Strategies of Sharing Community Fundamental Education Spaces: Take Shanghai as an Example

ZHAO Yun, ZHANG Ming

Abstract: In the era of urban renewal, functional integration and space sharing in public facilities planning holds significant importance. Based on a review of the trends in fundamental and community education in Shanghai, the paper emphasizes the importance of promoting functional integration and community-based space sharing to achieve high-quality education goals. These strategies also facilitate the establishment of 15-minute life circles and the development of regional learning communities/cities. The paper explores strategies for integrating functions and sharing fundamental education facilities, advocating for the utilization of smart city tools to manage campus spaces. It investigates various combinations of sharing arrangements in time and space for educational facilities, sports facilities, parking areas, lecture halls, libraries, and other amenities in the campus vicinity. The paper aims to provide in- sights for future campus planning and renewal. Furthermore, the paper suggests areas for further research, including the definition of property rights, operational models, functional combinations, and the organization of learning communities/cities in space sharing.

Since 2014, Shanghai has proposed the concept of achieving "negative growth in planned construction land" during a new round of overall urban planning research. This marked a shift from incremental development to stock renewal. Subsequently, Shanghai initiated pilot urban renewal projects centered on the transformation of existing buildings. Starting in 2016, the city promoted four major action plans—"Shared Community Plan," "Innovation Park Plan," "Charming Landscape Plan," and "Leisure Network Plan"—with the core goal of creating "15-minute community living circles." These plans signify a pivot towards improving people's livelihoods in urban renewal, with the city and district governments focusing on optimizing community spatial organization [1].

For a long time, research on updating basic education facilities has been relatively sparse. On the one hand, spatial equilibrium in the planning and management of basic education and quality balance in educational administration provide a solid foundation due to the collaborative efforts of planning and education departments. The distribution of basic education facilities in central urban areas is relatively balanced, and diverse school operation modes and zoning-based enrollment policies have reduced disparities in educational resource quality. On the other hand, the renewal model for basic education has remained relatively traditional, focusing primarily on maintaining internal campus infrastructure. Updates generally involve refurbishing the built environment and upgrading facilities and equipment. Out of safety considerations for teaching environments, schools have rarely participated in co-construction and sharing with surrounding communities, leading to the creation of well-secured "ivory towers."

As stock renewal increasingly emphasizes community needs, key areas for research on the

renewal of basic education facilities now include functional integration and spatial sharing, as well as responding to community and societal demands, particularly community education needs.

This paper discusses community sharing strategies for basic education spaces within the context of stock renewal. It addresses four dimensions: the development trends of basic and community education, integration pathways for basic education and communities, functional integration and spatial sharing models for basic education, and the challenges and approaches to implementation.

1. Trends: Integration of Basic and Community Education Under the Goal of Building a Learning City

1.1 The Need for Basic Education Resources to Supplement the Community Education System in Learning Cities

Since 2006, Shanghai has taken the lead in promoting the construction of a "learning city." By organizing across departments, it has established a vertically integrated educational network within communities, forming a preliminary framework for a learning society where "everyone learns, learning is possible everywhere, and learning is available at all times" [2]. Since 2016, Shanghai has refined and implemented the requirements for building "15-minute living circles," guiding community education resources to grassroots areas. This effort has led to the establishment of a four-level community education system—city, district, subdistrict/township, and neighborhood/village committees—offering learning services to various groups, including youth, parents, and new workforce members.

The broader concept of community education encompasses even richer connotations. Dai Chun et al. [3] describe community education as an "educational complex," involving coordinated educational activities by schools, families, and society. Liu Zhu [4] views community education as a series of educational activities aimed at improving the overall quality of all community members, enhancing quality of life, and fostering community development by fully leveraging regional educational resources. Jiang Keyuan [5] believes community education should ensure universal access to educational opportunities, diversity in learning content, personalized learning approaches, multilayered interaction, and sustainable support and follow-up. This broad concept of community education offers extensive possibilities in terms of audience, educational forms, and organizational models.

