



Developing Guidelines for Promoting Competence of Ice and Snow Major Students

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Abstract

Background and Aim: As the societal demand for ice and snow professionals continues to rise rapidly, the shortage of qualified teachers has become a major barrier to the development of ice and snow sports. In addition, many colleges and universities face challenges such as unclear talent training objectives, curricula that lack scientific rigor and targeted design, and outdated teaching models that require innovation. To address these issues, this research seeks to develop guidelines for enhancing the competencies of students majoring in ice and snow studies, thereby supporting the sustainable growth of both ice and snow sports education and the related industries.

Methodology: This study employed a mixed-methods research design. The research population comprised 1,461 students and 210 teachers specializing in ice and snow sports across four universities: Capital University of Physical Education and Sports, Harbin Sport University, Northeast Normal University, and Zhangjiakou University. Based on Taro Yamane's sample size table, 316 students were selected as the sample, while all 210 teachers were included due to the relatively small population size. Data collection involved the distribution of online questionnaires to 316 students and 210 teachers to investigate the current situation and challenges in promoting the competence of ice and snow major students. In addition, seven experts participated in face-to-face interviews to draft the initial elements of the guidelines, and 15 experts engaged in a focus group discussion to finalize the formulation of the guidelines. Data were analyzed using descriptive statistics (mean and standard deviation) and qualitative content analysis.

Results: The finalized guidelines comprise four core aspects as follows: (1) Training objectives divided 1 element was overall goals; (2) Core competence module and training path divided 4 elements were special sports skills module, teaching and guidance ability module, event and industry competency module, interdisciplinary and digital competence module; (3) Implement safeguards divided 5 elements were curriculum and teaching material construction, practice base and resource integration, dual-teacher training plan, evaluation and incentive mechanism, and regional





differentiation support; (4) Collaboration mechanisms divided 3 elements were school-enterprise cooperation, government, enterprise and school linkage, and international co-operation.

Conclusion: The guidelines developed in this study systematically integrate, for the first time, a comprehensive pathway of curriculum optimization, practical enhancement, and collaborative education.

Keywords: Guideline; Ice and Snow; Promoting Competence

Introduction

In November 2016, several national ministries jointly released two major development plans for ice and snow sports, providing clear strategic guidance for the nationwide promotion of winter sports (Wang, 2019). The policy of “ice where suitable, snow where suitable, and combining indoor and outdoor conditions” significantly boosted public enthusiasm, contributing to the historic achievement of engaging 300 million people in ice and snow activities. The successful conclusion of the Beijing Winter Olympics further symbolized a new era in China’s ice and snow development, underscoring Xi Jinping’s calls to “engage 300 million people in winter sports” and “promote leapfrog development,” thereby linking winter sports to broader national strategies for social progress, Healthy China, and the construction of a sporting power.

Despite this momentum, serious challenges remain. The demand for qualified professionals has expanded rapidly, yet the shortage of teachers restricts sustainable development (Liu et al., 2022). Because of the highly specialized nature of ice and snow sports, teachers must possess both advanced technical expertise and strong professional competencies, but the current teaching force still lacks adequate professionalism (Kang et al., 2020). Universities therefore shoulder the responsibility of cultivating professional teachers and diversified talent to meet the demands of social and industrial development (Gao et al., 2021). At present, however, the overall scale of talent training remains limited, falling short of societal needs; shortages extend beyond teachers to include athletes and industry professionals (Sun, 2020).

In addition, many universities face challenges such as unclear training objectives, unsystematic curricula, and outdated teaching models. A more effective training system must integrate theory with practice, ensuring professional alignment and practical applicability. Investment in educational resources, including faculty, venues, and facilities, is also essential to promote ice and snow culture and expand participation. The teacher education accreditation system, which emphasizes student-centeredness, learning outcomes, and continuous improvement, offers a valuable framework for standardizing program design and enhancing teaching quality (Dong, 2022). Within this framework, aligning ice and snow talent cultivation programs with accreditation standards ensures that graduates acquire both solid theoretical





knowledge and practical teaching competence (Li et al., 2021). Developing such targeted guidelines will enable curriculum optimization, strengthen practical training, encourage interdisciplinary integration, and ultimately provide the professional talent foundation necessary for the sustainable development of China's ice and snow sports.

Research Objectives

To develop guidelines for promoting the competence of ice and snow major students.

