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Investigating User Feedback for Learning Space Design in Primary Schools of Shandong Province, China

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Abstract: A well-designed learning environment is crucial for enhancing both the physical and mental health of students, which in turn improves their learning outcomes. However, many classrooms in China, particularly in rural areas, were constructed and designed several decades ago, so it is essential to redesign these learning spaces to align with the requirements of 21st Century education. This study aims to develop the stimulation, individuality, and naturalness (SIN) theoretical framework for identifying the learning environment of current classroom by examining the full range of sensory effects experienced by individuals. This study conducted qualitative interviews with 72 students and 18 class teachers to explore major issues with their existing learning spaces in four primary schools in Shandong Province of China. The results show that high temperatures and poor air quality are frequently raised by respondents, which directly impact students' learning experience. This finding confirms naturalness likely underpins human comfort. Teachers and students felt that the classroom should be improved from the aspects of crowded space, imperceptible decoration, congestion and monotonous layouts. The study emphasised the important factors that designers and policymakers should consider to promote a comfortable, efficient, and healthy learning environment.

Keywords: classroom design; comfort; learning space; primary schools; users' view

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Citation: Sun, R.; Firzan, M. Investigating User Feedback for Learning Space Design in Primary Schools of Shandong Province, China. *Buildings* **2024**, *14*, 2467. https://doi.org/10.3390/buildings14082467

Academic Editor: Chi Yan Tso

Received: 6 July 2024
Revised: 3 August 2024
Accepted: 5 August 2024
Published: 10 August 2024

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1. Introduction

Incorporating user assessments into the design process could enhance the outcomes of teaching. The perspectives of users influence the practical use of teaching spaces, thereby contributing to improvements in school atmosphere. In turn, teachers and students can advocate a pedagogical imperative to establish learning environments that enhance students' comprehension [1]. Since students spend most of their time in learning spaces, particularly classrooms at school, obtaining their opinions would provide significant insights into their vulnerability and mental adaptability [2,3]. The school physical environment has a significant impact on students' health, well-being, and academic performance. First, it is crucial that the fundamental natural environmental components are maintained within reasonable limits, as human bodies react instinctively to the presence of natural and healthful materials in their surroundings. Secondly, individualisation refers to how the needs of specific groups of students are satisfied in the classroom. Cultivating a sense of ownership among students is facilitated when they feel a connection to their classroom environment [4]. Third, the level of excitement and vibrancy in the classroom relates to the stimulation principle, which includes two parameters: colour and complexity. For example, room colour affects physiology and emotions, potentially leading to mood swings that might affect productivity [5]. Different spatial characteristics and elements influence students' learning behaviours, enhancing learning diversity and interest while involving the educational attributes of teaching space. By positively affecting students' emotions, these elements promote learning and cultivate a strong emotional connection between teachers

and students [6]. Pedagogical frameworks [7–9] influence teaching and learning practices, activities, and behaviours rather than simply serving as containers for learning activities [10]. In Finland, Niemi et al. [11] found that active classroom designs significantly enhance student performance and engagement in learning.

In England, Cardellino and Woolner [12] investigated a case of an open school that solved the particular noise problem through the participation of users in the design process. This is a common issue met by open schools in Australia [13] and New Zealand [14] as well. However, some stakeholders feel that incorporating user participation and experience in the design practice is a waste of time [15]. Additionally, there is a contradiction between the real practice of stakeholder involvement and the rhetoric of inclusion [16]. In fact, an uncomfortable classroom can cause numerous disciplinary issues and negatively impact learning effectiveness [17]. Neglecting student input leads to several issues, such as overcrowded spaces [18,19], the operation of large classes, declining space quality [20] and reduced activity space, all of which impact teaching quality and the physical and mental health of students [18,21]. Classroom elements such as noise, lighting, poor air quality, temperature [22], uncomfortable furniture [23], colour and decoration [24] can overwhelm young children's developing ability to maintain task goals and resist distractions, making it extremely challenging to stay focused in these environments [25]. Many studies focus on indoor environmental quality (IEQ) [22], layout [22], furniture [23] and colour [24,26,27], as well as their impact on student engagement, attention and learning performance. However, the integration of these elements in the design of school physical environments has been relatively limited in previous studies, particularly regarding students' perceptions and emotions. Although user participation is important in design practice, their perspectives and opinions have been under-represented in classroom design practices, particularly in China.

The research findings on the school physical environment are summarised in Table 1 [28–30], highlighting the physical elements of space that affect user reaction. Major school physical design principles include naturalness, individuality, and stimulation, as listed in Table 1. Pressly and Heesacker [31] and Evans and McCoy [32] conducted research on interior design elements and their impact on human health, identifying spatial physical design attributes that meet basic user needs [31,32]. These principles can also be applied to other places, such as community housing for the elderly [33]. Promoting a higher level of human-centered design in the classroom involves considering learning space design to enhance learning and meet user needs. While many researchers have systematically examined specific aspects of the school environment and their effects on performance [34,35], limited attempts have been made to synthesize and summarize this accumulated evidence coherently. The relationship between users' needs and learning spaces remains unclear, with many unanswered questions [36]. There appears to be no single study devoted to understanding the impacts of different features of school buildings, such as architectural design, aesthetic qualities, spatial and physical features, interior layout and furniture, and external spaces, on users, including patterns of learning outcomes, needs, preferences, expectations, emotions, and behaviours.

