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Research on the Construction and Improvement Strategy of Barrier-free Environment System in Colleges and Universities: A Case Study of Wenzhou Polytechnic

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Abstract

This study aims to explore the construction and enhancement strategies of the accessibility system in colleges and universities exemplified by Wenzhou Polytechnic. The study will examine the existing framework of accessibility system, analyze its application in the practice of colleges and universities, and put forward strategies and suggestions applicable to different colleges and universities. Relevant data will be collected and analyzed through tools such as case studies and questionnaire surveys. The study will focus on elements such as accessible design of campus buildings and facilities, information accessibility, assistive technology support, and inclusiveness in teaching and assessment. Through the conduct of this study, it aims to increase awareness of accessibility in higher education institutions, to promote improved policies and practices, and to build an inclusive and equitable higher education system that contributes to the personal development and well-being of each student, faculty, staff, and visitor, while promoting the sustainable development of society.

Keywords

Barrier-free environment, Barrier-free facilities, Current problems, Countermeasures analysis.

1. Introduction

As society advances and concerns about inclusion and equality grow, the construction and enhancement of accessible environments at colleges and universities has become an important topic[1,2]. An accessibility system is a campus environment that provides equal opportunities and accommodations for all students, faculty, staff, and visitors, regardless of whether they have physical, sensory, cognitive, or other types of functional disabilities. In this diverse society, building accessible environments is not only a legal obligation for colleges and universities, but also an important initiative to promote social progress and foster academic achievement[3,4].

The purpose of this study is to explore the construction and enhancement strategies of accessibility systems in higher education to promote inclusive education and social justice. We will study the existing frameworks and international standards of accessibility systems, analyze their application in university practices, and propose strategies and recommendations applicable to different universities. Through in-depth research and empirical analysis, we aim to provide effective guidance to university administrators, policy makers, and relevant stakeholders in constructing and upgrading accessibility systems to meet the needs and interests of diverse learners.

This study will use qualitative and quantitative research methods, combined with tools such as case studies and questionnaire surveys to collect and analyze relevant data. We will focus on the core elements of the accessibility system in HEIs, including the accessible design of campus buildings and facilities, information accessibility, assistive technology support, and

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inclusiveness in teaching and assessment. At the same time, we will also focus on the challenges and dilemmas faced by colleges and universities in the construction and enhancement of the accessibility system, and propose feasible solutions.

Through the conduct of this study, we expect to enhance the awareness of universities about accessibility, promote the improvement of policies and practices, and ultimately build an inclusive and equitable higher education system. This will not only contribute to the personal development and well-being of each student, staff and visitor, but will also positively contribute to the sustainable development of society.

2. Research situation analysis

The basis of this research is the Barrier-Free Design Code (GB50763-2012) (hereinafter referred to as the Design Code), and the content of the research is whether the barrier-free facilities in the main buildings are complete, whether the existing barrier-free facilities meet the requirements of the Code and whether the barrier-free facilities are damaged or occupied. Through the understanding of the information on students with disabilities in the summary of information on key protection groups (issued by the central government) of Wenzhou Polytechnic. The proportion of physically disabled students in the disabled student group is as high as 73.33%, while the proportion of visually disabled and hearing disabled is only 6.7% and 13.3%. Therefore, considering the cost of school construction and the actual situation of the campus. In the design requirements of barrier-free facilities, only the curbstone ramp; barrier-free entrances and exits; wheelchair ramps; barrier-free passages and doors; barrier-free staircases and steps; barrier-free elevators and lifting platforms; public toilets and barrier-free toilets; barrier-free housing and dormitories; wheelchair seats; barrier-free signage systems; and information accessibility are taken as the objectives of the research for the field study. The research places are divided according to the main functions as 1. the main teaching area of the teaching building including classrooms and training rooms. 2. the main large-scale public activity area including libraries, lofty halls, gymnasiums. 3. the main life activity area range mainly includes dormitory buildings, canteens, sidewalks.