Literature Review

1. Teacher Education Certification Standards

The Teacher Education Certification Standards in China were introduced by the Ministry of Education to improve the quality and accountability of teacher preparation programs. Key documents such as the Implementation Measures for the Certification of Teacher Education Majors in Ordinary Institutions of Higher Education (Interim) and the Guidelines for the Certification of Teacher Education Majors in Ordinary Institutions of Higher Education (Trial) provide a unified framework for program evaluation, curriculum construction, faculty qualifications, and student learning outcomes. The standards emphasize outcome-based education (OBE), requiring institutions to align program objectives with professional teacher competencies, including pedagogical knowledge, moral character, practical teaching ability, and the capacity for innovation. Certification is not only a measure of institutional quality assurance but also a strategic initiative to revitalize teacher education and cultivate a high-quality teaching workforce capable of supporting national educational modernization goals (Liu, 2022).

In practice, these standards highlight student-centeredness, process monitoring, and continuous improvement. Institutions are required to strengthen the monitoring of students' academic progress, establish effective formative and summative assessment systems, and ensure that teacher education graduates possess both solid theoretical knowledge and strong teaching practice abilities. Furthermore, the certification process encourages universities to optimize curricula, integrate interdisciplinary learning, and enhance practical training through school-based teaching internships. By doing so, teacher education certification acts as both a regulatory tool and a developmental mechanism, promoting professionalization and ensuring the alignment of teacher training with the broader national strategies of Healthy China 2030 and the construction of a strong education system (Dong, 2022).

2. Sports professional certification

2.1 Domestic sports professional certification





Professional certification plays a crucial role in enhancing the quality of teacher education in China, serving as an institutional guarantee to ensure that basic education practitioners meet required training standards. For certification to achieve its intended impact, colleges and universities must earnestly fulfill their mission of modern talent cultivation by strengthening the comprehensive training of physical education teachers across all stages of professional development. Only through such systematic efforts can the overall teaching competence of physical education teachers be elevated, thereby enabling the cultivation of high-quality professionals who align more closely with the demands of future social development and grassroots education under the framework of professional certification (Ya et al., 2022).

As a key initiative to strengthen and consolidate the teaching workforce in the new era, teacher education certification plays a vital role in the cultivation of physical education professionals in local universities. By establishing unified standards for teacher preparation, the certification system provides a clear framework for improving the quality of talent training and ensuring the professionalization of teaching staff. Within the broader context of building a strong education nation, teacher education certification should be viewed as a strategic opportunity to enhance the quality of physical education talent cultivation. To maximize its impact, institutions must correctly recognize the function of teacher education certification in guiding physical education training, identify the appropriate positioning of talent cultivation, and optimize curriculum structures. At the same time, it is essential to strengthen students' practical training, integrate theoretical knowledge with applied teaching skills, and draw insights from international models of physical education talent cultivation. Through these initiatives, universities can more effectively align with national education strategies and contribute to the development of a larger pool of high-quality physical education professionals in China (Li & Wang, 2023).

2.2 Foreign sports professional certification

Since 1995, Canada has begun to pilot the certification of physical education majors and formulated corresponding certification standards and procedures. My country lags in some aspects of education, promulgating professional certification relatively late, and at the same time, the implementation methods of physical education major certification are not targeted. Canada's physical education professional certification has unique characteristics, which make it different from the certification methods of other countries. (1) The independence of the certification body should be maintained and not subject to any external interference. (2) Participation in certification is voluntary, not mandatory; (3) The purpose of designing certification indicators is to obtain meaningful results; (4) The fairness of the certification process must be ensured; (5) The credibility of the certification results is very important. Canada's physical education professional certification





system has developed into a relatively complete certification method, and my country can learn from it to improve the quality of physical education majors (Li et al., 2021).

3. Training of talents in ice and snow sports

The current challenges in the cultivation of ice and snow talents in China include both a shortage of reserve talents and the generally low quality of existing personnel. Scholars argue that only through the systematic training of high-level, high-quality reserve talents can China enhance its international competitiveness in ice and snow sports (Wu et al., 2017). However, the late start of China's ice and snow development, weak foundations, limited popularization, and pronounced regional disparities between the north and south have restricted progress. In line with the Healthy China 2030 Plan, vocational sports colleges are tasked with advancing the goal of “engaging 300 million people in ice and snow sports” by creating distinctive training models and practical pathways tailored to student and market needs, thereby playing a vital role in the sustainable development of the field (He, 2020; Sun et al., 2024).

At present, the lack of reserve talents, the insufficient number of high-level professionals, and imbalances in talent structure and regional distribution have become major bottlenecks restricting development (Wang & Li, 2023). Existing training methods, organization, and management models can no longer meet the growing demand. Key problems include uneven distribution of athletes, fragmented training channels, and limited volunteer engagement. To address these issues, it is necessary to strengthen policy support, draw lessons from leading ice and snow nations, and improve multi-channel talent development (Zhao & Li, 2021). Moreover, limited scientific research investment and the shortage of professional expertise have further hindered industrial progress. Establishing a scientific, systematic talent training mechanism is therefore essential, with school sports playing a foundational role by equipping students with the necessary skills and qualities to become future athletes (An, 2021).

