3.96	0.81		
	Junior	979	4.13	0.68		
	Senior	924	4.06	0.73		
EP	Freshman	1018	4.21	0.74	3.023	0.029*
	Sophomore	997	4.12	0.73		
	Junior	979	4.15	0.72		
	Senior	924	4.15	0.68		
PI	Freshman	1018	4.40	0.55	37.384	<0.001**
	Sophomore	997	4.38	0.49		
	Junior	979	4.27	0.53		
	Senior	924	4.16	0.65		
PE	Freshman	1018	4.22	0.83	4.775	0.003*
	Sophomore	997	4.14	0.81		
	Junior	979	4.10	0.70		
	Senior	924	4.20	0.74		
EO	Freshman	1018	3.99	0.68	11.941	<0.001**
	Sophomore	997	3.84	0.70		

	Junior	979	3.95	0.70		
	Senior	924	4.01	0.68		
TS	Freshman	1018	4.50	0.61	24.019	<0.001**
	Sophomore	997	4.37	0.64		
	Junior	979	4.30	0.51		
	Senior	924	4.32	0.55		
F/PS	Freshman	1018	4.35	0.75	14.923	<0.001**
	Sophomore	997	4.14	0.83		
	Junior	979	4.21	0.65		
	Senior	924	4.23	0.68		
SN	Freshman	1018	4.11	0.68	21.705	<0.001**
	Sophomore	997	3.95	0.73		
	Junior	979	3.92	0.63		
	Senior	924	4.11	0.64		

Note: Physical=Sports physical environment, Policy=Sports policy environment, Social=Sports social environment, SSG=Sports Space and Guidelines; SVE=Sports Venue and Equipment, EP=Education Policy, PI=Policy Implementation, PE=Physical Education, EO=Exercise Opportunities, TS=Teacher Support, F/PS=Friends or Peer Support, SN=Social Norms.

Note: * p<0.05 ** p<0.001

According to the table 31, the F values of Physical, Policy, Social, SSG, SVE, PI, EO, TS, F/PS, and SN are 9.981, 16.096, 16.251, 35.645, 8.075, 37.384, 11.941, 24.019, 14.923, and 21.705. All reached the significant level ($P<0.001$). The F values of EP and PE were 3.023 and 4.775, which also reached the significant level ($P<0.05$). It proved that there are differences in various variables of the university sports environment in different year level of study. A post hoc test was conducted and it was found that there were varying degrees of differences among the four grades.

2. Exercise Motivation Data Analysis

2.1 Descriptive and Correlation Analysis of Exercise Motivation

Table 32 Descriptive Statistics Analysis of exercise motivation

Items	Min	Max	M	SD	Skewness	Kurtosis
M1	1	5	4.39	0.75	-1.01	0.537
M2	1	5	4.51	0.64	-1.007	0.199
M3	2	5	4.55	0.63	-1.134	0.428
M4	1	5	4.41	0.75	-1.096	0.823
M5	1	5	4.50	0.67	-1.123	0.573
M6	1	5	4.36	0.75	-0.958	0.436
M7	1	5	4.45	0.69	-1.005	0.483
M8	2	5	4.57	0.62	-1.185	0.414
M9	2	5	4.55	0.62	-1.079	0.155
M10	1	5	4.38	0.71	-0.856	0.111
M11	1	5	4.35	0.72	-0.826	0.201
M12	1	5	4.19	0.84	-0.888	0.533
M13	1	5	4.34	0.74	-1.004	1.021
M14	1	5	4.38	0.69	-0.957	1.069
M15	1	5	4.43	0.67	-0.95	0.714
M16	1	5	3.37	1.51	-0.307	-1.411
M17	1	5	3.38	1.56	-0.353	-1.437
M18	1	5	3.70	1.31	-0.621	-0.811
M19	1	5	4.31	0.78	-0.92	0.528
M20	1	5	4.26	0.76	-0.735	0.189
M21	1	5	4.24	0.77	-0.757	0.242
M22	1	5	4.10	0.96	-0.778	-0.059
M23	1	5	4.09	0.94	-0.76	-0.046
M24	1	5	4.29	0.84	-1.145	1.23
M25	1	5	4.13	0.79	-0.599	0.099
M26	1	5	4.30	0.73	-0.737	0.132
M27	1	5	4.29	0.76	-0.81	0.221

Analysis results showed that the data skewness range was -1.185~0.307, and the kurtosis range was -1.437 ~ 1.23 (table 32). The normal distribution of the data is judged by checking the kurtosis and skewness of the data before data and model analysis. The common standard for evaluating data normality is that the skewness value is between ± 3 and the kurtosis value is between ± 8 . When the data is not higher or lower than this range, it means that the data conforms to the normal distribution and passes the normal test. Therefore, all items in the exercise motivation questionnaire meet the requirements of approximate normal distribution, this data is suitable to analysis in this study.

Table 33 Descriptive Statistics and Correlation Analysis of overall exercise motivation

Variables	Mean(SD)	Intrinsic	Extrinsic
Intrinsic	4.42(0.52)		
Extrinsic	4.03(0.61)	.634**	
Exercise Motivation	4.25(0.50)	.911**	.897**

Note: Intrinsic=Intrinsic Motivation, Extrinsic=Extrinsic Motivation.

**** Correlation is significant at the 0.01 level**

According to the table 33, the Mean (SD) and correlation of the exercise motivation questionnaire and each subscales. The Exercise Motivation Questionnaire contains two subscales: intrinsic motivation and extrinsic motivation. The overall Mean (SD) of the exercise motivation questionnaire was 4.25 (0.50), and the two subscales were 4.03 (0.61) and 4.42 (0.52) respectively. The correlation of exercise motivation questionnaire and its two subscales ranged from low to high, Pearson's r value ranging from 0.634** - 0.911**, all at 0.01 significant level. The exercise motivation questionnaire was highly positively correlated with Intrinsic ($r=0.911^{**}$) and Extrinsic ($r=0.897^{**}$) subscales. The relationship between Intrinsic and Extrinsic ($r=0.634^{**}$) reached a moderate positive correlation level.

Table 34 Descriptive Statistics and Correlation Analysis of Intrinsic Motivation

According to the table 34, the Mean (SD) and correlation of the intrinsic motivation subscale, five dimensions and each item. The intrinsic motivation subscale includes five dimensions: health motivation (M1-M3), appearance motivation (M4-M6), Pleasure motivation (M7-M9), curiosity motivation (M10-M12) and social motivation (M13-M15). The intrinsic motivation subscale Mean (SD) is 4.42 (0.52). The correlations between the intrinsic motivation subscale and the five dimensions and each item ranged from low to high, Pearson's r value ranging from 0.366** - 0.918**, all at a significant level of 0.01. The relationship between HM and M2 is the most significant ($r=0.918^{**}$), reaching a very high level of positive correlation, and the relationship between M3 and M12 is the lowest ($r=0.366^{**}$), reaching a low level of positive correlation.

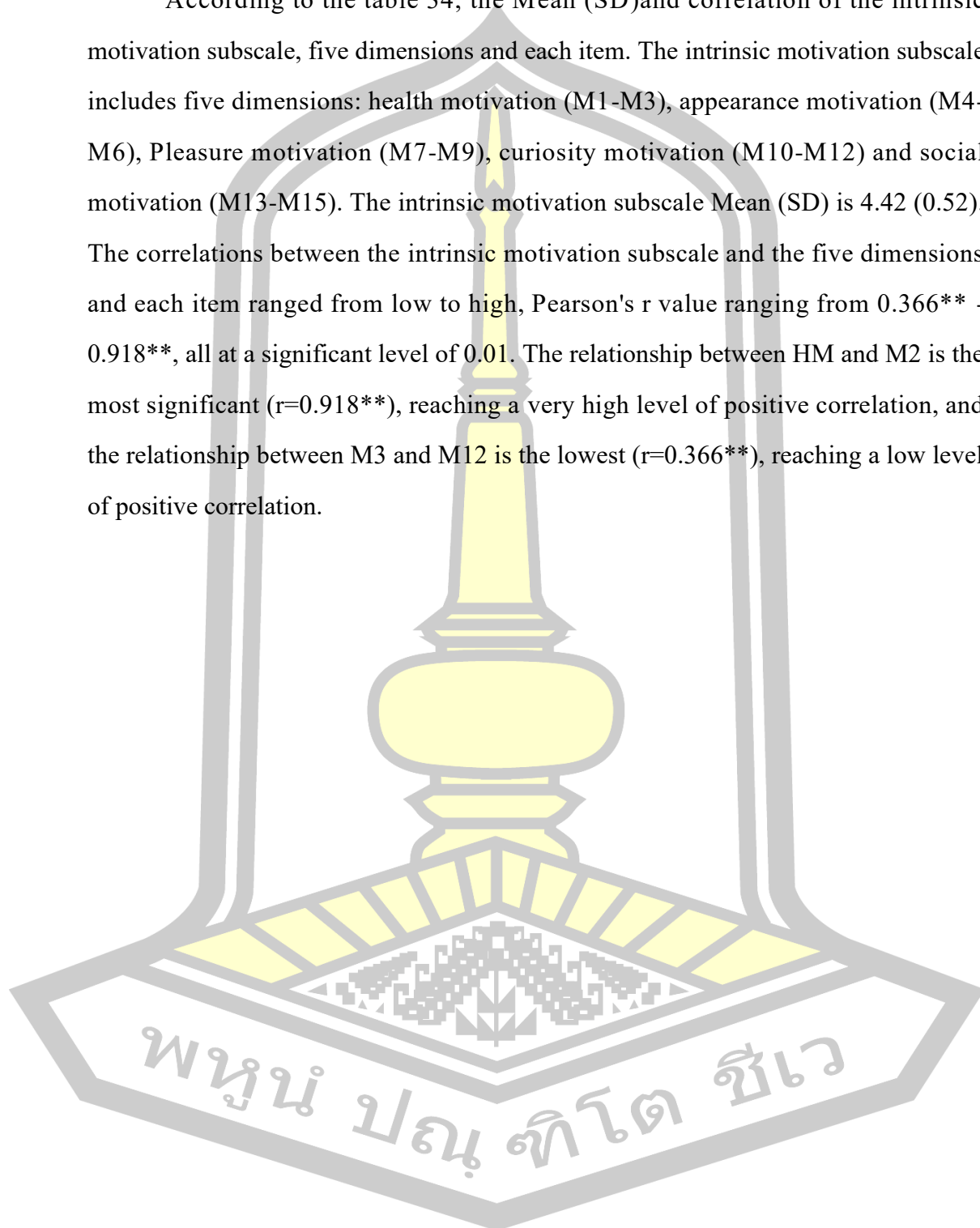


Table 35 Descriptive Statistics and Correlation Analysis of Extrinsic Motivation

Variables	Mean																					
	(SD)	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	HM	AM	FM	CM	SM	
M1	4.39(0.74)																					
M2	4.51(0.64)	.727**																				
M3	4.55(0.62)	.619**	.744**																			
M4	4.41(0.74)	.448**	.488**	.467**																		
M5	4.50(0.67)	.437**	.515**	.513**	.702**																	
M6	4.36(0.75)	.448**	.489**	.392**	.614**	.632**																
M7	4.45(0.68)	.594**	.589**	.529**	.515**	.543**	.584**															
M8	4.57(0.62)	.542**	.660**	.642**	.456**	.510**	.507**	.664**														
M9	4.55(0.62)	.508**	.619**	.618**	.464**	.532**	.514**	.610**	.758**													
M10	4.38(0.71)	.530**	.568**	.468**	.526**	.580**	.556**	.615**	.570**	.610**												
M11	4.35(0.71)	.468**	.498**	.478**	.558**	.607**	.536**	.560**	.503**	.539**	.732**											
M12	4.19(0.84)	.396**	.398**	.366**	.467**	.461**	.431**	.459**	.375**	.384**	.534**	.591**										
M13	4.34(0.73)	.499**	.550**	.507**	.403**	.410**	.441**	.545**	.532**	.496**	.575**	.522**	.463**									
M14	4.38(0.69)	.487**	.551**	.554**	.485**	.475**	.479**	.540**	.538**	.505**	.482**	.553**	.483**	.678**								
M15	4.43(0.66)	.497**	.593**	.608**	.474**	.519**	.467**	.551**	.571**	.542**	.527**	.584**	.445**	.668**	.760**							
HM	4.482(0.59)	.890**	.918**	.870**	.523**	.544**	.497**	.641**	.684**	.647**	.585**	.538**	.434**	.580**	.592**	.629**						
AM	4.42(0.63)	.508**	.567**	.520**	.884**	.880**	.861**	.626**	.560**	.574**	.632**	.646**	.517**	.478**	.548**	.555**	.595**					
PM	4.52(0.56)	.621**	.702**	.671**	.542**	.597**	.606**	.866**	.907**	.885**	.677**	.604**	.461**	.594**	.597**	.626**	.742**	.665**				
CM	4.30(0.65)	.534**	.560**	.503**	.597**	.632**	.584**	.626**	.553**	.584**	.862**	.887**	.840**	.599**	.586**	.597**	.597**	.689**	.666**			
SM	4.38(0.62)	.552**	.630**	.620**	.506**	.521**	.516**	.610**	.611**	.574**	.591**	.617**	.519**	.881**	.906**	.898**	.670**	.588**	.676**	.664**		
Intrinsic	4.42(0.52)	.727**	.790**	.744**	.720**	.749**	.722**	.788**	.773**	.762**	.790**	.779**	.658**	.737**	.760**	.778**	.843**	.834**	.875**	.856**	.847**	

Note:Intrinsic=Intrinsic Motivation, HM=Health Motivation, AM=Appearance Motivation, PM=Pleasure Motivation, CM=Curiosity Motivation, SM=Social Motivation.

**** Correlation is significant at the 0.01 level**

Variables	Mean (SD)	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	ACM	IDM	ECM	HOM
M16	3.37(1.51)																
M17	3.38(1.55)	.905*															
M18	3.70(1.31)	.831*	.853*														
M19	4.31(0.77)	.059*	.039*	.098*													
M20	4.26(0.75)	.089*	.052*	.096*	.696*												
M21	4.24(0.77)	.110*	.080*	.109*	.587*	.706*											
M22	4.10(0.95)	.147*	.125*	.166*	.496*	.430*	.478*										
M23	4.09(0.94)	.215*	.182*	.200*	.428*	.465*	.517*	.713*									
M24	4.29(0.83)	.208*	.188*	.217*	.409*	.439*	.499*	.599*	.551*								
M25	4.13(0.78)	.177*	.157*	.178*	.380*	.453*	.515*	.497*	.482*	.574*							
M26	4.30(0.72)	.116*	.075*	.113*	.481*	.592*	.516*	.345*	.377*	.455*	.560*						
M27	4.29(0.75)	.099*	.078*	.121*	.547*	.486*	.440*	.514*	.424*	.485*	.575*	.607*					
ACM	3.48(1.39)	.957*	.959*	.927*	.089*	.104*	.126*	.166*	.218*	.230*	.191*	.123*	.124*				
IDM	4.27(0.68)	.108*	.073*	.122*	.858*	.900*	.864*	.531*	.532*	.511*	.504*	.603*	.556*	.130*			
ECM	4.16(0.79)	.231*	.202*	.232*	.516*	.521*	.576*	.898*	.884*	.791*	.593*	.454*	.542*	.247*	.613*		
HOM	4.24(0.65)	.164*	.131*	.168*	.545*	.593*	.570*	.541*	.505*	.594*	.848*	.830*	.846*	.181*	.647*	.630*	
Extrinsic	4.03(0.61)	.672*	.652*	.669*	.554*	.589*	.601*	.647*	.666*	.654*	.628*	.556*	.576*	.705*	.661*	.762*	.694*

Note: Extrinsic=Extrinsic Motivation, ACM=Academic Motivation, IDM=Identification Motivation, ECM=Economic Motivation, HOM=Honor Motivation.

*Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

According to the table 35, the Mean (SD) and correlation of the external motivation subscale, four dimensions and each item. The extrinsic motivation subscale includes four dimensions: academic motivation (M16-M18), identification Motivation(M19-M21), economic motivation (M22-M24) and honor motivation (M25-M27). The Mean (SD) of the extrinsic motivation subscale is 4.03 (0.61). The correlations between the extrinsic motivation subscale and the four dimensions and each question ranged from low to high, with Pearson's r values ranging from 0.039* - 0.959**. The relationship between ACM and M17 was the most significant ($r=0.959^{**}$) significantly at the 0.01 level, reaching a high level of positive correlation, while the relationship between M17 and M19 was the lowest ($r=0.039^*$), significantly at the 0.05 level reaching a small coefficients level of positive correlation.

2.2 Analysis of differences in demographic characteristics of exercise motivation

Table 36 Gender descriptive and difference analysis

Variable	Gender	N	M	SD	t	P
Intrinsic	Male	1978	4.42	0.54	-0.769	0.442
	Female	1940	4.43	0.51		
Extrinsic	Male	1978	4.05	0.62	0.682	0.495
	Female	1940	4.03	0.60		
HM	Male	1978	4.51	0.60	2.674	0.008*
	Female	1940	4.46	0.60		
AM	Male	1978	4.36	0.67	-6.437	<0.001**
	Female	1940	4.49	0.58		
PM	Male	1978	4.54	0.57	1.414	0.158
	Female	1940	4.51	0.57		
CM	Male	1978	4.30	0.66	-0.638	0.523
	Female	1940	4.32	0.64		

SM	Male	1978	4.39	0.63	0.068	0.945
	Female	1940	4.38	0.62		
ACM	Male	1978	3.46	1.39	-0.909	0.363
	Female	1940	3.50	1.41		
IDM	Male	1978	4.30	0.68	2.395	0.017*
	Female	1940	4.24	0.69		
ECM	Male	1978	4.18	0.80	0.898	0.369
	Female	1940	4.15	0.79		
HOM	Male	1978	4.25	0.66	0.905	0.365
	Female	1940	4.23	0.64		

Note:Intrinsic=Intrinsic Motivation, HM=Health Motivation, AM=Appearance Motivation, PM=Pleasure Motivation, CM=Curiosity Motivation, SM=Social Motivation, Extrinsic=Extrinsic Motivation, ACM=Academic Motivation, IDM=Identification Motivation, ECM=Economic Motivation, HOM=Honor Motivation.

Note: * $p < 0.05$ ** $p < 0.001$

According to the table 36: The t values of Intrinsic, Extrinsic, PM, CM, SM, ACM, ECM, and HOM are -0.769, 0.682, 1.414, -0.638, 0.068, -0.909, 0.898, 0.905, which did not reach the significant level ($P > 0.05$), It was proved that eight variables of exercise motivation have gender consistency characteristics. The t values of HM ($P < 0.05$), AM ($P < 0.001$), and IDM ($P < 0.05$), It was proved that three are gender differences in these three variables in exercise motivation, and they reach a significant level.

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Table 37 Year level of study descriptive and difference analysis

Variable	Gender	N	M	SD	F	P
Intrinsic	Freshman	1018	4.48	0.56	5.535	<0.001**
	Sophomore	997	4.38	0.57		
	Junior	979	4.43	0.46		
	Senior	924	4.41	0.48		
Extrinsic	Freshman	1018	4.40	0.55	418.941	<0.001**
	Sophomore	997	4.25	0.58		
	Junior	979	3.76	0.49		
	Senior	924	3.70	0.50		
HM	Freshman	1018	4.49	0.63	7.729	<0.001**
	Sophomore	997	4.41	0.67		
	Junior	979	4.54	0.53		
	Senior	924	4.49	0.54		
AM	Freshman	1018	4.51	0.64	9.708	<0.001**
	Sophomore	997	4.44	0.61		
	Junior	979	4.38	0.66		
	Senior	924	4.37	0.61		
PM	Freshman	1018	4.55	0.59	11.588	<0.001**
	Sophomore	997	4.46	0.62		
	Junior	979	4.60	0.52		
	Senior	924	4.49	0.53		
CM	Freshman	1018	4.40	0.66	11.931	<0.001**
	Sophomore	997	4.29	0.68		
	Junior	979	4.23	0.65		
	Senior	924	4.31	0.61		
SM	Freshman	1018	4.43	0.63	5.596	<0.001**
	Sophomore	997	4.32	0.67		

	Junior	979	4.39	0.58		
	Senior	924	4.40	0.62		
ACM	Freshman	1018	4.67	0.50	3004.723	<0.001**
	Sophomore	997	4.54	0.55		
	Junior	979	2.48	1.04		
	Senior	924	2.09	0.88		
IDM	Freshman	1018	4.28	0.75	8.149	<0.001**
	Sophomore	997	4.18	0.73		
	Junior	979	4.33	0.58		
	Senior	924	4.30	0.65		
ECM	Freshman	1018	4.34	0.80	28.347	<0.001**
	Sophomore	997	4.10	0.92		
	Junior	979	4.04	0.67		
	Senior	924	4.17	0.73		
HOM	Freshman	1018	4.31	0.64	8.857	<0.001**
	Sophomore	997	4.18	0.70		
	Junior	979	4.20	0.62		
	Senior	924	4.27	0.63		

Note: Intrinsic=Intrinsic Motivation, HM=Health Motivation, AM=Appearance Motivation, PM=Pleasure Motivation, CM=Curiosity Motivation, SM=Social Motivation, Extrinsic=Extrinsic Motivation, ACM=Academic Motivation, IDM=Identification Motivation, ECM=Economic Motivation, HOM=Honor Motivation.

Note: * p<0.05 ** p<0.001

According to the table 37, the F values of Intrinsic, Extrinsic, HM, AM, PM, CM, SM, ACM, IDM, ECM, and HOM are 5.535, 418.941, 7.729, 9.708, 11.588, 11.931, 5.596, 3004.723, 8.149, 28.347, and 8.857. All reached the significant level (P<0.001). It proved that there are differences in various variables of the exercise

motivation in different year level of study. A post hoc test was conducted and it was found that there were varying degrees of differences among the four grades.

3.Exercise Behavior Data Analysis

3.1 Gender Difference Analysis

Table 38 Exercise behavior variable statistical analysis of different gender

Variables	Statistics	Gender		Total	P
		Male	Female		
Light Exercise Behavior	Number	1179	1289	2468	
	Exercise behavior%	47.80%	52.20%	100.00%	
	Gender%	59.60%	66.40%	63.00%	
	Total%	30.10%	32.90%	63.00%	
Medium Exercise Behavior	Number	502	453	955	
	Exercise behavior%	52.60%	47.40%	100.00%	
	Gender%	25.40%	23.40%	24.40%	<0.001**
	Total%	12.80%	11.60%	24.40%	
Heavy Exercise Behavior	Number	297	198	495	
	Exercise behavior%	60.00%	40.00%	100.00%	
	Gender%	15.00%	10.20%	12.60%	
	Total%	7.60%	5.10%	12.60%	
Total		1978	1940	3918	

According to the table 38, the number and percentage of male university students and female university students in exercise behavior are 2,468 (63%) in light exercise behavior, 955 (24.4%) in medium exercise behavior, and 495 (12.6%) in heavy exercise behavior. Male students have higher exercise behavior than female students in heavy exercise behavior and medium exercise behavior, There were significant differences ($P < 0.001$).

3.2 Year level of study Difference Analysis

Table 39 Exercise behavior variable statistical analysis of different year level of study

Variables	Statistics	Year level of study				Total	P
		Freshman	Sophomore	Junior	Senior		
Light Exercise Behavior	Number	577	599	632	660	2468	
	Exercise behavior%	23.40%	24.30%	25.60%	26.70%	100.00%	
	Year level of study%	56.70%	60.10%	64.60%	71.40%	63.00%	
	Total%	14.70%	15.30%	16.10%	16.80%	63.00%	
Medium Exercise Behavior	Number	255	263	236	201	955	
	Exercise behavior%	26.70%	27.50%	24.70%	21.00%	100.00%	
	Year level of study%	25.00%	26.40%	24.10%	21.80%	24.40%	<0.001**
	Total%	6.50%	6.70%	6.00%	5.10%	24.40%	
Heavy Exercise Behavior	Number	186	135	111	63	495	
	Exercise behavior%	37.60%	27.30%	22.40%	12.70%	100.00%	
	Year level of study%	18.30%	13.50%	11.30%	6.80%	12.60%	
	Total%	4.70%	3.40%	2.80%	1.60%	12.60%	
Total		1018	997	979	924	3918	

According to the table 39, the number and percentage of exercise behaviors in university students of different year level of study are as follows: The heavy exercise behavior are freshman 186 (37.6%) > sophomore 135 (27.3%) > junior 111 (22.4%) > senior 63 (12.7%). The medium exercise behaviors are sophomore 263 (27.5%) > freshman 255 (26.7%) > junior 236 (24.7%) > senior 201 (21%), There were significant differences (P<0.001).

4. Correlation analysis among university sports environment, exercise motivation and exercise behavior

Table 40 Correlation between university sports environment and exercise behavior

Variables	SSG	SVE	EP	PI	PE	EO	TS	F/PS	SN
SVE	.685**								
EP	.570**	.619**							
PI	.414**	.449**	.542**						
PE	.661**	.641**	.626**	.580**					
EO	.415**	.432**	.483**	.463**	.592**				
TS	.526**	.519**	.542**	.611**	.702**	.572**			
F/PS	.628**	.580**	.595**	.483**	.724**	.533**	.655**		
SN	.590**	.548**	.575**	.505**	.731**	.612**	.686**	.742**	
EB	.368**	.263**	.288**	.280**	.356**	.224**	.325**	.392**	.339**

Note: SSG=Sports Space and Guidelines;SVE=Sports Venue and Equipment, EP=Education Policy,PI=Policy Implementation,PE=Physical Education, EO=Exercise Opportunities, TS=Teacher Support, F/PS=Friends or Peer Support, SN=Social Norms,EB=Exercise Behavior.

** Correlation is significant at the 0.01 level

The correlation between the nine dimensions of university sports environment and exercise behavior was from low to high, Pearson's r value was between 0.224**-.0.392**, all at the significance level of 0.01. The relationship between EB and F/PT was the most significant ($r=0.392^{**}$), reaching the low positive correlation level. The relationship between EB and EO was the lowest ($r=0.224^{**}$). Therefore, this data is suitable to analysis in this study.