After the author's field research, the teaching function area of Wenzhou Polytechnic in the east and west sides among the 8 major teaching buildings, in addition to the SiXing building and MinXing building of the teaching building of the entrance and exit and the ground has a ramp entrance, the other teaching buildings are present steps. They do not meet the requirements of accessible entrances and wheelchair ramps in the barrier-free design specifications. In the construction of barrier-free access, door and barrier-free stairs and steps, the construction width of barrier-free access meets the requirements but lacks barrier-free instructions, and the construction of barrier-free door basically meets the requirements; the school lacks the color of the tread and kicking surface on the basis of the existing staircases, which should be differentiated and contrasted, and the first step of the staircases upward and downward should be clearly differentiated from the platforms in terms of the color or material. The biggest problem exists in the construction of kerbstone ramp in WZP, on the one hand, the height difference between the sidewalk and the steps of the road surface only uses 60cm movable slope platform to transition its steps; on the other hand, the sidewalk is used as a parking space for bicycles and battery cars, and there are certain problems in the planning of road purpose. On the construction of barrier-free elevator, the newly maintained elevators in WZP after 2022 have barrier-free signs that meet the requirements, but the elevators that existed before the construction in 2022 do not have the floor selection buttons with Braille, handrail settings with symbols requirements and so on. There are no measures in public restrooms, accessible toilets, accessible signage systems, information accessibility, no accessible toilets have been constructed and no instructions have been given to incorporate information on accessibility,

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and the awareness of accessibility in the school is generally low. In the living activity area (dormitory building and cafeteria) and large public activity area (library, conference hall, gymnasium), except for a wheelchair ramp at the entrance of Gaoyuan Hall, which will be newly completed in 2022, the other building areas are not equipped with corresponding barrier-free entrances and exits, wheelchair ramps, barrier-free staircases, barrier-free toilets, and barrier-free signage systems. Therefore, the promotion of the barrier-free environment in this school is basically zero, and there are serious problems and deficiencies. There is a lack of sufficient awareness and recognition of the importance and value of barrier-free environment construction.

3. Questionnaire analysis of college students' awareness of barrier-free sports facilities in WenZhou Polytechnic

3.1. Results of validity and reliability analysis of the questionnaire

3.1.1. Results of validity analysis of the questionnaire

Table 1: validity analysis

Results of validity analysis				
name	factor loading factor			Commonality (common factor variance)
	Factor 1	Factor 2	Factor 3	
I'll look out for accessibility in public places	0.92	0.08	0.05	0.896
I'll be watching the news for information on accessibility.	0918	0.138	-0.039	0.864
Accessibility is not just for people with disabilities	0.94	0.103	0.037	0.896
I've heard or understand some of the roles of accessibility	0.938	0.072	0.056	0.887
I will be aware of the accessibility of the surrounding area	-0.027	-0.059	0.657	0.436
It's rare to see students with disabilities using the accessible facilities at my university	0.04	-0.001	0.761	0.579
Financial abundance of colleges and universities can affect the construction of accessible sports facilities	0.068	0.852	-0.053	0.734
The prevalence of accessibility in colleges and universities affects accessibility	0.008	0.831	-0.057	0.693
How well colleges care for college students with disabilities affects accessibility	0.104	0.858	-0.047	0.75

Here, an exploratory factor analysis was done on each question item using principal component analysis, which was used to identify each cognitive factor in the evaluation scale. These three factors accounted for 74.42 of the total standard deviation of the raw variables, which is more than 60%. Overall, there was less loss of information content in the raw variables and the factor analysis was practically effective.

The first four scale items have high loadings on the first component, and from the semantics of the items, most of them are the basic knowledge of barrier-free facilities or barrier-free sports facilities, and the component 1 is named "basic knowledge cognition"; the middle two items

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have high loadings on the second component, and from the semantics of the items, all of them are the cognitive factors of knowledge about the use of barrier-free facilities or barrier-free sports facilities. The semantic meaning of the two items is that they are all about the knowledge of the use of barrier-free facilities or accessible sports facilities, and they are named as "knowledge of the use" in component 2. The last three items had high loadings on the third component, and from the semantic point of view, the third component was named "awareness of reasons affecting the construction of facilities" see table 1. The results of exploratory factor analysis showed that there are three dimensions of college students' perception of barrier-free facilities or accessible sports facilities, namely: basic knowledge dimension, usage perception dimension, and perception of reasons affecting the construction of facilities.