Table 1. Summary of main design elements.

Design Principle	Design Parameter	Design Element	Design Item	Sources	
				Influencing Factors on Students in Previous Studies	Code for Design of School GB 5099-2011
Naturalness	Light	a. Window (orientation and size) b. Door c. Lighting	Natural light (window orientation and size; door) Electrical lighting quality Glare	Natural light: Daylighting has a big impact on science and reading vocabulary results [37] and learning performance [38,39]. Large windows were associated with better learning results, and there must be control over the shading of the windows [40]. Artificial light: Poor electrical illumination quality affects health [41].	Full window sunshine on the winter solstice should not be less than two hours. Special blackboard light without direct glare. Bare lights. Light height must be at least 1.70 m away from the tabletop. Non-glare lighting. Doors should have an upper light window and observation window.

Table 1. *Cont.*

Design Principle	Design Parameter	Design Element	Design Item	Sources	
				Influencing Factors on Students in Previous Studies	**Code for Design of School GB 5099-2011**
Naturalness	Noise		Noise	Noise has a negative influence on concentrating on learning [42] and learning outcome [43].	Walls should be sound-proofed.
	Temperature	a. Window (ventilation) d. Air conditioning or electric fan	Air conditioning Window ventilation Electric fan	Wargocki et al. [44].	Hot summer areas: Air conditioning, window ventilation, or suspended electric fans. Winter: At least 18 °C.
	Air quality	a. Window (ventilation) e. Mechanical ventilation	Window: Opening size Mechanical ventilation	The CO_2 issue [45,46]. Mechanical ventilation, large volume or large window openings [47].	Natural ventilation priority. At least 2.5 times per h mechanical ventilation per capita. Fresh air volume must be at least 19 m/h/person.
	Natural view	a. Window (vision) f. Natural decoration	Windows area and view Plants Natural decoration	Rooms with plants, greenery or flowers [48,49] or green window views [20,49,50] have a positive influence, with a comfortable, relaxing, and natural feeling [51,52].	None.
Individualisation	Ownership	g. Furniture h. Display area	Furniture Display items	Inappropriate furniture [53,54] affects students' attention and creativity [55], academic performance [56] and mental health [57]. Private, personalised settings, feeling of classroom ownership [58].	None.
	Flexibility	i. Layout j. Desk and chair (seating arrangement) k. Lockers l. Corridors m. Equipment	Layout Furniture Seating arrangement Corridor Information and Communication Technology (ICT)	Flexible furniture affects comfort, collaboration and concentration levels [23] and improves cooperation [59].	Desk plane size should be at least 0.6 m × 0.4 m. Classrooms should have small lockers dedicated to each student. The corridor width should be at least 2.4 m. Radio speaker, cabinet, external network communication interface.
Stimulation	Complexity	n. Wall h. Display style	Moderate decoration	Low visual distraction improves attention [12].	The window glass must not be stained glass.
	Colour	o. Ceiling, floor, or wall h. Display colour g. Furniture colour	Ceiling colour Wall colour Curtain Display colour Furniture colour	Colour influences intentions, performance, cognitive capacities, and behaviour [60]. Warm colours in materials—like yellow and orange—instead of cool ones—like grey—can improve students' learning [61].	None.

In China, the Ministry of Education (MOE) released the "Modernisation of Chinese Education 2035" and the "Education Blue Book: China's Education Development Report (2020)" in 2020. These documents outlined the post-2020 goal to improve the effective utilisation of educational resources and improve education quality. By 2035, the aim is to achieve the comprehensive modernisation of education and establish a modern education system nationwide. Schools strengthen students' practical, cooperation, and innovation abilities, clarify core quality requirements for student development, and establish innovative approaches to talent training. They seek to cultivate students' innovative spirit and practical skills through heuristic, exploratory, participatory, and cooperative teaching methods, as well as through flexible teaching organization models like class systems and elective systems [62]. However, the school design in China remains traditional [21], which limits the development of new skills and innovative talent among students [10,11,23].

This study aims to develop the stimulation, individualisation, and naturalness (SIN) model to offer a contextualised and comparative perspective on users' experiences in different school physical environment in China. It addresses two research questions: (1) What are the key design factors in classroom design? (2) What are the practical challenges of current learning spaces, as perceived by users? This study covers crucial viewpoints that should be considered throughout the design phase. The developed guideline can be applied

in other schools across China to improve classroom design, and assist designers in creating high-quality learning space that cater to 21st Century learning styles and users' needs. Ultimately, this study provides supportive environments that facilitate effective learning.