Table 41 Correlation between university sports environment and exercise motivation

Variables	SSG	SVE	EP	PI	PE	EO	TS	F/PS	SN	HM	AM	PM	CM	SM	ACM	IDM	ECM
SVE	.685**																
EP	.570**	.619**															
PI	.414**	.449**	.542**														
PE	.661**	.641**	.626**	.580**													
EO	.415**	.432**	.483**	.463**	.592**												
TS	.526**	.519**	.542**	.611**	.702**	.572**											
F/PS	.628**	.580**	.595**	.483**	.724**	.533**	.655**										
SN	.590**	.548**	.575**	.505**	.731**	.612**	.686**	.742**									
HM	.331**	.333**	.405**	.421**	.465**	.457**	.550**	.459**	.467**								
AM	.378**	.344**	.405**	.427**	.441**	.375**	.473**	.461**	.459**	.585**							
PM	.326**	.361**	.422**	.458**	.468**	.419**	.515**	.473**	.472**	.691**	.710**						
CM	.517**	.424**	.421**	.427**	.550**	.387**	.497**	.556**	.531**	.565**	.673**	.678**					
SM	.347**	.310**	.339**	.381**	.426**	.362**	.518**	.440**	.455**	.656**	.565**	.631**	.640**				
ACM	.163**	.081**	.148**	.269**	.177**	.080**	.285**	.197**	.147**	.182**	.248**	.213**	.239**	.192**			
IDM	.405**	.411**	.390**	.350**	.504**	.397**	.486**	.529**	.485**	.576**	.514**	.579**	.613**	.611**	.130**		
ECM	.470**	.372**	.405**	.324**	.477**	.353**	.437**	.533**	.495**	.435**	.471**	.429**	.563**	.492**	.247**	.613**	
HOM	.443**	.378**	.422**	.397**	.530**	.430**	.470**	.541**	.556**	.557**	.574**	.608**	.671**	.584**	.181**	.647**	.630**

Note: SSG=Sports Space and Guidelines;SVE=Sports Venue and Equipment, EP=Education Policy,PI=Policy Implementation,PE=Physical Education, EO=Exercise Opportunities, TS=Teacher Support, F/PS=Friends or Peer Support, SN=Social Norms,HM=Health Motivation , AM=Appearance Motivation, PM=Pleasure Motivation, CM=Curiosity Motivation, SM=Social Motivation, ACM=Academic Motivation,IDM=Identification Motivation, ECM=Economic Motivation,HOM=Honor Motivation.

** Correlation is significant at the 0.01 level

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According to the correlation analysis in Table 41, The correlation between the nine dimensions of university sports environment and the nine dimensions of exercise motivation was from low to high, Pearson's r value was between 0.080** -0.742**, all at the significance level of 0.01. The relationship between SN and F/PT was the most significant ($r=0.742^{**}$) and reached a high positive correlation level, while the relationship between ACM and EO was the lowest ($r=0.080^{**}$). Therefore, this data is suitable to analysis in this study.

Table 42 Correlation between exercise motivation and exercise behavior

Variables	HM	AM	PM	CM	SM	ACM	IDM	ECM	HOM
AM	.585**								
PM	.691**	.710**							
CM	.565**	.673**	.678**						
SM	.656**	.565**	.631**	.640**					
ACM	.182**	.248**	.213**	.239**	.192**				
IDM	.576**	.514**	.579**	.613**	.611**	.130**			
ECM	.435**	.471**	.429**	.563**	.492**	.247**	.613**		
HOM	.557**	.574**	.608**	.671**	.584**	.181**	.647**	.630**	
EB	.238**	.297**	.276**	.358**	.224**	.182**	.253**	.274**	.335**

Note:HM=Health Motivation, AM=Appearance Motivation, PM=Pleasure Motivation, CM=Curiosity Motivation, SM=Social Motivation, ACM=Academic Motivation, IDM=Identification Motivation, ECM=Economic Motivation, HOM=Honor Motivation, EB=Exercise Behavior.

**** Correlation is significant at the 0.01 level**

The correlation between the nine dimensions of exercise motivation and exercise behavior was from low to high, Pearson's r value was between 0.182** -0.358**, all at the significance level of 0.01. The relationship between EB and CM was the most significant ($r=0.358^{**}$), reaching the low positive correlation level. The relationship between EB and EO was the lowest ($r=0.182^{**}$). Therefore, this data is suitable to analysis in this study.

Table 43 Correlation analysis among university sports environment, exercise motivation and exercise behavior

Variables	Physical	policy	Social	Intrinsic	Extrinsic	USE	EM
Policy	.623**						
Social	.703**	.699**					
Intrinsic	.493**	.540**	.658**				
Extrinsic	.439**	.457**	.551**	.641**			
USE	.826**	.817**	.964**	.659**	.560**		
EM	.514**	.556**	.668**	.904**	.895**	.675**	
EB	.340**	.322**	.381**	.331**	.326**	.397**	.359**

Note:Physical=Sports physical environment,Policy=Sports policy environment, Social=Sports social environment, USE=University Sports Environment,EM=Exercise Motivation,Intrinsic=Intrinsic Motivation,Extrinsic=Extrinsic Motivation,EB=Exercise Behavior.

**** Correlation is significant at the 0.01 level**

The correlation between university sports environment, exercise motivation and exercise behavior was from low to high, Pearson's r value was 0.359**-.397**, all at the significance level of 0.01. The relationship between EB and USE was the most significant ($r=0.397^{**}$) and reached a low level of positive correlation, while the relationship between EB and EM was the lowest ($r=0.359^{**}$). Therefore, this data is suitable to analysis in this study. Structural equation models can be constructed.

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Phase III: To create equations to predict physical exercise behavior for Chinese university students, and to put forward strategies for promoting exercise behavior for Chinese university students.

1. Multivariate Regression Analysis of University Sports Environment, Exercise Motivation, and Exercise Behavior

According to the analysis of Table (40、41、42、43), it is proved that there are different degrees of correlation between the university sports environment, exercise motivation and exercise behavior. In order to further understand whether the dimensions of university sports environment and exercise motivation can predict the exercise behavior of university students. Therefore, this study conducted a multiple regression analysis on university sports environment, exercise motivation, and exercise behavior. According to the research Objectives, this study proposes three regression models, which are as follows:

Regression model 1: The dependent variable is exercise motivation, and the independent variables are sports physical environment, sports policy environment, and sports social environment.

Regression model 2: The dependent variable is exercise behavior, and the independent variables are sports physical environment, sports policy environment, and sports social environment.

Regression model 3: The dependent variable is exercise behavior, and the independent variables are intrinsic motivation and extrinsic motivation.

Regression model 4: The dependent variable is exercise behavior, and the independent variables are sports physical environment, sports policy environment, sports social environment, intrinsic motivation, and extrinsic motivation.

Table 44 Multiple regression analysis of university sports environment and exercise motivation

Model	Variables	R	R ²	F	B	β	TOL	VIF	D-W
	B0				1.623				
Exercise Motivation	Social Environment	0.659	0.434	3008.764**	0.492	0.56	0.546	1.833	1.713
	Policy Environment	0.668	0.446	1578.218**	0.139	0.148	0.546	1.833	

Note: ** p<0.001

Regression model 1: The dependent variable is exercise motivation, and the independent variables are sports physical environment, sports policy environment, and sports social environment.

According to the analysis of table 44, it can be seen that there are two variables that had significant predictive power on exercise motivation among the three predictor variables in the university sports environment, which were sports social environment and sports policy environment in order. The multiple correlation coefficient between the two predictor variables and exercise motivation was 0.668, and the coefficient of determination was 0.446. The F value of the regression model integrity test was 1578.218 (P<0.001), Therefore, the two variables of university sports environment can effectively explain 44.6% of the variation of exercise motivation. The regression model was overall significant. The sports social environment and sports policy environment in the university sports environment had significant explanatory power on exercise motivation. The standardized regression coefficients were 0.56 and 0.148 respectively, both positive numbers, indicating that both the sports social environment and the sports policy environment in the university sports environment had a positive and significant impact on exercise motivation.

Table 45 Multiple regression analysis of university sports environment and exercise behavior

Model	Variables	R	R ²	F	B	β	TOL	VIF	D-W
	B0				-0.558				
Exercise Behavior	Social Environment	0.368	0.135	612.77**	0.304	0.249	0.403	2.483	1.829
	Physical Environment	0.377	0.142	324.453**	0.098	0.1	0.48	2.085	
	Policy Environment	0.381	0.145	221.133**	0.095	0.073	0.518	1.929	

Note: ** p<0.001

Regression model 2: The dependent variable is exercise behavior, and the independent variables are sports physical environment, sports policy environment, and sports social environment.

According to the analysis of table 45, it can be seen that the three predictor variables in the university sports environment had significant predictive power on exercise behavior. The multiple correlation coefficient between the three predictor variables and exercise behavior was 0.381, the coefficient of determination was 0.145, the F value of the regression model integrity test was 221.133 (P<0.001), Therefore, the three variables of university sports environment can effectively explain 14.5% of the variation of exercise behavior. The R square was comparatively low, reflecting the multi-factor complexity of the dependent variable. Nevertheless, the regression model was overall significant, and the sports social environment, the sports physical environment and the sports policy environment in the university sports environment had significant explanatory power on exercise behavior. The standardized regression coefficients were 0.2439, 0.1 and 0.073 respectively, all positive numbers, indicating that the sports social environment, sports physical environment and sports policy environment in the university sports environment had a positive and significant impact on university students' exercise behavior.

Table 46 Multiple regression analysis of exercise motivation and exercise behavior

Model	Variables	R	R ²	F	B	β	TOL	VIF	D-W
	B0				-.549				
Exercise Behavior	Intrinsic Motivation	0.328	0.108	471.89**	0.256	0.221	0.599	1.671	1.886
	Extrinsic Motivation	0.353	0.125	278.652**	0.228	0.169	0.599	1.671	

Note: ** p<0.001

Regression model 3: The dependent variable is exercise behavior, and the independent variables are intrinsic motivation and extrinsic motivation.

According to the analysis of table 46, it can be seen that the two predictor variables of exercise motivation had significant predictive power on exercise behavior. The multiple correlation coefficient of the two predictor variables and exercise behavior was 0.353, the coefficient of determination was 0.125, the F value of the regression model integrity test was 278.652 (P<0.001), Therefore, the two variables of exercise motivation can effectively explain 12.5% of the variation of exercise behavior. The R square was comparatively low, reflecting the multi-factor complexity of the dependent variable, Nevertheless, the regression model was overall significant, and the intrinsic motivation and Extrinsic motivation had significant explanatory power on exercise behavior. The standardized regression coefficients were 0.221 and 0.169 respectively, both positive numbers, indicating that both intrinsic motivation and extrinsic motivation in exercise motivation had a positive and significant impact on university students' exercise behavior.

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Table 47 Multiple regression analysis of university sports environment, exercise motivation and exercise behavior

Model	Variables	R	R ²	F	B	β	TOL	VIF	D-W
	B0				-0.918				
Exercise Behavior	Social Environment	.368	0.135	612.77**	0.189	0.154	0.324	3.086	1.862
	Extrinsic Motivation	.398	0.158	367.453**	0.179	0.154	0.561	1.781	
	Physical Environment	.405	0.164	255.609**	0.095	0.097	0.479	2.09	
	Policy Environment	.407	0.165	193.714**	0.064	0.049	0.507	1.973	
	Intrinsic Motivation	.408	0.166	155.945**	0.059	0.044	0.47	2.126	

Note: ** p<0.001

Regression model 4: The dependent variable is exercise behavior, and the independent variables are sports physical environment, sports policy environment, sports social environment, intrinsic motivation, and extrinsic motivation.

According to the analysis of table 47, it can be seen that the five predictor variables of university sports environment and exercise motivation had significant predictive power on exercise behavior. The multiple correlation coefficient of the five predictor variables and exercise behavior was 0.408, the coefficient of determination was 0.166, the F value of the regression model integrity test was 155.945 (P<0.001), Therefore, the five variables of university sports environment and exercise motivation can effectively explain 16.6% of the variation of exercise behavior. The R square was comparatively low, reflecting the multi-factor complexity of the dependent variable, Nevertheless, the regression model was overall significant, and the university sports environment and exercise motivation had a significant impact on Exercise behavior had significant explanatory power. The standardized regression coefficients were 0.154, 0.154, 0.479, 0.507 and 0.47 respectively, all positive numbers, indicating that both the university sports environment and exercise motivation had a positive and significant impact on university students' exercise behavior.

2.SEM

With the conceptual model as the theoretical guide, the university sports environment, exercise motivation and exercise behavior were put into the structural equation model for analysis. The structural equation model is shown in Figure 11.

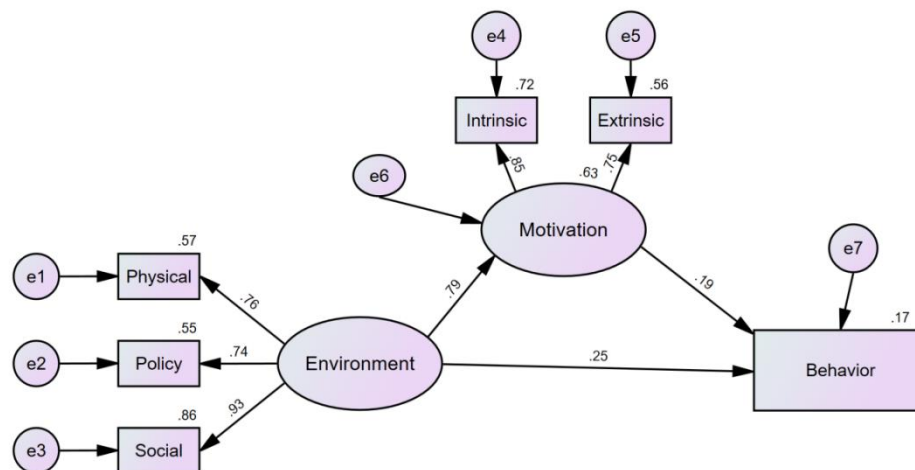


Figure 11 SEM of university sports environment, exercise motivation and exercise behavior
Note : Environment=University Sports Environment, Motivation=Exercise Motivation , Behavior=Exercise Behavior, Physical=Sports physical environment, Policy=Sports policy environment, Social=Sports social environment, Intrinsic=Intrinsic Motivation , Extrinsic=Extrinsic Motivation.

Model Fit

The fitting index provided the most basic indication of the degree of fit between the proposed theory and the data. Initial model fit results revealed $\chi^2/df=19.219$, RMSEA=0.068, RMR=0.008, CFI=0.966, GFI=0.989, AGFI=0.967, NFI=0.987, IFI=0.988, the detail shown in table 48. The model fit index met the statistical requirements, It proved that the model fit is well and has good adaptability.

Table 48 Model Fit of SME

index	Accept Value	The results of the test
RMSEA	<0.08	0.068
Root Mean Square Residual (RMR)	<0.05	0.008
Goodness of Fit Index (GFI)	>0.90	0.966
Adjusted Goodness of Fit Index (AGFI)	>0.90	0.967
Normed Fit Index (NFI)	>0.90	0.987
Incremental Fit Index (IFI)	>0.90	0.988
Comparative Fit Index (CFI)	>0.90	0.988
Relative Fit Index(RFI)	>0.90	0.972
Tucker-Lewis Index(TLI)	>0.90	0.974

Path analysis

Table 49 Path relationship test of SME

	Path	Estimate	S.E.	C.R.	P
Motivation	<----- Environment	0.792	0.014	47.232	<0.001***
Behavior	<----- Environment	0.251	0.042	7.799	<0.001***
Behavior	<----- Motivation	0.19	0.053	5.658	<0.001***

Note: *** $p < 0.001$

From the perspective of path coefficients(table 49), the path coefficient of the university sports environment to exercise motivation is 0,792, the path coefficient of the university sports environment to exercise behavior is 0.251, the path coefficient of exercise motivation to exercise behavior is 0.19, and the three path coefficients are all positive numbers, and all reached a significant level ($P < 0.001$), indicating that the three paths all have a significant positive impact relationship. The university sports environment can explain 63% of the variation in exercise motivation; the two variables of the university sports environment and exercise motivation can explain 17% of the variation in exercise behavior.

Table 50 Bootstrap mediation effect test results

Path	Parameter	Estimate	Lower	Upper	P	Effect ratio
Environment ↓	indirect effect	0.198	0.135	0.266	<0.001***	37.36%
Motivation ↓	direct effect	0.331	0.252	0.413	<0.001***	62.45%
Behavior	Total effect	0.53	0.487	0.571	<0.001***	

Note:Environment=University Sports Environment, Motivation=Exercise Motivation, Behavior=Exercise Behavior.

***** p<0.001**

Table 50 shows that the mediating effect of the path of university sports environment→exercise motivation→exercise behavior is significant ($P<0.001$), and the 95% confidence interval (CI) is 0.135-0.266, excluding 0; at the same time, the direct effect is significant ($P<0.05$), It proved that this is a partial mediation effect, and exercise motivation plays a partial mediating role in the impact of university sports environment on exercise behavior. The indirect effect accounts for 37.36%.

3. Strategies for promoting exercise behavior for Chinese university students.

The results show that university sports environment and exercise motivation have a positive and significant predictive effect on the exercise behavior of Chinese university students. According to the results of the study, the following strategies are proposed to promote the physical exercise behavior for Chinese university students.

3.1 Strategies for university sports environment

3.1.1 University sports physical environment

Reasonable planning of sports space

Through the analysis of university space, determine the best sports field layout and allocation. Ensure the safety and convenience of the site, make it easy to access

and use, and provide adequate rest and changing facilities according to the space situation. Rationally plan and utilize the sports space in the campus to maximize its use.

Provide a variety of sports venues

Universities should evaluate the use of existing sports venues, and build and maintain diversified sports venues according to the needs and interests of university students, such as: basketball courts, football fields, athletics fields, swimming pools, tennis courts, gyms, etc., to meet the exercise needs of different groups of students.

Increase indoor exercise space

When building new or retrofitting buildings, consider adding indoor sports space. In bad weather or at night, provide indoor exercise space, such as: indoor basketball, badminton, table tennis, dance room, gym and other multi-purpose sports venues, ensure that these spaces are well equipped to meet the needs of different sports.

Provide high quality exercise equipment

Equip and maintain high quality sports equipment, such as: dumbbells, treadmills, yoga MATS, etc., to ensure the equipment is safe and functional. Check and update sports equipment regularly to ensure it is in good condition. Provide a variety of equipment to meet different exercise needs.

Improve the accessibility of equipment

Set up a convenient borrowing and returning system, such as: a self-service loan and return machine, or manage the borrowing process through a mobile app. Provide a sufficient number of equipment to prevent students from being unable to exercise due to lack of equipment. Ensure easy access to sports equipment for university students to borrow and return.

Improve the utilization of site and equipment

According to the university students' work and rest time, reasonable arrangement of the opening time of the sports venue. A reservation system is

introduced to avoid waste of space and equipment and ensure that every university student has a chance to use it. Improve the utilization of sports venues and equipment through reasonable opening hours and reservation system.

Set up sports as the theme of the sculpture or sports celebrities and famous words

By setting up sports-themed sculptures or sports celebrities and famous quotes billboards, the sports culture literacy is displayed to university students through visual and written forms, conveys the spirit and values of sports, and stimulates university students' cognition and perception of sports.

3.1.2 University sports policy environment

Implement national and university sports policies

Publicize and popularize national and university sports policies, such as: physical education curriculum, physical education credits, national physical fitness test standards, graduation requirements, etc., and increase the strength of policy implementation. To make university students understand the national and university sports policy and implementation.

Developing and promoting health policies

To develop and promote health policies to promote university students' physical exercise, such as: 3 times a week of extracurricular physical exercise. Through campus publicity, lectures and activities, health policies were promoted to university students and were guided to establish correct sports values. Ensure the implementation and supervision of policies, and regularly check and evaluate the implementation effect of policies.

Provide policy support and incentives

Set up relevant reward policy, such as: sports scholarship, exercise points exchange rewards, etc., to encourage university students to actively participate in sports activities. Ensure that rewards are fair and transparent, and regularly evaluate

the effectiveness of the reward policy to make adjustments and improvements as necessary.

3.1.3 University sports social environment

The optimization of physical education course

The combination of compulsory and optional courses, in the course, there are not only compulsory physical education courses (freshman and sophomore), but also a variety of elective courses (junior and senior) to meet the needs of university students in different grades. According to the interest survey of university students, a variety of physical education courses are designed and offered, such as ball games, combat sports, traditional ethnic sports, etc. At the same time, some projects that female students are more fond of are offered, such as yoga, Pilates, aerobics, etc., to meet the exercise interests and needs of university students of different genders. Through the course guide, consultation, experience and so on to help university students to choose the right physical education courses.

Diverse opportunities for physical exercise

To promote physical exercise opportunities for university students of different grades through the combination of compulsory and elective courses. At the same time, by providing the necessary facilities and funds to support and develop a variety of university student sports associations, such as: school sports teams, sports clubs and so on. And regularly organize various sports competitions in the university to increase extracurricular exercise opportunities for university students.

Provide professional teacher support

Equipped with professional physical education teachers and coaches to provide high-quality physical exercise guidance and support. Regular training of physical education teachers and coaches to ensure that they have professional knowledge and skills. Through the guidance of physical education teachers, to help university students master sports skills, make a reasonable exercise plan, enhance their exercise effect.

Enhance friend/peer support

Organize group exercise activities to promote communication and trust between friends/peers, encourage exercise with friends/peers to enhance each other's motivation and support. Through social media platforms, university students were encouraged to share their exercise experience and results to form a good exercise atmosphere.

Social norms and sports culture

Create supportive groups of sports associations that enhance university students' sense of belonging and participation through social and physical activities. Carry out healthy lifestyle promotion activities, such as: sports meeting, sports and health lecture, experience sharing meeting of sports stars or elite athletes of school team, sports week, etc. Through the campus media and publicity platform, positive sports values are transmitted, a positive and healthy campus culture is created, and university students are encouraged to develop good exercise habits.

3.2 Strategies for exercise motivation

3.2.1 Intrinsic Motivation

Health Motivation

Health education and publicity, regular health lectures, workshops and publicity activities, invited professional nutritionists, fitness coaches and psychological counselors to explain the benefits of physical exercise on physical and mental health, to increase university students' understanding of the health benefits of physical exercise, so as to enhance their health motivation. At the same time, personalized health assessment was carried out to provide free or low-cost health assessment services for university students, including health examination, physical test, bone test and personalized exercise advice. Through specific data and analysis, university students can realize the importance of physical exercise to their personal health and enhance their health motivation.

Appearance Motivation

Teaching university students how to keep and control their weight and improve their body shape and appearance through physical exercise. To improve university students' expectation of the appearance improvement effect of exercise and enhance their appearance motivation. Provide regular physical measurement and progress feedback services, such as: body fat test, muscle circumference measurement, etc., so that university students can see the concrete changes brought about by exercise and enhance their appearance motivation.

Pleasure Motivation

Build a rich content of physical education courses, organize a variety of recreational sports activities, such as: sports games, outdoor adventure, fun games, etc., to increase the interest of exercise. Engaging university students in exercise through interesting activities enhances their pleasure motivation. "Sports Experience Day" was held regularly to introduce new and interesting sports, so that university students could experience different exercise methods, increase their understanding and interest in different sports, and enhance their pleasure motivation.

Curiosity Motivation of sports Skills

Regularly set up a variety of sports skills training and improvement courses or projects, such as: ball games, dance, ethnic tradition projects, etc., provide professional guidance to help university students master or improve sports skills. To stimulate university students' interest in learning and improving their sports skills, and enhance their curiosity motivation of sports skills. School sports competitions and competitive activities are held regularly to provide a platform for displaying and improving skills. Through competition and challenge, university students' desire for learning and improving skills is stimulated, and their curiosity motivation of sports skills is enhanced.

Social Motivation

Support and encourage university students to set up various sports associations and clubs, provide venues and resources to support university students, and enhance

university students' social interaction and social motivation through associations and club activities. Organize team exercise activities, such as: group running, group gymnastics, ball games, etc., to enhance university students' team cooperation and social connection. Through team activities, enhance university students' social relationship and sense of participation, and improve their social motivation.

3.2.2 Extrinsic Motivation

Academic Motivation

Physical education courses are linked to physical exercise, and university students can get extra points for participating in a certain number of physical exercises. Through academic rewards, students are encouraged to actively participate in physical exercise. Strict implementation of the national physical health standards policy, urge academics to carry out physical exercise in order to complete the physical examination goals. At the same time, elective courses combining academic and physical education, such as: "Sports and health", "Sports psychology", "Sports appreciation", etc., are set up to combine academic learning and physical exercise, increase university students' academic interest in physical exercise and enhance their academic motivation.

Identification Motivation

University students who actively participate in sports activities should be publicized and commended on campus media to set an example, and their sports identity and motivation should be enhanced through social recognition and commendation. University students who actively participate and perform well will be awarded sports activity certificates and honorary titles, such as: "Best Athlete" and "Health expert", etc., which will enhance university students' sense of achievement and identity and enhance their identity motivation through honor and recognition.

Economic Motivation

Establish an exercise point system, university students get points by participating in sports activities, points can be exchanged for gifts, gym membership

cards or campus meal vouchers. Financial rewards were used to encourage university students to participate in physical exercise and improve their economic motivation. Sports scholarships are set up to reward university students with outstanding performance in sports activities, and financial support and rewards are used to encourage university students to actively participate in sports and enhance their economic motivation.

Honor Motivation

University students are encouraged to actively participate in physical exercise and enhance their motivation of honor by holding regular sports competitions inside and outside the university and awarding medals, trophies and certificates to the winners. To establish the list of university sports activities, record and publicize the physical exercise of university students. Through public rankings and records, university students' sense of competition and honor can be enhanced, and their honor motivation can be improved.

