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A study of informal learning spaces in university student residences based on ergonomics

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Abstract

Student residences are the main place of informal learning for students, extending the function of structured formal learning spaces. Instead of presenting a monotonous and mechanical atmosphere, these informal learning spaces should create a comfortable and relaxing environment. The design of informal learning spaces in student flats is directly related to students' learning efficiency and physical and mental health. Most of the existing studies have examined and researched the informal learning space or ergonomics from a single point of view, but few scholars have considered the design of informal learning space in college student apartments from the perspective of ergonomics. Therefore, this paper firstly defines the connotation of informal learning space in college student flats, then analyses the human-machine-environment system of informal learning space in college student apartments based on human-computer science, and finally puts forward suggestions for the design of informal learning space in college student apartments.

Keywords

Ergonomics; Informal learning spaces; University student residences.

1. Introduction

With the emergence of the concept of "school," educational architecture has undergone a long period of development. As an integral part of university campuses, student dormitories play a crucial role in influencing students' learning and living experiences. Additionally, with the transformation of educational models and information technology, there has been a significant shift in the learning needs of college students, with autonomous learning and personalized development becoming characteristic of their educational journey. Therefore, the rational design of informal learning spaces on campus has become increasingly important in meeting the learning needs of college students.

Human-environment interaction (HEI) is an interdisciplinary field that addresses the design of engineering systems, including machinery and environmental systems, to accommodate the physiological and psychological requirements of individuals. By applying theories and methods from HEI to spatial design, spaces can be created that facilitate efficient, safe, healthy, and comfortable work and study environments. Hence, this paper, based on HEI principles, analyzes the human-machine-environment systems within university dormitories and defines the essence of college student dormitories based on relevant literature. Finally, it proposes design strategies for informal learning spaces in university settings.

2. Literature review

The concept of "informal learning" was introduced by Knowles in 1950 in Informal Education for Adults: A Guide for Administrators, Leaders, and Teachers. The European Commission (EC) recognises that informal learning is a form of learning that takes place in the context of the

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education system. According to the European Commission (EC), informal learning is learning that occurs as a result of everyday activities, in a form that is unstructured, so that there is no education or qualification, and where the learner's learning may be conscious or unconscious, but in most cases it is unconscious, random and incidental. The learner may be conscious or unconscious, but in most cases it is unconscious, random and accidental. Resnick points out that informal learning can be recognised on the basis of four dimensions: shared cognition, manipulation of tools, situational thinking and the practice of specific competences. Marsick and Watkins believe that formal learning is an organised, disciplined and systematic activity that takes place in schools and classrooms to develop people. Informal learning is learning that occurs outside the classroom environment. Yu Shengquan and Mao Fang (2005) Informal learning refers to the process of acquiring new knowledge through activities such as work, life, and social interaction, which is very different from formal learning through formal learning venues such as classrooms and laboratories. Informal learning has experiential characteristics such as "learner-inspired, voluntary, individualised, contextualised, collaborative, and non-linear". Informal learning has experiential characteristics such as "learner-motivated, voluntary, contextualised, collaborative, non-linear," and the learner has the freedom of choice to learn.

Informal learning space is an extension on the basis of the concept of informal learning. Sorting out the literature at home and abroad, scholars at home and abroad mainly study informal learning space from the overall level of informal learning space as well as with informal learning space in colleges and universities. Wang Qing (2010) divides informal learning space into four categories: learning space, social space, teamwork space and teacher-student communication space, and analyses typical cases and proposes the design principles of informal learning space in the context of educational information technology. Jerry Wang (2018) talked about the creation of informal learning places in campus public spaces such as campus public buildings and campus outdoor public spaces . Weber (2015) proposed a four-quadrant learning rhythm theoretical framework, which includes private/alone, public/alone, private/shared, and public/shared, and argued that the learning space in which students engage in self-direction is an informal learning space, and gave design principles based on the characteristics of these four different informal learning spaces . S Vanichvatana, 2018) used questionnaires and interviews to survey students at a university business school in Bangkok to explore how such students use informal learning spaces on campus. Yan, Jianzhang (2019) argued that the construction and development of informal learning spaces in universities should give more consideration to issues such as cost, convenience and comfort, and that they need to be reasonably designed according to the location distribution, service population and use function of informal learning spaces. Hu Jianbo (2020) By analysing the case of student flat renovation in a college, proposed the functional spatial positioning and renovation design strategy of informal learning space in college student apartments.

