Research on the Construction and Development Pathways of Cross-Country Skiing (Roller Skiing) Courses in General Higher Education Institutions in Heilongjiang Province

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Abstract: *Under the dual context of the upcoming Harbin Asian Winter Games and the deepening of quality-oriented education, the Cross-Country Skiing (Roller Skiing) course, as a distinctive physical education program integrating fitness, athletic competition, and recreational value, is playing an increasingly prominent role in university physical education. This study focuses on the Cross-Country Skiing (Roller Skiing) courses in general higher education institutions within Heilongjiang Province. Employing research methods such as literature review, expert interviews, questionnaire surveys, mathematical statistics, and logical analysis, it systematically investigates the current state of course provision, faculty resources, and student perceptions. The research analyzes core issues in course development, including an incomplete system and a shortage of qualified instructors. Subsequently, it proposes targeted optimization pathways. The findings can provide theoretical support for standardizing the construction of Cross-Country Skiing (Roller Skiing) courses and enriching campus sports culture in Heilongjiang Province's universities, while also offering practical references for promoting winter characteristic sports courses in higher education institutions nationwide.*

Keywords: *Heilongjiang Province; General Higher Education Institutions; Cross-Country Skiing (Roller Skiing); Course Construction; Development Pathway*

1. Introduction

1.1 Research Background

In recent years, China's ice and snow sports have experienced a surge in development. The preparation and hosting of the Harbin Asian Winter Games have further promoted the popularization of winter sports on campuses. Cross-Country Skiing (Roller Skiing), by integrating seasonal and year-round practice without strict constraints of venue or season, has emerged as an excellent option for enriching the physical education curriculum in higher education institutions. As a leading province for ice and snow sports in China, Heilongjiang Province possesses inherent natural and geographical advantages. However, the Cross-Country Skiing (Roller Skiing) courses in its general higher education institutions are still in a developmental phase, facing numerous urgent issues regarding standardized course construction and the enhancement of teaching quality. Against this backdrop, conducting research on the construction and development pathways of these courses aligns with the practical needs of physical education curriculum reform in higher education institutions.

1.2 Research Significance

Theoretical Significance: Current domestic research predominantly focuses on public skiing or alpine skiing instruction, with a relative scarcity of systematic studies on Cross-Country Skiing (Roller Skiing) courses in general higher education institutions. By clarifying the conceptual framework of the course and analyzing its developmental status, this research can enrich the theoretical system of ice and snow sports curricula in higher education. It aims to clarify the positioning of this course within university physical education and lay a theoretical foundation for subsequent related studies.

Practical Significance: By precisely identifying the practical challenges faced by higher education institutions in Heilongjiang Province regarding curriculum design, faculty training, and student

engagement, and by proposing feasible optimization strategies, this research can directly guide universities in enhancing the teaching quality of Cross-Country Skiing (Roller Skiing) courses. It contributes to improving students' physical fitness and fostering their resilient character. Simultaneously, the study provides a basis for decision-making to relevant departments in formulating policies for winter sports curricula in higher education institutions.

1.3 Literature Review on Domestic and International Research

International Research Status: Cross-Country Skiing originated in Europe, and international research on it commenced relatively early. Regarding course development in higher education, some universities in Europe and America have established mature Cross-Country Skiing (Roller Skiing) course systems. These systems emphasize the integration of theoretical instruction with practical training and have established comprehensive mechanisms for instructor training and course evaluation. Their diversified development models for such courses can provide valuable references for China. However, international research is based on different educational systems and regional characteristics, resulting in applicability gaps when compared to the actual conditions of higher education institutions in China.

Domestic Research Status: Domestic scholars have conducted numerous studies focusing on ice and snow sports. Wang Yan and Tan Hong pointed out that Cross-Country Skiing in China faces issues such as policy constraints and insufficient scientific research. Cui Xinghe suggested that universities in Northeast China could offer skiing as an elective course, while Li Shangbin posited that implementing skiing instruction in northern universities represents a development trend in physical education. However, existing research predominantly concentrates on development strategies for public skiing or macro-level instructional studies of skiing sports. There is a relative scarcity of systematic investigations and research on optimizing pathways specifically dedicated to the construction of Cross-Country Skiing (Roller Skiing) courses in general higher education institutions. This gap makes it difficult to meet the practical needs of current curriculum development.