Table 51 The IOC results of the strategies to promote exercise behavior among Chinese university students

N0.	Dimension	Factors	RESULTS
1	University sports physical environment	Reasonable planning of sports space	0.8
2		Provide a variety of sports venues	1
3		Increase indoor exercise space	1
4		Provide high quality exercise equipment	1
5		Improve the accessibility of equipment	1
6		Improve the utilization of site and equipment	1
7		Set up sports as the theme of the sculpture or sports celebrities and famous words	0.8
8	University sports policy environment	Implement national and university sports policies	1
9		Developing and promoting health policies	1
10		Provide policy support and incentives	1
11	University sports social environment	The optimization of physical education course	0.8
12		Diverse opportunities for physical exercise	1
13		Provide professional teacher support	0.8

14		Enhance friend/peer support	1
15		Social norms and sports culture	1
16	Intrinsic Motivation	Health Motivation	1
17		Appearance Motivation	0.8
18		Pleasure Motivation	1
19		Curiosity Motivation of sports Skills	0.8
20		Social Motivation	1
21	Extrinsic Motivation	Academic Motivation	1
22		Identification Motivation	0.8
23		Economic Motivation	0.8
24		Honor Motivation	1
total			0.933

In the IOC evaluation, Reasonable planning of sports space, Set up sports as the theme of the sculpture or sports celebrities and famous words, The optimization of physical education course, Provide professional teacher support, Appearance Motivation, Curiosity Motivation of sports Skills, Identification Motivation and Economic Motivation scored 0.8, and the remaining strategies were all 1 point (Table 51). The IOC value of each item was greater than or equal to 0.8 (≥ 0.8), indicating that experts had a high degree of recognition of the consistency between the strategy and its designed goals.

Table 52 The expert evaluation results of the strategies to promote exercise behavior among Chinese university students

Item	Mean	S.D	CV
Reasonable planning of sports space	4.6	0.548	0.12
Provide a variety of sports venues	4.6	0.548	0.12
Increase indoor exercise space	4.8	0.447	0.09
Provide high quality exercise equipment	4.8	0.447	0.09
Improve the accessibility of equipment	4.6	0.548	0.12
Improve the utilization of site and equipment	4.8	0.447	0.09

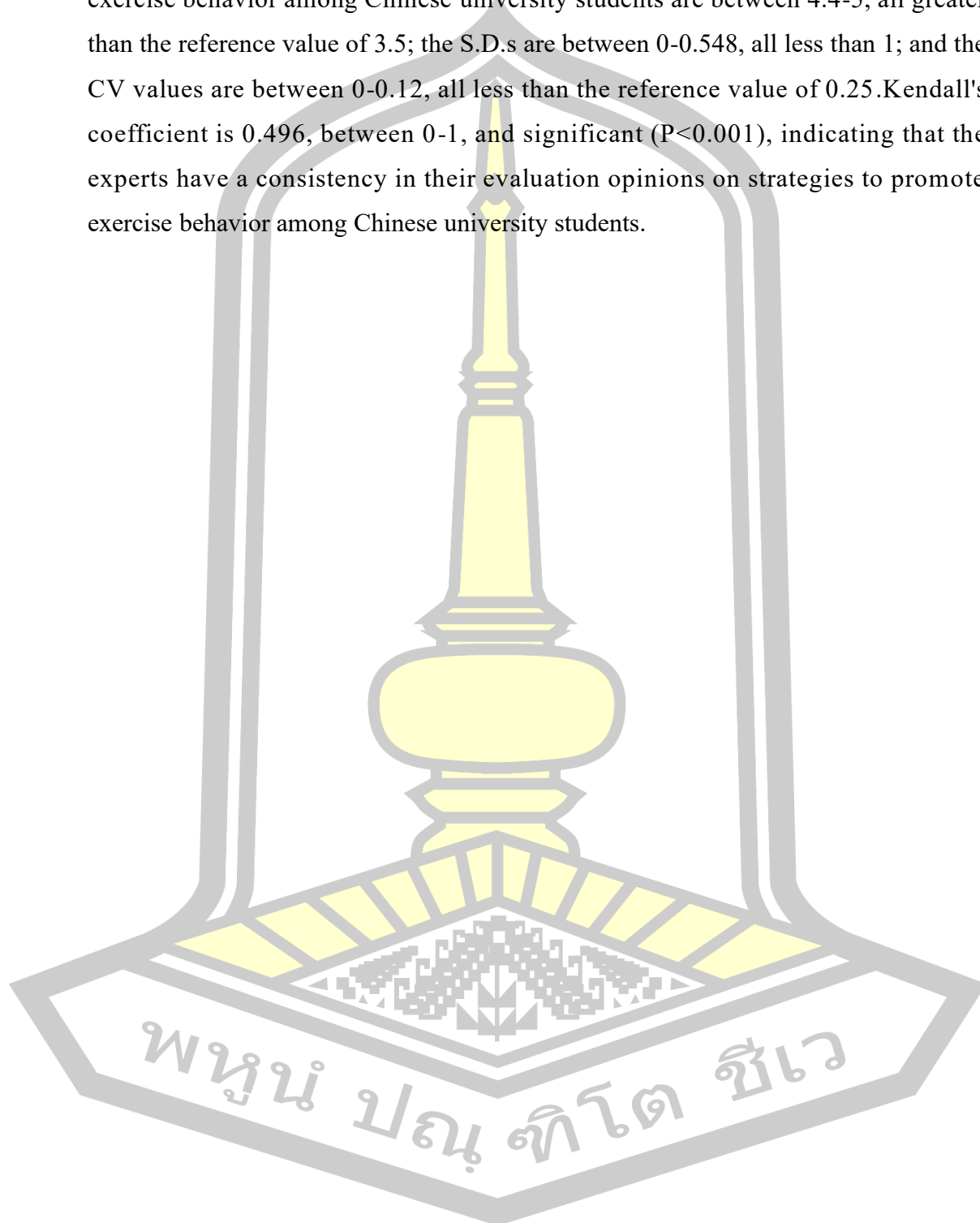
Set up sports as the theme of the sculpture or sports celebrities and famous words	4.8	0.447	0.09
Implement national and university sports policies	5	0	0.00
Developing and promoting health policies	5	0	0.00
Provide policy support and incentives	4.6	0.548	0.12
The optimization of physical education course	4.4	0.548	0.12
Diverse opportunities for physical exercise	4.6	0.548	0.12
Provide professional teacher support	4.8	0.447	0.09
Enhance friend/peer support	4.4	0.548	0.12
Social norms and sports culture	4.6	0.548	0.12
Health Motivation	5	0	0.00
Appearance Motivation	4.4	0.548	0.12
Pleasure Motivation	4.8	0.447	0.09
Curiosity Motivation of sports Skills	4.4	0.548	0.12
Social Motivation	4.4	0.548	0.12
Academic Motivation	4.4	0.548	0.12
Identification Motivation	4.8	0.447	0.09
Economic Motivation	4.6	0.548	0.12
Honor Motivation	4.8	0.447	0.09

Note: CV=the coefficient of variation

Table 53 The coordination coefficient of expert evaluation of the strategies to promote exercise behavior among Chinese university students

Kendall's W	χ^2	df	P
0.496	47.636	4	<0.001

As shown in Table 52、53, the mean expert scores on strategies to promote exercise behavior among Chinese university students are between 4.4-5, all greater than the reference value of 3.5; the S.D.s are between 0-0.548, all less than 1; and the CV values are between 0-0.12, all less than the reference value of 0.25. Kendall's coefficient is 0.496, between 0-1, and significant ($P < 0.001$), indicating that the experts have a consistency in their evaluation opinions on strategies to promote exercise behavior among Chinese university students.



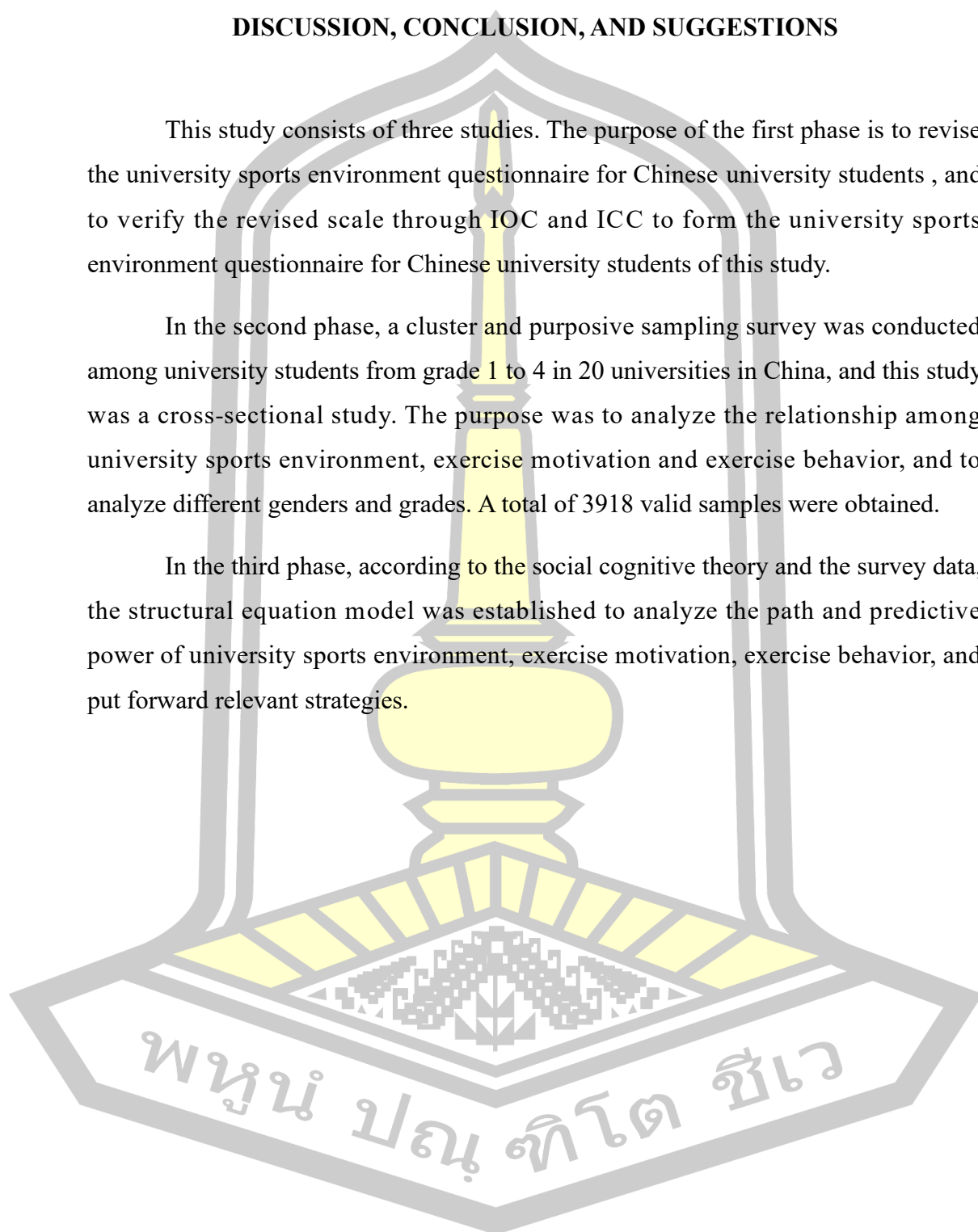
CHAPTER V

DISCUSSION, CONCLUSION, AND SUGGESTIONS

This study consists of three studies. The purpose of the first phase is to revise the university sports environment questionnaire for Chinese university students, and to verify the revised scale through IOC and ICC to form the university sports environment questionnaire for Chinese university students of this study.

In the second phase, a cluster and purposive sampling survey was conducted among university students from grade 1 to 4 in 20 universities in China, and this study was a cross-sectional study. The purpose was to analyze the relationship among university sports environment, exercise motivation and exercise behavior, and to analyze different genders and grades. A total of 3918 valid samples were obtained.

In the third phase, according to the social cognitive theory and the survey data, the structural equation model was established to analyze the path and predictive power of university sports environment, exercise motivation, exercise behavior, and put forward relevant strategies.



DISCUSSION

1. To revise and validate the university sports environment questionnaire for Chinese university students.

There are differences in cognitive, emotional and social development between university students and middle school students. The middle school students are usually at an earlier stage of cognitive development, and their psychological needs are different from those of university students. At the same time, different age groups also face different cultural, environmental and social backgrounds, which can also affect the applicability of the measurement questionnaire. Therefore, when conducting surveys and research on different groups, the measurement questionnaire needs to be appropriately revised and adjusted according to the study group to avoid cultural and situational biases and ensure the accuracy and validity of the measurement questionnaire in different groups. The research group of this study is Chinese university students, while the research subjects of the original questionnaire are middle school students (Guo, 2019). The university sports environment is more open, dynamic and sustainable than the middle school sports environment, including natural environment, sports venues, sports facilities, sports courses, sports activities and competitions (Wang, 2022). Therefore, this study revised and validated the university sports environment questionnaire according to the study group to ensure the accuracy, validity and applicability of the measurement questionnaire.

The main objectives of this phase were to determine the items and factors of the scale by IOC analysis and to test the reliability of the scale by ICC and test-retest. In order to achieve this goal, in this phase of the study, we conducted it in three parts.

Phase I, On the basis of maintaining the original questionnaire stratification (three subscales: sports physical environment, sports policy environment and sports social environment), the university sports environment questionnaire for this study was revised and was revised and formed. It was evaluated and revised by a panel of five experts in sports related majors. The index of item-objective congruence (IOC) introduced by Rovinelli and Hambleton(1977) is one method to quantitatively measure content experts' judgments of items to evaluate the fit between test items and the table of specifications (Berk, 1984; Turner, et al., 2002; Turner and Carlson,

2003). Further, Turner and Carlson (2003) cite Berk (1984) “that an evaluation of the match between items and objectives is the most important assessment during the content validation stage” IOC is a process in which SME rate individual items on the degree to which they agree or do not agree with the specific objectives listed by the test developer (Turner et al., 2002; Fouzul Kareema and Bt Zubairi. 2021). Finally, the score of 25 items of the university sports environment questionnaire was 1, and the score of 9 items was 0.8, and all items were greater than or equal to 0.8. The results show that the validity of the university sports environment questionnaire is reasonable (Fouzul Kareema and Bt Zubairi. 2021; Supparerkchaisakul et al., 2017). Subsequently, 20 university students were randomly asked as survey subjects. The aim was to assess the feasibility of the questionnaire and reduce misperception. Based on the results of the interviews, all respondents gave good responses and agreed that the items were easy to understand.

Phase II. After the questionnaire was revised, the questionnaire was predicted to analyze the validity of the university sports environment questionnaire. Then 120 university students were recruited as survey subjects, and 103 valid questionnaires were obtained. The university sports environment questionnaire in this study was a textual revision of the original questionnaire, which is clearly divided into three subscales and items included in each subscales are clearly defined, and the revised university sports environment questionnaire has been validated by experts for validity. Therefore, this study adopts the factor analysis method at different subscales. That is, according to each subscales of the questionnaire, factor analysis was carried out with the items included in the subscales (Wu, 2010). EFA results showed (table 19, table 20, table 21) that the factor distribution of the three subscales of the university sports environment was consistent with the original questionnaire research (Guo, 2019), and the eigenvalues were all greater than 1, explaining the total variance of more than 60%, which proved that the university sports environment questionnaire had high validity.

Phase III. The questionnaire was validated to analyze the reliability of the three subscales and each dimension of the university sports environment. Test-retest reliability and Cronbach’s alpha were used for ICC validation. 496 university students

were recruited for the survey, and the retest survey was conducted two weeks later (14 days). After eliminating the invalid questionnaires from the two questionnaires, a total of 451 valid questionnaires were obtained. The results showed (table 23) that the Cronbach's α coefficients of the three subscales of the university sports environment questionnaire were between 0.822 and 0.935 in the two tests, and the Cronbach's α coefficients of each dimension were between 0.802 and 0.830. The α coefficient of the sports social environment subscale was the highest, and values greater than 0.90 indicated excellent reliability. The α coefficients of the sports physical environment, sports policy environment and each sub-dimension were all greater than 0.8, indicating good reliability (Koo and Li, 2016; Nunnally and Bernstein, 1994; Miller, 1995; Ellinoudis et al., 2011; Vaske et al., 2017).

The test-retest reliability r values of the three subscales of the university sports environment questionnaire were between 0.878 and 0.944, and the test-retest reliability r values of each dimension were between 0.823 and 0.901, and all reached a significant level ($P < 0.001$), and all TRR values were greater than 0.8. According to the reliability evaluation standard, the test-retest reliability r values of the three subscales of the university sports environment questionnaire were between 0.878 and 0.944. Test-retest reliability coefficients of more than 0.8 are considered high confidence (Nunnally and Bernstein, 1994). It shows that the three subscales and dimensions of the university sports environment Questionnaire have high credibility among the measurement results at different time points. Test-retest reliability coefficients of 0.8 and above are generally considered very good, especially in psychological and social science research (Cohen, 1988).

In summary, the ICC and test-retest reliability r values of the measurement results of the University Sports Environment Questionnaire reached a satisfactory standard, providing strong evidence for the use of the university sports environment questionnaire. It shows that it has good reliability and validity in measuring the university sports environment and can be used as a test tool for subsequent studies of this study. This is of great significance for subsequent research and practice, and also provides theoretical and empirical basis for the future application of the scale in Chinese university students.

2. Discussion of group differences in university sports environment, exercise motivation and exercise behavior

This phase is to study university students in grades 1-4 in 20 universities in China, with a valid sample size of 3918 to analyze the relationship between university sports environment, exercise motivation and exercise behavior, and group differences.

2.1 Discussion of gender differences

2.1.1 Discussion of gender differences in the university sports environment

The results of the university sports environment study show (table 30) that the three subscales and each dimension of the university sports environment questionnaire have gender consistency characteristics. It shows that there is no significant gender difference among Chinese university students in sports physical environment, sports policy environment and sports social environment ($P>0.05$). This is similar to relevant studies, There is no significant difference between the physical environment of school sports and gender of students (Guo, 2019), and the support of school natural environment and school interpersonal environment have gender consistency characteristics (Dong, 2021).

The university's sports venues and sports facilities are relatively neutral, and can basically meet the exercise needs and sports preferences of male and female university students (plastic track and field, basketball court, indoor badminton/table tennis hall/gym, etc.). At the same time, the number of sports venues and facilities for female university students in the university is gradually increasing (aerobics hall, yoga hall, dance room, body shape room, etc.), providing female university students with more exercise options. This is a significant improvement compared with the previous venue restrictions, when only simple and easy exercise activities with low venue requirements (walking, jogging) could be selected (Dong et al., 2013; Dong and Mao, 2021). The university has opened a variety of physical education courses for male and female university students (basketball, football, volleyball, badminton, table tennis, tennis, taekwondo, martial arts, etc.), and has also opened some physical education courses (aerobics, yoga, sports dance, etc.) to meet the exercise needs of female university students (Wang and Wang, 2017), so that both male and female

university students can choose corresponding physical education courses according to their interests.

University physical education teachers provide male and female university students with equal professional guidance, exercise opportunities, support and encouragement, demonstrating gender equality. At the same time, male and female university students are in the same university sports policy environment (physical education courses, national physical fitness tests, graduation requirements related to sports, etc.). The construction of university sports environment such as sports venues, equipment, and physical education courses shows that the school pays attention to the physical health of university students. The university provides male and female university students with the same exercise environment and opportunities. The school basically achieves gender equality in the sports physical environment, sports policy environment, and sports social environment. Therefore, male and female university students perceive a similar level of university sports environment.

2.1.2 Discussion of gender differences in exercise motivation

The results of exercise motivation research showed (table 36) that there was no significant gender difference in the two subscales of intrinsic motivation and extrinsic motivation ($P > 0.05$). Further analysis showed that there were significant gender differences in health motivation, appearance motivation and identification motivation between male and female university students ($P < 0.05$). The health motivation of male university students was higher than female university students, and the difference was significant ($P < 0.05$). This is similar to relevant studies, there is a significant difference between male and female university students in the health motivation ($P < 0.05$). Male university students have higher health motivation than female university students, and male university students may pay more attention to health problems, especially the improvement of strength and physical fitness (Chen et al., 2006; Zhang et al., 2009; Chen et al., 2013; Nan, 2020; Chen, 2022; Chen et al., 2023; Wang, 2024); Contemporary male university students pursue a strong body and muscular beauty, and consult and pay attention to relevant health knowledge according to their needs, so they pay more attention to health problems than female university students.

In terms of appearance motivation, female university students are higher than male university students, with a significant difference ($P < 0.05$). This is similar to related research. There are large differences in exercise motivations of different genders. Female's exercise motivation is more concerned about self-image, such as weight, body shape and appearance (DiBartolo and Shaffer., 2002; Egli et al., 2011; Yang, 2017). There is a significant difference between females and males in the dimension of appearance motivation ($P < 0.05$). Females' appearance motivation stronger than males, females' participation in physical exercise focuses more on improving body shape and managing weight (Kilpatrick et al., 2005; Chen et al., 2013; Chen, 2022; Shen, 2023). Female are more concerned about weight and obesity, and therefore have high levels of walking and greater intensity of physical activity (SATTER et al. 2018; Shen, 2023). Physical exercise can effectively improve the temperament and body shape of female university students and create a perfect image, thus forming the most acceptable incentive stimulus for female university students, producing an urgent and strong desire to shape the body and effectively stimulating the motivation of exercise behavior (Dong et al., 2013).

In terms of identification motivation, male university students are higher than female university students, and there is a significant difference ($P < 0.05$). This is similar to related research. There is a significant difference in university students' identification motivation ($P < 0.05$). Male university students are higher than female university students. (Chen et al., 2023) Male tend to have a more positive and reasonable understanding of the value and meaning of sports, and have a stronger sense of identity and belonging to exercise groups (WILK et al. 2018; Dong and Mao, 2020), male's exercise motivation may be for challenge, competition, social recognition or to achieve a certain level of ability (Kilpatrick et al., 2005). Male may be more susceptible to social expectations and show higher exercise motivation (Wang, 2024).

2.1.3 Discussion of gender differences in exercise behavior

The results of exercise behavior research showed (table 38) that there was a significant gender difference in exercise behavior among university students ($P < 0.05$). The male university students had more vigorous and moderate exercise than the

female university students. This is similar to related studies, Gender can strongly predict physical activity level, and male's self-reported physical activity levels are higher than females (Liang, 2020). There is a significant difference in physical activity level between students of different genders. Males have a significantly higher level of physical activity than females, especially in high-intensity physical activity (Yang,2017). The extracurricular exercise behavior of female university students lacks scientificity, standardization, and guidance, resulting in its characteristics of "low intensity, short duration, low frequency of exercise and small amount of exercise" (Dong et al., 2014). The physical activity level of males is higher than that of females, which may be due to physiological differences or social environmental factors (Meng, 2015). Compared with females, males have higher exercise intensity, exercise time and exercise frequency, which is mainly affected by gender differences and induced by exercise motivation (Zhang et al., 2009; Chen,2022;Shen, 2023; Zuo,2023). There were significant differences in exercise behavior between university students of different genders, and male students were better than female students ($P<0.05$) (Nan, 2020; Kang, 2022).

The characteristics of exercise behavior of Chinese university students are usually reflected in the level of exercise intensity, duration and frequency, which are easily affected by gender, thus showing corresponding differences. Male students' exercise behavior is usually at the level of large and medium exercise, while female students' exercise behavior is at the level of small exercise, and male students' exercise behavior is generally higher than that of female students. that is, male students exercised more, longer and with higher intensity. This is because the physical quality and physiological characteristics of male and female students are different. Male students have better physical conditions and can adapt to various physical exercise environments. However, female students are difficult to perform well in the frequency, time and intensity of exercise due to various psychological and physiological reasons (Wang, 2023).

2.2 Discussion of year level of study differences

2.2.1 Discussion of year level of study differences in the university sports environment

The results of university sports environment research show (table31) that the three sub-scales and each dimension of the university sports environment questionnaire have significant year level of study differences ($P < 0.05$), indicating that university students have dynamic changes in the needs and expectations of the sports environment in different periods. This is similar to relevant studies, and the differences in the perception of physical education curriculum, teacher support, institutional environment, physical environment and the overall perception of university sports environment among university students of different year level of study have reached a significant level ($P < 0.05$) (Gong, 2021). There are significant year level of study differences in sports physical environment of different grades ($P < 0.05$) (Si et al., 2015; Lv, 2021). Due to different levels of social adaptation and different stages of self-consciousness development, students may have differences in their support for school physical environment and interpersonal environment (Dong, 2021). Freshman students have the highest mean in sports physical environment, sports policy environment and sports social environment. Freshmen have just entered the university campus, and The sports physical environment, the sports policy environment and the sports social environment are different between the sports environment of universities and middle schools. Freshmen have an increased sense of curiosity about the surrounding environment and high enthusiasm for various sports activities in universities. Sports are loved by freshmen because of their unique collective integration function (Gong, 2021). Therefore, freshmen students pay more attention to the university sports environment than students in other grades, to understand and integrate into the university sports physical environment, sports policy environment and sports social environment.

There are significant differences in the perception of school physical education policy environment among students of different year level of study ($P < 0.05$) (Guo, 2019; Yao, 2023). Freshmen are not long into university, and the publicity and implementation of physical education policy are more strict. In addition, freshmen

and sophomore students are required to implement more physical education policies (such as physical education credit, national physical fitness test, extracurricular exercise, etc.). In the sports social environment, teacher support, social norms, friend/peer support and physical education courses all have significant year level of study differences ($P < 0.05$) (Guo, 2019). The recognition of physical education courses in each grade decreases with the increase of year level of study, and there are significant year level of study differences (Lv, 2021; Yao, 2023). Chinese universities offer compulsory physical education courses in both the freshman and sophomore years, but only some universities offer elective courses in the junior and senior years. Therefore, freshmen and sophomore students pay more attention to physical education courses than junior and senior years. There was a significant difference between friend/peer support and teacher support in terms of grade (Si et al., 2017). Freshman and sophomore students have physical education courses, so the teacher support is higher than junior and senior students. In terms of exercise opportunities and friend/peer support, freshman and senior students are higher than sophomore and junior students. Freshmen have just entered campus and tend to participate in sports activities to socialize and adapt to university life, while senior students are about to graduate and leave university. They exercise together with friends/peers in their spare time to stay healthy, relieve stress and socialize.