2. Literature Review

The design of classrooms impacts the learning of primary school students. Psychology, neuroscience, brain science, and environmental psychology researchers proved that primary school students' perception of the spatial environment greatly impacts their cognitive development [63,64]. In the UK, multilevel modeling was utilised to separate the impact of physical design from the characteristics of 3766 students across 153 classrooms in 27 primary schools. This analysis revealed that classroom design and layout accounted for up to 16% through analyses of student achievement, classroom physical environment and design characteristics [20,65]. Haverinen-Shaughnessy and Shaughnessy [66] found that maintaining adequate ventilation and thermal comfort in the classroom can improve students' test scores, based on research from 140 fifth-grade classes in 70 elementary school districts in the south-western United States. The finding is supported by Korsavi and Montazami [22]. Adeyemi and Lasisi [67] found that there was a significant improvement in the students' academic performance after the intervention of ergonomic furniture among students of tertiary institutions in Northwest Nigeria. Llinares, Higuera-Trujillo [24] found that cool colours are effective in improving memory and attention performance after assessing 160 participants, using 12 warm colours and 12 cool colours in a virtual classroom. In accordance with these studies, other research also found the physical space characteristics affect students' behaviour and self-esteem [68], cognitive and affective domains [69], and learning progress [20]. Figure 1 shows the relationship between learning space and students' learning, demonstrating that favorable space elements positively influence students' spatial perception and emotions, which in turn improves their learning performance. However, interior spaces in primary schools often face challenges related to noise, air quality [70], ventilation [71], and furniture. In addition, other issues such as overloading, large class sizes, and decreased activity spaces affect teaching quality as well as the physical and mental health of students in China [21].

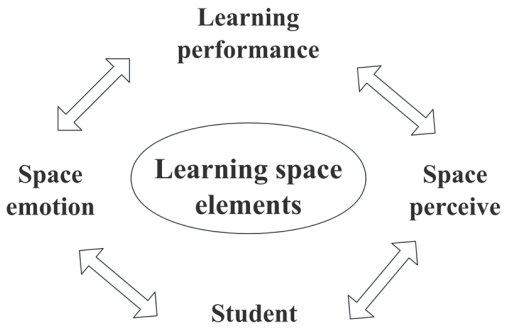


Figure 1. The relationship of learning space with student performance from the literature.

Barrett et al. [20] proposed the SIN model, established based on an in-depth exploration of the brain's implicit systems performed by Rolls [72]. This model encapsulates a person's holistic perception of space, formed by the integration of various influences processed by the brain and senses. This model applies neuroscientific theories on how the human brain processes information and involves the following design principles and factors [20] as stated in Table 1: (1) naturalness—light, sound, temperature, air quality, and natural view; (2) individualisation—ownership and flexibility; and (3) stimulation—complexity and colour. This study adopted the approach outlined by Zeisel et al. [73] and Barrett et al. [20], constructing an environment–behaviour factors model based on existing literature. The SIN model was informed by preparatory surveys of pupils [28] and teachers [29], post-occupancy evaluations of schools [74], and the Chinese Code for Design of School GB 5099-2011 [75]. Design guidelines for primary and secondary schools in China strictly

follow the Code for Design of School GB 5099-2011, which includes specific requirements for window size, ventilation frequency, and room height. This study modified and refined design parameters and factors by integrating the environment–behaviour factors model with the specific provisions set out in the code and relevant literature, based on SIN design principles. Table 1 summarises the main design elements extracted from the literature and the Code for Design of School GB 5099-2011.

3. Materials and Methods

3.1. Study Area

All surveyed schools are located in Shandong Province, China. Shandong has a warm temperate monsoon climate characterized by hot and rainy summers, cold and dry winters, and four distinct seasons. Precipitation is concentrated in summer, with relatively shorter spring and autumn seasons than winter and summer seasons. According to the data from the Dezhou Meteorological Bureau [76], the average annual temperatures over the past two years ranged from 11 to 14 °C, with temperatures ranging from −20 °C in January to 40 °C in June. The total annual precipitation averaged 883.2 mm. Figure 2 depicts the weather distribution and temperature in Shandong from June 2022 to December 2023. These climatic conditions affect the temperature, lighting, windows direction, and air quality in schools. The optimal classroom temperature normally ranges from 20 to 22 °C, which helps students maintain optimal attention and cognitive function [77]. Temperatures above 25 °C can cause physical discomfort, such as headaches, excessive sweating and dehydration, leading to decreased concentration and cognitive abilities in students, which in turn affects academic performance [77] and lowers learning efficiency [65]. In contrast, cold environments of below 18 °C can also cause discomfort and thus be distracting [66]. The classroom temperature is adjusted according to the season and weather conditions [66], and one should ensure that the temperature in the classroom is kept within the appropriate range of 20–22 °C, using air conditioning or heating equipment as necessary [77].