In summary, ice and snow sports play a significant role in advancing the construction of a strong sporting nation and the Healthy China strategy. Yet, China still faces a serious gap in both the reserve and professional training of ice and snow talents. Improving talent cultivation models, expanding training opportunities, and enhancing teacher education are urgent priorities. With the conclusion of the Winter Olympics, new opportunities and challenges have emerged, leading to a surge in demand for ice and snow professionals. The sustainable progress of China's ice and snow sports is therefore inseparable from the effective cultivation of outstanding teachers and practitioners, making this a critical issue for future development (Han, 2020).

4. Competence of the teacher





The self-development ability of teachers in vocational colleges requires the integration of teaching ability, practical ability, and industry adaptability. Research shows that some teachers have problems such as a disconnection between teaching and industrial demand and a lagging application of new technologies. For example, teachers of intelligent manufacturing professionals lack sufficient mastery of cutting-edge technologies in the industry (such as industrial robot programming), which affects the timeliness of teaching content. Teachers in vocational colleges should establish a circular development model of "teaching - practice - reflection", and improve professional practical capabilities through enterprise training and participation in technical research and development projects. At the same time, strengthen cooperation with industry experts to achieve the same frequency of self-development and industrial upgrading. (Xu, 2015).

Moreover, Strong faculty are essential for delivering professional guidance and cutting-edge knowledge. Yet, in this study, only 20% of teachers updated their professional skills on a quarterly basis, indicating a lag in faculty development and an inability to fully meet students' evolving needs. At the same time, 30% of practical assessments relied primarily on "participation" rather than measurable criteria. Such a rigid evaluation system fails to accurately capture students' practical abilities or learning outcomes and does little to inspire them to actively improve their skills (Li & Wang, 2023).

Summary

China's teacher education certification standards were established to strengthen the quality and accountability of teacher preparation programs, with an emphasis on outcome-based education, student-centered learning, and continuous improvement. These standards provide a unified framework for evaluating curricula, faculty qualifications, and student competencies while ensuring that graduates possess both theoretical knowledge and practical teaching abilities. In physical education, certification serves as a critical mechanism to improve talent cultivation by optimizing curriculum structures, enhancing practical training, and promoting professionalization. Domestically, universities are encouraged to treat certification as an opportunity to align teacher training with national education goals, while internationally, countries such as Canada offer mature models of certification that stress independence, fairness, and credibility, providing valuable lessons for refining China's system.

Alongside certification, the training of sports professionals, particularly in emerging fields like ice and snow sports, faces pressing challenges. The talent pool remains insufficient in both quantity and quality, with outdated training models, uneven regional development, and gaps in scientific research investment slowing progress. Addressing these issues requires developing systematic talent pipelines, expanding practical opportunities, and drawing from international best practices while adapting them to local contexts. At the same time, improving teacher competence



in vocational colleges is essential, as many educators face disconnections between teaching and industry needs. By strengthening practical training, fostering collaboration with industry experts, and promoting continuous self-development, China can cultivate a new generation of high-quality sports professionals and educators, laying the foundation for sustainable progress in national education and the broader sports industry.

Conceptual Framework

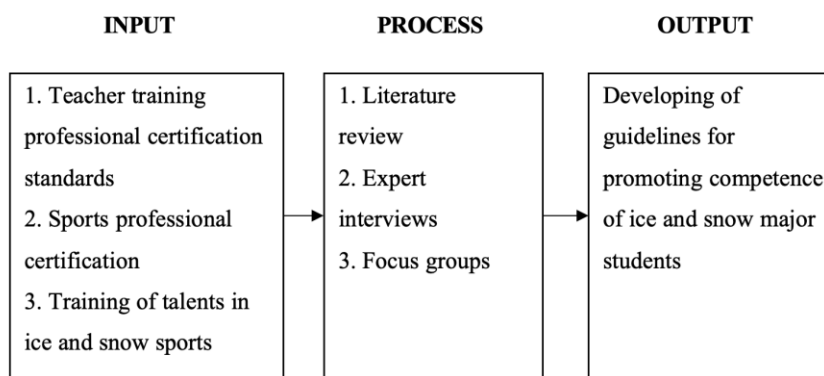


Figure 1 Conceptual framework

This framework showed the systematic process of developing guidelines for promoting the competence of ice and snow major students. The input stage draws on three core foundations: teacher training professional certification standards, sports professional certification practices, and existing approaches to training talents in ice and snow sports. These inputs provide both theoretical underpinnings and practical references. In the process stage, a combination of literature review, expert interviews, and focus groups is employed to gather evidence, integrate professional insights, and validate ideas. This ensures the guidelines are grounded in both academic research and practical expertise. The output of this process is the formulation of a comprehensive set of guidelines aimed at enhancing the competence of students majoring in ice and snow sports, aligning talent training with educational standards and industry demands to better support sustainable development in the field.