2.2.2 Discussion of year level of study differences in exercise motivation

The results of exercise motivation research show (table 37) that university students have significant differences in the two subscales and each dimension of exercise motivation ($P < 0.05$). This is similar to related research. Year level of study has a significant impact on students' exercise motivation. The exercise motivation among different year level of study students is significant ($P < 0.05$) (Yang, 2017; Nan, 2020; Kang, 2022; Bao, 2023; Wang, 2024). Different grades have different exercise motivation, grades 1-4 have higher intrinsic motivation, the pursuit of health, pay attention to appearance, enhance pleasure is the basic needs of every university student, through exercise to improve or learn new sports skills is also one of the important factors for university students to participate in physical exercise, and sports is a good social activity. Enhance the relationship between friends/peer through

sports. There are significant year level of study differences in the extrinsic motivation of university students ($P < 0.05$) (Song, 2022). Freshmen and sophomores need to pass physical education exams to complete physical education credits to meet graduation requirements, while junior and senior students do not worry about the examination of physical education courses, so their academic motivation decreases with the increase of year level of study. It can be seen that different year level of study have different exercise motivation according to their own needs and interests.

2.2.3 Discussion of year level of study differences in exercise behavior

The results of exercise behavior research show (table 39) that there is a significant difference in exercise behavior among university students in different year level of study ($P < 0.05$), This is similar to related research. There are significant differences in physical activity level among students in different grades ($P < 0.05$), and the low and middle grades are significantly higher than the high grades (Yang, 2017; Zuo, 2023). There are significant differences in the exercise intensity, time and frequency of different year level of study students ($P < 0.05$). Freshmen had the highest exercise behavior, showing a trend of decline with the increase of year level of study (Nan, 2020; Shen, 2023, Yu et al., 2021). Physical activity levels gradually decrease with age (Pate, et al., 1996; McKenzie et al. 2000).

There are significant differences in exercise behaviors among university students of different grades ($P < 0.05$) (Kang, 2022). There is a common inversion phenomenon of "decreasing with age" in exercise behaviors (Dong and Mao, 2021). After the sophomore year, the phenomenon of quitting physical exercise is serious (Chen, et al., 2014.). The exercise behavior of lower grade students is better than that of higher grade students. This may be because physical education courses are offered in the freshman and sophomore years, and the school has a hard requirement that they must pass the physical test to obtain credits. However, for junior and senior students, due to internships, preparation for postgraduate entrance examinations, and job hunting, their participation in exercise is passive and random, and there is uncertainty in their exercise behavior. Therefore, the exercise behavior of lower grade students is better than that of higher grade students.

3. Discussion on the relationship and influence of university sports environment, exercise motivation and exercise behavior

In this phase, based on the cross-sectional survey data, we first analyzed the correlation between university sports environment, exercise motivation and exercise behavior, then used multiple regression to analyze the interactive effects of university sports environment and exercise motivation on exercise behavior, and finally, constructed an influence mechanism model using cross-sectional data to analyze the intensity of direct and indirect influence effects.

3.1 Discussion on the relationship and influence of university sports environment and exercise motivation

The results showed that there was a significant positive correlation between the university sports environment and exercise motivation ($r=0.675^{**}$). The three subscales of the university sports environment: sports physical environment, sports policy environment, sports social environment and exercise motivation of the two subscales intrinsic motivation and extrinsic motivation also showed significant positive correlation (r values between 0.439^{**} to 0.658^{**}), The correlation coefficient between sports social environment and intrinsic motivation is the highest. A good sports social environment plays an irreplaceable role in promoting university students' exercise motivation. It can be seen from the regression equation that the sports social environment and sports policy environment have significant predictive power on exercise motivation, with a coefficient of determination of 0.446. Therefore, the sports social environment and sports policy environment together can effectively explain 44.6% of the variation in exercise motivation; The β values were 0.56 and 0.148, respectively, which were both positive numbers, indicating that the sports social environment and sports policy environment had a positive and significant impact on exercise motivation.

The sports environmental factors refer to the environment and conditions in which individuals are located, such as school facilities, course, social support, etc. Sports environment has a significant impact on individual exercise motivation, such as school facilities and course setting may have a positive impact on individual exercise motivation (Hou,2023).The extrinsic environment can stimulate students'

exercise motivation. In a sports environment with perfect policy, suitable atmosphere and material guarantee, students' exercise motivation will be stimulated (Richard and Edward, 2000; Zuo, 2023). A good sports environment can help stimulate the motivation of young people to exercise, thereby increasing the amount of physical activity (Yang, 2017), and appropriate sports activity resources (venues, facilities, layout) can improve accessibility and operability (Dong, 2021). These potential external resources can internalize intrinsic motivation and promote individual exercise practice (Dai et al., 2018; Chen and Zhu, 2022).

The sports policy environment can effectively promote university students' exercise motivation. In order to pass physical education courses or physical fitness tests, some students meet extrinsic requirements through physical exercise (Dong et al., 2014). The university's physical education credit policy and graduation physical education requirements encourage university students to have extrinsic motivation and then participate in physical exercise. The sports social environment affects the exercise motivation of university students. The social supportive environment is that students feel the support of teachers, friends/peers (Liang, 2020), and then produce exercise motivation. At the same time, teaching practices within school settings represent a powerful influence on students' motivation (Eccles and Roeser, 2011; Taylor, et al., 2014). University students have different interests and needs, so it is very important to provide them with a variety of sports, venues, social support, etc. This can not only meet the individual needs of university students, but also allow them to find sports they are interested in, so that it is easier to generate exercise motivation (Hou, 2023).

3.2 Discussion on the relationship and influence of university sports environment and exercise behavior

The results showed that the university sports environment was significantly positively correlated with exercise behavior ($r=0.397^{**}$), and the three subscales of sports physical environment, sports policy environment and sports social environment were also significantly positively correlated with exercise behavior (r values ranged from 0.322^{**} to 0.381^{**}). The correlation coefficient between sports social environment and exercise behavior is the highest. A good sports social environment

plays an irreplaceable role in promoting university students' exercise behavior. According to the regression equation, the regression model was significant as a whole, and the sports physical environment, sports social environment and sports policy environment had significant explanatory and predictive power on exercise behavior. The β values were 0.249, 0.1 and 0.073, respectively, which were all positive numbers, indicating that sports physical environment, sports social environment and sports policy environment had a positive and significant impact on exercise behavior.

The sports environment is an integral part of the school education environment and one of the factors that influence the generation and development of students' exercise behavior. The convenient conditions provided by the school in terms of time and space can help students better carry out physical exercise. A good university sports environment can have a positive impact on the generation and development of university students' exercise behavior in a subtle process (Wang, 2023). The school environment can significantly impact students' physical activity levels. (Robertson-Wilson et al., 2007). The sports physical environment is the basis of students' exercise behavior, and behavior is the process of the subject forming a certain reaction and taking an activity to meet a certain need under environmental stimulation (Dong and Mao, 2021). The occurrence of exercise behavior is easily directly affected by the surrounding environment (Humpel et al., 2002; Hong and Li, 2022). Factors such as the number, layout and convenience of exercise venues can affect individual exercise behavior (Pan et al., 2010; Ran, 2011; Hong and Li, 2022). Complete school stadiums, facilities, equipment and other natural environments can provide opportunities and conditions for young people to exercise, which is beneficial to improving the operability and accessibility of behaviors, reducing the difficulty of execution, and making it possible for exercise behaviors to occur (Dong and Mao, 2021; Shen, 2023).

The sports policy environment is a favorable guarantee for students' exercise behavior, and sports policy plays an important role in promoting students' exercise behavior (Su et al., 2017; Guo, 2019; Gong et al., 2021; Hong, 2022). The physical education policies help schools create healthy, equitable environments (Burson et al., 2021). University sports credit policy, physical health standard policy, graduation sports requirement policy, etc., have improved students' awareness of physical

exercise and promoted university students' physical exercise behavior. Reasonable sports venues, sports equipment and sports policies stimulate university students' enthusiasm and motivation for physical exercise, and also provide a platform for the establishment of university students' interpersonal relationships and improvement of social adaptation (Shen, 2023). The correlation between behavior and environment can not only explain and predict behavior, but also influence people's behavior by designing, changing and controlling the environment. The university sports environment, which is composed of physical environment, policy environment and social environment, is an important factor to promote exercise behavior and strengthen exercise consciousness of university students. Individual exercise behavior is closely related to sports environment, and the perception of surrounding environment can directly affect the beginning and persistence, suspension and withdrawal of university students' exercise behavior. (Hong and Li, 2022).

3.3 Discussion on the relationship and influence of exercise motivation and exercise behavior

The research results show that there is a significant positive correlation between exercise motivation and exercise behavior in general ($r=0.359^{**}$). The two subscales of exercise motivation: Intrinsic motivation and extrinsic motivation also had a significant positive correlation with exercise behavior (r values were 0.326^{**} to 0.331^{**}). The correlation coefficient between intrinsic motivation and exercise behavior was the highest, and intrinsic motivation was more favorable to promote the production of exercise behavior. According to the regression equation, the regression model was significant as a whole, and extrinsic motivation and intrinsic motivation had significant explanatory and predictive power on exercise behavior. The β values were 0.221 and 0.169, respectively, which were both positive numbers, indicating that extrinsic and intrinsic motivation had a positive and significant effect on exercise behavior.

Motivation is the root of behavior (Zeng, 2023). Exercise motivation is the basic driving force for physical exercise, which can promote students to actively participate in physical exercise and affect students' physical exercise behavior. (Zhu and Zhang, 2016; Wang, 2023; Hou, 2023). There is a close internal relationship between students'

exercise behavior and exercise motivation. Exercise motivation affects and dominates exercise behavior, so that "exercise duration", "exercise intensity" and "exercise frequency" are strengthened and sustained (Wang,2023). Exercise motivation can drive individual exercise participation and predict exercise behavior.(Zuo, 2023).

3.4 Discussion on the relationship and influence of university sports environment and exercise motivation on exercise behavior

This study used structural equation modeling (SEM) to analyze the relationship between university sports environment, exercise motivation, and exercise behavior. The model fitting index showed that the model fit was good and met the statistical requirements. The specific fitting indexes were as follows: RMSEA=0.068, RMR=0.008, CFI=0.966, GFI=0.989, AGFI=0.967, NFI=0.987, IFI=0.988. All indices were within the acceptable range, indicating that the model has good adaptability. The path results showed that university sports environment had a significant positive impact on exercise motivation (Estimate=0.792, $p<0.001$). the university sports environment had a significant positive impact on exercise behavior (Estimate = 0.251, $p<0.001$). Exercise motivation had a significant positive effect on exercise behavior (Estimate = 0.19, $p<0.001$). At the same time, the mediating effect of the university sports environment and exercise motivation on the path of exercise behavior is significant ($P<0.001$), and the 95% confidence interval was 0.135-0.266, excluding 0, indicating that exercise motivation played a partial mediating role in the influence of university sports environment on exercise behavior, accounting for 37.36% of the indirect effect. The results showed that exercise motivation played an important role in the influence of university sports environment on exercise behavior, and university sports environment further promoted students' exercise behavior by improving their exercise motivation.

Schools are an ideal environment for physical exercise to enhance students physical and mental health by providing a variety of physical activity opportunities, including provision of school physical education, physical activity and sports (McKenzie et al.,2000; Pate et al., 2006; Robertson-Wilson, et al.,2007; Morton et al., 2016; ISPAH, 2020; Kwon et al.,2020; Leiss and Kim ,2022; Rocliffet al.,2024).After entering the university campus, students will always exist in the university sports

environment, so the university sports environment can greatly affect the students' physical education awareness and behavior(Wang,2023).

Individual exercise behavior is determined by the interaction of environment, individual psychology and behavior (Xie et al.,2009; Hong and Li, 2022; Assavanopakun et al., 2022).The maintenance, change and development of individual exercise behavior are affected by two major factors: internal and external factors (Dong,2017; Zhang et al.,2002). Internal factors mainly refer to individual psychological factors, while external factors mainly refer to environmental factors. (Hong and Li ,2022; Zuo, 2023).The sports environment can stimulate individual motivation and thus produce sports behavior (Zeng, 2023).Motivation is a key point to achieve successful learning(Ryan and Deci,2017; Sotos-Martinez et al.,2023).The occurrence of exercise behavior is easily influenced directly by the surrounding environment (Humpel et al., 2002;Hong and Li, 2022),The behavior of individuals participating in physical exercise is closely related to the surrounding environment, and people's perception of the surrounding environment can directly affect their exercise behavior and the persistence of exercise behavior.(Hong and Li ,2022). Students' exercise motivation and behavior are often based on the campus environment (Chen and Zhu, 2022). The environmental information perceived by the subject can stimulate or change the behavioral motivation and decision-making, thus forming the corresponding behavior (Peng, 2015;Chen and Zhu, 2022).The sports physical environment, sports policy environment and sports social environment in the university can continuously strengthen the perception and cognition of students in the process of participating in physical exercise, prompting them to generate intrinsic and extrinsic motivation for exercise behavior, and then internalize it in their mind and externalized in the practice, and form correct exercise habits. Strengthening the construction and management of university sports environment can provide better physical exercise environment and conditions for university students, thus enhancing their exercise motivation and promoting them to develop good exercise behavior. (Hou, 2023).

Discussion on strategies of university sports environment and exercise motivation to improve exercise behavior for Chinese university students

Through the investigation and analysis of Chinese university students, the results show that the university sports environment and exercise motivation have a positive and significant predictive effect on the exercise behavior of Chinese university students. In order to better improve the exercise behavior of Chinese university students and enhance their physical and mental health. This study combines survey data and results to propose strategies to promote Chinese university students' exercise behavior from the perspective of university students' sports environment and exercise motivation.

By rationally planning the university sports physical environment, formulating and implementing sports policies, providing a variety of exercise venues and high-quality equipment, increasing indoor exercise space, and creating a strong university sports culture atmosphere, we can provide convenience, accessibility, easy access and safety for university students' exercise. And by optimizing physical education courses, enriching exercise opportunities, providing professional teacher support, enhancing peer support and creating a positive sports social environment. At the same time, according to the exercise needs of university students, health propaganda and physical activities should be carried out to enhance the interest and participation of university students in exercise, stimulate the exercise motivation of university students, and then improve their exercise behavior.

The IOC results of the strategies for promoting exercise behavior of Chinese university students were all greater than 0.8, indicating that the content of the strategies for promoting exercise behavior of Chinese university students was reasonable. At the same time, the mean score of the experts was between 4.4 and 5, that is, the experts believed that the rationality of each indicator was between "reasonable" and "very reasonable", and tended to be "very reasonable"; all were greater than the reference value of 3.5; S.D was less than 1; CV values were less than the reference value of 0.25, and the Kendall coefficient was 0.496, between 0 and 1 ($P < 0.001$), indicating that the experts' evaluation opinions on the strategies for

promoting exercise behavior of Chinese university students were highly consistent (Wu, 2020; Guo, 2021; Yan, 2023). Experts unanimously believed that the strategy had a positive effect on promoting the exercise behavior of Chinese university students and had good theoretical and practical significance.

Although the rationality and necessity of the strategy have been highly recognized by experts, it provides an important theoretical and practical basis for improving the exercise behavior of Chinese university students in the future. However, the implementation and effect of the strategy have not been fully confirmed. Future research should explore the implementation and effect of the strategy, further verify and improve the strategy to promote the exercise behavior of Chinese university students, and continuously explore the applicability of different strategies in different contexts to better promote the exercise behavior of university students.

CONCLUSION

The reliability and validity of the revised University Sports Environment Questionnaire reached acceptable standards ($IOC \geq 0.8$ and $ICC \geq 0.8$), providing strong evidence for the use of the University Sports Environment Questionnaire and providing theoretical and empirical basis for the future application of the scale among Chinese university students.

University students had gender-consistent characteristics in the university sports environment, and there was no significant difference ($P > 0.05$); there were significant gender differences between male and female university students in the dimensions of health motivation, appearance motivation and identification motivation ($P < 0.05$), among which In terms of health motivation, male were higher than female university students, and there was a significant difference ($P < 0.05$); in terms of appearance motivation, female were higher than male university students, and there is a significant difference ($P < 0.05$); in terms of identification motivation, male were higher than female university students, there was a significant difference ($P < 0.05$). There were significant gender differences in exercise behavior among university students ($P < 0.05$). Male were higher than female university students in both higher

vigorous and moderate exercise behavior. There were significant differences in university sports environment, exercise motivation and exercise behavior among university students ($P < 0.05$), and the lower grades were generally higher than the higher grades.

The correlation between university sports environment, exercise motivation and exercise behavior was from low to high, Pearson's r value was 0.359^{**} - 0.397^{**} , all at the significance level of 0.01. There was a significant positive correlation between university sports environment and exercise motivation. The sports social environment and sports policy environment had a significant positive influence and predictive power on exercise motivation. There was a positive correlation between university sports environment and university students' exercise behavior. University sports environment had a significant positive influence and predictive power on exercise behavior. Exercise motivation had a significant positive correlation with university students' exercise behavior, and exercise motivation had a significant positive influence and predictive power on university students' exercise behavior.

The structural equation model of the university sports environment, exercise motivation and exercise behavior of university students had a good fit, and the model had a good adaptability. The model path showed that university sports environment had a significant positive impact on exercise motivation and exercise behavior. Exercise motivation had a significant positive effect on university students' exercise behavior. At the same time, the mediating effect of the path between university sports environment-exercise motivation-exercise behavior was significant, and exercise motivation plays a partial mediating role in the impact of university sports environment on exercise behavior.

University sports environment and exercise motivation had a significant positive prediction effect on university students' exercise behavior. According to the results of the study, the corresponding strategies were put forward to improve the university students' exercise behavior by improving the university sports environment, stimulating the university students' exercise motivation, and promoting the development of university students' physical and mental health.

Limitation of the study

Although this study analyzed the relationship and predictive ability among university sports environment, exercise motivation, and exercise behavior of Chinese university students by surveying 3,918 university students from 20 universities, there are still several limitations. The data in this study were mainly collected through self-reported questionnaires, and there is a certain degree of self-report bias. Respondents may have provided inaccurate information because of social expectations or memory biases, especially on issues related to exercise behavior, which may have influenced the study conclusions. This research sample comes from 20 universities in China, which may not completely represent the situation of all universities in China. Different regions and different types of universities may have differences in university sports environment and exercise behavior, and the geographical limitation of the sample may affect the broad applicability of the study results. According to the data results, this study proposed a strategy to promote the exercise behavior of Chinese university students through university sports environment and exercise motivation, which was also recognized by experts. However, the implementation and effect of the strategy have not been verified in practice.

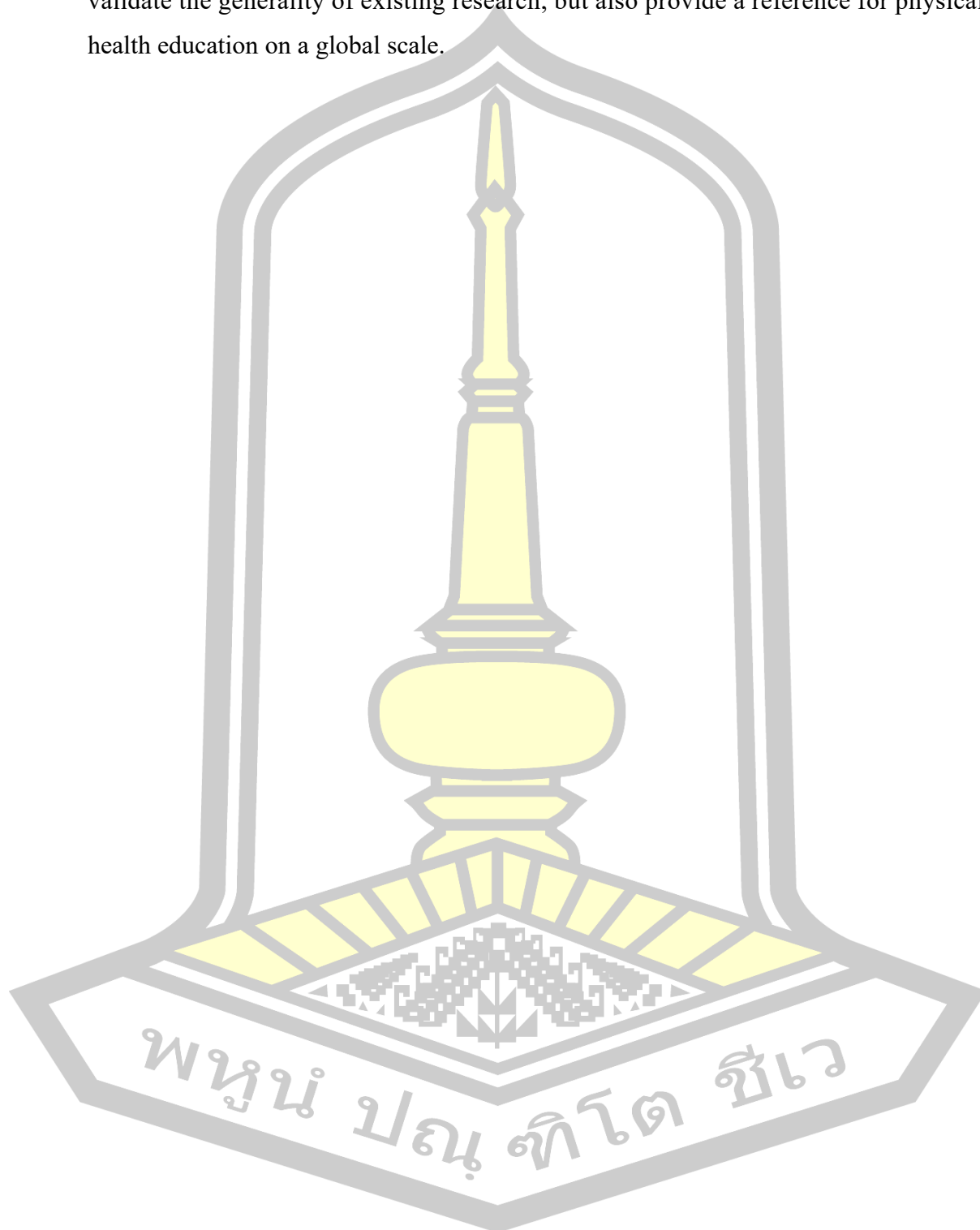
Suggestions for further research study

A longitudinal study design was used to track changes in exercise motivation and behavior of the same group of students at different time points. Further explore how changes in sports environment and motivation affect exercise behavior to provide a more evidence-based reference for strategy development.

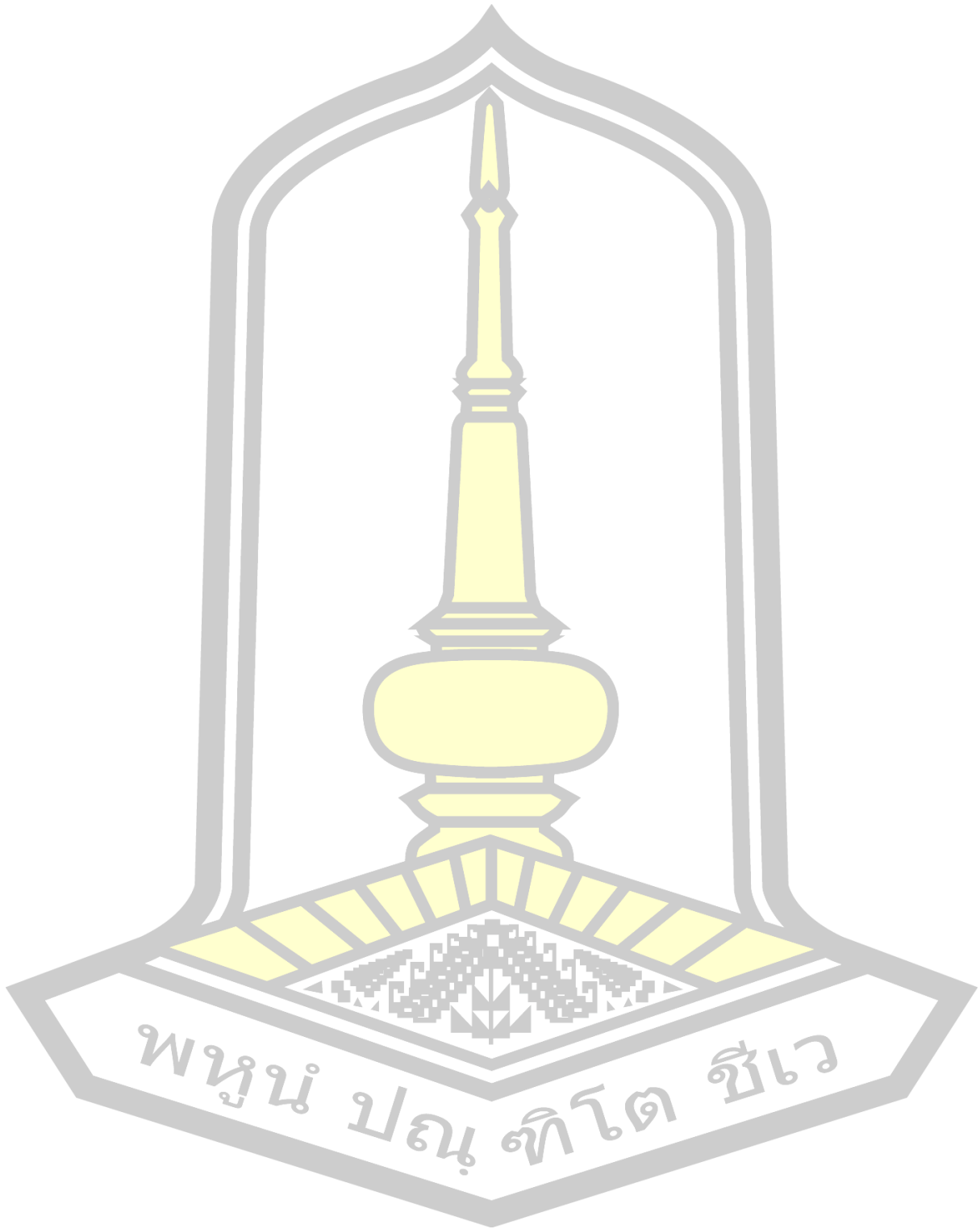
Expand the geographical scope of the sample to cover more different regions and different types of universities, so as to improve the representativeness and extensiveness of the research results. At the same time, increasing the diversity of the sample will help to understand the university students' exercise behavior in different backgrounds more comprehensively.