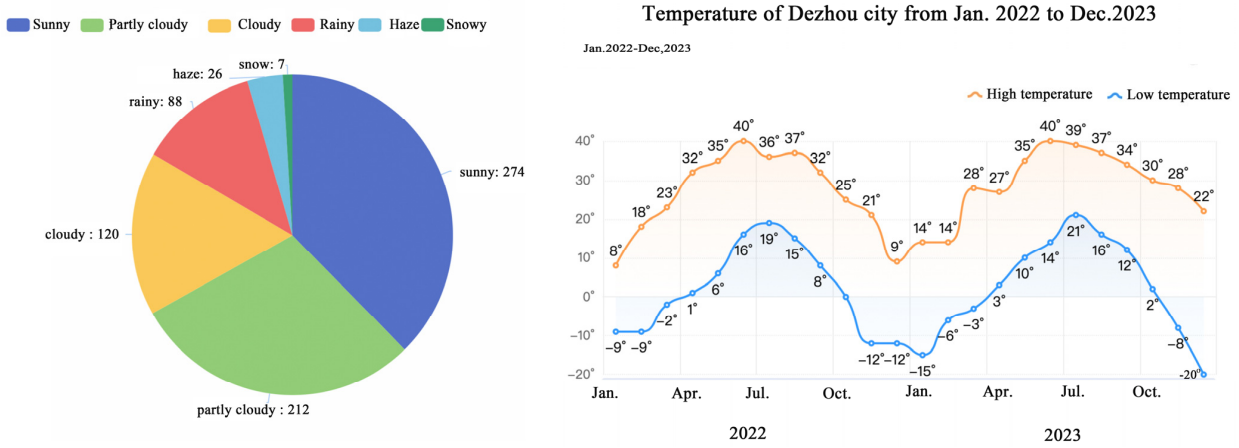


Figure 2. Weather distribution map and temperature of Dezhou city in Shandong province, China. **Source:** https://www.tianqi24.com/dezhou/history.html (access in 10 January 2024).

Dezhou City, located in Shandong Province, had 1049 primary schools as of the end of 2023. The Shandong Province Department of Education performed the Shandong Province Public Opinion Survey Center to investigate students' learning time, sleep time, and homework in 2013. The result show that Dezhou City had the worst implementation of quality education in primary schools and the heaviest school load [78]. To address these issues, this study focused on primary schools located in urban, rural–urban, town, and village areas within the city. These locations were selected due to the significant disparities in compulsory education [79] and school resource quality [80] between urban and rural areas. Four primary schools in Dezhou City were selected as case studies to ensure diversity and richness of data. Figure 3 presents the appearances and layouts of these four schools.

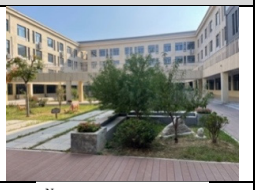
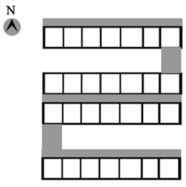
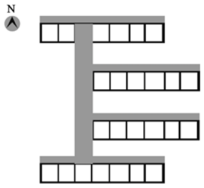
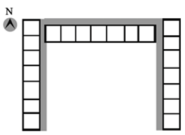
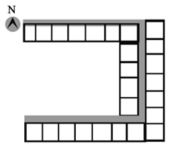
–	Case 1: CPS	Case 2: MCS	Case 3: ETPS	Case 4: CHPS
Photo				
Building plan				
Location	Urban	Between	Town	Rural
Year of construction	2019	2015	2020	2020
Grade	1–6	1–9	1–6	1–6
Site area (m^2)	18,000	80,000	27,336	26,667
Building floor area (m^2)	21,390	590,000	11,000	18,000
Classrooms	20	72	19	12
Students	1021	2107	855	561
Class teachers	20	72	19	12
Window direction	North, south	South	South, east, west	South, east, west
Window opening direction	Inward: 90° flat and downward	Inward: 90° flat	Inward: 30° flat and downward	Inward: 90° flat and downward
Ventilation	Window, door	Window, door	Window, Door	Window, door
Temperature control	Single air conditioner, radiator	Central air conditioning	Single air conditioner, fan, radiator	Single air conditioner, fan, radiator
Furniture (classroom)	Bookcase, locker, teacher's office corner	Bookcase, locker	Bookcase, locker	Bookcase, locker, teacher's office corner
Interior space	Science classrooms, instrument rooms, computer rooms, dance rooms, art activity rooms, library, psychological counselling rooms, health rooms, comprehensive practice rooms	Technology space, library, scientific inquiry room, history and geography classroom, music and dance and other professional classrooms	Science classrooms, instrument rooms, computer rooms, dance rooms, art activity rooms, library, psychological counselling rooms, health rooms, comprehensive practice rooms	Comprehensive experimental activity room, dance room, art room, calligraphy room
Outdoor space	Football fields, basketball court	Standard plastic playground (400 m), three football fields, nine basketball courts, six volleyball courts in the ball area	Football fields, basketball court	Football fields, basketball court

Figure 3. The appearance and layout of the College primary school (CPS), Mingcheng school (MCS), Ertun primary school (ETPS) and Chunhui primary school (CHPS) in Shandong, China.

3.2. Conceptual Framework

The conceptual framework is shown as Figure 4 of this paper, derived from the SIN model. Learning space issues were identified using observation and group interviews. Focus group interviews can be defined as 'using a semi structured group session, moderated by a group leader, held in an informal setting, with the purpose of collecting information

on a designated topic' [81]. The selected schools were studied in a similar manner: on-site observations and group interviews with teachers and students, followed by informal interviews with the principals to explore more complex feelings, beliefs, and attitudes.