Methodology

1. Research Tools

In this research, the following tools were used to conduct the research: (1) Questionnaire for students and teachers; (2) Expert interview outline; (3) Focus group outline.



2. Population and sample

The research population consisted of four universities: Capital University of Physical Education and Sports, Harbin Sport University, Northeast Normal University, and Zhangjiakou University. The survey focused on students majoring in ice and snow sports as well as teachers specializing in this field within the four institutions. In total, the population was 1,461 students and 210 teachers engaged in ice and snow sports programs. Based on Taro Yamane's sample size table, 316 students were selected as the sample. Due to the small number of teachers, the total population of 210 teachers was used as the sample. The details of the sample were as follows:

1. There were 70 students and 79 teachers from the Capital University of Physical Education and Sports.
2. There were 13 students and 10 teachers from Northeast Normal University.
3. There were 60 students and 50 teachers from Zhangjiakou University.
4. There were 173 students and 71 teachers from Harbin Sport University.

3. Data Collection

1. The questionnaires were distributed to 316 students and 210 teachers majoring in ice and snow sports from four universities to study the current status and existing issues in promoting competence of ice and snow major students.

2. Seven experts, including 3 ice and snow sports coaches, 2 professors of ice and snow sports, 1 ice and snow athlete, and 1 university leader, were invited for face-to-face interviews to draft the elements of guidelines for promoting competence of ice and snow major students.

3. Fifteen experts were invited to participate in the focus group discussion, including 3 ski coaches, 2 curling coaches, 2 curlers, 1 skier, 3 physical education teachers, 2 university professors, and 2 university leaders. The purpose of the discussion was to develop guidelines for promoting the competence of ice and snow major students.

4. Data Analysis

1. Descriptive statistical methods, such as the mean value ($\bar{x}$) and the standard deviation (S.D.), were used to analyze the data from the questionnaires of students and teachers.

2. The Item Objective Congruence (IOC) index is used to evaluate the content validity of the questionnaires for students, the questionnaires for teachers, and the expert interview outline. The IOC value was as follows: the questionnaires for students were 0.93, the questionnaires for teachers were 0.87, and the expert interview outline was 0.90.

3. Content analysis was used to analyze the interviews with experts and the focus group discussion.



Results

This study aims to formulate guidelines to promote the development of ice and snow students' abilities, and the core goal is to improve the comprehensive literacy of ice and snow students. To achieve this goal, the researchers conducted a sample survey of students and teachers at the Capital Institute of Physical Education, Harbin Institute of Physical Education, Northeast Normal University, and Zhangjiakou University, and interviewed experts. Subsequently, 15 experts were organized to carry out focus group discussions and jointly formulate specific implementation plans. The research results were as follows:

Part 1: Investigation of the current situation and existing problems of ice and snow students' ability training.

To examine the current situation and identify existing problems in the ability training of ice and snow sports students, this research employed a questionnaire survey targeting students and teachers. A total of 316 students and 210 teachers from four universities participated in the survey. The results of the questionnaire survey were as follows:

Table 1 The students' questionnaire survey results

Survey Dimensions	Issue	Options	Number of people	Percentage (%)
Curriculum and teaching	Satisfaction with the professional curriculum design	Very satisfied	42	13.30
		Satisfied	115	36.40
		Moderate	121	38.30
		Dissatisfied	38	12.00
	Perceived adequacy of practical teaching hours	Very sufficient	59	18.70
		Moderate	104	32.90
		Insufficient	153	48.40
Cultivation of practical ability	Average monthly participation in off-campus practice	3 times or more	31	9.80
		1-2 times	97	30.70
		Occasionally participate	142	44.90
		Never participated	46	14.60
	Self-assessment of specialized skill level	Excellent	28	8.90
		Good	127	40.20
		Intermediate	136	43.00
		Poor	25	7.90
Faculty		More than 80%	65	20.60



Survey Dimensions	Issue	Options	Number of people	Percentage (%)
	Proportion of faculty with professional experience in ice and snow sports	50%-80%	132	41.80
		30%-50%	98	31.00
		Under 30%	21	6.60
	Frequency of teachers sharing updates on industry trends	Updated weekly	47	14.90
		Updated monthly	129	40.80
		Updated occasionally during the semester	118	37.30
		Never updated	22	7.00
Policy and resource support	Adequacy of ice and snow sports equipment provided by the school	Very sufficient	68	21.50
		Moderate	145	45.90
		Insufficient	103	32.60
	Awareness of local government policies supporting ice and snow talent development	Very understand	39	12.30
		Moderate	156	49.40
Student psychology and development	Primary sources of stress encountered in the learning process	Not understand	121	38.30
		Skill	134	42.40
		Employment	152	48.10
		Learning contents	97	30.70
	Confidence in the prospects of the ice and snow industry	Other	23	7.30
		High	85	26.90
		Moderate	167	52.80
		Poor	64	20.30