In view of the possible influence of cultural background on exercise motivation and behavior, a cross-cultural comparison was conducted to explore the similarities and differences in sports environment, exercise motivation and exercise

behavior of university students in different countries or regions. This can not only validate the generality of existing research, but also provide a reference for physical health education on a global scale.



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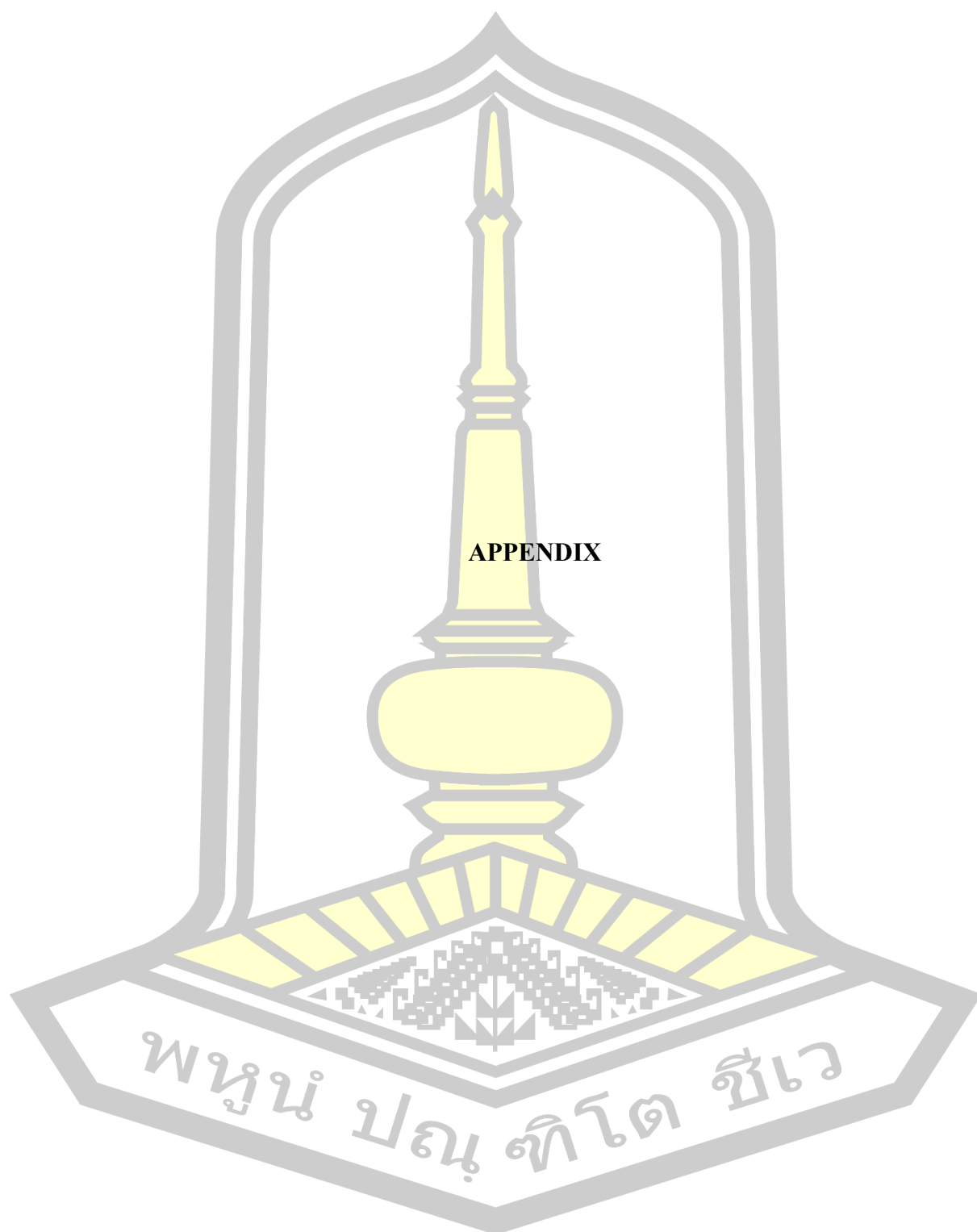
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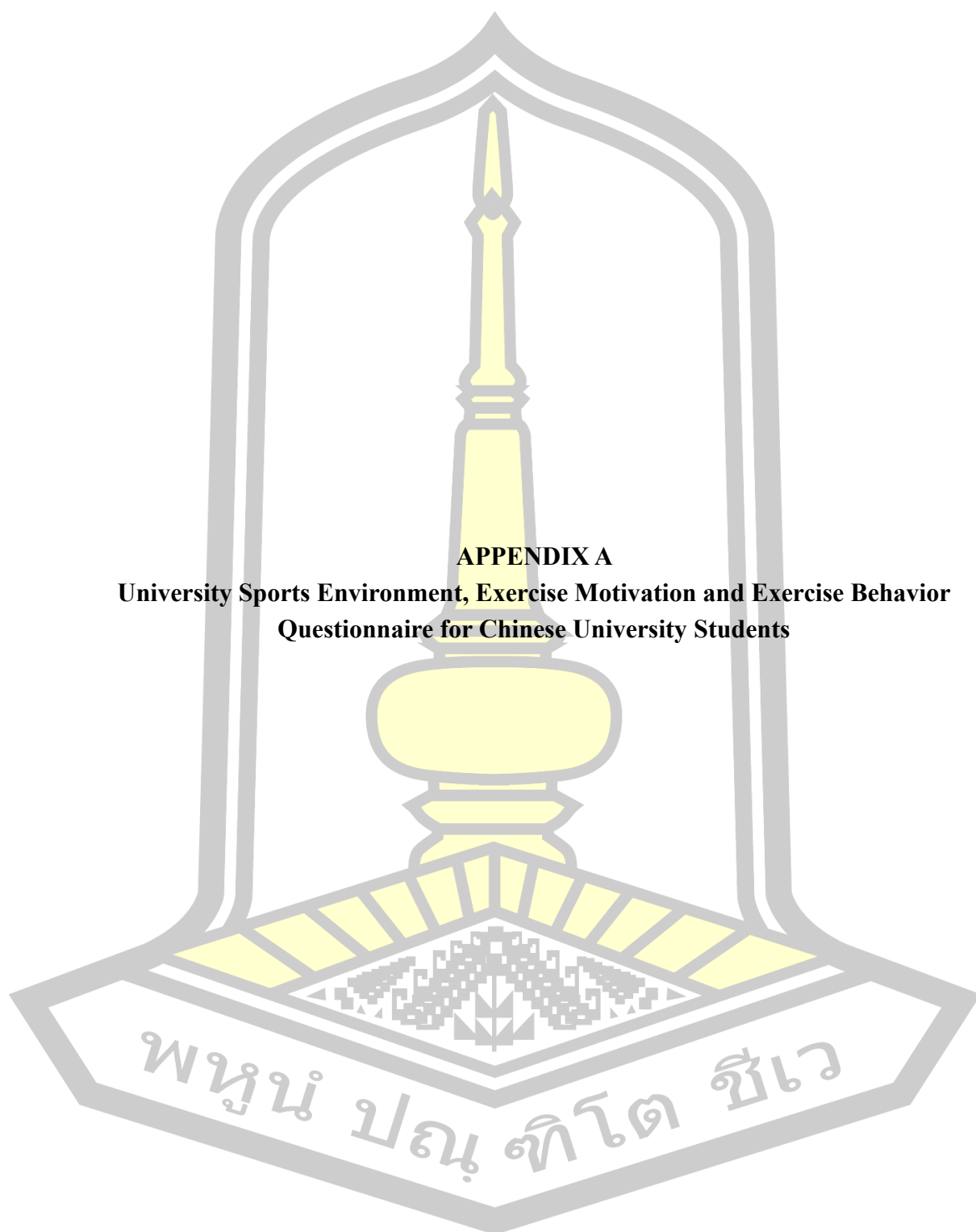
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APPENDIX

พหุมนุ ปณุ ทิโต ชีเว



APPENDIX A

**University Sports Environment, Exercise Motivation and Exercise Behavior
Questionnaire for Chinese University Students**

Part I

Information on demographic variables

Dear Participant:

Greetings! In order to better grasp your perception of the school sports environment, exercise motivation and exercise behavior, we need your support and help. The results of this survey are for academic research only, please answer the questions based entirely on your own perceptions and realities, there are no right or wrong answers, and your support is truly appreciated!

For the following questions, please put a "√" in front of "□" for the option that corresponds to your actual situation.

Basic information

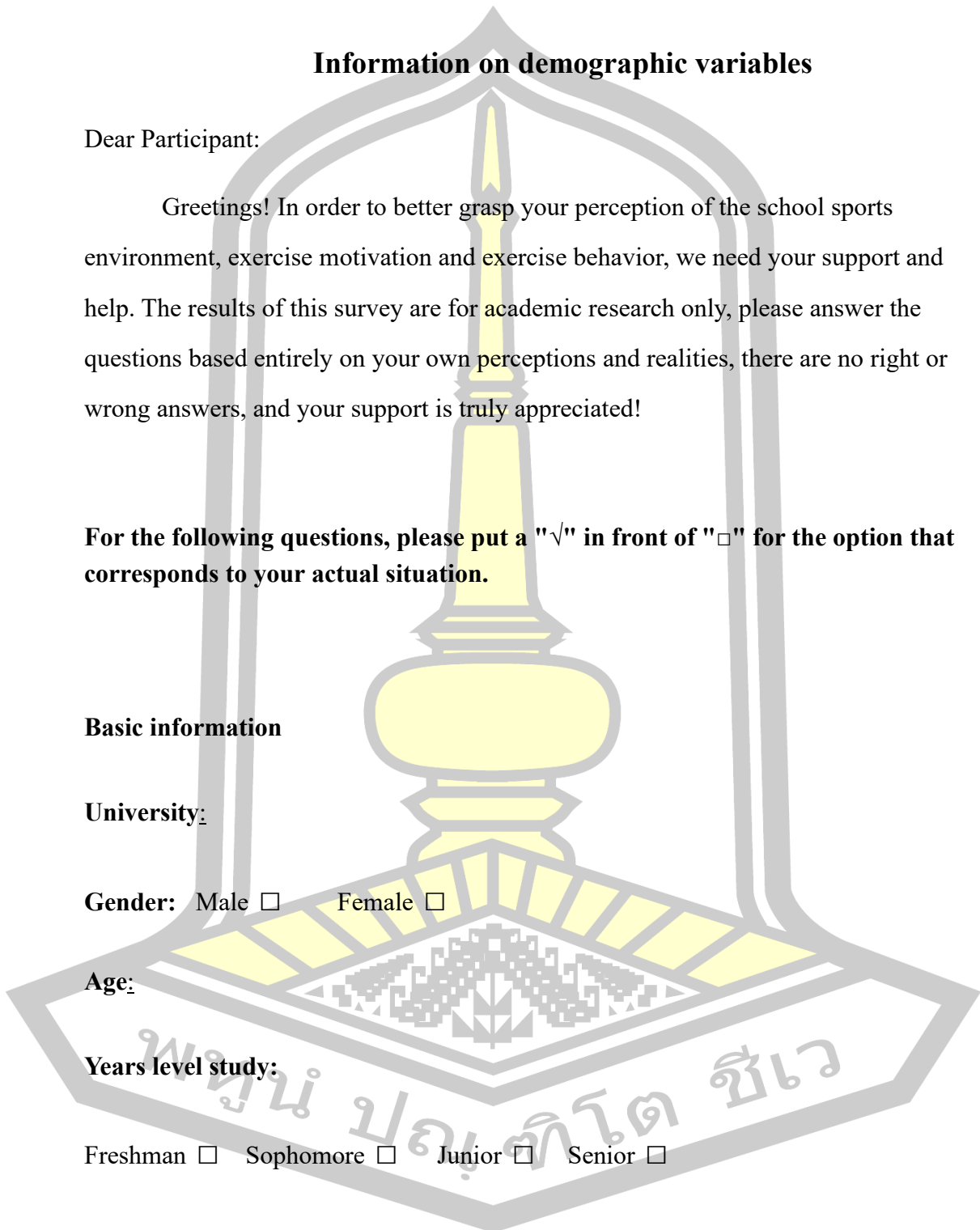
University: _____

Gender: Male Female

Age: _____

Years level study: _____

Freshman Sophomore Junior Senior



Part II

University Sports Environment

For the following questions, please put a "√" in front of "□" for the option that corresponds to your actual situation.

NO.	Question title	5	4	3	2	1
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Q1	My university's green environment and sports activity space design attract me to participate in physical exercise.					
Q2	My university has complete sports venues and facilities, which enable me to participate in physical exercise for at least 1 hour every day.					
Q3	My university has plenty of time for extracurricular sports activities.					
Q4	My university sports equipment can meet my physical exercise needs.					
Q5	I can easily use my university's sports equipment for physical exercise.					
Q6	My university regularly maintains and updates sports venues and sports equipment.					
Q7	The regular physical fitness tests conducted by my university prompted me to take part in physical exercise.					
Q8	My university physical education examination prompted me to take part in physical exercise.					
Q9	My university did not cancel some dangerous sports (such as long-distance running, throwing, etc.) due to concerns about sports accidents.					
Q10	My university publicized and strictly implemented the sports policy.					
Q11	My university organizes at least one school sports meeting every year.					
Q12	My university has relevant extracurricular physical exercise policies (such as running clock-in, physical exercise clock-in, etc.).					
Q13	My university arranges physical education courses according to policy requirements and conducts them normally.					
Q14	Physical education classes have played a positive role in cultivating my interest in sports					
Q15	The form and content of extracurricular sports activities are attractive to me.					

Q16	My university sports curriculum is rich in content, and you can choose your favorite sports.					
Q17	My university has a variety of sports organizations (such as sports clubs, sports associations, sports associations, class/school sports teams, etc.).					
Q18	My university often organizes sports activities (such as class and department sports competitions, sports meetings, sports recreation activities, sports and cultural festivals, etc.).					
Q19	I often take part in sports activities organized by my university.					
Q20	My physical education teacher is conscientious and responsible in his work					
Q21	My teacher often takes part in physical exercise with his/her students.					
Q22	The number of physical education teachers in my university can meet the needs of physical education work.					
Q23	I like my physical education teacher very much.					
Q24	Other teachers (such as counselors, class mentors, etc.) actively support me to participate in physical exercise.					
Q25	Most of my good friends/companions like to take part in physical exercise.					
Q26	Most of my good friends/companions often encourage me to take part in physical exercise.					
Q27	My friends/companions often take part in sports exercises with me.					
Q28	I prefer to take part in physical exercise with friends/companions.					
Q29	I often see other professional teachers (non-PE teachers) in my university participating in physical exercises.					
Q30	The students in the class are very enthusiastic about participating in physical exercise, and most of them like to participate in physical exercise very much.					
Q31	Our principals, deans and other leaders like to take part in physical exercise.					
Q32	The members of my university's sports team set a good example for me to take part in physical exercise.					
Q33	There is a strong atmosphere of physical exercise in my university.					
Q34	The attitude of teachers and students towards students with good physical education and students with good academic performance is exactly the same.					

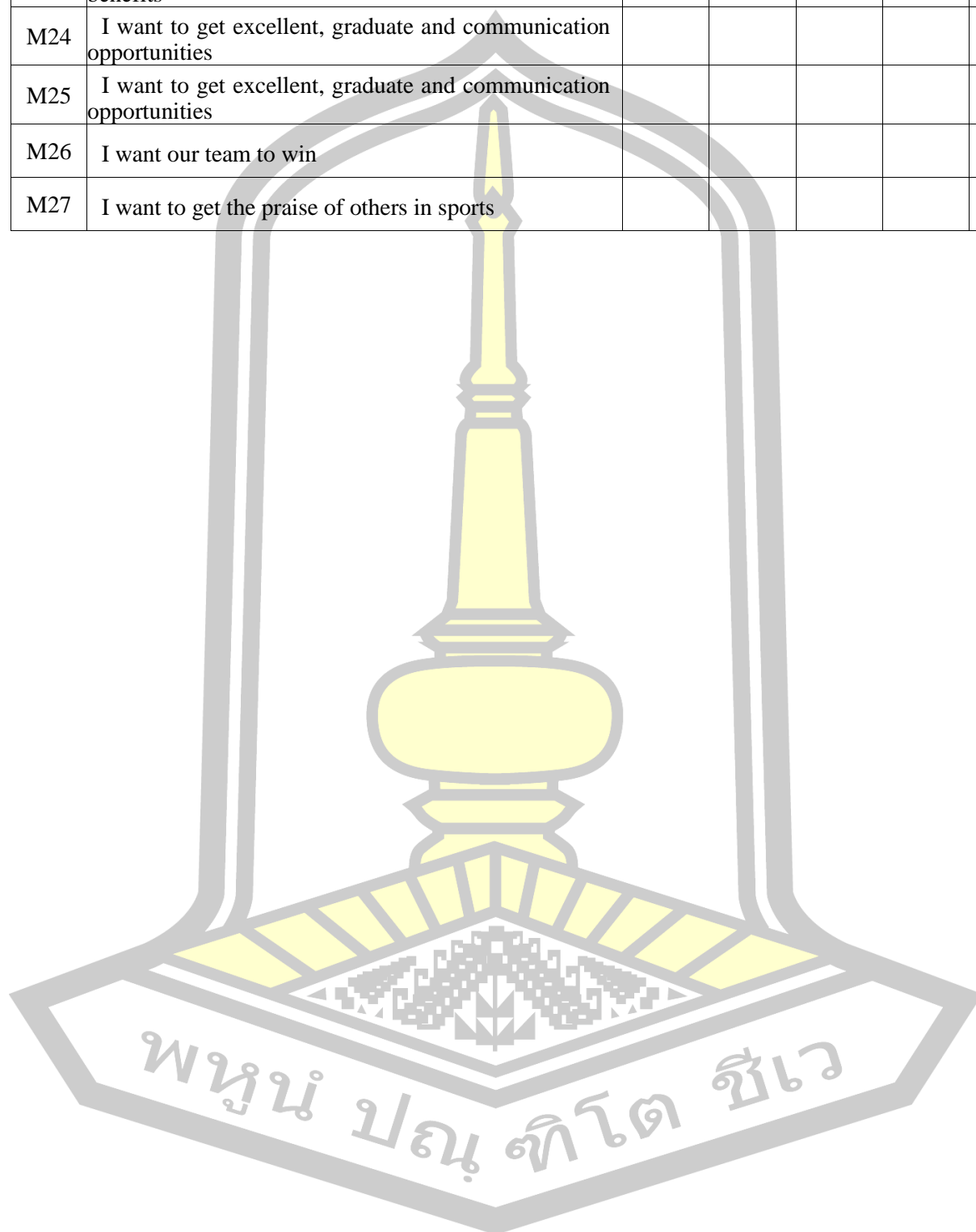
Part III

Exercise Motivation

For the following questions, please put a "√" in front of "□" for the option that corresponds to your actual situation.

NO.	Question title	5	4	3	2	1
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
M1	I want to have a strong body					
M2	I want to keep my mind and body healthy					
M3	I want to live a healthy life					
M4	I want to control my weight					
M5	I want to keep or improve my body shape					
M6	I want to make my appearance more attractive					
M7	I'd like something more entertaining					
M8	I want to be happy					
M9	I want to enjoy a happy life					
M10	I want to acquire new motor skills					
M11	I want to improve my current motor skills					
M12	I want to maintain my current level of athletic skill					
M13	I want to meet some new people					
M14	I want to enhance my feelings and friendship with my friends					
M15	I want to maintain good social relationships					
M16	I want to meet the physical activity attendance requirement					
M17	I want to pass the PE exam					
M18	I want to get some credits in sports					
M19	I want to follow my friend's advice					
M20	I want to listen to my classmates					
M21	I want to listen to my parents					
M22	I want to use sports to get a scholarship					

M23	I want to use physical activity to get some financial benefits					
M24	I want to get excellent, graduate and communication opportunities					
M25	I want to get excellent, graduate and communication opportunities					
M26	I want our team to win					
M27	I want to get the praise of others in sports					



Part IV

Exercise behavior

The following questions are about your exercise behavior in the past month. There are three questions in total, and there is only one answer for each question. Please choose the one that is most suitable for you and tick "√" on the question mark(Select only one).

1. What is the intensity of your physical exercise?

- A. Mild exercise (such as walking, doing radio gymnastics, playing gateball, etc.)
- B. Low-intensity and less intense exercise (such as playing volleyball, table tennis, jogging, Tai Chi, etc. for entertainment)
- C. Moderate-intensity and more intense long-term exercise (such as cycling, running, playing table tennis, etc.)
- D. High-intensity but not long-term exercise with shortness of breath and a lot of sweating (such as playing badminton, tennis, basketball, playing football, etc.)
- E. High-intensity and long-term exercise with shortness of breath and a lot of sweating (such as running, a set of aerobics exercises, swimming, etc.)

2. When you do the above-mentioned intensity physical activities, how many minutes do you spend at a time?

- A. Less than 10 minutes

B. 11 to 20 minutes

C. 21 to 30 minutes

D. 31 to 59 minutes

E. More than 60 minutes

3. How many times a month do you do the above sports activities?

A. Less than once a month

B. 2 to 3 times a month

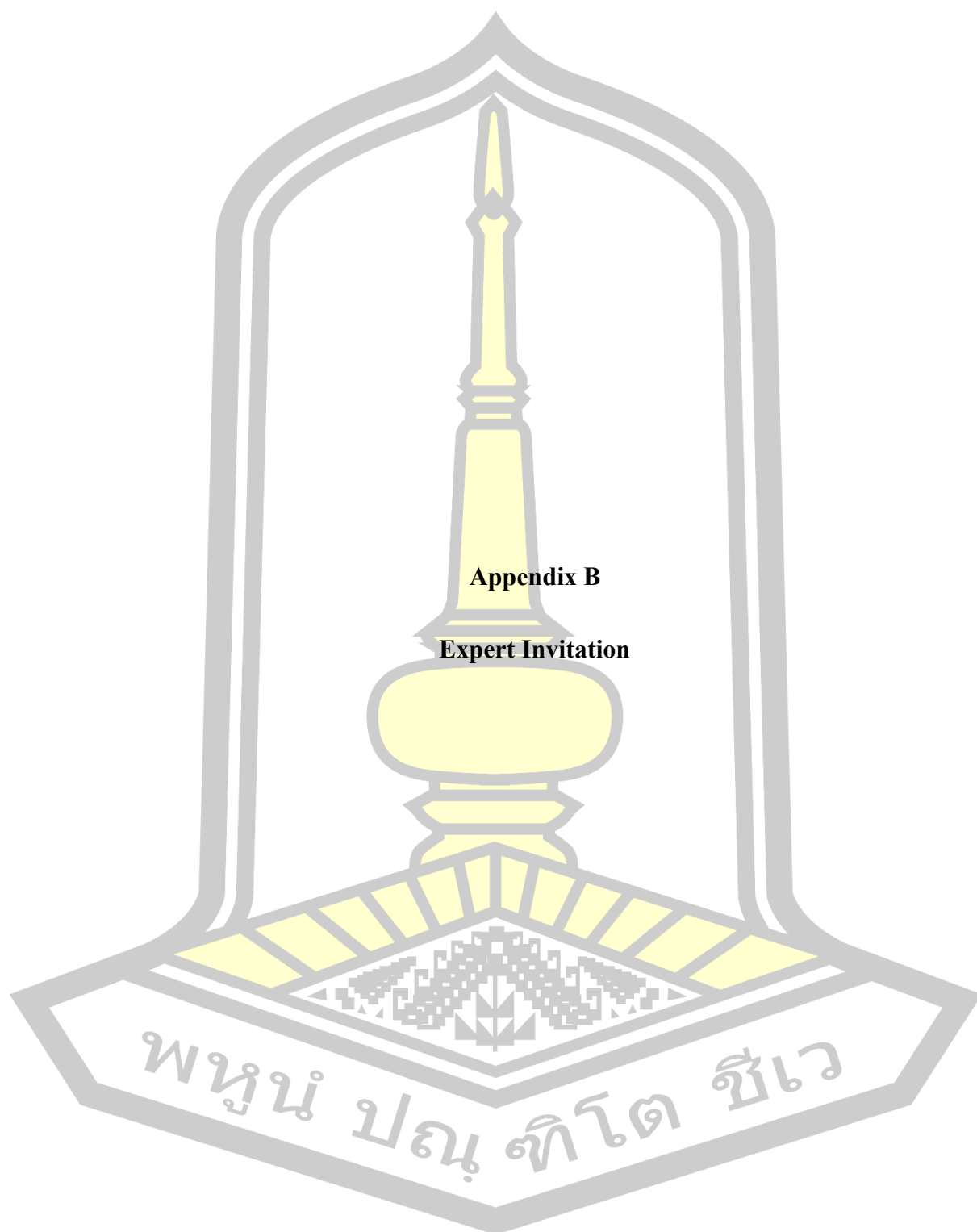
C. 1 to 2 times a week

D. 3 to 5 times a week

E. About once a day

Thank you very much!!!