1.4 Research Content and Methodology

1.4.1 Research Content

The core research content of this paper encompasses four key aspects. First, it investigates the current status of Cross-Country Skiing (Roller Skiing) course implementation in general higher education institutions in Heilongjiang Province, covering elements such as course objectives, textbook selection, and teaching evaluation. Second, the study examines the current situation of the faculty teaching these courses, analyzing dimensions including age, teaching experience, and knowledge structure. Third, it explores students' awareness and participation in these courses, including their learning motivation and satisfaction levels. Fourth, based on the current status and identified issues, the research aims to construct an optimized pathway for course development.

1.4.2 Research Methodology

Literature Review Method: This method involves consulting Chinese journal databases, university library collections, and high-quality sports website resources to review existing research findings related to course construction and Cross-Country Skiing. Expert Interview Method: This method entails conducting face-to-face interviews with physical education scholars and educational experts from higher education institutions in Heilongjiang Province to gather professional recommendations on course development.

Questionnaire Survey Method: Targeted questionnaires were designed and distributed to teachers and students offering or taking Cross-Country Skiing (Roller Skiing) courses in over 10 higher education institutions within the province to collect first-hand data on course implementation, faculty status, and student perceptions. To ensure the validity of the questionnaires, five experts (holding associate professor or higher titles) in the fields of physical education teaching and curriculum development were invited to evaluate the content validity of the questionnaire (using a 1-5 point scale) prior to formal distribution. The experts' overall validity rating for the questionnaire averaged 4.2 points (on a 5-point scale), indicating a reasonable structure and high content validity. The reliability of the questionnaire was tested using Cronbach's α coefficient (the overall scale α coefficient was 0.86), reaching an acceptable level of reliability.

Logical Analysis Method: This method involves employing inductive and deductive approaches to

integrate the findings from the literature review and the survey results. It is used to conduct in-depth analysis of the identified issues and propose corresponding development pathways.

2. Definition of Core Concepts and Theoretical Basis

2.1 Definition of Core Concepts

Cross-Country Skiing: As an ancient snow sport, it utilizes skis and ski poles as equipment to glide along a designated course in undulating mountainous terrain. The competition course is composed of approximately one-third uphill, one-third downhill, and one-third flat sections. The highest point of the ski trail should not exceed an altitude of 1,800 meters. It encompasses two core technical sets of rules: classical technique and free technique[1].

Roller Skiing: It originated in Europe and was initially developed as an off-season dryland training method for cross-country skiers. Its movement techniques share over 90% similarity with those of Cross-Country Skiing. Unconstrained by specific venues or seasons, it is a fashionable sport that integrates fitness, competition, and recreation[2].

Cross-Country Skiing (Roller Skiing) Course: This refers to a physical education course centered on Cross-Country Skiing techniques, encompassing instructional content for both winter Cross-Country Skiing and summer Roller Skiing. The course aims to impart theoretical knowledge and technical skills of the sport, enhance students' physical fitness, and cultivate lifelong exercise habits along with strong willpower and character[3].

2.2 Theoretical Basis

This study is guided by the theory of quality-oriented education, aligning with the core objective of higher education to cultivate well-rounded individuals. It aims to synergistically enhance students' physical fitness and willpower through course instruction. Supported by the theory of school physical education, the research is grounded in the essential attributes of physical education in higher education institutions, ensuring that course development adheres to the pedagogical principles and developmental needs of school sports. Based on curriculum development theory, the study focuses on core elements such as course objectives, teaching content, and evaluation systems to construct a scientific and comprehensive course framework.