Through combing the literature at home and abroad, it is found that the theoretical exploration of informal learning space in China has gradually increased and the theoretical framework has been gradually improved, but even so, the theoretical research only stays on the research on the classification, structure, and learning mode of informal learning space, and there is a lack of theoretical system that can guide the design of informal learning space.

As a discipline that studies the interactions between people, machines and their working environments, ergonomics is a cutting-edge discipline that emerged in the late 1940s and applies the principles, methods and data of various disciplines to different subject areas. It integrates knowledge from multiple disciplines such as physiology, psychology, medicine, and others to study the interrelationships between people, machines, and the environment. These relationships are improved through appropriate design to ensure that the working system achieves the desired results while safeguarding human health and comfort as well as safety.

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Informal learning spaces based on ergonomics can improve the efficiency of informal learning for students.

3. Connotations of informal learning spaces in higher education student residences

The concept of "informal learning" was first introduced in 1950 by the American scholar Malcolm Knowles in Informal Education for Adults. According to Watkin and Marsick, "informal learning" is a relatively free and unguided way of learning, and belongs to a sense of conscious learning. Informal learning is different from formal learning in terms of the amount of time spent on learning. Learning styles [12]. and the main motivation etc. "Informal learning space" is a term used to describe learning spaces that support informal learning in addition to traditional teaching spaces (classrooms, laboratories, etc.) in the campus learning space system, such as laboratories, libraries, exhibition halls, student flats, corridors, lawns and other places. In recent years, with the progress of society, changes in the economic environment, changes in the education model and the integration of information technology and higher education, the traditional structured formal learning environment can not meet the changing needs of the teaching model. As an extension and supplement to the formal learning environment, "informal learning spaces" play an important role in providing students with the necessary space for self-organised learning activities.

As a comprehensive place for students to study, live, play and socialise, the student residence has always been one of the most frequently used places by students in colleges and universities, playing an important role in education and training. As the core carrier of informal learning space for students in colleges and universities, the student residence occupies the most important position in the informal learning environment of colleges and universities, and students spend the longest time here. It is not only the main place for students to carry out self-education, self-management and self-service, but also an important place for mutual influence. In addition, the student residence is also an important space for the exchange of politics, culture, ideas and values among students. The space of student residence in higher education generally consists of dormitory rooms, common lounge areas, study areas, bathing and sanitary facilities, kitchens and dining halls, management offices, and other facilities. These areas are the main components of the design of informal learning spaces in higher education student residences.

Learning in informal learning spaces in student flats mainly includes three modes of learning: individual learning, group learning, and collective learning. According to the demand for space in different learning modes, this paper draws on Professor Lennie Scott-Webber2's method of dividing the informal learning space through the four-quadrant theoretical framework to divide the informal learning space in college flats into a learning support space, exercise and rest space, display space, and service space. Learning support space is a learning space that provides students with different learning modes, mainly including cooperative learning area, daily learning area, network learning area, etc. Exercise and rest space is an indispensable place for students to carry out communication and learning, including gymnasium, indoor rest area and outdoor rest area, etc. The display space is a place for students to browse and learn. The display space is a place for students to receive education consciously or unconsciously during the browsing process; the display space is a space for students to receive education consciously or unconsciously during the browsing process, and it is mainly set up in conjunction with the foyer, the rest corridor and other public areas; it is mainly set up by relying on the foyer, the rest corridor and other public areas; and the service space is a place that provides students with the necessary living services and psychological counselling The service space is a place that provides students with necessary living services and psychological counselling, including areas such as laundry, bathroom, psychological counselling and student affairs service area.

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4. Analysis of human-computer-environment system in informal learning space of higher education students' flats

4.1. Analysis of Human Factors in Informal Learning Spaces in Higher Education Student Residences

The group of students in colleges and universities shows obvious heterogeneity and commonality. They are usually young people of similar age and full of vigour, brought together through similar gaokao experiences, but at the same time they also show great differences in terms of geography, family background, living habits, interests and hobbies. This unique group will spend a long time together on the university campus and spend four years or even longer collective life together.