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Appendix B

Expert Invitation

พหุจน์ ประดิษฐ์ ชัยเว



FACULTY OF EDUCATION
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MHESRI No. 0605.5 (2) / CL544

Date: April 29, 2024

To: Professor Yanni Wang
Chongqing University of Posts and Telecommunications, China
Professor Xiaoxi Dong
Lanzhou University, China
Professor Ling Gao
Nanyang Normal University, China
Professor Jing Li
Sichuan University, China
Professor Qingjian Zhang
Chongqing University of Posts and Telecommunications, China

Subject: Expert Invitation

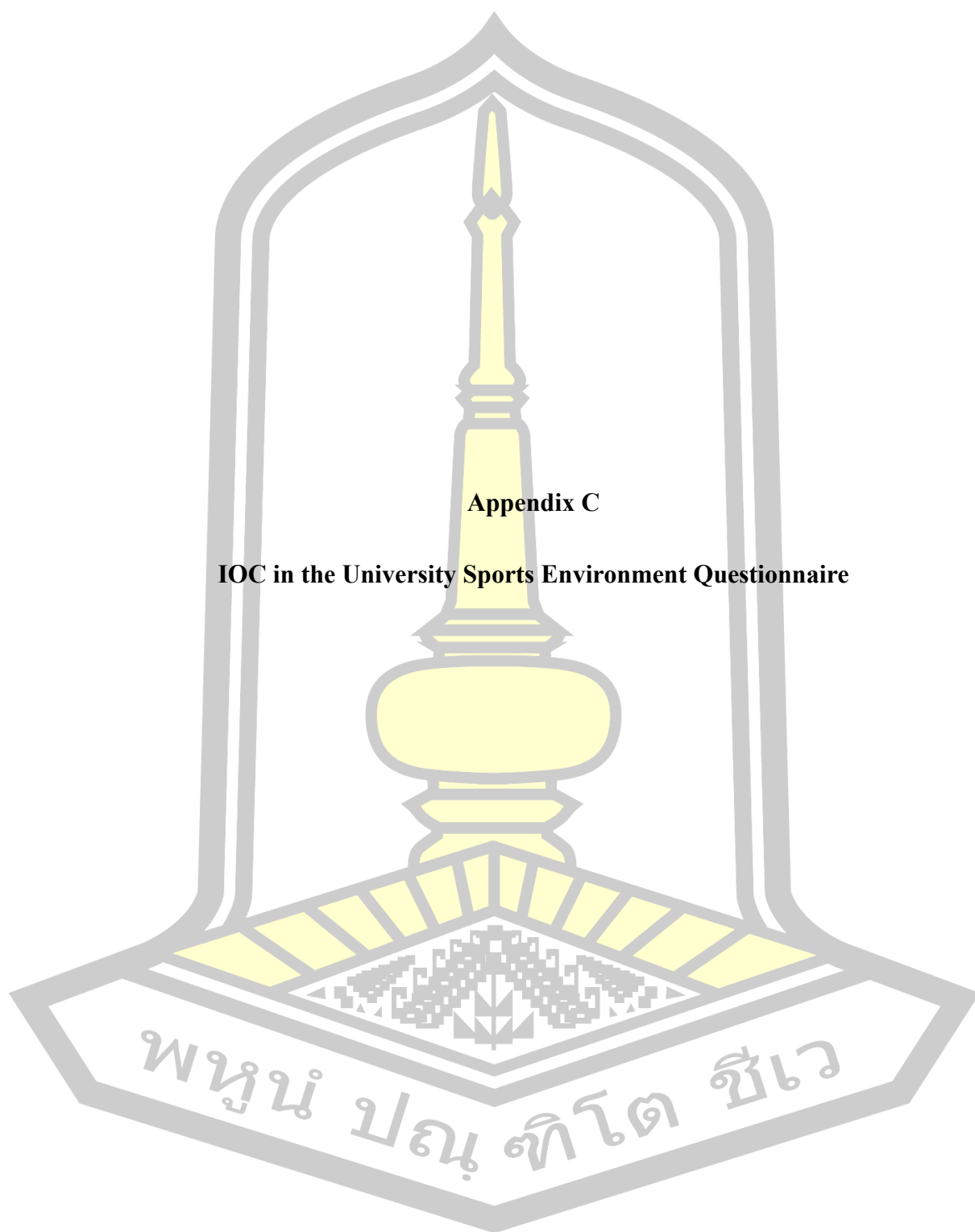
Our student, **Mr. Zengyin Yan, student ID 64010564014**, majoring in the Ph.D. Exercise and Sports Science Program is currently undertaking a research project titled "**The Relationship and Prediction of School Sports Environment, Exercise Motivation, and Physical Exercise Behavior among Chinese University Students**" under the supervision of Dr. Wannaporn Sumranpat Brady.

To ensure the successful execution and the highest quality of this research project, we are seeking your valuable expertise and experience. Therefore, I am sending a formal invitation to you to serve as the expert reviewer for the research instrument designed for this thesis project.

Your participation in this academic endeavor is highly valued and appreciated. Should you require any further information or have questions regarding this invitation, please do not hesitate to contact us by email.

Yours sincerely,

(Assoc. Prof. Chowwalit Chookhampaeng)
Dean, Faculty of Education,
Mahasarakham University



Appendix C

IOC in the University Sports Environment Questionnaire

ITEM OBJECTIVE CONGRUENCE

Dear experts:

Hello!

I am (Mr.Zengyin Yan, PhD Student Health and Sport Science. Faculty of Education, Mahasarakham University) under the advisor of Wannaporn Sumranpat Brady,Ph.D,now doing on research name"The Relationship and prediction of university sports environment, Exercise Motivation, and Physical Exercise Behavior among Chinese University Students" With the objective (specify) :

1. To validate the university sports environment questionnaire for Chinese university students.
2. To determine the relationship between school sports environment and exercise motivation and exercise behavior as a whole and classified by gender and year level of study.
3. To determine the relationship between exercise motivation and exercise behavior as a whole and classified by gender and year level of study.
4. To create equations to predict physical exercise behavior for Chinese university students.

5. To put forward strategies for promoting exercise behavior for Chinese university students.

You are a senior expert with rich knowledge and experience. I sincerely ask for your guidance and help. I hope you can give me guidance and evaluation in your busy schedule and put forward your valuable opinions and suggestions.

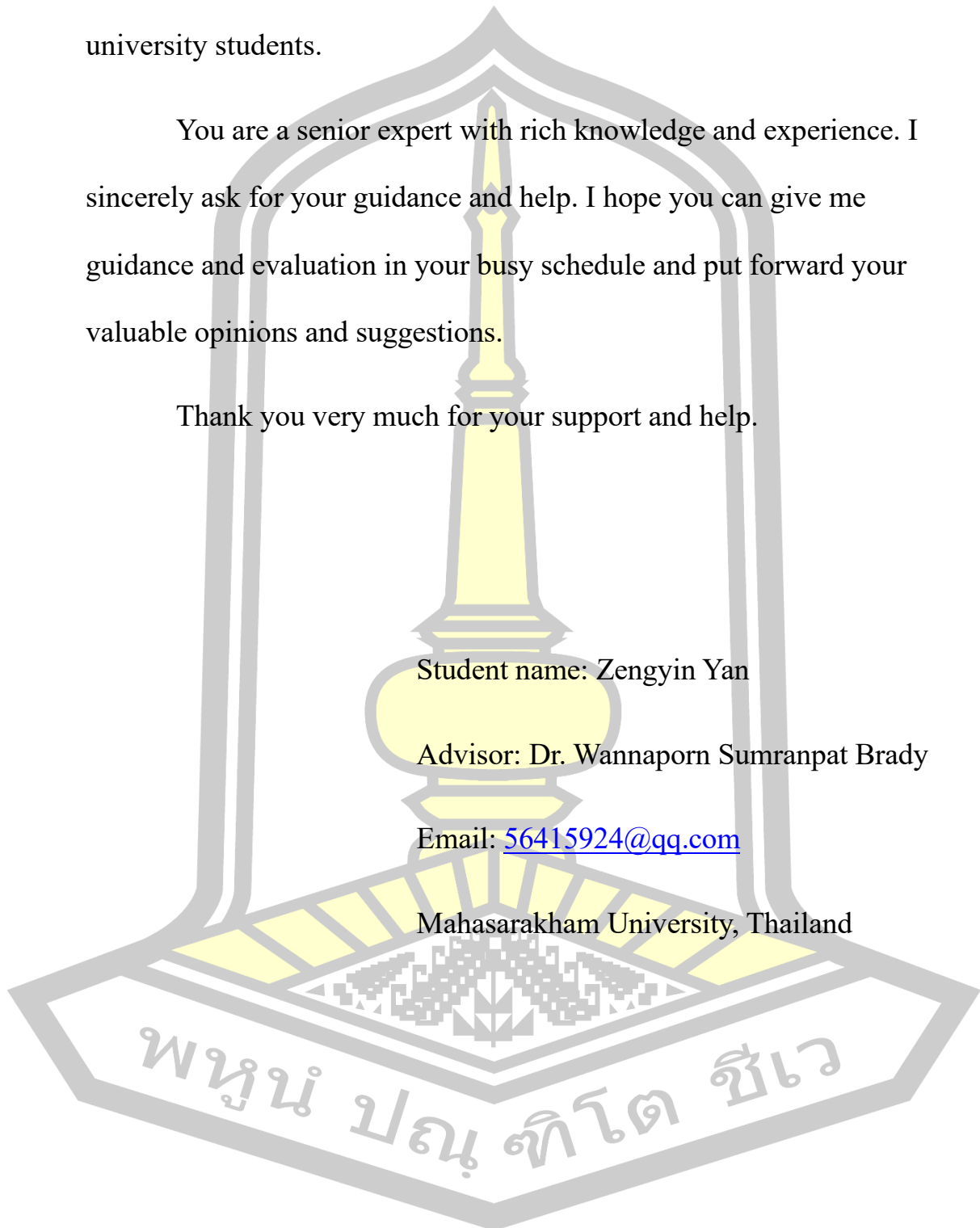
Thank you very much for your support and help.

Student name: Zengyin Yan

Advisor: Dr. Wannaporn Sumranpat Brady

Email: 56415924@qq.com

Maharakham University, Thailand



Please fill in the following personal information:

Expert's name:

Professional title:

Work unit:

Dear experts, the following is the university sports environment questionnaire in this study. Please rate in the score column (**-1 is not suitable, 0 is general, 1 is suitable** between "√"), and give relevant modification suggestions in the topics that need to be modified. Thank you for your guidance and evaluation in the help.

University Sports Environment Questionnaire

N0.	Item	IOC score for the expert			Suggestion
		-1.0	0	1.0	
Q1	My university's green environment and sports activity space design attract me to participate in physical exercise.				
Q2	My university has complete sports venues and facilities, which enable me to participate in physical exercise for at least 1 hour every day.				
Q3	My university has plenty of time for extracurricular sports activities.				
Q4	My university sports equipment can meet my physical exercise needs.				
Q5	I can easily use my university's sports equipment for physical exercise.				
Q6	My university regularly maintains and updates sports venues and sports equipment.				

Q7	The regular physical fitness tests conducted by my university prompted me to take part in physical exercise.				
Q8	My university physical education examination prompted me to take part in physical exercise.				
Q9	My university did not cancel some dangerous sports (such as long-distance running, throwing, etc.) due to concerns about sports accidents.				
Q10	My university publicized and strictly implemented the sports policy				
Q11	My university organizes at least one school sports meeting every year.				
Q12	My university has relevant extracurricular physical exercise policies (such as running clock-in, physical exercise clock-in, etc.).				
Q13	My university arranges physical education courses according to policy requirements and conducts them normally.				
Q14	Physical education classes have played a positive role in cultivating my interest in sports				
Q15	The form and content of extracurricular sports activities are attractive to me.				
Q16	My university sports curriculum is rich in content, and you can choose your favorite sports.				
Q17	My university has a variety of sports organizations (such as sports clubs, sports associations, sports associations, class/school sports teams, etc.).				
Q18	My university often organizes sports activities (such as class and department sports competitions, sports meetings, sports recreation activities, sports and cultural festivals, etc.).				
Q19	I often take part in sports activities organized by My university.				
Q20	My physical education teacher is conscientious and responsible in his work				
Q21	My teacher often takes part in physical exercise with his/her students.				

Q22	The number of physical education teachers in my university can meet the needs of physical education work				
Q23	I like my physical education teacher very much.				
Q24	Other teachers (such as counselors, class mentors, etc.) actively support me to participate in physical exercise.				
Q25	Most of my good friends/companions like to take part in physical exercise.				
Q26	Most of my good friends/companions often encourage me to take part in physical exercise.				
Q27	My friends/companions often take part in sports exercises with me.				
Q28	I prefer to take part in physical exercise with friends/companions.				
Q29	I often see other professional teachers (non-PE teachers) in my university participating in physical exercises				
Q30	The students in the class are very enthusiastic about participating in physical exercise, and most of them like to participate in physical exercise very much.				
Q31	Our principals, deans and other leaders like to take part in physical exercise.				
Q32	The members of my university's sports team set a good example for me to take part in physical exercise.				
Q33	There is a strong atmosphere of physical exercise in My university.				
Q34	The attitude of teachers and students towards students with good physical education and students with good academic performance is exactly the same.				

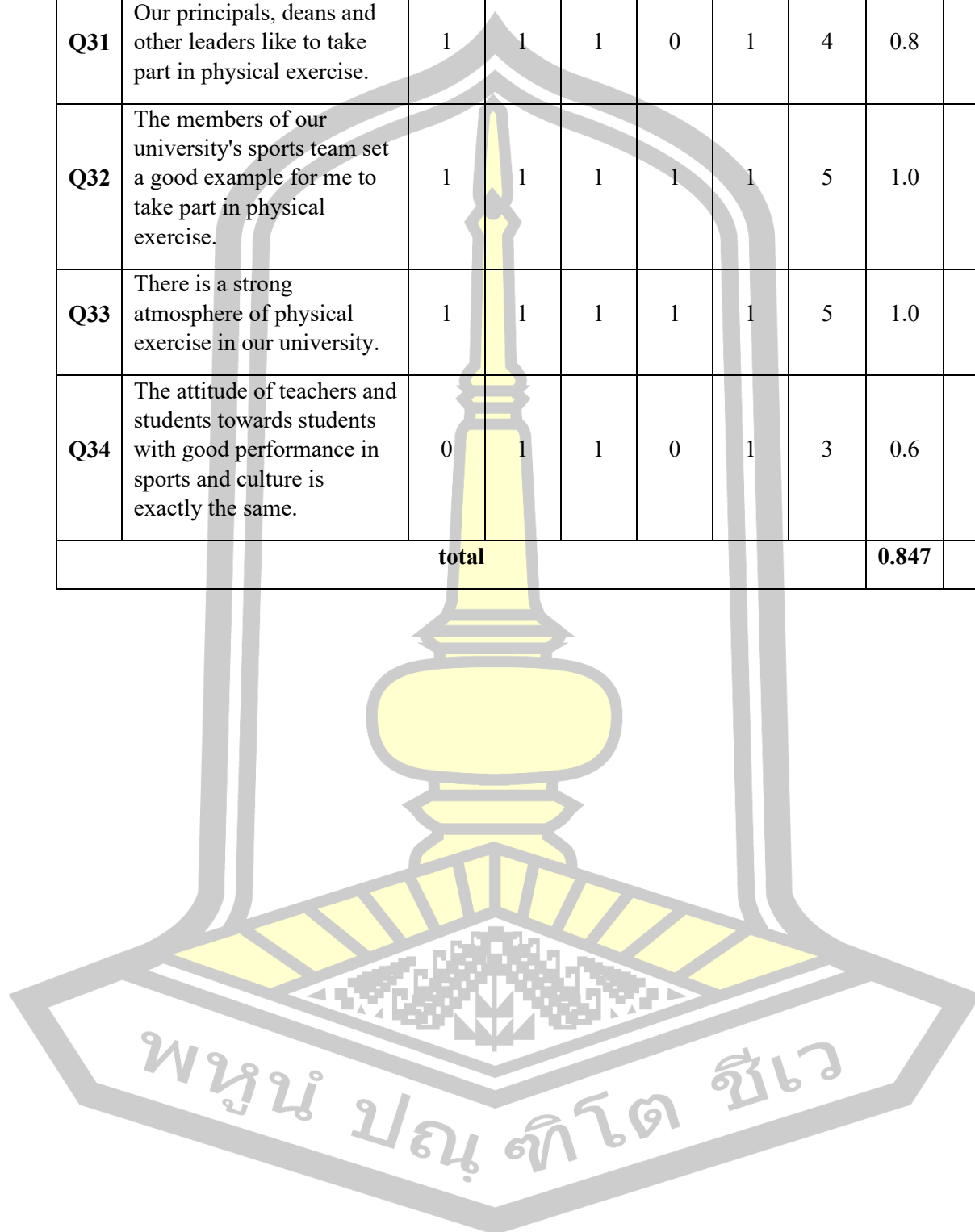
IOC results from the first round of the University Sports Environment questionnaire

N0.	Item	Exp1	Exp2	Exp3	Exp4	Exp5	Total	IOC value	RESULTS
Q1	The green environment of the university and the design of sports activity space attract me to participate in physical exercise.	0	1	1	1	1	4	0.8	Pass
Q2	At university, I can take at least one hour of physical exercise every day.	1	0	1	0	1	3	0.6	Pass
Q3	The university has plenty of time for extracurricular sports activities. (Spatiotemporal characteristics)	0	1	0	1	1	3	0.6	Pass
Q4	The university's sports equipment can meet my physical exercise needs.	1	1	1	1	0	4	0.8	Pass
Q5	I can easily use the university's sports equipment for physical exercise.	1	1	1	1	0	4	0.8	Pass
Q6	The school can provide sufficient financial support for sports.	0	0	0	1	1	2	0.4	Not pass
Q7	The regular physical fitness tests conducted by the university prompted me to take part in physical exercise.	1	1	1	1	1	5	1.0	Pass
Q8	The university physical education examination prompted me to take part in physical exercise.	1	1	0	1	1	4	0.8	Pass
Q9	The university did not cancel some dangerous sports, such as long-distance running and throwing, for fear of	0	1	1	1	1	4	0.8	Pass

	accidental injury.								
Q10	The university propagandizes the sports policy and carries it out strictly.	1	1	0	1	1	4	0.8	Pass
Q11	Our university organizes at least one university sports meeting every year.	1	1	1	1	1	5	1.0	Pass
Q12	The university has relevant extracurricular physical exercise policies (such as running clock-in, physical exercise clock-in, etc.).	1	1	1	1	1	5	1.0	Pass
Q13	The university arranges physical education courses according to policy requirements and conducts them normally.	1	1	1	1	1	5	1.0	Pass
Q14	Physical education has played a positive role in the formation of my interest in sports.	1	1	0	1	1	4	0.8	Pass
Q15	The form and content of extracurricular sports activities are attractive to me.	1	1	0	1	1	4	0.8	Pass
Q16	The university sports curriculum is rich in content, and you can choose your favorite sports.	1	1	1	1	1	5	1.0	Pass
Q17	Our university has a variety of sports organizations (such as sports clubs, sports associations, sports associations, class/school sports teams, etc.).	1	1	1	1	1	5	1.0	Pass
Q18	The university often organizes sports activities (such as class and department sports competitions, sports meetings, sports recreation	1	1	1	1	1	5	1.0	Pass

	activities, sports and cultural festivals, etc.).								
Q19	I often take part in sports activities organized by the university.	1	1	1	1	1	5	1.0	Pass
Q20	My PE teacher is conscientious and responsible in her work.	1	1	1	1	1	5	1.0	Pass
Q21	My teacher often takes part in physical exercise with her students.	1	1	0	1	1	4	0.8	Pass
Q22	The number of PE teachers in our university can meet the needs of PE work.	0	1	1	1	1	4	0.8	Pass
Q23	I like my PE teacher very much.	1	1	0	1	1	4	0.8	Pass
Q24	Other teachers (such as counselors, class mentors, etc.) actively support me to participate in physical exercise.	1	1	0	1	1	4	0.8	Pass
Q25	Most of my good friends/companions like to take part in physical exercise.	1	1	1	1	1	5	1.0	Pass
Q26	My friends/companions often encourage me to take part in physical exercise.	0	1	1	1	1	4	0.8	Pass
Q27	My friends/companions often take part in sports exercises with me.	1	1	1	1	1	5	1.0	Pass
Q28	I prefer to take part in physical exercise with friends/companions.	1	1	1	1	1	5	1.0	Pass
Q29	I often see other professional teachers in our university (non-PE) taking part in physical exercise.	0	1	1	1	1	4	0.8	Pass
Q30	Most students in my class like taking part in physical	0	1	0	1	1	3	0.6	Pass

	exercise very much.								
Q31	Our principals, deans and other leaders like to take part in physical exercise.	1	1	1	0	1	4	0.8	Pass
Q32	The members of our university's sports team set a good example for me to take part in physical exercise.	1	1	1	1	1	5	1.0	Pass
Q33	There is a strong atmosphere of physical exercise in our university.	1	1	1	1	1	5	1.0	Pass
Q34	The attitude of teachers and students towards students with good performance in sports and culture is exactly the same.	0	1	1	0	1	3	0.6	Pass
total								0.847	Pass



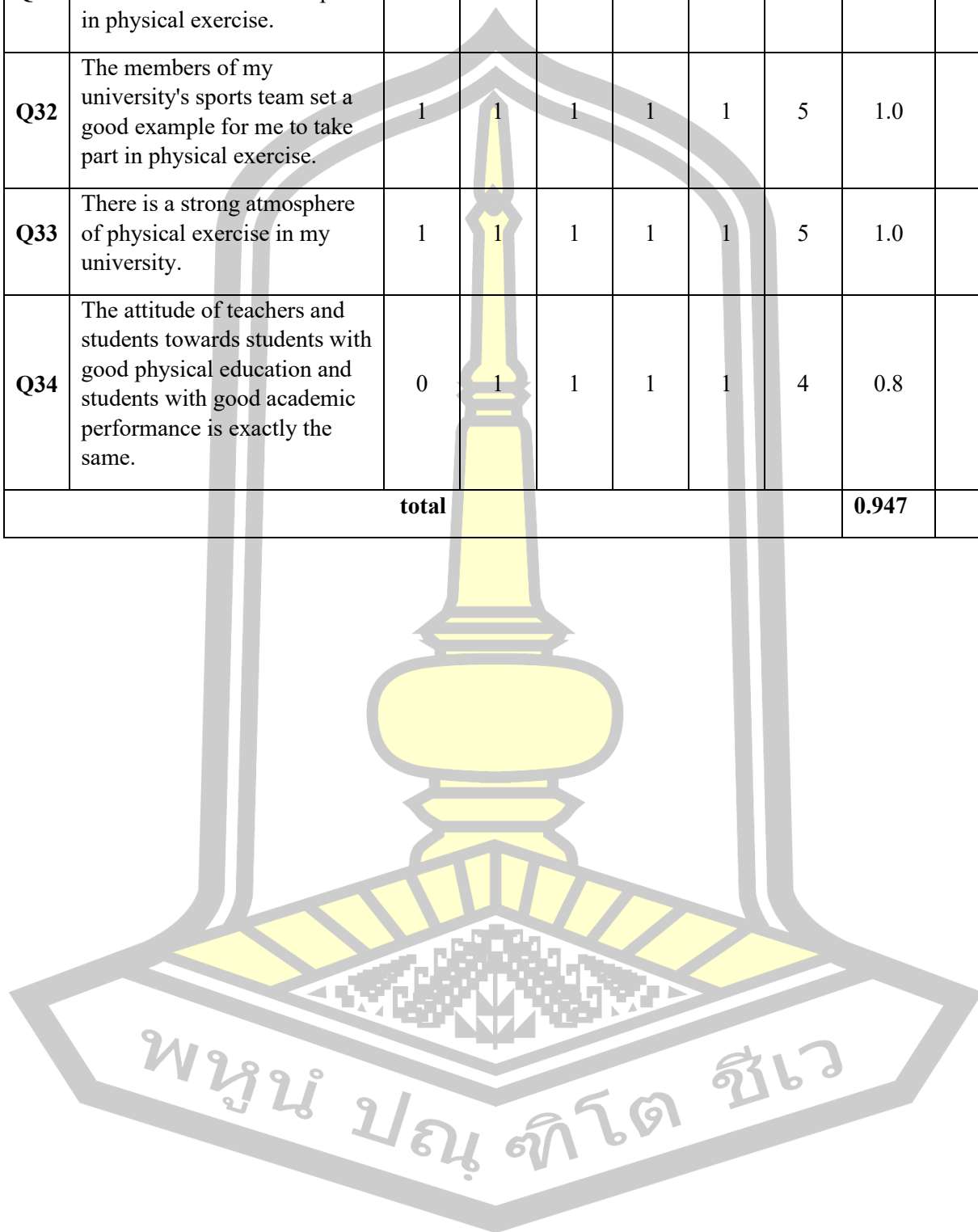
IOC results from the second round of the University Sports Environment questionnaire

N0.	Item	Exp1	Exp2	Exp3	Exp4	Exp5	Total	IOC value	RESULTS
Q1	My university's green environment and sports activity space design attract me to participate in physical exercise.	1	1	1	1	1	5	1.0	Pass
Q2	My university has complete sports venues and facilities, which enable me to participate in physical exercise for at least 1 hour every day.	1	1	1	1	1	5	1.0	Pass
Q3	My university has plenty of time for extracurricular sports activities.	0	1	1	1	1	4	0.8	Pass
Q4	My university sports equipment can meet my physical exercise needs.	1	1	1	1	0	4	0.8	Pass
Q5	I can easily use my university's sports equipment for physical exercise.	1	1	1	1	1	5	1.0	Pass
Q6	My university regularly maintains and updates sports venues and sports equipment.	1	1	0	1	1	4	0.8	Pass
Q7	The regular physical fitness tests conducted by my university prompted me to take part in physical exercise.	1	1	1	1	1	5	1.0	Pass
Q8	My university physical education examination prompted me to take part in physical exercise.	1	1	1	1	1	5	1.0	Pass
Q9	My university did not cancel some dangerous sports (such as long-distance running, throwing, etc.) due to concerns about sports accidents.	1	1	1	1	1	5	1.0	Pass
Q10	My university publicized and strictly implemented the	1	1	1	1	1	5	1.0	Pass

	sports policy								
Q11	My university organizes at least one school sports meeting every year.	1	1	1	1	1	5	1.0	Pass
Q12	My university has relevant extracurricular physical exercise policies (such as running clock-in, physical exercise clock-in, etc.).	1	1	1	1	1	5	1.0	Pass
Q13	My university arranges physical education courses according to policy requirements and conducts them normally.	1	1	1	1	1	5	1.0	Pass
Q14	Physical education classes have played a positive role in cultivating my interest in sports	1	1	1	1	1	5	1.0	Pass
Q15	The form and content of extracurricular sports activities are attractive to me.	1	1	0	1	1	4	0.8	Pass
Q16	My university sports curriculum is rich in content, and you can choose your favorite sports.	1	1	1	1	1	5	1.0	Pass
Q17	My university has a variety of sports organizations (such as sports clubs, sports associations, sports associations, class/school sports teams, etc.).	1	1	1	1	1	5	1.0	Pass
Q18	My university often organizes sports activities (such as class and department sports competitions, sports meetings, sports recreation activities, sports and cultural festivals, etc.).	1	1	1	1	1	5	1.0	Pass
Q19	I often take part in sports activities organized by my university.	1	1	1	1	1	5	1.0	Pass