3. Investigation on the Current Status of Cross-Country Skiing (Roller Skiing) Course Implementation in General Higher Education Institutions in Heilongjiang Province

3.1 Current Status of Course Provision

An investigation of 14 higher education institutions in Heilongjiang Province (see Table 1 for details) revealed several issues regarding the course. 85.7% of the institutions offer it as an elective course. The course objectives in 92.8% of cases focus primarily on teaching basic techniques, with insufficient attention given to fostering interest (42.9%) or cultivating lifelong physical education awareness (35.7%). Regarding teaching materials, 71.4% of the institutions use generic textbooks or self-compiled handouts, lacking dedicated, appropriately adapted teaching materials. While 100% of the teaching syllabi emphasize basic techniques, only 28.6% systematically cover sports theory and tactical rules. Practical sessions constitute 75.4% of the total class hours, resulting in a shortage of theoretical instruction. Furthermore, the evaluation relies entirely (100%) on final skill tests, with only 21.4% incorporating process-oriented assessment.

Table 1: Investigation on the Provision of Cross-Country Skiing (Roller Skiing) Courses in General Higher Education Institutions in Heilongjiang Province (N=14 Institutions)

Survey Dimension	Main Options/Content	Number (Institutions)	Percentage (%)
Course Nature	Public Elective Course	12	85.7
	Public Required Course	2	14.3
Main Course Objectives	Mastering basic technical skills	13	92.8
	Cultivating interest in the sport	6	42.9
	Enhancing physical health and fitness	9	64.3
	Cultivating lifelong physical education habits	5	35.7
	Developing willpower and character	4	28.6
Selection of Teaching Materials	Using generic skiing textbooks	8	57.1
	Using self-compiled handouts	2	14.3
	No fixed teaching materials	4	28.6
	Using dedicated specialized textbooks	*0*	*0.0*
Focus of Teaching Content	Basic technical training	14	100.0
	Sports theory and history (systematic instruction)	4	28.6
	Technical rules (systematic instruction)	3	21.4
	Basic tactics	2	14.3
Practical Class Hour Proportion (%)	(Average Value Range)		75.4%
Evaluation and Assessment Methods	Final skill test as the primary basis	14	100.0
	Inclusion of process-oriented assessment (attendance, practice attitude, progress rate, etc.)	3	21.4
	Inclusion of theoretical knowledge assessment	2	14.3

(Note: The items for course objectives, teaching materials, content, and evaluation allow for multiple selections; therefore, the total percentage may exceed 100%.)

3.2 Current Status of the Teaching Faculty

Based on the analysis of data from the teacher questionnaires (see Table 2 for details), the faculty teaching Cross-Country Skiing (Roller Skiing) courses in higher education institutions in Heilongjiang Province exhibits multiple structural issues. There is a pronounced polarization in the age distribution. Senior teachers aged 45 years and above account for 42.9%, while young teachers under 35 years old constitute 35.7%. In contrast, the core backbone of teachers aged 36-45 represents only 21.4%, indicating a generational gap. Regarding professional backgrounds, 92.9% of the teachers have general backgrounds such as school physical education, with only 28.6% possessing specialized teaching or training experience in this specific field. In terms of academic titles, associate professors (50.0%) and lecturers (42.9%) dominate, while professors account for merely 7.1%, reflecting a lack of academic leadership. Furthermore, 85.7% of the teachers have not participated in any systematic, relevant training in the past three years, leading to a severe lag in knowledge updating.

Table 2: Survey on the Teaching Faculty for Cross-Country Skiing (Roller Skiing) Courses in General Higher Education Institutions in Heilongjiang Province (N=14 persons)

Survey Dimension	**Category/Content**	**Number (Persons)**	**Percentage (%)**
Age Distribution	35 years old and below	5	35.7
	36 - 45 years old	3	21.4
	46 years old and above	6	42.9
Academic Background	School Physical Education / Physical Education Pedagogy	13	92.9
	Ice and Snow Sports Specialization (including Cross-Country Skiing specialization)	4	28.6
	Other Sports Programs	2	14.3
Highest Academic Title	Professor	1	7.1
	Associate Professor	7	50.0
	Lecturer	6	42.9
Specialized Training in the Past Three Years	Participated in systematic training or further studies	2	14.3
	Did not participate in systematic training or further studies	12	85.7

(Note: The item for academic background allows for multiple selections.)