The design of informal learning space in college student flats should be based on students' psychological, physiological and behavioural patterns. College students are psychologically focused on reality, but with utilitarian values; they have a strong sense of individuality and self-consciousness, but poor social communication skills; they are active and dynamic in thinking, and have a critical mindset. In terms of behavioural patterns, the behaviour of college students is diversified. It includes physiological behaviour, social behaviour as well as creative and free behaviour. Students' demand for learning space is more obvious in both spatial environment and physical environment. Such as focusing on the concentration and freedom of space, lighting, ventilation, sound insulation and other aspects of the difference between the needs.

4.2. Analysis of factors of machines in informal learning spaces in student residences in higher education institutions

Machines in informal learning spaces include spatial layout as well as the physical environment. The spatial layout includes scale form, furniture arrangement, vertical enclosure, and node placement. The physical environment includes colour, material, lighting and acoustic control. In the informal learning space of university student residence, machine refers to various facilities, resources and technologies, which play an important role in students' learning.

4.2.1. Facilities and equipment

Facilities and equipment in the informal learning space in the student residence include desks, chairs, blackboards, computers, projectors, printers, etc. The quality and quantity of equipment directly affects the learning experience and efficiency of students. For example, comfortable and appropriate chairs and spacious desks can enhance students' learning comfort, while high-quality projectors and computer equipment can provide better learning resources and tools.

4.2.2. Learning resources

Learning resources in informal learning spaces include books, periodicals, electronic materials, teaching videos and so on. The quality and richness of these resources have a direct impact on students' learning outcomes.

4.2.3. Technical support

Informal learning spaces in student residences in modern universities are usually equipped with advanced technical support, such as wireless networks and intelligent learning systems. These technical supports can provide convenient learning tools and platforms to help students access information, conduct research and communicate and cooperate with others.

4.2.4. Social platforms

Informal study spaces in student residences are also platforms for students to socialise and communicate. Through social media, online forums and other technical support, students can share knowledge, discuss and exchange ideas in these spaces, and promote academic cooperation and communication among themselves.

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4.3. Factors analysing the environment in informal learning spaces in university student residences

The element of environment in informal learning spaces refers to the cultural atmosphere of the space. The interaction between people and space creates the physical, emotional and mental realms, which are the expression of the cultural nature of informal learning spaces in university student residences. Physical context means that the design of the space should comply with the basic design norms, and improve the user's perceptual experience on the basis of meeting his or her material needs; context means that the environment needs to have a certain degree of interest and richness, attracting the user to move around in the space; and intentionality is the higher sublimation of the physical and emotional contexts, so as to make the informal learning space of the college flats a manifestation of the spirit of culture.

Environmental characteristics include space entity characteristics and humanistic characteristics. Inheriting the campus characteristic culture and the pioneering culture of the times is an important part of establishing the spirit of the indoor space of university buildings, and the construction of the cultural atmosphere of university student apartments, as an important part of the campus buildings, has an important role in the cultivation of students. Campus characteristic culture is a comprehensive reflection of humanistic qualities such as university development history and atmosphere temperament, which is the core factor distinguishing it from other spaces. The precipitation of the history and culture of universities and disciplines constitutes the campus culture with distinctive characteristics, which is incorporated into the design of informal learning space, and reasonably inherited and carried forward, which is conducive to the formation of a unique spatial humanistic atmosphere.

The pioneering nature of the culture of the university era is reflected not only in the development and promotion of scientific and technological products and other products of knowledge that can directly contribute to economic development, but also in its leadership of the culture of society as a whole. It plays an active role in promoting the pursuit of social values and ethics, the mode of production and life of society, and the critical consciousness of society and culture. As the birthplace of advanced culture and the practitioner of pioneering culture, one of the specific manifestations of universities is to incorporate the pioneering culture into the design of informal learning spaces in schools, and to integrate the pioneering culture with architectural interiors and gradually radiate it to the whole society from within the university.

5. Recommendations for the design of informal learning spaces in student residences in higher education

Based on the analysis of the human-machine-environment system of informal learning space in college student flats, this paper proposes relevant design ideas.