Shanghai's four-level community education system broadly meets the lifelong learning needs of all community members. Subdistrict-level community colleges and cultural activity centers serve as the main platforms, extending coverage to all residents via neighborhood/village committee activity rooms. These facilities are well-received by various demographics but face challenges such as uneven regional development and limited professionalization. The community school–neighborhood/village activity room system primarily serves older adults and has limited resources, which cannot meet the diverse educational and service needs of a broader social demographic. Additional supplementation of community education resources is urgently required. Shanghai's Opinions on Further Deepening the Construction of a Learning City encourages the co-construction and sharing of high-quality resources. Schools at all levels are

urged to actively participate in building a learning city by leveraging their facilities, curricula, faculty, and training equipment [2]. Integrating the basic education system can not only provide spatial resources for community education but also contribute content and human resources.

1.2 Re-Spatialization of Educational Spaces as a Mediator of Community and Social Relationships

From a sociological perspective, educational spaces can be considered mediators of community and social relationships. The organizational structure of spaces arises from social relations and, in turn, can influence those relationships. Dai Chun et al. [3] argue that public educational spaces are venues where meanings are generated and interactions occur, fostering residents' identification with and sense of belonging to the space. This accelerates community interaction, enhances cohesion, and supports the development of diverse learning systems.

The realization of the mediating role of educational spaces occurs mainly through "reorganization" and "simulation." Reorganization refers to the expansion of the user base of public educational spaces and the blending of relationships to form new social connections. As the audience grows, the social networks of participants—students, families, and communities—intertwine further, fostering new relationships that may drive innovation and, consequently, community development. When basic education spaces are transformed into hubs for community interaction and integration, they can address the current shortage of community education spaces.

Simulation involves using physical spaces to construct corresponding virtual spaces. For instance, during the pandemic, "air classrooms" became a virtual educational space linking the city's foundational education courses. This initiative further fostered online community networks, such as loosely structured interactive groups (e.g., interest or research groups) or media-centric sharing communities (e.g., Tongji University physics professor Wu Yuren's educational outreach in virtual spaces). Advances in network technology enable reorganization and simulation to proceed concurrently and reinforce one another. Thus, physical educational spaces—particularly schools—can act as catalysts for forming social and virtual relationships, promoting "learning communities." Through simulation, the open sharing of physical spaces also gains symbolic significance in fostering lifelong learning across communities, enhancing the community education functionality of basic education spaces.

1.3 Broad Community Education as an Extension of Basic Education

While basic education provides possibilities for community education, broad community education also supplements and supports basic education resources (Figure 1). Beyond the four-level community education system, Shanghai actively involves various government departments, enterprises, and social organizations in community education. Public service facilities at city, district, and subdistrict levels increasingly offer life skills and knowledge enrichment opportunities for students of all ages. Examples include fire safety station experiences, school-street collaborative flag-raising ceremonies, and the Shanghai Urban Planning Exhibition Hall's "Junior Planners" activities for community students (Figure 2). Integrating and utilizing broad community education resources has become a bridge to enhancing the quality of basic education.

(a) 潍坊社区文化中心图书馆成为社区居民自习场所　　(b) 潍坊社区文化中心内的古筝教学场地　　(c) 潍坊社区文化中心内的美术作品展示

Fig.1 The education space for all provided by the Weifang Street Community Center

(a) 规划师向小朋友介绍上海市总体规划2035　　(b) 小小规划师们体验城市实验室　　(c) 城市实验室的小朋友共建墙

Fig.2 Urban planning experience for primary and secondary school students organized by the Shanghai Planning Exhibition Hall

2. Pathways: Promoting the Formation of a "School + Community" Education Community through Integration and Sharing

2.1 The Balanced and High-Quality Development of Basic Education Requires Community Resource Support

In recent years, the primary direction of Shanghai's basic education development has been achieving "balanced and high-quality" growth while gradually transitioning toward educational modernization. The aim is to build a high-quality education system characterized by greater inclusiveness, vibrancy, openness, and quality, aligning with the standards of leading global cities (14th Five-Year Plan for Shanghai Education Development) [6]. By 2020, Shanghai had achieved a relatively high level of educational balance [7]. Policies such as proximity-based enrollment without entrance exams, simultaneous enrollment for public and private schools, and allocating high school seats to each middle school have further reduced the capacity of "elite schools" to monopolize high-quality students, thereby elevating the overall regional education level.