3.3 Student Awareness and Participation Status

Analysis of the student questionnaire data (see Table 3 for details) reveals the following: Students have a relatively low level of awareness regarding Cross-Country Skiing (Roller Skiing), with 42.3% being either unfamiliar with it or having only heard of it, and only 28.1% understanding its basic rules. The primary learning motivation is to earn credits (65.4%), while interest-driven motivation is relatively weak (38.2%). Merely 18.7% of students occasionally practice outside of class, and over 70% engage in less than 2 hours of weekly exercise related to the course. Monotonous teaching methods (61.2%) and insufficient venue facilities (57.8%) are the main sources of dissatisfaction.

Table 3: Awareness and Participation Status of Students Enrolled in Cross-Country Skiing (Roller Skiing) Courses in General Higher Education Institutions in Heilongjiang Province (N=326 students)

Survey Dimension	Options/Content	Number (Persons)	Percentage (%)
Awareness Level of the Sport	Completely unfamiliar	67	20.5
	Heard the name only	71	21.8
	Know it is a type of skiing sport	96	29.4
	Understand its basic rules/technical characteristics	92	28.1
Main Learning Motivation	To earn physical education credits	213	65.4
	Interest in ice and snow sports	124	38.2
	For fitness purposes	90	27.8
	To experience a novel sport	58	17.8
	To acquire a sports skill	45	13.8
Frequency of Active Practice After Class	Practice frequently (≥1 time/week)	11	3.4
	Practice occasionally (<1 time/week)	61	18.7
	Rarely practice	254	77.9
Average Weekly Activity Duration	< 1 hour	75	23.0
	1 - 2 hours	151	46.3
	>2 hours	100	30.7
Main Sources of Dissatisfaction	Insufficient venue/facilities	188	57.8
	Monotonous teaching methods	199	61.2
	Course content lacks appeal	137	42.1
	Inadequate teacher guidance	85	26.1
	Adverse weather conditions (e.g., cold)	102	31.3

(Note: The items for motivation and dissatisfaction allow for multiple selections; therefore, the total percentage exceeds 100%.)

4. Issues in the Construction of Cross-Country Skiing (Roller Skiing) Courses in General Higher Education Institutions in Heilongjiang Province

4.1 Incomplete Course System

The course positioning is ambiguous, failing to establish tiered course objectives tailored to students at different levels. The selection of teaching materials is disorganized, and the absence of dedicated specialized textbooks results in a lack of systematic instructional content and insufficient representation of regional characteristics. The teaching syllabus lacks personalized design, with content organization overemphasizing technique at the expense of theory, culture, and application, making it difficult to meet students' diverse needs. The evaluation and assessment methods are singular and rigid, excessively focused on final skill tests while neglecting the assessment of the learning process, theoretical literacy, sports interest, and habit cultivation. This approach fails to comprehensively reflect actual teaching effectiveness or the improvement of students' comprehensive abilities.

4.2 Weak Faculty Resources

The professional structure of the teaching faculty is unreasonable. There is a scarcity of teachers with systematic specialized learning and training backgrounds in Cross-Country Skiing (Roller Skiing) (accounting for only 28.6%), which constrains the depth and professionalism of instruction. The age distribution within the faculty is imbalanced. The teaching force primarily relies on experienced senior teachers and relatively inexperienced young teachers (those under 35 and over 46 years old together constitute 78.6%), while there is a severe shortage of core, mid-career faculty in the prime 36-45 age group (accounting for only 21.4%). This imbalance leads to instability in pedagogical continuity and a lack of vigor in teaching research innovation. The mechanism for faculty training is severely inadequate (85.7% of teachers have not received any professional training in the past three years), resulting in outdated professional knowledge and skills. Furthermore, there is a lack of professorial-level academic leaders (accounting for only 7.1%), making it difficult to guide high-level course development and achieve breakthroughs in scientific research.