Q20	My physical education teacher is conscientious and responsible in his work	1	1	1	1	1	5	1.0	Pass
Q21	My teacher often takes part in physical exercise with his/her students.	1	1	0	1	1	4	0.8	Pass
Q22	The number of physical education teachers in my university can meet the needs of physical education work	1	1	1	1	1	5	1.0	Pass
Q23	I like my physical education teacher very much.	1	1	0	1	1	4	0.8	Pass
Q24	Other teachers (such as counselors, class mentors, etc.) actively support me to participate in physical exercise.	1	1	1	1	1	5	1.0	Pass
Q25	Most of my good friends/companions like to take part in physical exercise.	1	1	1	1	1	5	1.0	Pass
Q26	Most of my good friends/companions often encourage me to take part in physical exercise.	1	1	1	1	1	4	1.0	Pass
Q27	My friends/companions often take part in sports exercises with me.	1	1	1	1	1	5	1.0	Pass
Q28	I prefer to take part in physical exercise with friends/companions.	1	1	1	1	1	5	1.0	Pass
Q29	I often see other professional teachers (non-PE teachers) in my university participating in physical exercises	1	1	1	1	1	5	1.0	Pass
Q30	The students in the class are very enthusiastic about participating in physical exercise, and most of them like to participate in physical exercise very much.	0	1	1	1	1	4	0.8	Pass

Q31	Our principals, deans and other leaders like to take part in physical exercise.	1	1	1	0	1	4	0.8	Pass
Q32	The members of my university's sports team set a good example for me to take part in physical exercise.	1	1	1	1	1	5	1.0	Pass
Q33	There is a strong atmosphere of physical exercise in my university.	1	1	1	1	1	5	1.0	Pass
Q34	The attitude of teachers and students towards students with good physical education and students with good academic performance is exactly the same.	0	1	1	1	1	4	0.8	Pass
total								0.947	Pass



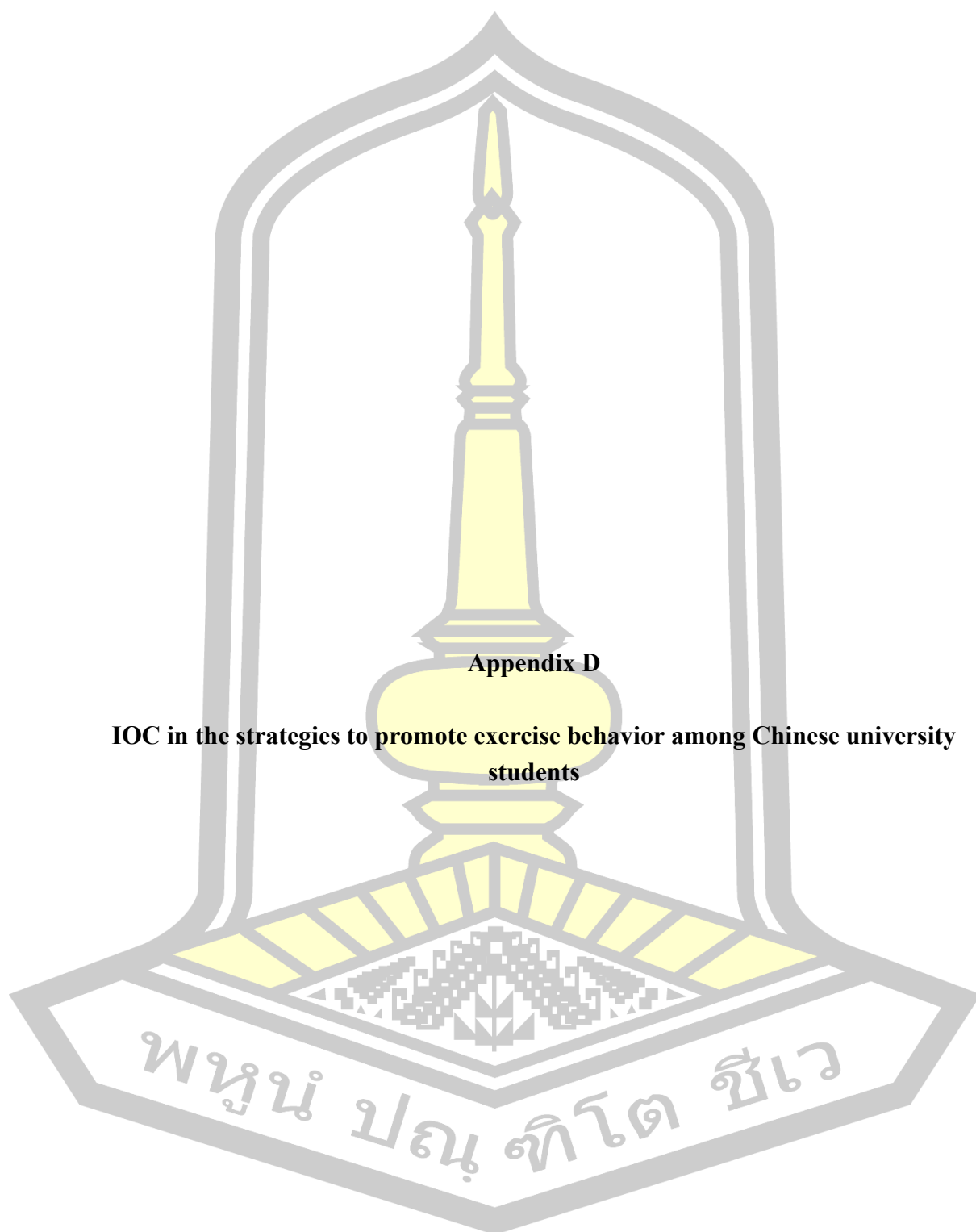
IOC final results of the University Sports Environment questionnaire

N0.	Item	Round 1	Round 2	Result
Q1	My university's green environment and sports activity space design attract me to participate in physical exercise.	0.8	1.0	Pass
Q2	My university has complete sports venues and facilities, which enable me to participate in physical exercise for at least 1 hour every day.	0.6	1.0	Pass
Q3	My university has plenty of time for extracurricular sports activities.	0.6	0.8	Pass
Q4	My university sports equipment can meet my physical exercise needs.	0.8	0.8	Pass
Q5	I can easily use my university's sports equipment for physical exercise.	0.8	1.0	Pass
Q6	My university regularly maintains and updates sports venues and sports equipment.	0.4	0.8	Pass
Q7	The regular physical fitness tests conducted by my university prompted me to take part in physical exercise.	1.0	1.0	Pass
Q8	My university physical education examination prompted me to take part in physical exercise.	0.8	1.0	Pass
Q9	My university did not cancel some dangerous sports (such as long-distance running, throwing, etc.) due to concerns about sports accidents.	0.8	1.0	Pass
Q10	My university publicized and strictly implemented the sports policy	0.8	1.0	Pass
Q11	My university organizes at least one school sports meeting every year.	1.0	1.0	Pass
Q12	My university has relevant extracurricular physical exercise policies (such as running clock-in, physical exercise clock-in, etc.).	1.0	1.0	Pass

N0.	Item	Round 1	Round 2	Result
Q13	My university arranges physical education courses according to policy requirements and conducts them normally.	1.0	1.0	Pass
Q14	Physical education classes have played a positive role in cultivating my interest in sports	0.8	1.0	Pass
Q15	The form and content of extracurricular sports activities are attractive to me.	0.8	0.8	Pass
Q16	My university sports curriculum is rich in content, and you can choose your favorite sports.	1.0	1.0	Pass
Q17	My university has a variety of sports organizations (such as sports clubs, sports associations, sports associations, class/school sports teams, etc.).	1.0	1.0	Pass
Q18	My university often organizes sports activities (such as class and department sports competitions, sports meetings, sports recreation activities, sports and cultural festivals, etc.).	1.0	1.0	Pass
Q19	I often take part in sports activities organized by My university.	1.0	1.0	Pass
Q20	My physical education teacher is conscientious and responsible in his work	1.0	1.0	Pass
Q21	My teacher often takes part in physical exercise with his/her students.	0.8	0.8	Pass
Q22	The number of physical education teachers in my university can meet the needs of physical education work	0.8	1.0	Pass
Q23	I like my physical education teacher very much.	0.8	0.8	Pass
Q24	Other teachers (such as counselors, class mentors, etc.) actively support me to participate in physical exercise.	0.8	1.0	Pass
Q25	Most of my good friends/companions like to take part in physical exercise.	1.0	1.0	Pass
Q26	Most of my good friends/companions often encourage me to take part in physical exercise.	0.8	1.0	Pass

N0.	Item	Round 1	Round 2	Result
Q27	My friends/companions often take part in sports exercises with me.	1.0	1.0	Pass
Q28	I prefer to take part in physical exercise with friends/companions.	1.0	1.0	Pass
Q29	I often see other professional teachers (non-PE teachers) in my university participating in physical exercises	0.8	1.0	Pass
Q30	The students in the class are very enthusiastic about participating in physical exercise, and most of them like to participate in physical exercise very much.	0.6	0.8	Pass
Q31	Our principals, deans and other leaders like to take part in physical exercise.	0.8	0.8	Pass
Q32	The members of my university's sports team set a good example for me to take part in physical exercise.	1.0	1.0	Pass
Q33	There is a strong atmosphere of physical exercise in My university.	1.0	1.0	Pass
Q34	The attitude of teachers and students towards students with good physical education and students with good academic performance is exactly the same.	0.6	0.8	Pass
total		0.847	0.947	Pass





Appendix D

IOC in the strategies to promote exercise behavior among Chinese university students

**Expert evaluation questionnaire on strategies to promote
exercise behavior among Chinese university students**

Dear experts:

Hello!

I am (Mr.Zengyin Yan, PhD Student Health and Sport Science. Faculty of Education, Mahasarakham University) under the advisor of Wannaporn Sumranpat Brady,Ph.D,now doing on research name"The Relationship and prediction of university sports environment, Exercise Motivation, and Physical Exercise Behavior among Chinese University Students".The research results show that the university sports environment and exercise motivation have a positive and significant predictive effect on the exercise behavior of Chinese university students. Based on the research results, the following strategies are proposed to promote the exercise behavior of Chinese university students.

You are a senior expert with rich knowledge and experience. I sincerely ask for your guidance and help. I hope you can give me guidance and evaluation in your busy schedule and put forward your valuable opinions and suggestions.

Thank you very much for your support and help.

Student name: Zengyin Yan

Advisor: Dr. Wannaporn Sumranpat Brady

Email: 56415924@qq.com

Mahasarakham University, Thailand

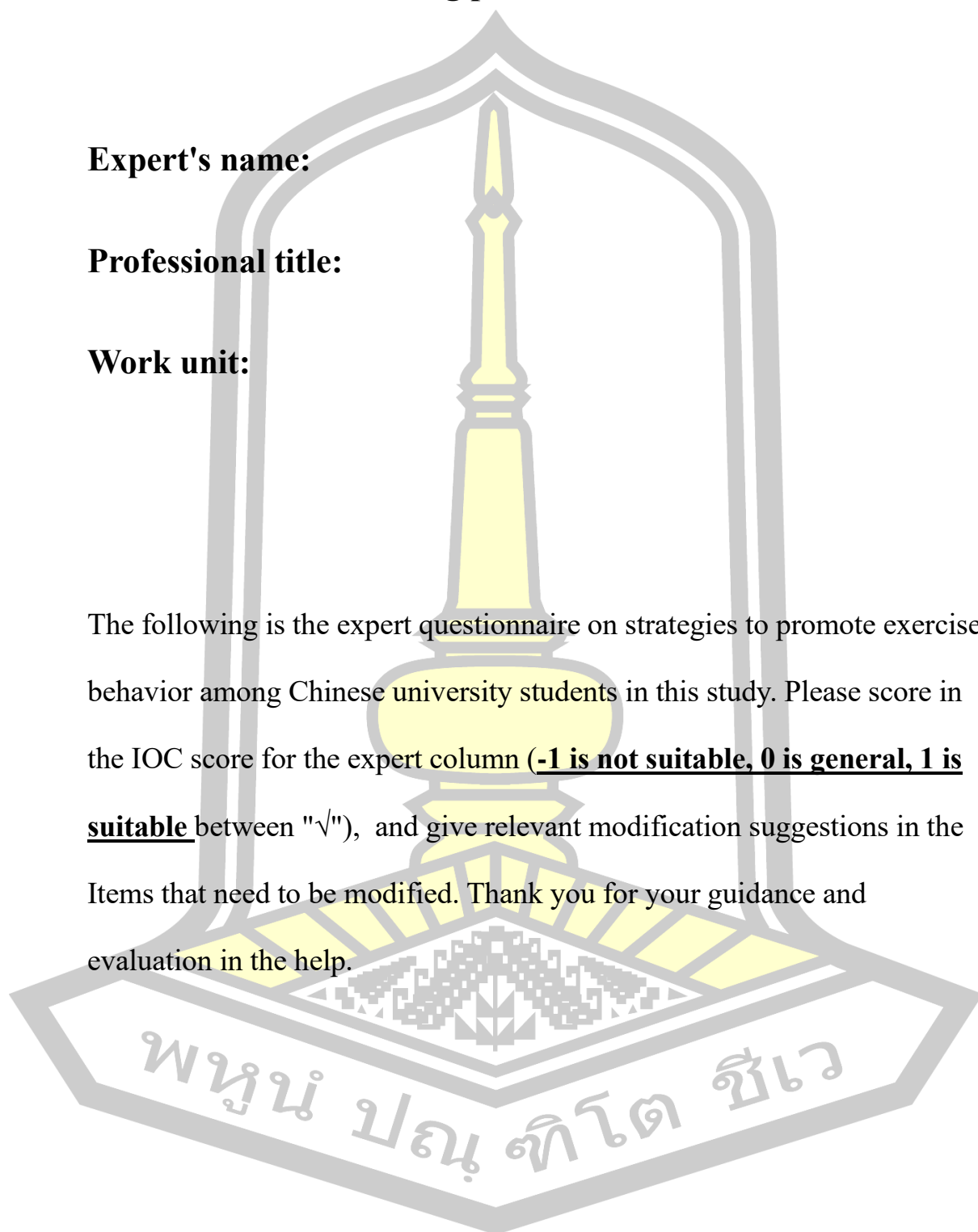
Please fill in the following personal information:

Expert's name:

Professional title:

Work unit:

The following is the expert questionnaire on strategies to promote exercise behavior among Chinese university students in this study. Please score in the IOC score for the expert column (**-1 is not suitable, 0 is general, 1 is suitable** between "√"), and give relevant modification suggestions in the Items that need to be modified. Thank you for your guidance and evaluation in the help.



IOC evaluation of strategies to promote exercise behavior among Chinese university students

1. Strategies for university sports environment

1.1 University sports physical environment

Factors	Details	IOC score for the expert			Suggestion
		-1	0	1	
Reasonable planning of sports space	Through the analysis of university space, determine the best sports field layout and allocation. Ensure the safety and convenience of the site, make it easy to access and use, and provide adequate rest and changing facilities according to the space situation. Rationally plan and utilize the sports space in the campus to maximize its use.				
Provide a variety of sports venues	Universities should evaluate the use of existing sports venues, and build and maintain diversified sports venues according to the needs and interests of university students, such as: basketball courts, football fields, athletics fields, swimming pools, tennis courts, gyms, etc., to meet the exercise needs of different groups of students.				

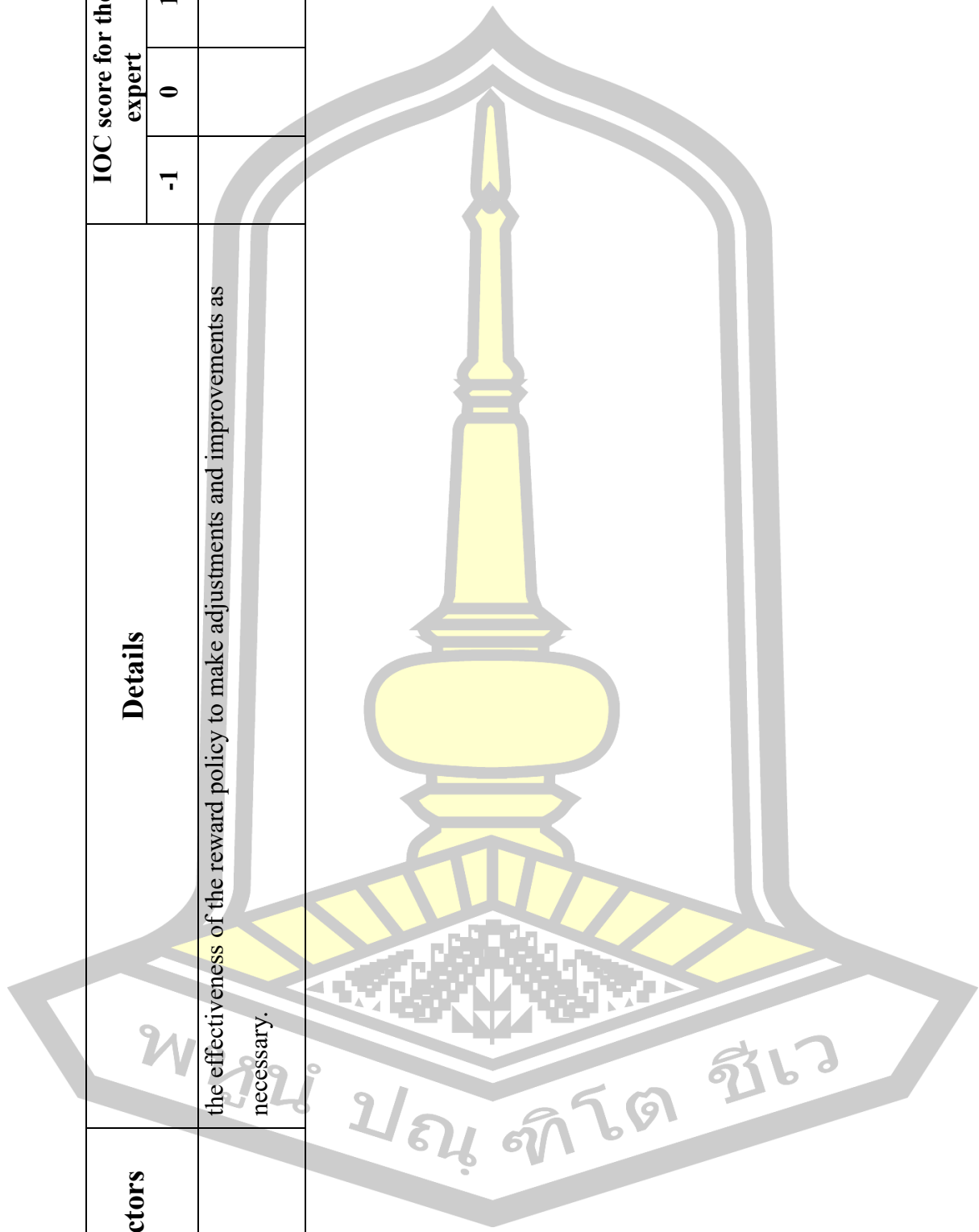
Factors	Details	IOC score for the expert			Suggestion
		-1	0	1	
Increase indoor exercise space	When building new or retrofitting buildings, consider adding indoor sports space. In bad weather or at night, provide indoor exercise space, such as: indoor basketball, badminton, table tennis, dance room, gym and other multi-purpose sports venues, ensure that these spaces are well equipped to meet the needs of different sports.				
Provide high quality exercise equipment	Equip and maintain high quality sports equipment, such as: dumbbells, treadmills, yoga MATS, etc., to ensure the equipment is safe and functional. Check and update sports equipment regularly to ensure it is in good condition. Provide a variety of equipment to meet different exercise needs.				
Improve the accessibility of equipment	Through the analysis of university space, determine the best sports field layout and allocation. Ensure the safety and convenience of the site, make it easy to access and use, and provide adequate rest and changing facilities according to the space situation. Rationally plan and utilize the sports space in the campus to maximize its use.				

Factors	Details	IOC score for the expert			Suggestion
		-1	0	1	
Improve the utilization of site and equipment	According to the university students' work and rest time, reasonable arrangement of the opening time of the sports venue. A reservation system is introduced to avoid waste of space and equipment and ensure that every university student has a chance to use it. Improve the utilization of sports venues and equipment through reasonable opening hours and reservation system.				
Set up sports as the theme of the sculpture or sports celebrities and famous words	By setting up sports-themed sculptures or sports celebrities and famous quotes billboards, the sports culture literacy is displayed to university students through visual and written forms, conveys the spirit and values of sports, and stimulates university students' cognition and perception of sports.				

1.2 University sports policy environment

Factors	Details	IOC score for the expert			Suggestion
		-1	0	1	
Implement national and university sports policies	Publicize and popularize national and university sports policies, such as: physical education curriculum, physical education credits, national physical fitness test standards, graduation requirements, etc., and increase the strength of policy implementation. To make university students understand the national and university sports policy and implementation.				
Developing and promoting health policies	To develop and promote health policies to promote university students' physical exercise, such as: 3 times a week of extracurricular physical exercise. Through campus publicity, lectures and activities, health policies were promoted to university students and were guided to establish correct sports values. Ensure the implementation and supervision of policies, and regularly check and evaluate the implementation effect of policies.				
Provide policy support and incentives	Set up relevant reward policy, such as: sports scholarship, exercise points exchange rewards, etc., to encourage university students to actively participate in sports activities. Ensure that rewards are fair and transparent, and regularly evaluate				

Factors	Details	IOC score for the expert			Suggestion
		-1	0	1	
	the effectiveness of the reward policy to make adjustments and improvements as necessary.				



1.3 University sports social environment

Factors	Details	IOC score for the expert			Suggestion
		-1	0	1	
The optimization of physical education course	<p>The combination of compulsory and optional courses, in the course, there are not only compulsory physical education courses (freshman and sophomore), but also a variety of elective courses (junior and senior) to meet the needs of university students in different grades. According to the interest survey of university students, a variety of physical education courses are designed and offered, such as ball games, combat sports, traditional ethnic sports, etc. At the same time, some projects that female students are more fond of are offered, such as yoga, Pilates, aerobics, etc., to meet the exercise interests and needs of university students of different genders. Through the course guide, consultation, experience and so on to help university students to choose the right physical education courses.</p>				
Diverse opportunities	<p>To promote physical exercise opportunities for university students of different grades through the combination of compulsory and elective</p>				

Factors	Details	IOC score for the expert			Suggestion
		-1	0	1	
for physical exercise	<p>courses. At the same time, by providing the necessary facilities and funds to support and develop a variety of university student sports associations, such as: school sports teams, sports clubs and so on. And regularly organize various sports competitions in the university to increase extracurricular exercise opportunities for university students.</p>				
Provide professional teacher support	<p>Equipped with professional physical education teachers and coaches to provide high-quality physical exercise guidance and support. Regular training of physical education teachers and coaches to ensure that they have professional knowledge and skills. Through the guidance of physical education teachers, to help university students master sports skills, make a reasonable exercise plan, enhance their exercise effect.</p>				
Enhance friend/peer support	<p>Organize group exercise activities to promote communication and trust between friends/peers, encourage exercise with friends/peers to enhance each other's motivation and support. Through social media</p>				

Factors	Details	IOC score for the expert			Suggestion
		-1	0	1	
	platforms, university students were encouraged to share their exercise experience and results to form a good exercise atmosphere.				
Social norms and sports culture	<p>Create supportive groups of sports associations that enhance university students' sense of belonging and participation through social and physical activities. Carry out healthy lifestyle promotion activities, such as: sports meeting, sports and health lecture, experience sharing meeting of sports stars or elite athletes of school team, sports week, etc. Through the campus media and publicity platform, positive sports values are transmitted, a positive and healthy campus culture is created, and university students are encouraged to develop good exercise habits.</p>				

1. Strategies for exercise motivation

2.1 Intrinsic Motivation

Factors	Details	IOC score for the expert			Suggestion
		-1	0	1	
Health Motivation	Health education and publicity, regular health lectures, workshops and publicity activities, invited professional nutritionists, fitness coaches and psychological counselors to explain the benefits of physical exercise on physical and mental health, to increase university students' understanding of the health benefits of physical exercise, so as to enhance their health motivation. At the same time, personalized health assessment was carried out to provide free or low-cost health assessment services for university students, including health examination, physical test, bone test and personalized exercise advice. Through specific data and analysis, university students can realize the importance of physical exercise to their personal health and enhance their health motivation.				
Appearance Motivation	Teaching university students how to keep and control their weight and improve their body shape and appearance through physical exercise. To improve university students' expectation of the appearance improvement effect of exercise and enhance their appearance motivation. Provide regular physical				

Factors	Details	IOC score for the expert			Suggestion
		-1	0	1	
	<p>measurement and progress feedback services, such as: body fat test, muscle circumference measurement, etc., so that university students can see the concrete changes brought about by exercise and enhance their appearance motivation.</p>				
<p>Pleasure Motivation</p>	<p>Build a rich content of physical education courses, organize a variety of recreational sports activities, such as: sports games, outdoor adventure, fun games, etc., to increase the interest of exercise. Engaging university students in exercise through interesting activities enhances their pleasure motivation.</p> <p>"Sports Experience Day" was held regularly to introduce new and interesting sports, so that university students could experience different exercise methods, increase their understanding and interest in different sports, and enhance their pleasure motivation.</p>				
<p>Curiosity Motivation of sports Skills</p>	<p>Regularly set up a variety of sports skills training and improvement courses or projects, such as: ball games, dance, ethnic tradition projects, etc., provide professional guidance to help university students master or improve sports</p>				

Factors	Details	IOC score for the expert			Suggestion
		-1	0	1	
	<p>To stimulate university students' interest in learning and improving their sports skills, and enhance their curiosity motivation of sports skills. School sports competitions and competitive activities are held regularly to provide a platform for displaying and improving skills. Through competition and challenge, university students' desire for learning and improving skills is stimulated, and their curiosity motivation of sports skills is enhanced.</p>				
Social Motivation	<p>Support and encourage university students to set up various sports associations and clubs, provide venues and resources to support university students, and enhance university students' social interaction and social motivation through associations and club activities. Organize team exercise activities, such as: group running, group gymnastics, ball games, etc., to enhance university students' team cooperation and social connection. Through team activities, enhance university students' social relationship and sense of participation, and improve their social motivation.</p>				

2.2 Extrinsic Motivation

Factors	Details	IOC score for the expert			Suggestion
		-1	0	1	
Academic Motivation	Physical education courses are linked to physical exercise, and university students can get extra points for participating in a certain number of physical exercises. Through academic rewards, students are encouraged to actively participate in physical exercise. Strict implementation of the national physical health standards policy, urge academics to carry out physical exercise in order to complete the physical examination goals. At the same time, elective courses combining academic and physical education, such as: "Sports and health", "Sports psychology", "Sports appreciation", etc., are set up to combine academic learning and physical exercise, increase university students' academic interest in physical exercise and enhance their academic motivation.				
Identification Motivation	University students who actively participate in sports activities should be publicized and commended on campus media to set an example, and their sports identity and motivation should be enhanced through social recognition and commendation. University students who actively participate and perform well will be awarded sports activity certificates and honorary titles, such as: "Best Athlete" and "Health expert", etc., which will enhance university students' sense of achievement and identity and enhance their identity				

Factors	Details	IOC score for the expert			Suggestion
		-1	0	1	
	motivation through honor and recognition.				
Economic Motivation	<p>Establish an exercise point system, university students get points by participating in sports activities, points can be exchanged for gifts, gym membership cards or campus meal vouchers. Financial rewards were used to encourage university students to participate in physical exercise and improve their economic motivation. Sports scholarships are set up to reward university students with outstanding performance in sports activities, and financial support and rewards are used to encourage university students to actively participate in sports and enhance their economic motivation.</p>				
Honor Motivation	<p>University students are encouraged to actively participate in physical exercise and enhance their motivation of honor by holding regular sports competitions inside and outside the university and awarding medals, trophies and certificates to the winners. To establish the list of university sports activities, record and publicize the physical exercise of university students. Through public rankings and records, university students' sense of competition and honor can be enhanced, and their honor motivation can be improved.</p>				

Thank you very much!!!

