Optimization Strategy of University Campus Outdoor Environment in Cold Area

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Abstract. The paper aims to construct the outdoor space environment which is suitable for the cold climate, meets the campus structure and natural conditions of university, and meets the needs of the activities of teachers and students. On the basis of a large number of actual investigation and case collection, this paper studies the culture, landscape elements and design methods of the outdoor environment of universities in cold areas. The paper analyzes and summarizes the trend and existing problems, provide some feasible suggestions and strategies for the design of outdoor space environment in cold universities during the contemporary economic and social conditions.

1. Introduction
Outdoor space is the important part of campus space, the effect of which is no trivial matter, whether on its use of function or space intention. As the most dynamic place in the campus, outdoor space has become the core component of the whole campus space and the important carrier of campus life. Therefore, the design of the outdoor space should be suitable to the climate background of the cold area, so as to ensure that the efficiency of use in outdoor space of the campus will not be affected by weather. The campus outdoor space in cold region has its special requirements due to the influence of the different regional conditions. The research on the design of campus outdoor space which starts from the characteristics of cold region and the behavior mode of students can promote the better development and extension of its spiritual connotation, improve the utilization rate of the campus outdoor space in different seasons, and make it easier facilitate communication and interaction between students.

2. The status survey of Outdoor Environment of university campus in cold area
2.1. Lack of regional characteristics
The design of outdoor space environment of campus in cold region pays more attention to the state of space environment in spring, summer and autumn, but ignores the seasonal factors in winter. The design lacks the relevant countermeasures meet the needs of seasonal characteristics, which leads to the design of outdoor public space of campus in cold region lacks the consideration of geographical conditions, climate characteristics and regional culture, and lacks local characteristics. At the same time, some architects don't have enough knowledge about the cold city, so that they copy the existing design schemes of other universities in the South blindly without considering the characteristics of the cold city. As a result, the use function of public space is seriously damaged, and they built some leisure spaces that are not consistent with the cold city environment. For example, when some leisure...
squares or leisure green space are being built in some university campuses, there is a trend of “seeking greatness”, seeking for large space, large pattern and large scale. However, the climate in cold areas is cold and dry, windy and sandy in autumn and winter, and there is a lack of shelter structures in large-scale space, so these leisure spaces are almost unused in autumn and winter.

2.2. Lack of humanistic care
Through investigation, it is not difficult to find that in the design of public environment space of campus in cold regions, there are generally three types: the first type is non-human space. For example, the layout of environment space with strong public activity can not be satisfied on a very small site, which will also produce reaction to a certain extent. The second is non-cultural space, such as inappropriate sculptures, steps, corridors, etc.; the third is contradictory space, such as placing seats for rest and Study on both sides of crowded roads, designing closed private space among people coming and going, etc. In the investigation of colleges and universities, there is a lack of human design and unified planning; some schools even have the problem of idle land, so that the public space environment can not play a positive role in the campus.

2.3. The environment design is single
The outdoor space design of campus planning in cold area is inflexible, stereotyped, and lacking public recognition. The boundaries among outdoor square, courtyard and road are not clear and the designers lack the research on the behavior mode of students and teachers. At the same time, in order to pursue the use efficiency of functional buildings such as classrooms, libraries and dormitories, architects put their campus planning focuses on the design of functional buildings in the campus, but pays less attention to the outdoor space with open functions and ignores the construction of external space. As a result, students, who are the main carrier of the campus lack communication in outdoor space and campus feelings. In such an environment, students only feel a tense and serious atmosphere of learning. Also, such kind of environment lacks the atmosphere of university life, which makes students have a disgust, indifference feeling towards campus. Students and teachers often lack a sense of familiarity, and emotional sustenance of the school.

3. Optimization strategy of Suitability of the Outdoor Environment of university Campus in cold region
Because the college education reform advocates outdoor teaching mode, cold outdoor environment of campus from pure living space development become the scene of teaching and life with. Campus in cold, however due to the limitation of climate conditions, the use of the campus outdoor environment has obvious seasonal effect, therefore, the optimization of cold outdoor environment of the campus, to attract the teachers and students gathered, activities, communication, need to create a different functional requirements, different hierarchical levels of contact space, the contact space enriched the spatial characteristics, make the optimization of cold has the practical significance of outdoor space in campus.

3.1. Increase the campus cultural connotation
Design feature space: a good campus environment can make students get emotional identity, on behalf of the school development or spiritual connotation of cultural facilities can make students recognition and respect history, heritage has a long tradition of the campus. The design of the outdoor environment should fully reflect the campus culture. Node signs such as cultural squares, sculptures and time corridors can be set up to symbolize the development of the school. These facilities can convey the campus spirit.

The introduction of ice and snow culture: the culture of ice and snow is cold to the unique landscape culture, in the cold set in the campus landscape, should make full use of its for regional culture inheritance and carry forward. There are various ways of expression of ice and snow culture, such as abstract or concrete forms, artistic conception endowed with cultural connotation, and snow
landscapes created in specific places to create a frozen atmosphere. At the same time, the design of
campus landscape in winter, can guide university students to participate in, to let them in the creation
combining campus culture and learning life, increase the students' emotional attention in the campus,
can also create a distinct characteristic of the campus landscape of cold.