4.3 Limited Student Engagement Motivation

Insufficient promotion and guidance for the course have resulted in a generally low initial awareness among students (42.3% are largely unfamiliar with it), failing to effectively stimulate their potential learning interest. The teaching methods remain traditional and monotonous (this is the primary source of student dissatisfaction, accounting for 61.2%), often relying on one-way, instructive technical teaching, which struggles to mobilize student initiative, collaboration, and inquiry. Some students, due to their weak athletic foundation and the relatively complex technical movements (compared to general fitness activities), are prone to developing psychological resistance. Coupled with a lack of effective post-class guidance (26.1% of students reported insufficient guidance) and convenient, safe practice facilities (57.8% of students expressed dissatisfaction with the venues), extracurricular practice is difficult to implement. This further weakens student engagement and retention, as well as the consolidation of skills.

4.4 Insufficient Supporting Conditions for the Course

Overall investment from higher education institutions is limited, and a dedicated funding guarantee mechanism is lacking. This has resulted in a severe shortage of specialized teaching venues for Cross-Country Skiing (Roller Skiing), particularly standard roller skiing facilities (reflected in 57.8% of students expressing dissatisfaction with the venues). Existing venues and facilities are often outdated or insufficient in number. The maintenance, updating, and safety assurance of teaching equipment (such as roller skis, poles, and bindings) are difficult to guarantee. Funding constraints further hinder the development of suitable teaching materials (the lack of dedicated textbooks), the systematic implementation of specialized teacher training (85.7% of teachers have not received training), and the execution of teaching reform projects. There is inadequate integration of internal and external high-quality resources. The abundant resources within Heilongjiang Province, such as large-scale ski

resorts, roller skiing venues, professional clubs, and high-level athletes, have not been fully utilized for collaborative education initiatives (e.g., jointly building practice bases, organizing expert lectures, and conducting practical teaching). Consequently, the course development lacks external synergistic support.

5. Optimization Pathways for the Construction of Cross-Country Skiing (Roller Skiing) Courses in General Higher Education Institutions in Heilongjiang Province

Addressing the core issues identified in the construction of Cross-Country Skiing (Roller Skiing) courses in general higher education institutions in Heilongjiang Province, such as an incomplete system, weak faculty resources, limited student engagement, and insufficient supporting conditions, this section integrates the advantages of regional ice and snow resources. It proposes scientific and standardized optimization pathways from four dimensions: the course system, the teaching faculty, student participation, and the foundational support base, aiming to promote the high-quality development of these courses.

5.1 Construct a Scientific and Tiered Curriculum System

With the core principles of "popularizing ice and snow characteristics, mastering core skills, and cultivating a lifelong interest in physical education," a differentiated curriculum system should be constructed. Based on students' foundational levels, the system is divided into three tiers: beginner, intermediate, and advanced, with clearly defined quantitative objectives for each stage. For example, the beginner level focuses on mastering the alternating stride, the intermediate level emphasizes strengthening snowplow braking techniques, and the advanced level prioritizes tactical coordination.

The Provincial Department of Education should take the lead in compiling standardized provincial textbooks that integrate the ice and snow culture of Longjiang (Heilongjiang), while simultaneously establishing a digital resource library that includes VR simulations. Implement tracked teaching, where the proportion of theory in the basic-level curriculum accounts for 20-25% and 25-30% in the advanced-level curriculum, and create competitive scenarios to deepen integration. Establish a diversified evaluation system in which process-oriented evaluation constitutes 40%, thereby shifting the overemphasis on final examinations.

5.2 Develop a Professional and Tiered Teaching Faculty

To address the issue that specialized teachers constitute only 28.6% of the faculty, recruitment efforts should prioritize retired athletes and professionals specializing in ice and snow sports. There should be a focused effort to supplement the core faculty aged 36-45 (currently only 21.4%) to alleviate the structural imbalance of over-reliance on teachers over 46 (42.9%) and new teachers under 35 (35.7%). A "mentor-apprentice pairing" mechanism should be established.