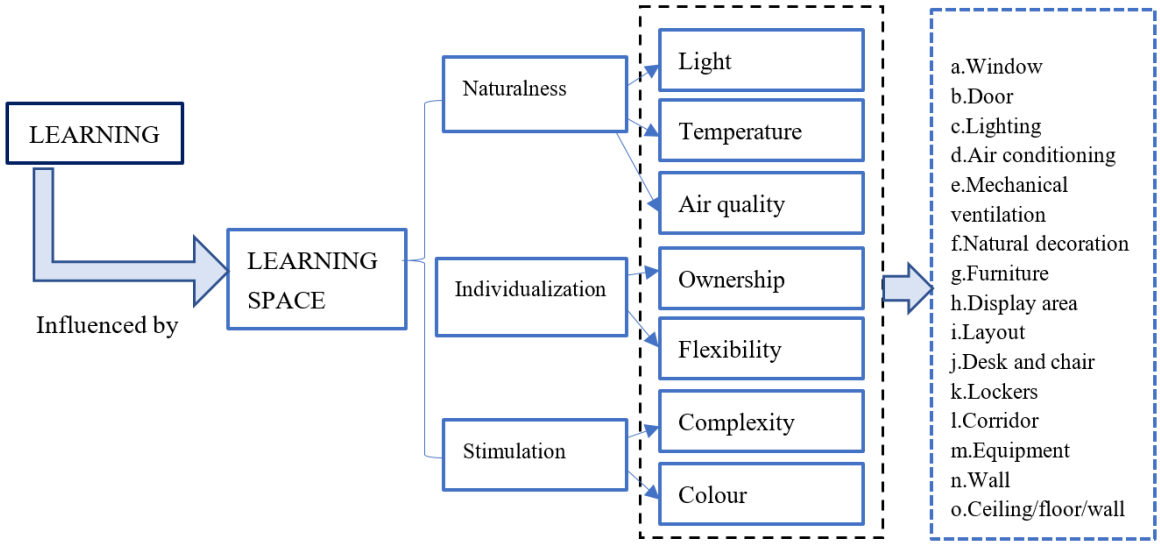


Figure 4. The conceptual framework of this study.

The design elements influencing the learning environment were identified using a comprehensive literature review (Table 1). Some aspects of the survey questions were informed by more general user surveys, such as building use studies [82]. Barrett and Zhang's [29] teacher questionnaire, along with the student questionnaire [28], served as crucial references for this study. The observation parameters consisted of 15 design elements and interview questions comprising nine classroom parameters (Table 1). The interview questions were reviewed by two educational experts, who clarified some confusing questions. After piloting the questionnaire at the first school, respondents found the questionnaire clear and easy to complete. Therefore, only minor enhancements were made before distributing the questionnaire to all four schools.

3.3. Participants

The sample included 18 class teachers, each with more than 2 years of teaching experience and 72 students in Grades 3–5, aged between 7 and 11 years old. The respondents were familiar with the school physical environment and provided accurate answers based on their perceptions or experience. Table 2 presents the basic characteristics of the schools and the number of participants.

Table 2. Case or school profiles.

School	Classrooms	Students	Respondents	Class Teachers	Respondents
Case 1: DCES	20	500	20 (4%)	20	4 (20%)
Case 2: MCS	36	765	35 (4.5%)	36	7 (19.4%)
Case 3: ETCPS	19	400	19 (5%)	19	4 (21%)
Case 4: CCEPS	12	270	17 (6%)	12	3 (25%)

3.4. Thematic Analysis

The interview findings have been summarised using thematic analysis [83]. The group interviews were recorded and transcribed. All recordings were converted to text, which was edited and sorted, individually numbered, and imported into NVivo as internal data. For example, data No. 202309-S-1 indicate that the interview time was September 2023 and

that the interviewees were students. The group interview data were analysed manually using Braun and Clarke's [83] six-step thematic analysis approach.

4. Results

Although the Chinese government has invested substantial funds in constructing new schools, many issues persist regarding the use of these newly built schools, which were designed according to the Code for Design of School GB 5099-2011. The student and teachers' data analysis was organised around the four themes of holistic impressions (HI), space components (SC), colour and pattern (CAP), and furniture and accessories (FAA), along with their sub-themes, shown in Table 3.

Table 3. The themes and sub-themes of this study.

Themes	Sub-Themes
Holistic impressions (HI)	Monotonous layout, space congestion, and discomfort in physical environment
Space components (SC)	Unsafe window and floor and offset tile wall
Colour and pattern (CAP)	Monochromatic colour and imperceptible decoration
Furniture and accessories (FAA)	Ill-fitting furniture and challenging décor

4.1. Holistic Impressions (HI)

Holistic Impressions (HI) referred to individuals' first impressions when using and perceiving space. The HI contained three sub-themes of monotonous layout, congested space, and uncomfortable physical environment.