As the scope of basic education expands to include both the intrinsic and extrinsic aspects of quality education in response to societal needs, more community resources are required to support individual-focused education and development.

2.1.1 "Quality Education" Drives the Integration and Sharing of School and Community Resources

Basic education, as the foundation of national education, is essentially about cultivating the qualities needed to produce qualified citizens. In essence, basic education is synonymous with quality education. Traditionally, "quality education" has been positioned in opposition to "exam-oriented education," aiming to rectify the overemphasis on test scores and academic credentials

at the expense of holistic development in moral, intellectual, physical, artistic, and practical aspects. Today, quality education emphasizes individuality and is evolving into a model that encompasses "learning throughout life and across spaces," covering all aspects of education and promoting active student development [8].

In alignment with these goals, Shanghai's drive for "balanced and high-quality" basic education increasingly encourages the alignment of school and community resources across multiple dimensions, such as physical spaces and programs, to better meet the needs of individual learners. According to the Ministry of Education's guidelines for integrated practical courses, quality education employs methods like field investigations, social service, design projects, and career experiences. The open nature of these courses in terms of topics, schedules, and venues necessitates collaboration with community resources. As students progress to higher grades, themes such as community safety, environmental protection, clean energy, waste management, eldercare, and community governance emerge as major project topics, requiring solutions that deepen the scope and breadth of research. These trends underscore the growing need for systematic community resource integration into quality education (Figure 3).

Each community contains a wealth of public service facilities that can effectively support the expansion of quality education initiatives in nearby schools [9]. Moreover, schools and communities often possess functionally similar or complementary facilities, providing further opportunities for spatial and functional optimization, especially with the reduced barriers to shared management facilitated by "Internet+" technologies.

Fig.3 From closed to open campuses

2.1.2 "Innovation Training" Encourages Schools to Seek Community Resource Support

With technological advancements, particularly in artificial intelligence, repetitive tasks and low-creativity work are increasingly being automated. As a result, many industries face transformation, making the cultivation of innovative thinking more critical than ever. While basic education excels in producing "standardized" talent, it has significant shortcomings in fostering creativity and innovation. The pathways for diverse talent development, widened under the "Double Reduction" policy, still lack a systemic core framework aimed explicitly at innovation.

On the one hand, the education system needs a holistic reconstruction to identify and nurture each student's unique strengths, shaping a development model compatible with and integrated

into basic education. On the other hand, fostering innovation requires a broad perspective, interdisciplinary approaches, and the integration of theory and practice. For traditional schools, seeking support from universities, research institutes, businesses, community organizations, and local governments is essential for building a foundation for innovation education.

2.1.3 "Internet+" Advances Transform Teaching Resources and Methods, Promoting Virtual "School + Community" Education Communities

In recent years, rapid advancements in communication technology have reshaped economic development and lifestyles. Technologies like digitization, cloud computing, virtual reality, and artificial intelligence (e.g., ChatGPT) are significantly influencing how we work and learn. The global pandemic that erupted in 2020 posed immense challenges to the continuity of basic education. However, the rapid development of digital technologies mitigated the impact, accelerating a systemic overhaul of education models. Although basic education has largely returned to normal post-pandemic, the technological advancements made during that period continue to alter educational perceptions and practices. Online platforms and digital tools developed during the pandemic laid the groundwork for virtual "school + community" education communities. These virtual networks allow for the integration of school and community resources, enabling joint exploration of learning opportunities, digital resources, and collaborative programs that enhance both in-person and online educational experiences.