Based on Table 1, the student survey revealed several issues in curriculum and teaching. Only 13.30% were “very satisfied” with the curriculum, while 38.30% rated it “average” and 12% were dissatisfied, showing room for improvement. Insufficient practical teaching hours and weak integration of theory with practice were identified as major problems.

In terms of practical ability, participation in off-campus practice was low, with 44.90% “occasionally” and 14.60% “never” participating. Only 8.90% rated their skills as “excellent,” and 43% as “average,” indicating that skill proficiency is closely tied to practice opportunities.





Teacher-related issues were also evident: although 62.40% had relevant professional experience, many lacked depth, and few shared industry updates. This reduced students' awareness of new trends, such as smart ski equipment and online training, leading to a gap with industry needs.

Resource and policy support were imbalanced. About 32.60% of students reported insufficient equipment, with shortages most common at Zhangjiakou and Northeast Normal Universities, while Harbin Sport University fared better. Policy awareness was low, as 38.30% of students were unaware of local support policies and only 12.30% were very familiar.

Finally, students faced psychological and developmental pressures. Around 42.40% struggled with mastering difficult skills, and 48.10% worried about employment prospects. With the decline in post-Olympic enthusiasm, many lacked confidence in career stability, and some even considered changing majors.

Table 2 The teachers' questionnaire survey results

Survey Dimensions	Issue	Options	Number of people	Percentage (%)
Teaching and curriculum	Evaluation of the rationality of the current professional curriculum system	Very reasonable	35	16.70
		Reasonable	102	48.60
		Moderate	63	30.00
		Unreasonable	10	4.70
Teacher competence and development	Frequency of updating personal professional skills	Updated every three months	42	20.00
		Updated every six months	84	40.00
		Updated yearly	63	30.00
		Rarely updated	21	10.00
	Frequency of participation in industry exchange activities	1 time per month	25	11.90
		1 time per 3 month	77	36.70
		1 time per semester	84	40.00
		Little participation	24	11.40
Practice and resource support	Perceived adequacy of the school's investment in practical teaching	Very sufficient	29	13.80
		Moderate	88	41.90
		Insufficient	93	44.30



Survey Dimensions	Issue	Options	Number of people	Percentage (%)	
	Extent of cooperation with off-campus ice and snow institutions	Deep cooperation (jointly build bases)	48	22.90	
		General cooperation (internship connection)	105	50.00	
		Few cooperation	57	27.10	
Student ability training	Key abilities that students consider most important to improve	Specific sport skills	112	53.30	
		Teaching and guidance ability	91	43.30	
		Event organization and management ability	63	30.00	
		Industry adaptability	84	40.00	
	Assessment of students' employment competitiveness	High	45	21.40	
		Moderate	126	60.00	
		Poor	39	18.60	
	Policy and industry awareness	Awareness of local policies on ice and snow talent development	Very High	53	25.20
			High	105	50.00
Moderate			42	20.00	
Poor			10	4.80	
Emerging requirements for teacher competencies in response to industry development		Application of intelligent teaching technology	126	60.00	
		Interdisciplinary knowledge integration	91	43.30	
		Master the rules of international ice and snow sports	70	33.30	
		Other	14	6.70	



Based on Table 2, the teacher survey highlighted several issues. For curriculum rationality, 16.70% rated it “very reasonable” and 48.60% “basically reasonable,” while 30% said it “needs optimization.” Practical teaching faced difficulties, with 46.70% citing insufficient venues and 40.50% a lack of funds.

Regarding teacher ability, only 20% updated professional skills quarterly, and 10% rarely did. Industry exchange participation was low, with just 11.90% engaging monthly and 40% only once per semester. Resource support was also lacking: 44.30% felt practical teaching investment was insufficient, and 27.10% reported rare cooperation with off-campus institutions, particularly in non-core ice and snow regions.

Teachers emphasized that students most need to improve “special sports skills” (53.30%) and “industry adaptability” (40%). On employability, 60% rated students as “average” and 18.60% as “weak.” While 25.20% of teachers were very familiar with local policies and 50% had a basic understanding, 20% knew little. Looking ahead, 60% saw mastering intelligent teaching technologies and 43.30% interdisciplinary knowledge as key requirements for teacher development.