4.1.1. Monotonous Layout

The classroom serves as the primary learning space for students in school, requiring a layout that prioritizes comfort. Although the Code specifies the classroom size and corridor width, it lacks specific guidance on classroom and corridor arrangements. Therefore, corridor-connected classrooms often only meet basic teaching requirements. According to the Code, buildings should not exceed four floors. Consequently, practical usage dictates that students change classrooms annually to accommodate new Grade 1 students each year, with school administrators considering student mobility. Younger grades are typically located on lower floors, and older grades on high floors. The users mentioned that:

> *"The corridor has very little functionality, mainly just walking through it." (Case 4: T-P1, 2023)*

> *"There are very few places for children to move. . . Students have too little time to run and jump. If the corridor were wider, the decoration would not be important. . . there is no place for students to engage activities between classes; they almost always stay in the classroom, however, the classroom is crowded." (Case 1: T-P4, 2023)*

4.1.2. Congested Space

The four schools had crowded classrooms and limited activity spaces. Primary schools are designed for 45-student classes based on the Code, but in practice, each class accommodates 50 to 60 students. The high number of students and limited spaces lead to insufficient storage and activity spaces. In the classrooms, students primarily remain seated in their chairs, with insufficient room for activities. The participants mentioned that:

> *"I think the first problem is the space, it is too small and crowded, there is no place for students to put things." (Case 1: T-P1, 2023)*

> *"The oppressive feeling comes from the crowded environment. There is no space at the back of the classroom and no place for activities in the classroom. The main problem now is crowding, though not excessively so." (Case 2: SG1P1, 2023)*

The current space limits effective interaction and small-group collaboration. Accommodating a large number of students in a limited space makes it difficult for them to engage deeply in collaborative learning activities with their peers. One user observed that:

> *"Group cooperative learning involves discussions in front of or between the tables, with four students in each group. The seats are fixed and cannot be moved. When we need to discuss, we quickly turn to face each other, and the chair design is not very conducive to this." (Case 3: SG1P2, 2023)*

4.1.3. Uncomfortable Physical Environment

According to Code 4.3.3, regular classrooms should receive at least two hours of daylight exposure during the winter so that students receive sufficient natural light. However, users encountered glare issues when staying in their classrooms. The users provided the following statements:

> *"Some classrooms close the curtains and turn on the lights during the daytime. . . This is problematic, classroom should be use transparent curtains that reduce glare without blocking the light." (Case 1: T-P3, 2023)*

> *"Sometimes when the sunlight is strong, we need to close the curtains and turn on the light because we can't see the all-in-one interactive machine clearly." (Case 2: SG2P2, 2023)*

The four schools experience notable temperature variations between summer and winter, heating during the winter and cooling during the summer. The interviews revealed high temperatures within the school during the summer. One user stated that:

> *"Some classrooms have air conditioning, but not in our building. It gets very hot in the summer, making it impossible to have classes on the top floor. The poor ventilation causes students to feel restless." (Case 1: T-P1, 2023)*

Due to the consistent temperature maintenance in both summer and winter, the duration of window ventilation was significantly decreased, leading to deteriorating air quality in classrooms crowded with many students. Two users stated:

> *"Classroom windows are equipped with inward-opening components, but they are often broken. Inward-opening windows are not very effective for ventilation. The only way to ventilate is through the crack." (Case 1: T-P2, 2023)*

> *"It's a bit hot in the summer, and the air quality is not so good because the windows cannot be kept open for long periods. In order to keep the temperature low, the classroom keeps the windows or doors closed." (Case 2: SG1P3, 2023)*

4.2. Space Components (SC)

Under the space components (SC), the sub-themes included unsafe windows and floors and offset tile walls. Most teachers and students expressed concerns related to these aspects of the learning space.

4.2.1. Unsafe Windows and Floors

The teachers and students identified windows as a major component, as they affect lighting, ventilation, and temperature. They repeatedly mentioned safety concerns related to inward-opening windows, which encroach upon students' learning space, and have rigid corners and edges that pose an injury risk to students. The users stated that:

> *"The windows open inwards most of the time. It's a safety issue when it's flat. Students always be hurt by the corner and hard edge." (Case 2: T-P4, 2023)*

> *"The design of the school window is indeed a problem. The kid might hit their head when looking outside through the window." (Case 1: T-P1, 2023)*

Some teachers also mentioned that the classroom floors were tiled and quite hard, expressing concern about students potentially falling. One of the teachers mentioned that:

"Do not dare to let students to engage activities between classes. The tile floor makes it unsafe for them to run, as we are afraid of falling. Children love to move, and head teachers are worried about the safety issues." (Case 2: T-P3, 2023)

4.2.2. Offset Tile Walls

All four classroom walls have tiled wainscoting extending to a height of at least 1.2 m. This feature effectively prevents wall-dirtying issues. Nevertheless, some teachers affixed students' work directly to the walls, resulting to cleaning challenges. Furthermore, each classroom has a designated area on the rear wall for displaying student artwork. In one school, both sides of the classroom contained designated display areas. The hallways of all four schools have exhibition walls, with one school combining display cabinets, seating, and exhibition areas in the corridors.