(1) Internet Integration in Education Promotes Horizontal Integration of Teaching Resources

The internet has facilitated the sharing of teaching plans and accelerated the openness and equity of teaching content. During the pandemic-induced lockdown, the demand for teaching led to the rapid development of online and televised courses. Sharing and disseminating courses from prestigious schools and renowned teachers enhanced the teaching capabilities of instructors, improving both the quality and efficiency of the courses. Features such as "traceability, choice, and comparability" not only accelerate the improvement of teachers' skills but also satisfy students (and parents) seeking access to top educators and precise control over learning content.

(2) Intelligent Teaching Promotes Vertical Transformation of Teaching Systems

The adoption of networked and personalized evaluations has become one of the approaches for individual learning assessment. Traditional education systems relied on standardized evaluations, but post-"Internet+," the focus of assessments has shifted towards reflecting individual competencies. Based on the standardization of teaching products, some schools have introduced online evaluations, gradually forming personalized teaching and evaluation systems. This approach facilitates timely feedback on teaching content, ultimately enhancing learning efficiency.

(3) Internetization of Educational Resources and Learning Methods Promotes Interaction Between School Resources and Virtual Network Communities

This interaction fosters the emergence of autonomous, multi-centered community collectives based on equal communication. According to Chen Li [10], internet educational communities exhibit self-organization, the iterative exchange of diverse conflicts leading to collective consensus through emergent group intelligence, and nonlinear relationships between teaching

and learning. Consequently, this has also contributed to the formation of educational communities within virtual spaces.

2.2 Integration and Sharing of "School + Community" Promotes the Formation of Community Culture and Quality

2.2.1 The "Weak Ties" of Parent Communities Guide the Formation of Community Interaction Spaces and Cultural Characteristics

The theory of "weak ties," proposed by American sociologist Mark Granovetter [11] in 1974, distinguishes itself from the "strong ties" associated with close work or career relationships. "Weak ties" refer to relatively loose interpersonal connections established through communication and interaction. Schools, as aggregations of students from diverse backgrounds, form weak-tie networks centered around "parent communities." These communities serve as crucial links connecting schools, families, and the broader community, becoming integral parts of both schools and neighborhoods.

Regardless of whether the schools are public, private, or international, diverse activities are often organized through parent communities. Examples include community services, experiential investigations, and study tours. These activities enrich teaching content with local community resources, achieving the goal of reducing academic burdens.

Since parent communities rely on the presence of students and are relatively fixed during their schooling years, stable social relationships emerge between schools and families during this period. Furthermore, the quality and societal influence of schools stimulate the dynamism and participation of parent communities. Thus, the positive interaction between high-quality schools and active parent communities forms the foundation of a school's overall character. The integration and sharing of community resources, indirectly guided by parent communities, lay the groundwork for vibrant community spaces and cultural development.

High participation by parent communities in school affairs increases the demand for schools to respond with composite functions and shared spaces, further promoting the integration of schools and communities.

2.2.2 Integration and Sharing Between Schools and Communities Enhances Community Quality

High-quality school resources often become markers of excellence within a region, attracting significant attention and sometimes leading to regional polarization due to competition for limited school capacity. The scarcity of premium resources is the root cause of "educational gentrification." Through various reforms in educational models (Table 1), Shanghai has expanded the shared availability of high-quality educational resources within regions, improving overall educational standards. The diffusion and connections facilitated by parent communities transform the presence of high-quality school resources into a community-wide cultural consensus. This positive interaction between school resources and community quality fosters the development of regional cultural brands and distinct characteristics.