3.1.2. Results of reliability analysis of the questionnaire

Table 2: credibility analysis

Cronbach's reliability analysis		
name	Deleted α coefficients for item	Cronbach α ratio
I'll look out for accessibility in public places	0.74	0.80
I'll be watching the news for information on accessibility.	0.74	
Accessibility is not just for people with disabilities	0.74	
I've heard or understand some of the roles of accessibility	0.74	
I will be aware of the accessibility of the surrounding area	0.81	
It's rare to see students with disabilities using the accessible facilities at my university	0.81	
Financial abundance of colleges and universities can affect the construction of accessible sports facilities	0.79	
The prevalence of accessibility in colleges and universities affects accessibility	0.80	
How well colleges care for college students with disabilities affects accessibility	0.79	

Cronbach's alpha is an index value for testing the reliability of questionnaires, which is widely used in the statistical analysis of empirical research data. Generally, the Cronbach's alpha value of a hierarchical scale designed for questionnaire surveys is less than 0.7, which indicates that the internal consistency of the independent variables of the scale is weak and the scale must be re-edited. The Cronbach's of the scale when the alpha value is greater than 0.7 can indicate that the internal consistency of several independent variables created for the rank scale is good and the reliability of the accurate measurement is high. According to the Cronbach'sAlpha results in the table above, we can find that the scale corresponds to a Cronbach'sAlpha value greater than 0.7 see table 2, which indicates that the internal consistency of the questionnaire is good, so the reliability of the results of this survey is extremely good. In summary, the data results of this paper passed the reliability test.

3.2. Dimensional descriptive statistics

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Table 3: Dimensional descriptive statistics table

Basic indicators						
name	sample size	minimum	maximum	average	standard deviation	median
Cognizance of basic knowledge	486.00	1.00	5.00	1.998	1.041	1.75
Utilization awareness	486.00	1.00	4.67	2.38	0.498	2.33
Perceived Reasons for Influencing Facility Construction	486.00	2.00	5.00	2.268	0.513	2.00

From the above table 3, it can be seen that the college students in the sample do not have sufficient basic knowledge about barrier-free facilities and accessible sports facilities, and the mean and median scores are both less than 3. They do not have a good understanding of the use of barrier-free facilities and accessible sports facilities and the reasons affecting the construction of such facilities, and the mean and median scores of these two dimensions are both less than 3. The table shows that college students pay less attention and have a lower level of cognition of barrier-free facilities and accessible sports facilities in their ordinary life. The table shows that college students pay less attention to and know less about barrier-free facilities and accessible sports facilities in their normal life, and the popularization of barrier-free facilities and accessible sports settings is not high enough, and the basic knowledge is weak.

4. Problems

4.1. Problems in the construction of barrier-free facilities

4.1.1. Lack of curb ramps

According to code requirements, a curb ramp is a type of ramp that facilitates pedestrian access to a sidewalk by avoiding the obstacles to movement posed by sidewalk curbs. However, the lack of such curb ramps in the WZP campus environment makes it difficult for people with mobility impairments to access the sidewalk.

4.1.2. Insufficient accessible entrances and exits

It is mentioned in the code that barrier-free entrances should be convenient for people with mobility disabilities in terms of slope, width and height, as well as floor materials and the form of handrails. However, the construction of barrier-free entrances and exits is very limited in WZP, and there is a lack of entrances and exits designed to meet the requirements of the code, which makes it difficult for people with mobility impairments to enter buildings.

4.1.3. Lack of wheelchair ramps and accessible elevators

The code states that wheelchair ramps and accessible elevators are important facilities for the convenience of wheelchair users. However, the lack of construction of wheelchair ramps and accessible elevators in the WZP makes it impossible for wheelchair users to conveniently access the different floors of the building.

4.1.4. Accessible routes, doors

The code mentions that accessible routes and doors should be of sufficient width and height to accommodate people who use assistive devices or have mobility impairments, such as wheelchair users. However, in some buildings in WZP, the width of access routes and doors is not wide enough to accommodate assistive devices such as wheelchairs, limiting accessibility for people with mobility impairments.

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4.1.5. Accessible stairs and steps

It is stated in the code that accessible stairs and steps should have appropriate slopes, handrails and anti-slip measures to ensure the safety and convenience of people with mobility impairments when using them. However, in the design of some staircases and steps in WZP, there is a lack of barrier-free design that meets the requirements of the code, which brings difficulties and risks to people with mobility impairments.

4.1.6. Accessible signage systems and information accessibility

The code emphasizes the accessibility of accessible signage systems and messages, including the visibility, understandability and reachability of signs. However, there are deficiencies in accessible signage systems and messaging in the campus environment at WZP, with a lack of obvious directions and easy-to-understand messages, causing confusion and difficulty for people with mobility impairments.