Part 2: Draft the elements of guidelines through expert interviews

After identifying the current situation and challenges of ice and snow students in universities through questionnaires, the researcher conducted interviews with seven experts to gain in-depth insights and establish the core elements for enhancing student competence in this field.

Recommended categories	Core ideas and specific measures
1. Core curriculum system	1. Construction of a “three-dimensional core system.” Sports skills courses: Focused on specialized skiing and skating techniques, such as advanced alpine skiing training and curling tactical analysis. Professional theoretical courses: Including subjects like exercise physiology and biomechanics. 2. Existing problems. In most universities, applied courses such as event organization and ice and snow tourism account for less than 20%, creating a gap with industry needs for versatile talent. Curriculum updates also lag, with emerging areas such as intelligent ski equipment operation and virtual simulation teaching not yet widely integrated.
2. Innovation of a practical linkage	1. Establish a “progressive practice system.”



Recommended categories	Core ideas and specific measures
mechanism	- Freshman year: On-campus simulation training (e.g., VR ski simulators). - Sophomore year: Basic job training at ski resorts (e.g., junior coach assistance). - Junior year: Participation in event operations (e.g., timing, refereeing, venue setup). 2. Innovative model. Adopt a “school–enterprise dual tutor system,” in which corporate mentors and university teachers jointly design practice plans. Evidence from Harbin Sport University shows this model can raise students’ practical ability scores by up to 30%. 3. Resource sharing. To address resource shortages in southern universities, promote north–south cooperation, such as partnerships between South China universities and Northeast ski resorts to jointly develop “winter training bases.”
3. Key paths for teacher capacity development	1. Implement the "dual track lifting mechanism". Industry placement system: Requires teachers to work full-time in ski resorts, event companies, or related institutions for at least six months every three years. 2. Addressing obstacles. The main challenge in teacher training is “time conflict.” It is recommended that industry practice be incorporated into the teacher evaluation system, with a weighting of no less than 30%.
4. Cultivation of interdisciplinary competencies	1. Key interdisciplinary competencies to be enhanced: (1) Digital tool application: proficiency in motion trajectory analysis software and interpretation of data from intelligent protective equipment; (2) Cross-cultural communication: ability to engage effectively in international competitions and collaborate with foreign students; and (3) Industrial integration mindset: understanding and designing business models for sectors such as ice and snow tourism and education. 2. Training pathway: establish a “Cross-Border Innovation in the Ice and Snow Industry” workshop and launch interprofessional projects in





Recommended categories	Core ideas and specific measures
	collaboration with the School of Economics and the School of Tourism.
5. Regional adaptability and institutional identity	1. Division of the “Three Major Training Sections”: (1) Northern sports colleges: emphasize cultivating competitive athletes and event management professionals, leveraging natural ice and snow resources to enhance high-level training; (2) Southern comprehensive universities: prioritize mass participation teaching and industry operations, developing ice and snow training courses tailored to local market demands; and (3) Universities in core ice and snow industry regions (e.g., Zhangjiakou): focus on specialized areas such as event services and emergency rescue to support the sustainable use of Winter Olympics legacies. 2. Institutional characteristics: comprehensive universities should avoid blindly replicating the model of sports colleges. Instead, they can build on their own strengths to develop niche areas, for example, normal universities may concentrate on designing campus-based ice and snow teaching programs
6. Collaborative development of employment support systems	1. Establish a “Trinity” Employment Promotion Mechanism: (1) Universities: introduce a compulsory course on Ice and Snow Career Planning, inviting retired athletes, ski resort executives, and other professionals to share their career journeys; (2) Government: broaden the scope of special subsidies for ice and snow talents to cover grassroots coaches and community instructors; and (3) Industry associations: create a talent database to facilitate precise school-enterprise matching. 2. Confidence Building: develop a “Success Story Library” that highlights exemplary cases, such as graduates advancing to ski resort operations directors within three years, to strengthen students’ professional identity and confidence.
7. Core objectives and elements of the guidelines	1. Core Goal: cultivate ice and snow professionals with the capacity for lifelong development.