Tab.1 Main functions and actions of government and schools in various education models in Shanghai [6]

Model	Government	School
Group-Based Schooling	Formulate policies to establish educational groups, carry out organization, promotion, and evaluation work.	Develop plans and implement promotion based on government documents.
District-Based Schooling	Define school districts and design policies at the top level.	Integrate resources among schools within the district, collaborate for joint development, and pursue unique development paths.
Flow of Outstanding Teaching Resources	Issue policies for the flow of outstanding teaching resources, specifying implementation, promotion, and assessment methods.	Facilitate inter-school exchange of teaching resources.
Advancement Projects for High-Quality Schools	Government support.	Schools develop flexibly based on local conditions.
Entrusted Management	The government takes the lead in purchasing educational services and issuing policies.	Schools submit applications for entrusted management, with assisted schools receiving enhancements.
Renowned Schools Establishing Branch Campuses in Other Locations	Government advocates and issues policies.	Schools planning to establish branch campuses gain significant autonomy after obtaining the right to operate them.
Universities Establishing Affiliated Schools	Government encourages and guides, issuing policies as needed.	Explore new schooling models based on the characteristics and foundations of their affiliated universities.

2.3 Community Renewal Requires Support from Basic Education Departments

2.3.1 Insufficient Public Service Capacity in Urban Centers and the Need to Optimize Basic Educational Facilities

The composite sharing of public service facilities is a direction for community planning practice. Zhang Fan [12] highlights that the multi-dimensional and spatiotemporal sharing of public service facilities, tailored to local conditions, is essential for maximizing comprehensive benefits. Xiao Feiyu et al. [13] suggest that public service facilities should fully consider the compatibility, hybridity, and transformability of land use and architectural forms to enable functional adaptability. Addressing community needs and promoting composite sharing can effectively alleviate the shortage of certain facilities.

In Shanghai's central urban areas, many old residential neighborhoods were established long ago, resulting in a general lack of public service facilities. To address this, the government has steadily implemented small-scale updates to continuously supplement and improve basic public service

capacity. Beginning in 2016, Shanghai enhanced the "15-minute community living circle" by comprehensively optimizing community public services, green spaces, and slow-moving transportation systems, with work focused on the "Five Livabilities"—livable, employable, visitable, learnable, and age-friendly environments. However, residents still face prominent challenges such as insufficient community education spaces, limited sports and cultural activity venues, inadequate slow-moving spaces, and a lack of parking.

The spatial potential of basic education facilities offers possibilities for further integrated optimization. Before the pandemic, some primary and secondary school campuses in Shanghai had already begun to allow limited access to nearby residents. Starting March 31, 2023, over 1,100 primary and secondary schools in Shanghai reopened their sports facilities to local residents, addressing their demand for exercise space [14]. Additionally, initiatives to open school parking spaces to nearby residents during non-school hours have been piloted in cities such as Hefei and Wuhan. These efforts alleviate parking difficulties in surrounding areas through the shared use of school parking facilities [15].

2.3.2 Diverse Community Public Service Spaces as Extensions of Extracurricular Education in Basic Education

Shanghai's ongoing development of the "15-minute community living circle," with its core focus on creating environments that are livable, employable, visitable, learnable, and age-friendly, also serves as an external extension of basic education. For instance, livability includes convenient services, resilient safety measures, and smart living systems, while age-friendliness includes facilities for eldercare—both of which are critical components of school extracurricular practice. Similarly, sports facilities under the visitable category and cultural and continuing education facilities under the learnable category are foundational for diversified and personalized student development.

Coordinating diverse resources within communities to maximize utilization and avoid duplication between community and school resources is a subject worthy of further study. For example, the learnable category within the 15-minute community living circle requires basic guarantee facilities (Table 2), such as 400-seat theaters in community cultural activity centers. These overlap with standard facilities required by middle schools. Community cultural venues are typically operated by professional teams, while schools often lack professional maintenance and underutilize their facilities. Shared use presents a potential win-win scenario. Similarly, multifunctional sports fields and community fitness centers required for visitable environments overlap partially with school sports facilities. Sharing these spaces can significantly improve their utilization efficiency.