"It is difficult to remove glue from the tile, and cleaning the tiles in each new classroom is very troublesome. It takes a week to clean them. I actually think the display area is quite large." (Case 2: T-P3, 2023)

4.3. Colour and Pattern (CAP)

Colour and pattern (CAP) play a significant role in creating an inviting and stimulating learning environment. Sub-themes include monochromatic colours, understated decorations, and contrasting tile walls. Colour and decoration impact students' cognitive performance, behavior, and engagement. Brightly colored or patterned feature walls can capture attention and create focal points, while elements like plants and nature-themed decorations can alleviate stress and enhance concentration. Classrooms that are attractively decorated but not overly stimulating can encourage positive behavior and boost student engagement.

4.3.1. Monochromatic Colour

Some students felt that the classroom walls were plain and wished for the addition of patterns and colour on the wall, as well as ceiling patterns. This is shown by the responses from two of the students, as follows:

"The suspended ceiling is currently white, but it can be decorated with the feeling of starry sky. When you look up, you can see the sky, which makes people feel relaxed and close to nature." (Case 1: SG1P6, 2023)

"The ceiling features white clouds and blue sky, which gives people the feeling that they are outdoors and close to nature." (Case 1: SG2P4, 2023)

There are differences in opinion between Grade 3 and Grade 5 students regarding the monochromatic colour scheme of the classroom. Grade 5 students mentioned that excessive patterns could be distracting, while Grade 3 students preferred classrooms with patterns and vibrant colours.

"If there is a pattern on the roof, it may attract attention during class, especially for students who often do not pay attention" (Case 2: SG1P4, 2023)

4.3.2. Unremarkable Decoration

Classroom decorations, such as celebrity calligraphy and class agreements, are ineffective if they are beyond the students' cognitive abilities or fail to capture their interest. Students prefer viewing their peers' works and their own drawings or handicrafts. Simultaneously, small classroom decorations can give students a sense of belonging to the school, creating a warm and comfortable feeling. Some respondents have stated that:

"The daily norms of primary and secondary schools are not easily perceived because the text is too small." (Case 2: SG3P2, 2023)

"In fact, students sometimes may not understand the words posted in the classroom because they are designed by an advertising company. The classroom should feature

more decorations that children can understand, maybe they like something close to their interests" (Case 1: T-P4, 2023)

"There are my handmade works and painting on the exhibition wall at the back of the classroom." (Case 1: SG2P2, 2023)

4.4. Furniture and Accessories (FAA)

Furniture and accessories (FAA) encompass two sub-themes: ill-fitting furniture and challenging décor. Ill-fitting furniture refers to chairs and desks that do not adequately accommodate students' varying sizes and ergonomic needs, potentially leading to discomfort and health issues. Challenging décor includes accent pieces that are overly stimulating, distracting, or mismatched with the intended learning space, which can hinder students' abilities to concentrate and engage actively in class activities.

4.5. Discussion

The findings offer insight into the perspectives of students and teachers concerning the learning spaces in Dezhou City, summarised in Table 4. The sub-themes that either supported or hindered student learning, as well as commonalities in viewpoints among students and teachers within each dimension, were discussed. Since all four schools were located in the same area and constructed according to the same Code for Design of School (GB 5099-2011), a more comprehensive evaluation by the users who utilise the facilities was preferable. It was proposed that the significant variations in user opinions related to specific elements of their schools could guide how this evaluation should be conducted.

Table 4. Thematic group interview findings.

Theme	Sub-Theme	Summary
HI	Congested space	The classrooms are crowded due to the large number of students.
	Monotonous layout	Students are concentrated in the classroom while other spaces remain underutilised, such as auxiliary rooms and low-occupancy meeting rooms.
	Uncomfortable physical environment	The glare issue persists in the learning spaces. Heat is also an issue in summer.
SC	Unsafe windows and floors	Windows that open inwards can injure students' limbs or other parts of their bodies.
	Offset tile walls	The tiles on the wall skirt are pasted with student work, which leaves an offset print that is very difficult to clean when removed.
CAP	Monochromatic colour	The classroom walls are all white, while only the curtains and storage cabinets have colour.
	Unremarkable decoration	Posters and notices displayed in the classroom have fonts or sentences that are beyond the students' comprehension, or the font size is too small.
FAA	Ill-fitting furniture	The desk and chair design in terms of size and structure cause discomfort to the students.
	Challenging decor	Teachers frequently feel perplexed when they arrange and decorate the display area.

Regarding the dimension of naturalness, significant challenges such as congestion, a monotonous layout, and an uncomfortable physical environment relating to thermal comfort and glare have been raised. These physical space factors significantly influence students' learning experience and outcomes. The results reveal various issues based on the users' overall perspectives of current learning spaces. First, congested space lead to increased off-task behavior and decreased on-task behavior [19]. Second, monotonous layouts hinder the use of diverse learning methods [84,85]. Third, high temperatures during summer are frequently raised as a concern by teachers and students. Additionally, poor air quality in classrooms persists during both summer and winter seasons, with ventilation

time failing to meet code requirements. Teachers and students have pointed out that high temperatures in summer directly impact students learning, consistent with findings by Barrett and Davies [20] and Higgs and Crisp [86], who noted that naturalness plays a crucial role in human comfort. Teachers and students have observed crowded classrooms, which were not previously mentioned in the literature, possibly exacerbated by the high population in China.