In summary, according to the requirements of the Barrier-Free Design Code, there are serious deficiencies in the construction of the barrier-free facility environment in WZP. The lack of basic facilities such as curb ramps, accessible entrances and exits, wheelchair ramps and accessible elevators leads to difficulties and safety risks for people with mobility impairments on campus. It is recommended that Wenzhou Polytechnic actively engage in the planning and construction of barrier-free facilities to improve the accessibility of the campus and ensure that all people can enjoy campus resources and conveniences equally. The deficiencies in the barrier-free facilities environment of Wenzhou Polytechnic include not only the lack of basic facilities, such as kerbstone ramps, accessible entrances and exits, wheelchair ramps, and accessible elevators, but also the non-standardized design of passages, doors, stairs, steps, toilets, bathrooms, and signage systems and information. Colleges and universities should take active measures to plan, build and renovate barrier-free facilities in accordance with the requirements of the Barrier-Free Design Code, so as to create an inclusive and friendly campus environment and ensure that all persons are able to participate in learning and activities on an equal footing.

4.2. Problems with awareness of accessible sports facilities

4.2.1. Lack of awareness and understanding

Some university students may lack full awareness and understanding of the environment of barrier-free facilities, and are not clear about the importance of these facilities and how they can help people with disabilities.

4.2.2. Visual or Psychological Barriers

Some university students may not be able to fully understand the impact of visual or psychological barriers on personal mobility and use of facilities, resulting in a lack of awareness of the need for and design principles of accessible facilities.

4.2.3. Ignoring the needs of others

Some university students may lack concern for the needs of others, and lack understanding and empathy for the difficulties and challenges faced by people with physical, sensory or cognitive disabilities in the campus environment.

4.2.4. Lack of Participation and Feedback

College students may not be given the opportunity to fully participate in the construction of the accessibility environment, and their opinions and feedbacks are not fully heard and applied, resulting in the construction not matching the actual needs.

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5. Recommendations and Reflections

5.1. Develop an accessibility policy

Wenzhou Polytechnic can formulate clear accessibility policies to clarify the school's commitment and goals for accessible facilities. These policies should cover facility construction, improvement plans, training requirements and monitoring mechanisms to ensure the implementation and maintenance of accessible facilities.

5.2. Conduct a Comprehensive Assessment

Conduct a comprehensive campus assessment to determine the current status and deficiencies of current accessibility facilities. This can include an assessment of the physical environment, building structure, transportation routes, facility configuration, etc. The results of the assessment can guide and prioritize the improvement plan.

5.3. Developing an Improvement Plan

Based on the assessment results, develop a specific improvement plan. Ensure that the plan contains feasible goals, timelines, and budgets. Prioritize solutions to the most pressing and wide-reaching accessibility issues, such as accessible routes, accessible toilets and accessible parking spaces.

5.4. Providing accessibility training

Provide accessibility training for campus members, including staff and students. The training may cover accessibility design principles, guidelines on the use of accessible facilities, and accessibility awareness development. By enhancing the accessibility awareness and knowledge of campus members, the proper use and maintenance of accessible facilities can be promoted.

5.5. Provision of information and communication channels

Ensure that campus members have easy access to information and guidance on accessibility. Establish effective communication channels, such as website pages, emails, hotlines, etc., so that campus members can ask questions, provide feedback and receive support.

By synthesizing these suggestions and reflections, Wenzhou Polytechnic can progressively improve accessibility, create an inclusive and friendly learning and living environment, and ensure that everyone has equal access to campus resources and conveniences.

6. Conclusion

In this study, we assessed and improved the accessibility facilities in Wenzhou Polytechnic, and explored related recommendations and reflections. We are committed to creating an inclusive and friendly learning and living environment through the development of an accessibility policy, comprehensive assessment, development of an improvement plan, provision of accessibility training, collaboration and advocacy, continuous monitoring and improvement, and provision of information and communication channels.

Accessibility improvement is an ongoing process that requires the concerted efforts and support of campus members[5]. We are confident that through our commitment to accessibility and improvement, we can provide equal opportunities and a barrier-free campus experience for people with disabilities. However, we also recognize that there are still challenges and room for improvement in the area of accessibility. We encourage WZP to continue to focus on the development of accessible facilities, pay close attention to the latest accessibility standards and guidelines, and maintain cooperation and communication with disabled persons' organizations, experts and related institutions. Through sustained efforts and continuous improvement, we

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can continue to improve the accessibility and inclusiveness of our campus and provide equal opportunities and accommodations for everyone[6].

Finally, we hope that the findings and recommendations of this study will provide useful references for WZP and other organizations and institutions concerned with accessibility improvement. It is only through joint efforts and cooperation that we can build a truly inclusive and barrier-free society where everyone can realize their full potential and participate in social life.

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