An institutionalized requirement should be established mandating that teachers participate in training at or above the provincial level every 1-2 years. This aims to address the issue where 85.7% of teachers have not received training in the past three years, with the training focusing on technical rules and tiered teaching methodologies. Expert studios should be established to cultivate professorial-level academic leaders (currently only 7.1%). Furthermore, teaching and research achievements should be incorporated into the evaluation process for academic title promotion, and a university teaching-research alliance should be formed to facilitate exchanges.

5.3 Stimulate Student Agency to Enhance Participation Quality

Promotional efforts should be conducted through campus platforms to highlight the value of the sport, aiming to reduce the proportion of students who are "completely unfamiliar" by 20.5%, and organizing experience days to alleviate psychological resistance. To break the monotony of the teaching model (which 61.2% of students are dissatisfied with), engaging methods such as scenario-based teaching and VR-assisted instruction should be adopted to enhance its appeal.

Guided by pre-test data, implement tiered instruction, offering additional tutoring for students with weaker foundations and setting competition-oriented tasks for high-achieving students. Extend the opening hours of sports facilities, establish student clubs, and construct a four-tier competition system encompassing "class-level, university-level, inter-university, and district-level" events to enhance

participation retention and elevate competitive standards.

5.4 Consolidate a Collaborative and Sustainable Support Foundation

Establish a dedicated funding stream to renovate and standardize sports facilities, addressing the issue of 57.8% of students expressing dissatisfaction with the venues. This includes equipping the facilities with standard-compliant apparatus and establishing a maintenance system. Collaborate with professional ski resorts, such as Yabuli, to jointly establish practical training bases. Additionally, hire part-time coaches and actively seek sponsorship from social capital to form a synergistic force for resource integration.

The Provincial Department of Education and the Provincial Sports Bureau should jointly issue guidelines, incorporating course development into the physical education evaluation framework for higher education institutions. Establish protocols for teaching quality certification and safety management to provide institutional safeguards for course advancement. Through these multidimensional and systematic optimizations, the challenges in course development can be effectively addressed, thereby enhancing educational outcomes.

6. Research Conclusions and Outlook

6.1 Research Conclusions

Through a systematic investigation of Cross-Country Skiing (Roller Skiing) courses in general higher education institutions in Heilongjiang Province, this study finds that while current course development has established a certain foundation, it still faces several prominent issues. Regarding the course system, problems include ambiguous objectives, a lack of dedicated teaching materials, and a singular evaluation approach. The teaching faculty exhibits issues such as an imbalance in professional backgrounds, an age gap, and insufficient competency. Student participation motivation is constrained by factors including inadequate awareness and unengaging teaching methods. In terms of supporting conditions, shortcomings exist in venues, funding, and resource integration. To address the aforementioned problems, it is necessary to construct optimization pathways from four dimensions—the course system, the teaching faculty, student guidance, and supporting conditions—to promote the scientific and standardized development of the courses.

6.2 Research Outlook

As ice and snow sports continue to gain popularity on campuses, Cross-Country Skiing (Roller Skiing) courses hold broad development prospects within higher education institutions in Heilongjiang Province. Future research can further expand its scope by conducting differentiated studies on course construction across various types of universities. It is also important to strengthen long-term tracking of teaching effectiveness to investigate the practical application outcomes of the proposed optimization pathways. Furthermore, exploring an "internet-plus-sports" teaching model can enrich the formats of course delivery. Additionally, the experience gained from course development can be extended to universities in other northern provinces across China, offering broader reference for the development of winter characteristic sports courses in the country's higher education institutions.

6.3 Research Limitations

This study focuses solely on general higher education institutions within Heilongjiang Province, resulting in a limited sample coverage. Consequently, the generalizability of the research conclusions requires further validation. Additionally, some data collected during the investigation may be subject to the influence of subjective factors, potentially introducing a degree of bias. Future research could expand the sample scope and integrate both quantitative and qualitative research methods to enhance the scientific rigor and accuracy of the findings.

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