From an individualisation perspective, displaying students' work and enhancing personal space improve their ownership [58]. Students express a strong preference for seeing their own work displayed in the classroom, which enhances their confidence and fosters a sense of belonging [58,87]. However, classroom design often neglects individualisation. Both teachers and students believe that classrooms lack flexibility, with students seated in fixed position every day. Desks and chairs are not movable during group collaborative learning. Another significant issue is ill-fitting furniture, aligning with numerous research results highlighting micro-ergonomics issues, such as the mismatch between the students' body dimensions and their desks and chairs [53,54].

In the stimulation dimension, colour is a major issue for students, although teachers did not mention it. Students mentioned that classroom colours were monotonous, and they preferred patterns that were close to natural elements, which is supported by previous research [88–90]. Many students expressed dissatisfaction with the colour of the classroom, and some even described the classroom as a "giant magnolia prison". Several students specifically mentioned a preference for patterns featuring green trees or plants, or the blue sky and white clouds, which made them feel as though they were surrounded by an outdoor environment. This finding is consistent with previous research by Meng and Zhang [90], indicating students' desire and fondness for nature elements. Some students mentioned that green colours could protect their eyes, as parents and teachers hoped that students could experience reduced myopia and alleviated eye fatigue as a result of watching green patterns [88,89]. Nonetheless, teachers in this study did not find the colour of the spaces to be a major issue, which is supported by Pile [91].

Congestion, a monotonous layout, and unremarkable decoration have not been described previously. Another notable finding is that most students expressed a strong desire for natural factors such as plants or natural patterns. Some teachers even kept turtles in classroom corners to improve student engagement in learning. Additionally, students hoped to display their own works, fostering a sense of responsibility as the students felt they own the classroom [4]. This finding suggests that a sense of belonging to school is associated with better overall well-being and outcomes related to academic achievement [92,93].

5. Conclusions

This study enhanced the understanding of current issues met in learning spaces by integrating data collected from both students and teachers working within the same context. Empirically, this study identified physical space-related issues. Beyond those already identified in the literature, this study revealed new issues related to the specific characteristics of classroom sizes and geographical locations in China. Overall, four themes were identified within these two groups: holistic impressions (HI), space components (SC), colour and pattern (CAP), and furniture and accessories (FAA). These themes encompassed nine sub-themes: space congestion, monotonous layout, unsafe windows and floors, offset tile walls, monochromatic colour, unremarkable decoration, ill-fitting furniture, and challenging decor.

Due to the relatively small sample size and single location of this study, more studies can be extended to other settings or areas. Furthermore, positions, experiences, and backgrounds inevitably influenced the qualitative data analysis. Nonetheless, the study team engaged in collaborative discussions during the analysis to refine and validate the themes, supported by quotes that strengthen the interpretation. Lastly, the experiences in this study were self-reported, thus subject to the limitations of self-report data. Despite

these limitations, collecting different viewpoints within the same setting contributes to a deeper understanding of learning spaces in China.

Numerous studies have identified crucial design elements to ensure that buildings are suitable for students. This study makes a significant contribution to the literature by addressing comprehensive issues affecting users in large class sizes, which have not been fully explored previously. This study highlighted crucial factors that designers and policymakers should consider when promoting a comfortable, efficient, and healthy learning environment for students.

Future research should increase the sample size in various areas and provide more comprehensive references to enhance existing guidelines for designers and school leaders. This will aid in improving the design of on-site learning spaces, as student-centered learning methods offer clear benefits. Utilizing evaluation tools to assess the interior environment of learning spaces and developing design guidelines with detailed requirements for furniture, decoration, and color is essential. A pleasant, warm, and flexible learning environment is crucial for promoting user well-being and performance. Specifically, attractive colors and images, ergonomic furniture, adequate acoustics, thermal comfort, ventilation, and natural lighting are important features that school designers should prioritize.

Author Contributions: Conceptualization, M.F. and R.S.; methodology, R.S.; formal analysis, R.S.; investigation, R.S.; writing—original draft preparation, R.S.; supervision, M.F. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: This study has been approved by the Jawatankuasa Etika Penyelidikan Manusia Universiti Sains Malaysia (JEPeM-USM). The code is USM/JEPeM/PP/23020167 (protocol code USM/JEPeM/PP/23020167 and date of approval 23 June 2023).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study. Written informed consent has been obtained from the participants to publish this paper.

Data Availability Statement: Data can be made available by contacting the corresponding author.

Acknowledgments: We would like to acknowledge the Ministry of Higher Education of Malaysia (MoE) in particular the Fundamental Research Grant Scheme (FRGS) (FRGS/1/2020/SSI02/USM/02/3) for funding the main study on spatial enhancement. The local authority has played a crucial role in carrying out extremely useful tasks that make it easier to interact with the schools and obtain data. We would like to thank the leaders, teachers, students and parents of the four schools for their support, which allowed the research to proceed smoothly. Heartfelt thanks to anyone who provided help, support or constructive comments on this study. Thank you also to everyone else who has contributed.

Conflicts of Interest: The authors declare no conflicts of interest.

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