Recommended categories	Core ideas and specific measures
	2. Three Key Dimensions: (1) Knowledge transfer: emphasize exposure to industry frontiers, such as real-time updates of international competition rules; (2) Skills training: focus on practical proficiency, requiring students to complete at least 500 hours of hands-on teaching or event service before graduation; and (3) Professionalism: strengthen safety awareness and service orientation, incorporating soft skills such as ski rescue and customer communication into the evaluation system.
8. Recommendations for localization of international experience	1. Learn from international models Norway's "community ice and snow education" model combines student training with local community ice and snow promotion to solve the problem of practice venues and serve national fitness; Canada's "certification system convergence" practice: link the course content with international certifications such as the Canadian Ski Instructors Association (CASI) to improve the gold content of students' professional qualifications. 2. Localization considerations: simplifying language and cultural barriers in international curricula. The cultivation plan is adjusted based on the rainy climate characteristics in the south and the cold in the north of our country.
9. Strategic positioning for digital transformation	1. Training Goal: Cultivating "Smart Ice and Snow Talents" Incorporate modules on intelligent ice and snow equipment into the curriculum and establish a digital ice and snow laboratory on campus. Work with technology companies to design practical training programs, such as engaging in smart ski user experience testing. 2. Necessity: Over the next five years, the salaries of ice and snow coaches proficient in data analysis are projected to be more than 30% higher than those of traditional coaches. Therefore, colleges and universities must integrate relevant skills training in advance to prevent students from facing future "technical gaps."

Part 3: Develop the guidelines through focus group discussions

After finishing the expert's interview. Fifteen experts were invited to participate in the focus





group discussion to develop guidelines for promoting competence of ice and snow major students. The focus group concluded that ice and snow talent training must emphasize special skills, practical ability, and industry awareness, with core competencies in safety, teamwork, and digital skills. Key recommendations include adding rescue and equipment modules, strengthening tactical analysis, updating textbooks, and improving practice opportunities through dual tutor systems and north-south cooperation. A standardized ability evaluation system, interdisciplinary course options, digital resource platforms, and stronger industry collaboration were also proposed to bridge the gap between theory and practice and enhance student employability. The details of the guidelines were in Table 3.

Table 3 Guidelines for promoting competence of ice and snow major students

Aspects	Elements	Core content
Training Objectives	Overall Goals	Cultivate high-quality, application-oriented talents in ice and snow sports who possess strong technical skills, practical teaching and event management abilities, and strong industry adaptability, enabling them to excel in teaching, training, event operations, and industrial management, while also meeting the dual needs of competitive sports talent development and mass participation promotion.
Core competence module and training path	Special sports skills module	1. Core Requirements 1.1 Skiing track: Master beginner to advanced skiing/snowboarding techniques, develop trail judgment and safety control skills, and obtain at least an intermediate-level national ski instructor certification. 1.2 Curling track: Demonstrate proficiency in throwing, ice brushing, and tactical layout, acquire basic referee skills, and participate in volunteer service at a minimum of two provincial-level or higher curling events. 2. Training Path. Adopt the structure of technical training (60%), event practice (30%), and safety/first aid (10%). Special training should be no less than 8 hours per week, with skill assessments conducted once per semester.



Aspects	Elements	Core content
	Teaching and guidance ability module	1. Core Requirements. Ability to design ice and snow teaching programs for different age groups (children, adults, elderly) and provide targeted guidance, including error correction and personalized training plans. 2. Training Path. Adopt a three-stage progressive model: micro-teaching (recording and reviewing teaching videos) → on-campus teaching simulations (trial classes for non-major students) → off-campus internships (assistant roles at ski resorts/ice rinks), with a total of 80 hours of teaching practice required.
	Event and industry competency module	1. Core Requirements. Students should understand the full process of ice and snow event management, including planning, execution, and refereeing, while developing basic organizational skills. They must also grasp the structure of the ice and snow industry chain and be able to analyze industry development trends. 2. Training Path. Requirements include: participation in at least one school-level ice and snow event, completion of courses such as Ice and Snow Event Management and Sports Industry Economics, submission of one regional industry research report, and a minimum one-month internship at an ice and snow company
	Interdisciplinary and digital competence module	1. Core Requirements: Students should master the operation and data interpretation of intelligent ice and snow equipment (e.g., motion sensors, VR simulators) and be able to use English for basic teaching and competition communication. 2. Training Path. Offer the course Application of Intelligent Ice and Snow Technology with hands-on equipment training (e.g., ski simulators); require completion of Ice and Snow Sports English and passing the proficiency test; and encourage participation in





Aspects	Elements	Core content
		cross-disciplinary teams, such as collaborating with computer science students to develop ski motion analysis applications
Implement safeguards	Curriculum and teaching material construction	Establish a textbook writing committee to update the core text every two years, incorporating the latest technologies and rules. Implement a modular course-selection system that lets students tailor electives to their intended career paths.
	Practice-based and resource integration	Each university should establish at least one on-campus ice and snow training center (including simulators) and develop in-depth partnerships with three or more off-campus institutions (such as ski resorts, ice rinks, or event companies). Practice-based agreements should be signed, clearly defining the rights and responsibilities of both parties.
	Dual-teacher training plan	The implementation of the "dual-teacher training plan" stipulates that professional teachers must complete at least six months of industry practice every three years. In addition, a minimum of 10 industry experts should be employed as part-time instructors, each delivering no fewer than 16 teaching hours per semester.
	Evaluation and incentive mechanism	Establish a three-dimensional evaluation system integrating credits, vocational qualifications, and practical performance; incorporate requirements such as obtaining skiing or curling coaching certificates and accumulating event referee experience as conditions for graduation; and create the "Ice and Snow Outstanding Student Scholarship" to recognize students who demonstrate exceptional practical skills and hold relevant industry certifications.
	Regional differentiation support	Northern colleges and universities will emphasize training in competitive skills and event services, while southern colleges will focus on mass participation