3.2. Decrease the negative impact of the climate
Change the form and layout of buildings: In the campus planning in the cold region, we should try to
reduce the influence of air flow on the campus environment in winter by changing the form and layout
of buildings. Reasonable form of architecture and layout of buildings around the environment has
certain control and guidance, create comfortable environment for shelter. Different architectural style
and layout will produce different effect, campus planning according to the function is divided into
different blocks, general layout in each block, consideration should be given to the prevailing
northwest wind in winter shelter, use of high building in block form similar to the effects of retaining
wall.

Make full use of natural elements: natural light is the most valuable natural resource in the cold
winter. In the campus planning, making full use of natural light can not only improve the comfort of
the living environment of teachers and students, but also generate positive psychological guidance. In
cold to campus planning, from the overall layout, try to place the main entrance on the south side, at
the same time, the south is unfavorable to decorate high dimension, big buildings. Within each
function block, the layout of the building should pay attention to the distance between buildings, avoid
to produce shade. In the planning and design of Northeast Petroleum University, active striving for
daylight is well considered. The main entrance of the campus is selected on the south side of the base,
through an axis running through the north and south, and a large square can be formed in front of each
functional group to ensure good spatial experience and lighting surface.

3.3. Diversification of design methods
Improving the square space: Roads and squares are the main traffic space in the campus. In the
planning and design of them, it is necessary to consider the capacity of pedestrian flow as well as the
effective utilization rate of square space. The square in front of the library of Northeast Petroleum
University can't be well used because of its too large scale and non-slip floor; the small square in front
of the activity center has dense activities but small scale. In the design of the square, the square with a
large scale can be divided at the spatial level, and the way of raising or sinking can be used, different
landscape elements can be combined to create a rich spatial form of the square, and meet the use needs
of different activities.

Building courtyard space: courtyard space is the main component of traditional architecture in
China, and it is also an ideal place for teachers and students to relax, live and communicate in
contemporary university campus. In the campus planning of cold area, considering the influence of
season, it is not suitable to create courtyard on a large scale. However, in each living area, such space
suitable for students' shelter should be designed to form an introverted outdoor space. At the same
time, courtyard should be designed in front or side of each teaching building or auxiliary building as
far as possible, so as to improve the learning environment of teachers and students.

Enrich the landscape elements: the landscape elements of cold campus outdoor environment are
relatively single compared with the warm areas in the south. In addition to considering the beauty, we
should also focus on the use and safety in winter. When dealing with the landscape, considering the
location of the winter ice rink should be combined with the surrounding, and should be combined with
the behavior mode of ice sports, should be set up to change shoes, to provide convenience for teachers
and students. In the layout of the campus road, we should not only consider the pedestrian and vehicle
flow lines in different directions, but also set up some seats or landscape nodes on the long road to
facilitate teachers and students to have a rest; at the same time, the road pavement should be mainly
made of anti-skid materials in winter to ensure traffic safety.
4. The conclusion
The outdoor space of cold campus should meet the cold climate conditions, maximize the utilization rate, adapt to the environment, and reduce the impact of cold climate on the outdoor space. First of all, in the layout of the campus environment, the unique ice and snow culture in the cold area should be combined with the campus culture, combined with the needs and imagination of users to further enhance the cultural connotation of the campus. Secondly, the cold campus site planning and architectural layout should focus on how to block the winter wind and the introduction of natural light, in order to reduce the adverse climate conditions on the campus outdoor environment. Finally, diversified design methods are adopted to improve the quality of the campus environment. The square space with moderate scale and pleasant scale is set up. The courtyard space with strong sense of enclosure and privacy and suitable for communication is added. The landscape elements used by teachers and students in winter and reflecting humanization are selected. The above strategies can make use of natural resources to improve the space, create communication space to improve the flow of people, and then improve the utilization rate of the cold campus outdoor environment.

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References
[1] Lang,X.Y.(2011)Research on Campus Outdoor Space Design Based on Environmental Behavior. Master's thesis of Northwest A&F University, Yangling
[2] Liu,K.X.(2013)Study on the Design of the Surrounding External Space Environment of Cold Campus. Master's thesis of Harbin Institute of Technology, Harbin
[3] Shi,Y.Y. (2015)Study on Composite Design of Living Area of Hindi University Campus. Master's thesis of Harbin Institute of Technology, Harbin
[4] Yu,F.F. (2009)Study on Landscape Design of Contemporary University Campus. Master's thesis of Southwest Jiaotong University, Chengdu
[5] Hai,J. (2011)Research on Sustainable Campus Planning Strategy Based on Symbiosis. Doctoral thesis of South China University of Technology, Guangzhou
[6] Huang, L.d. (2019)Influence of enclosed buildings on microclimate in the teaching area of cold campus. Building energy conservation,12:15~21