IOC results of strategies to promote exercise behavior among Chinese university students

N0.	Dimension	Factors					Total	RESULTS	
		Exp1	Exp2	Exp3	Exp4	Exp5			
1	University sports physical environment	Reasonable planning of sports space	1	1	1	0	1	0.8	
2		Provide a variety of sports venues	1	1	1	1	1	1.0	
3		Increase indoor exercise space	1	1	1	1	1	1.0	
4		Provide high quality exercise equipment	1	1	1	1	1	1.0	
5		Improve the accessibility of equipment	1	1	1	1	1	1.0	
6		Improve the utilization of site and equipment	1	1	1	1	1	1.0	
7		Set up sports as the theme of the sculpture or sports celebrities and famous words	1	1	0	1	1	0.8	
8		University sports policy environment	Implement national and university sports policies	1	1	1	1	1	1.0
9			Developing and promoting health policies	1	1	1	1	1	1.0
10			Provide policy support and incentives	1	1	1	1	1	1.0
11		University sports social environment	The optimization of physical education course	1	1	0	1	1	0.8
12			Diverse opportunities for physical exercise	1	1	1	1	1	1.0

13		Provide professional teacher support	1	1	1	0	1	4	0.8
14		Enhance friend/peer support	1	1	1	1	1	5	1.0
15		Social norms and sports culture	1	1	1	1	1	5	1.0
16		Health Motivation	1	1	1	1	1	5	1.0
17		Appearance Motivation	1	1	1	1	0	4	0.8
18	Intrinsic Motivation	Pleasure Motivation	1	1	1	1	1	5	1.0
19		Curiosity Motivation of sports Skills	1	1	1	0	1	4	0.8
20		Social Motivation	1	1	1	1	1	5	1.0
21		Academic Motivation	1	1	1	1	1	5	1.0
22	Extrinsic Motivation	Identification Motivation	1	1	0	1	1	4	0.8
23		Economic Motivation	1	1	0	1	1	4	0.8
24		Honor Motivation	1	1	1	1	1	5	1.0
total									0.933

Dear experts:

Please fill in the following personal information:

Expert's name:

Professional title:

Work unit:

The following is the expert questionnaire on strategies to promote exercise behavior among Chinese university students in this study. Please rate in the Expert evaluation column(The evaluation questions use a 5-level Likert scale, 1=Strongly Unreasonable, 2=Unreasonable, 3=Neutral, 4=Reasonable, 5=Strongly Reasonable), and give relevant modification suggestions in the Items that need to be modified. Thank you for your guidance and evaluation in the help.

Expert evaluation of strategies to promote exercise behavior among Chinese university students

1.Strategies for university sports environment

1.1University sports physical environment

Factors	Details	Expert evaluation					Suggestion
		1	2	3	4	5	
Reasonable planning of sports space	Through the analysis of university space, determine the best sports field layout and allocation. Ensure the safety and convenience of the site, make it easy to access and use, and provide adequate rest and changing facilities according to the space situation. Rationally plan and utilize the sports space in the campus to maximize its use.						
Provide a variety of sports venues	Universities should evaluate the use of existing sports venues, and build and maintain diversified sports venues according to the needs and interests of university students, such as: basketball courts, football fields, athletics fields, swimming pools, tennis courts, gyms, etc., to meet the exercise needs of different groups of students.						

Factors	Details	Expert evaluation					Suggestion
		1	2	3	4	5	
Increase indoor exercise space	When building new or retrofitting buildings, consider adding indoor sports space. In bad weather or at night, provide indoor exercise space, such as: indoor basketball, badminton, table tennis, dance room, gym and other multi-purpose sports venues, ensure that these spaces are well equipped to meet the needs of different sports.						
Provide high quality exercise equipment	Equip and maintain high quality sports equipment, such as: dumbbells, treadmills, yoga MATS, etc., to ensure the equipment is safe and functional. Check and update sports equipment regularly to ensure it is in good condition. Provide a variety of equipment to meet different exercise needs.						
Improve the accessibility of equipment	Through the analysis of university space, determine the best sports field layout and allocation. Ensure the safety and convenience of the site, make it easy to access and use, and provide adequate rest and changing facilities according to the space situation. Rationally plan and utilize the sports space in the campus to maximize its use.						

Factors	Details	Expert evaluation					Suggestion
		1	2	3	4	5	
Improve the utilization of site and equipment	According to the university students' work and rest time, reasonable arrangement of the opening time of the sports venue. A reservation system is introduced to avoid waste of space and equipment and ensure that every university student has a chance to use it. Improve the utilization of sports venues and equipment through reasonable opening hours and reservation system.						
Set up sports as the theme of the sculpture or sports celebrities and famous words	By setting up sports-themed sculptures or sports celebrities and famous quotes billboards, the sports culture literacy is displayed to university students through visual and written forms, conveys the spirit and values of sports, and stimulates university students' cognition and perception of sports.						

1.2 University sports policy environment

Factors	Details	Expert evaluation					Suggestion
		1	2	3	4	5	
Implement national and university sports policies	Publicize and popularize national and university sports policies, such as: physical education curriculum, physical education credits, national physical fitness test standards, graduation requirements, etc., and increase the strength of policy implementation. To make university students understand the national and university sports policy and implementation.						
Developing and promoting health policies	To develop and promote health policies to promote university students' physical exercise, such as: 3 times a week of extracurricular physical exercise. Through campus publicity, lectures and activities, health policies were promoted to university students and were guided to establish correct sports values. Ensure the implementation and supervision of policies, and regularly check and evaluate the implementation effect of policies.						
Provide policy support and incentives	Set up relevant reward policy, such as: sports scholarship, exercise points exchange rewards, etc., to encourage university students to actively participate in sports activities. Ensure that rewards are fair and transparent, and regularly evaluate the effectiveness of the reward policy to make adjustments and improvements as						

Factors	Details	Expert evaluation					Suggestion
		1	2	3	4	5	
	necessary.						

1.3 University sports social environment

Factors	Details	Expert evaluation					Suggestion
		1	2	3	4	5	
The optimization of physical education course	<p>The combination of compulsory and optional courses, in the course, there are not only compulsory physical education courses (freshman and sophomore), but also a variety of elective courses (junior and senior) to meet the needs of university students in different grades. According to the interest survey of university students, a variety of physical education courses are designed and offered, such as ball games, combat sports, traditional ethnic sports, etc. At the same time, some projects that female students are more fond of are offered, such as yoga, Pilates, aerobics, etc., to meet the exercise interests and needs of university students of different genders. Through the course guide, consultation, experience and so on to help university students to choose the right physical education courses.</p>						

Factors	Details	Expert evaluation					Suggestion
		1	2	3	4	5	
Diverse opportunities for physical exercise	To promote physical exercise opportunities for university students of different grades through the combination of compulsory and elective courses. At the same time, by providing the necessary facilities and funds to support and develop a variety of university student sports associations, such as: school sports teams, sports clubs and so on. And regularly organize various sports competitions in the university to increase extracurricular exercise opportunities for university students.						
Provide professional teacher support	Equipped with professional physical education teachers and coaches to provide high-quality physical exercise guidance and support. Regular training of physical education teachers and coaches to ensure that they have professional knowledge and skills. Through the guidance of physical education teachers, to help university students master sports skills, make a reasonable exercise plan, enhance their exercise effect.						
Enhance friend/peer support	Organize group exercise activities to promote communication and trust between friends/peers, encourage exercise with friends/peers to enhance each other's motivation and support. Through social media platforms, university students were encouraged to share their exercise experience and results to form a good exercise atmosphere.						

Factors	Details	Expert evaluation					Suggestion
		1	2	3	4	5	
Social norms and sports culture	<p>Create supportive groups of sports associations that enhance university students' sense of belonging and participation through social and physical activities. Carry out healthy lifestyle promotion activities, such as: sports meeting, sports and health lecture, experience sharing meeting of sports stars or elite athletes of school team, sports week, etc. Through the campus media and publicity platform, positive sports values are transmitted, a positive and healthy campus culture is created, and university students are encouraged to develop good exercise habits.</p>						

2.Strategies for exercise motivation

2.1 Intrinsic Motivation

Factors	Details	Expert evaluation					Suggestion
		1	2	3	4	5	
Health Motivation	Health education and publicity, regular health lectures, workshops and publicity activities, invited professional nutritionists, fitness coaches and psychological counselors to explain the benefits of physical exercise on physical and mental health, to increase university students' understanding of the health benefits of physical exercise, so as to enhance their health motivation. At the same time, personalized health assessment was carried out to provide free or low-cost health assessment services for university students, including health examination, physical test, bone test and personalized exercise advice. Through specific data and analysis, university students can realize the importance of physical exercise to their personal health and enhance their health motivation.						
Appearance Motivation	Teaching university students how to keep and control their weight and improve their body shape and appearance through physical exercise. To improve university students' expectation of the appearance improvement effect of exercise and enhance their appearance motivation. Provide regular physical measurement and						

Factors	Details	Expert evaluation					Suggestion
		1	2	3	4	5	
	<p>progress feedback services, such as: body fat test, muscle circumference measurement, etc., so that university students can see the concrete changes brought about by exercise and enhance their appearance motivation.</p>						
Pleasure Motivation	<p>Build a rich content of physical education courses, organize a variety of recreational sports activities, such as: sports games, outdoor adventure, fun games, etc., to increase the interest of exercise. Engaging university students in exercise through interesting activities enhances their pleasure motivation. "Sports Experience Day" was held regularly to introduce new and interesting sports, so that university students could experience different exercise methods, increase their understanding and interest in different sports, and enhance their pleasure motivation.</p>						
Curiosity Motivation of sports Skills	<p>Regularly set up a variety of sports skills training and improvement courses or projects, such as: ball games, dance, ethnic tradition projects, etc., provide professional guidance to help university students master or improve sports skills. To stimulate university students' interest in learning and improving their sports skills, and enhance their curiosity motivation of sports skills. School sports competitions and competitive activities are held regularly to provide a platform for displaying and</p>						

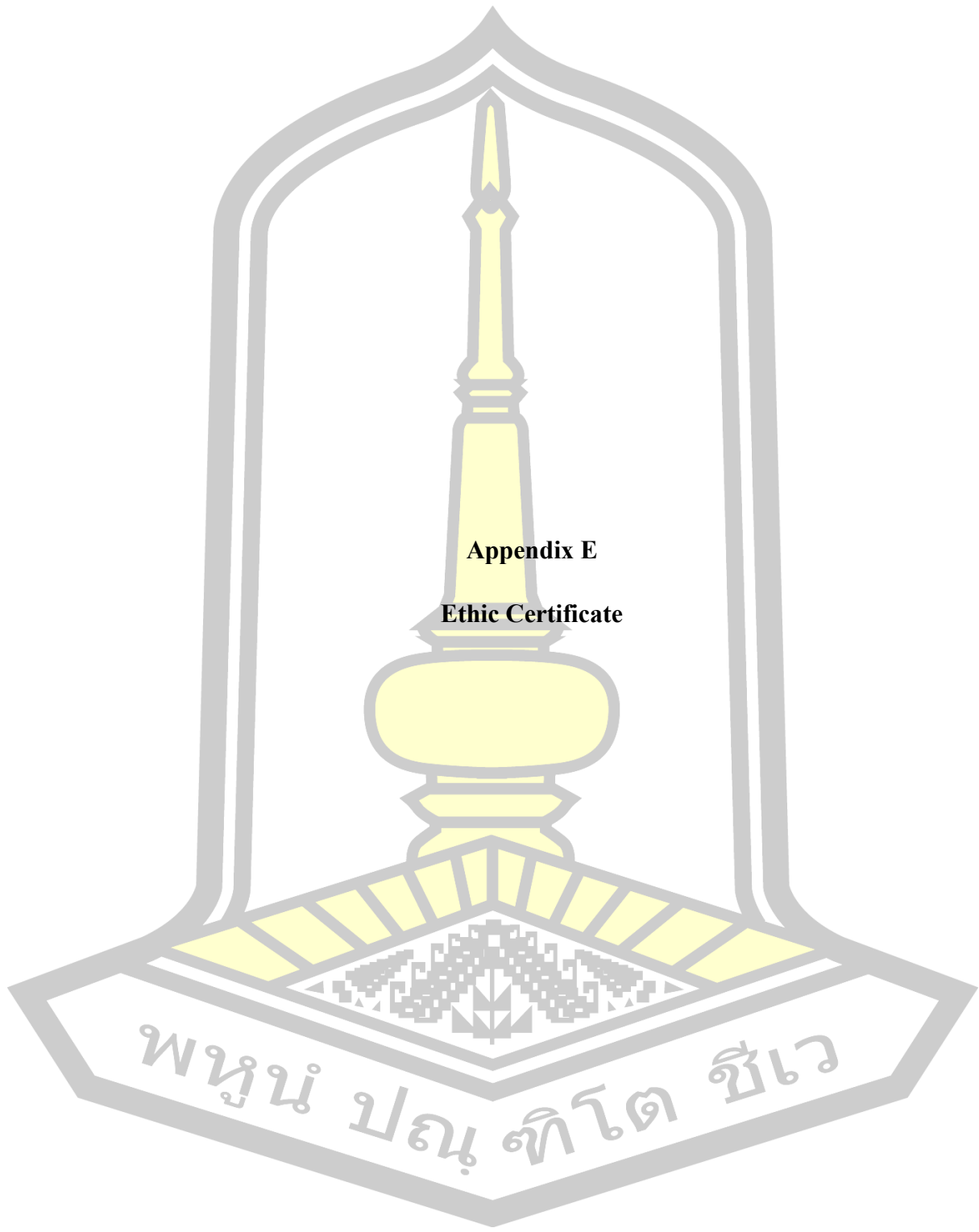
Factors	Details	Expert evaluation					Suggestion
		1	2	3	4	5	
	improving skills. Through competition and challenge, university students' desire for learning and improving skills is stimulated, and their curiosity motivation of sports skills is enhanced.						
Social Motivation	Support and encourage university students to set up various sports associations and clubs, provide venues and resources to support university students, and enhance university students' social interaction and social motivation through associations and club activities. Organize team exercise activities, such as: group running, group gymnastics, ball games, etc., to enhance university students' team cooperation and social connection. Through team activities, enhance university students' social relationship and sense of participation, and improve their social motivation.						

2.2 Extrinsic Motivation

Factors	Details	Expert evaluation					Suggestion
		1	2	3	4	5	
Academic Motivation	<p>Physical education courses are linked to physical exercise, and university students can get extra points for participating in a certain number of physical exercises.</p> <p>Through academic rewards, students are encouraged to actively participate in physical exercise. Strict implementation of the national physical health standards policy, urge academics to carry out physical exercise in order to complete the physical examination goals. At the same time, elective courses combining academic and physical education, such as: "Sports and health", "Sports psychology", "Sports appreciation", etc., are set up to combine academic learning and physical exercise, increase university students' academic interest in physical exercise and enhance their academic motivation.</p>						
Identification Motivation	<p>University students who actively participate in sports activities should be publicized and commended on campus media to set an example, and their sports identity and motivation should be enhanced through social recognition and commendation.</p> <p>University students who actively participate and perform well will be awarded sports activity certificates and honorary titles, such as: "Best Athlete" and "Health expert", etc., which will enhance university students' sense of achievement and identity and enhance</p>						

Factors	Details	Expert evaluation					Suggestion
		1	2	3	4	5	
	their identity motivation through honor and recognition.						
Economic Motivation	Establish an exercise point system, university students get points by participating in sports activities, points can be exchanged for gifts, gym membership cards or campus meal vouchers. Financial rewards were used to encourage university students to participate in physical exercise and improve their economic motivation. Sports scholarships are set up to reward university students with outstanding performance in sports activities, and financial support and rewards are used to encourage university students to actively participate in sports and enhance their economic motivation.						
Honor Motivation	University students are encouraged to actively participate in physical exercise and enhance their motivation of honor by holding regular sports competitions inside and outside the university and awarding medals, trophies and certificates to the winners. To establish the list of university sports activities, record and publicize the physical exercise of university students. Through public rankings and records, university students' sense of competition and honor can be enhanced, and their honor motivation can be improved.						

Thank you very much!!!



Appendix E

Ethic Certificate

พหุจน์ ปณฺ ทิโต สีเว



MAHASARAKHAM UNIVERSITY ETHICS COMMITTEE FOR
RESEARCH INVOLVING HUMAN SUBJECTS

Certificate of Approval

Approval number: 255-086/2024

Title : The Relationship and prediction of school sports environment, Exercise Motivation, and Physical Exercise Behavior among Chinese University Students.

Principal Investigator : Mr. Zengyin Yan

Responsible Department : Faculty of Education

Research site : Chongqing, China

Review Method : Expedited Review

Date of Manufacture : 25 April 2024

expire : 24 April 2025

This research application has been reviewed and approved by the Ethics Committee for Research Involving Human Subjects, Mahasarakham University, Thailand. Approval is dependent on local ethical approval having been received. Any subsequent changes to the consent form must be re-submitted to the Committee.

Ratree S

(Assistant Professor Ratree Sawangjit)

Chairman

Approval is granted subject to the following conditions: (see back of this Certificate)

Clarification documents for the volunteers who answered the questionnaires

Dear all Volunteers

Because I (Zengyin Yan, Ph.D. candidate, Health and Sport Science, Faculty of Education, Maharakham University) conducting research on "The Relationship and prediction of school sports environment, Exercise Motivation, and Physical Exercise Behavior among Chinese University Students". You may not benefit directly from participating in this research project. However, the research results of this project may make you understand the research in the field of school sports environment, exercise motivation and exercise behavior, and help you according to your own situation, combined with the school sports environment, reasonable, scientific and regular physical exercise, and develop a lifelong behavior habit of participating in physical exercise.

The data from this questionnaire will be used for academic research, aiming to understand the relationship between school sports environment, exercise motivation and exercise behavior. If you decide to participate in this study, if you decide to participate in this study, You will fill out the questionnaire for information on demographic variables (5 items), School Sports Environment (34 items), Exercise Motivation Scale (27 items) and Exercise behaviour (8 items) for 4 parts in total of 74 items, you will spend 10-20 minutes to complete the questionnaire. The questionnaire was distributed through a combination of online questionnaire (Wen Juan xing, a professional online questionnaire survey platform in China) and paper questionnaire. Online questionnaire set link and QR code, through Wechat or QQ scan code to fill in, all questions are required, that is, if there is a missing option, you can not complete the submission.

This questionnaire will be anonymous to avoid leaking your personal information - your personal data will be strictly confidential. The data in the questionnaire will be retained in grouped form. All participants' data will be encrypted and stored on the researcher's computer. There will be a password for the folder where the data is saved, and the computer set with a boot password. Only the overall research results will be reported to the public, without individualized results. Researcher will destroy relevant information after the research is completed. If you feel uncomfortable with certain questions, you have the right to not answer those questions. You have the right to withdraw from this study at any time without prior notice. The refusal or withdrawal from participation in the study will not affect your studies or your health. You will not receive any compensation or fees for participation.

If you have questions about the research Please feel free to contact us at (Zengyin Yan Health and Sport Science, Faculty of Education, Maharakham University, Phone: +8618580050866, Email: 56415924@qq.com).

If you were not treated as described or want to know your rights while participating in this study, You can contact at "Human Research Ethics Committee Maharakham University Division of Research and Academic Service Promotion Maharakham University "Tel. +66043754416 Internal number 1755



Sincerely

.....
(Mr. Zengyin Yan)
Researcher

ECMSU01-09.03 Update 2021

**Clarification documents for the volunteers who answered the questionnaires
(Respondents must be above 18 years of age to participate in answering the questionnaires.)**

To All respondents

I am (Mr.Zengyin Yan, PhD Student Health and Sport Science. Faculty of Education, Mahasarakham University) under the advisor of Wannaporn Sumranpat Brady,Ph.D, now doing on research name"The Relationship and prediction of school sports environment, Exercise Motivation, and Physical Exercise Behavior among Chinese University Students" With the objective (specify)

1. To validate the university sports environment questionnaire for Chinese university students.
2. To determine the relationship between school sports environment and exercise motivation and exercise behavior as a whole and classified by gender and year level of study.
3. To determine the relationship between exercise motivation and exercise behavior as a whole and classified by gender and year level of study.
4. To create equations to predict physical exercise behavior for Chinese university students.
5. To design strategies for promoting exercise behavior for Chinese university students.

Significant of study

1. From the perspective of concept cognition, it provides decision-making reference for university sports related departments and sports managers. Through the multi-dimensional analysis of the situation and relationship of school sports environment, exercise motivation and university students' exercise behavior, it is clear that the school sports environment is changeable. Strengthen the school sports environment construction to support and attach importance to university students' exercise motivation and exercise behavior.
2. Pay attention to the cultivation of university students' exercise behavior, improve their exercise motivation, and cultivate the value of "life lies in sports", so that university students can carry out physical exercise reasonably, scientifically and regularly according to their own conditions and the school sports environment, and develop the behavior habit of lifelong participation in physical exercise.
3. Enrich the school physical environment, exercise motivation and the theoretical research of university students' exercise behavior, solve the problems of the quantity and quality of university students' physical exercise participation, and provide ideas and suggestions for promoting university students' exercise behavior.



The data from this questionnaire will be used for academic research, aiming to understand the relationship between school sports environment, exercise motivation and exercise behavior. You may not directly benefit from participating in this research project. But the information obtained will be useful for the information you provide is conducive to exploring the relationship between the sports environment, exercise motivation and exercise behavior of Chinese university students, and building a theoretical model to provide theoretical support for predicting the physical exercise behavior of Chinese university students. If you decide to participate in this study, You will fill out the questionnaire for Information on demographic variables (5 items), School Sports Environment (34 items), Exercise Motivation Scale (27 items) and Exercise behaviour (8 items) for 4 parts in total of 74 items, you will spend 10-20 minutes to complete the questionnaire. The questionnaire was distributed through a combination of online questionnaire (Wen Juan xing, a professional online questionnaire survey platform in China) and paper questionnaire. Online questionnaire set link and QR code, through Wechat or QQ scan code to fill in, all questions are required, that is, if there is a missing option, you cannot complete the submission.

This questionnaire will be anonymous to avoid leaking your personal information - your personal data will be strictly confidential. The data in the questionnaire will be retained in grouped form. All participants' data will be encrypted and stored on the researcher's computer. There will be a password for the folder where the data is saved, and the computer set with a boot password. Only the overall research results will be reported to the public, without individualized results. Researcher will destroy relevant information after the research is completed. If you feel uncomfortable with certain questions, you have the right to not answer those questions. You have the right to withdraw from this study at any time without prior notice. The refusal or withdrawal from participation in the study will not affect your studies or your health. You will not receive any compensation or fees for participation.

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If you were not treated as described or want to know your rights while participating in this study, You can contact at "Human Research Ethics Committee Mahasarakham University Division of Research and Academic Service Promotion Mahasarakham University "Tel. +66043754416 Internal number 1755



BIOGRAPHY

NAME	Mr. Zengyin Yan
DATE OF BIRTH	Jul 15, 1987
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ADDRESS	School of Physical Education, Chongqing University of Posts and Telecommunications, No. 2 Chongwen Road, Nan'an District, Chongqing' P.R. China, 400065
POSITION	Lecturer
PLACE OF WORK	School of Physical Education, Chongqing University of Posts and Telecommunications
EDUCATION	2006 to 2010 Bachelor's Degree, Ethnic Traditional Sports Major, Beijing Sport University 2010 to 2013 Master's Degree, Physical Education And Sport Studies ,University of Macau 2021 to 2024 Doctor of Philosophy Program in Exercise and Sport Science, Mahasarakham University