5.1. Humanised design

In designing informal learning spaces in student residences, the hardware facilities should be ergonomically designed to ensure that they provide comfort and wellness to avoid discomfort associated with prolonged study. For example, the choice of comfortable seating and desktop heights, as well as their shapes and angles, should take into account students' body postures and movements to promote proper posture and reduce physical fatigue.

It is also vital to use warm colours and natural materials. Soft colours and natural materials can create a comfortable atmosphere for studying, which helps to ease students' tension and improve their learning efficiency. For example, choose soft blues or greens, which are colours that help to relax and improve concentration. And the use of natural wood or greenery can give a sense of closeness to nature, reducing study stress and increasing motivation.

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5.2. Diversified learning spaces

In order to meet the needs of different learning activities, the design of multiple types of informal learning spaces can meet the different learning needs of students. Firstly, independent study areas should provide a quiet, private environment where students can concentrate on reading, writing or individual learning activities. These types of spaces should be equipped with comfortable seating and tables, and provide adequate lighting and electrical outlets to support long periods of independent study. Second, small group discussion areas should be designed to be an appropriate environment for group learning and collaboration. Such spaces can be equipped with round tables and an appropriate amount of seating to facilitate interaction and discussion among group members. In addition, equipment such as whiteboards and projectors should be provided to facilitate students' presentation and sharing of information. Alternatively, multimedia display areas should be designed to support an environment for multimedia displays and presentations. Such spaces can be equipped with large screens, audio equipment and projectors to support multimedia presentations and observation by students.

Regardless of the type of learning space, necessary facilities and resources, such as books, computers, Wi-Fi, etc., should be provided to cater for the needs of students to engage in learning and communication. By designing multiple types of learning spaces and providing appropriate facilities and resources for each, the needs of different learning activities can be better catered for and the learning experience and effectiveness of students can be enhanced.

5.3. Technical Support

Informal learning spaces in student residences in higher education should be equipped with stable wireless networks and advanced learning technology support, providing convenient learning tools and platforms. This includes smart whiteboards and projection equipment to facilitate students' presentation and sharing of information. In addition, the provision of computers and printing devices is necessary to support students' learning activities such as literature searching and assignment writing. The provision of such equipment and technology can provide students with a wider range of learning resources and more efficient ways of learning, and facilitate their learning outcomes and academic development.

5.4. Social interaction and co-operation

One of the objectives of the design of informal learning spaces in student residences in tertiary institutions is to facilitate communication and cooperation among students and create more opportunities for knowledge sharing and teamwork. Therefore, open seating layout and spaciousness should be considered in the design to encourage students to move freely and interact with others. In addition, the study space should also provide comfortable rest areas and recreational facilities, such as comfortable sofas and game areas, to provide students with opportunities to relax. These facilities will not only help students to relieve learning pressure, but also enhance social interaction and learning motivation, and inspire them to participate more actively in learning and collaborative activities.

5.5. Personalised Learning Experience

Provide personalised learning support and guidance to students using smart technologies and data analysis, recommending learning resources and activities based on students' needs and interests. Provide personalised learning space settings to meet different students' learning preferences and needs, and enhance students' motivation and engagement.

5.6. Security and privacy protection

Design safe and reliable informal study spaces in student residences to ensure the personal and property safety of students. Respecting students' personal privacy, reasonable soundproofing

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and privacy protection measures are put in place to ensure students' privacy and sense of security in the study space.

5.7. Sustainable development

Adopt energy-saving and environmentally friendly design concepts and materials to reduce energy consumption and environmental impact and promote the sustainable development of informal learning spaces in student residences. Encourage students to participate in sustainable practices and promote the development of environmental awareness and behaviours in their learning spaces.

By comprehensively considering factors such as humane design, diverse learning spaces, technical support, social interaction and collaboration, personalised learning experience, security and privacy protection, and sustainability, informal learning spaces in university student residences based on the principles of ergonomics are able to maximise students' learning needs and promote their academic development and personal growth.

6. Conclusion

The informal learning spaces in student dormitories serve as vital supplements to the formal learning environments in schools, meeting the diverse and personalized learning needs of college students. Based on human-environment interaction principles, these informal learning spaces in university student dormitories can significantly alleviate students' physiological and psychological fatigue during the learning process, ignite their enthusiasm for learning, enhance their learning efficiency, and promote communication and collaboration among students. This is crucial for the construction of knowledge among students and the formation of a community.

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