Aspects	Elements	Core content
		teaching and industry operations. The “North-South University Exchange Program” will be implemented to promote the sharing of high-quality resources. In addition, special subsidies will be provided to southern institutions to support the development of dry-land ice and snow facilities
Collaboration mechanisms	School-enterprise cooperation	Enterprises will take part in designing talent training programs, offering practical training placements and equipment support, while giving priority to hiring graduates from partner universities. In return, universities will provide enterprises with technical consulting and employee training services, thereby creating a mutually beneficial, win-win collaboration model.
	Government, enterprise, and school linkage	Align with local ice and snow industry policies and actively seek government support for facility construction, internship subsidies, and related initiatives. Participate in government-led mass promotion projects, such as the “Ice and Snow in School” campaign, to create practical platforms for student engagement and experience.
	International co-operation	Build cooperative partnerships with overseas ice and snow universities to conduct teacher-student exchanges and joint training programs. Introduce international certification systems, such as those of the International Ski Instructors Association (ISIA) and the World Curling Federation (WCF), to strengthen the global recognition and competitiveness of trained professionals.

The finalized guidelines encompass four core aspects: (1) Training Objectives, focusing on the overall goals; (2) Core Competence Modules and Training Pathways, which include four elements, special sports skills, teaching and guidance ability, event and industry competency, and interdisciplinary and digital competence; (3) Implementation Safeguards, covering five elements, curriculum and teaching material development, practice base and resource integration, dual-





teacher training plan, evaluation and incentive mechanisms, and regional differentiation support; and (4) Collaboration Mechanisms, consisting of three elements—school-enterprise cooperation, government–enterprise–school linkage, and international cooperation.

Conclusion

The study identified four main challenges in training ice and snow students: weak links between curriculum and practice, unbalanced ability structures, uneven regional resources, and outdated teacher and evaluation systems. To address these, a “three-dimensional core” framework was developed, focusing on special skills as the foundation, practical ability as the core, and industry cognition as the extension. It highlights knowledge transfer, skill training (at least 500 practice hours), and professionalism. Implementation is supported by four measures: curriculum and practice innovation, teacher capacity development, evaluation optimization, and collaborative education. Overall, the guidelines integrate curriculum reform, practice enhancement, and multi-level cooperation to strengthen student competence.

Discussion

Related research in China has found that, with the rapid development of the ice and snow industry, the demand for talent is becoming increasingly diverse. Students are required not only to possess solid professional skills but also to master competencies in areas such as event operations, industrial management, and marketing (Wang & Li, 2023). Research further shows significant regional differences in the professional resource endowment of ice and snow sports education. Benefiting from natural ice and snow resources, Northern Sports Colleges enjoy unique conditions for practical teaching, offering students more opportunities for field training and thus better supporting the cultivation of competitive athletes and event management professionals (Sun et al., 2024). Meanwhile, the construction and evaluation system of teaching staff remains a crucial factor influencing the cultivation of students’ abilities. Studies indicate that excellent faculty can provide students with more professional guidance and access to cutting-edge knowledge (Li & Wang, 2023). However, findings reveal that only 20% of teachers in this study updated their professional skills on a quarterly basis, reflecting delays in faculty capacity enhancement and making it difficult to meet students’ learning needs for new knowledge and technologies. In addition, 30% of students’ practical assessments relied primarily on “participation” rather than quantitative criteria. This rigid evaluation mechanism fails to accurately measure students’ practical abilities and learning outcomes, while offering limited motivation for them to actively strengthen their skills. Collectively, the current situation of faculty development





and evaluation systems hinders, to some extent, the effective cultivation of talents in the field of ice and snow sports.

Recommendation

Recommendations for this study

1. In view of the current disconnect between the current curriculum and industry needs, colleges and universities should start a comprehensive curriculum reform.
2. To address the lag in teacher skills and knowledge updates, colleges and universities should implement mandatory teacher training programs.

Recommendation for further research

1. Future research should focus on analyzing the long-term impact of improved training methods on students' career development.
2. With the rapid development of ice and snow industry technologies such as artificial intelligence in training and virtual reality in teaching, further research is needed on how to better integrate these technologies into the training system.

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