Tab.2 Requirements for "learning" in the Shanghai Fifteen Minute Life Circle Guide

Key Tasks	Content	Planning and Construction Standards	Configuration Form	Layout and Construction Guidelines	Service Radius	Population Served	Industry Responsibility/ Guiding Depart

									ment
Basic Assurance Category									
Carefree Childcare	1	Infant and Childcare Centers	Infant care, childcare	General scale ≥360 ㎡	Comprehensive setup preferred	—	Service radius ≤500 m	One center per 15,000 residents	Municipal Education Commission
Lifelong Learning	2	Kindergartens		General scale: building area ≥5500 ㎡, land area ≥6490 ㎡; Per capita indicator: building area ≥550㎡/1000 people; land area ≥649㎡/1000 people	Independent plot	—	Service radius ≤300 m	One center per 10,000 residents	Municipal Education Commission
	3	Primary Schools		General scale: building area ≥10,800㎡, land area ≥21,770㎡; Per capita indicator: building area ≥432㎡/1000 people; land area ≥870㎡/1000 people	Independent plot	—	Service radius ≤500 m	One center per 25,000 residents	Municipal Education Commission
	4	Middle Schools		General scale: building area ≥10,350㎡, land area ≥19,670㎡; Per capita indicator: building area ≥414㎡/1000 people; land area ≥787㎡/1000 people	Independent plot	—	Service radius ≤1000 m	One center per 25,000 residents	Municipal Education Commission
	5	High Schools		General scale: building area ≥22,994㎡, land area ≥26,800㎡; Per capita indicator: building area ≥460㎡/1000 people; land area ≥536㎡/1000 people	Independent plot	—	—	One center per 50,000 residents	Municipal Education Commission
Cultural Resonance	6	Community Cultural Centers	Multi-purpose hall, library, information hubs, community education, activities for children and youth	General scale ≥4500 ㎡ per center; Per capita indicator: building area ≥90㎡/1000 people; Land area ≥100㎡/1000 people	Comprehensive setup possible	—	Service radius ≤1000 m	One center per street/town	Municipal Culture and Tourism Bureau

Category	No.	Name	Description	Scale	Setup	Integration		Quantity	Responsible Department
	7	Cultural Activity Rooms	Chess rooms, reading rooms, etc.	General scale 100㎡ per room	Comprehensive setup preferred	—	—	One center per 15,000 residents	Municipal Culture and Tourism Bureau
Quality Enhancement Category									
Carefree Childcare	8	Family Science Parenting Guidance Station	Provides scientific parenting guidance services for families with children aged 0-8 years	40-50 m²/each	Suitable for integrated setup	Encourages integration with community schools, New Era Civilization Practice Centers, Party and Mass Service Centers, Community Cultural Activity Centers, etc.	—	One per street (town)	Municipal Education Commission
	9	Children's Service Centers, Children's Homes	Provides services for children and their families, such as play and entertainment, parent-child reading, after-school care, family education guidance, thematic practical activities, protection, and referral, according to local conditions	Children's Service Centers: 200 m²/each; Children's Homes: 50 m²/each	Suitable for integrated setup	Encourages integration with New Era Civilization Practice Centers, Party and Mass Service Centers, Community Cultural Activity Centers, etc. According to the needs of children of different age groups, child-friendly renovations should be carried out. Independent setups are possible where conditions permit	—	One Children's Service Center per street (town); One or more Community Committees should have one Children's Home	Municipal Women's and Children's Work Committee Office
Lifelong Learning	10	Community Schools	Senior schools, adult interest training schools, vocational training centers, children's interest activities	100 m²/each	Suitable for integrated setup	Encourages integration with community cultural activity centers	—	One per street (town)	Municipal Education Commission
Cultural Resonance	11	Community Cultural Display Spaces (Community-level Museums, Art Galleries, Performance Venues, Science Popularization	Encourages each street (town) to build in a targeted manner based on functional positioning,	—	Suitable for integrated setup	—	—	Municipal Cultural and Tourism

	Education Centers)		industrial characteristics, and resource endowment					Bureau
12	Charity Supermarket	Responsible for receiving community charity donations, charity sales, aid to people in difficulty, volunteer services, and the dissemination of charity culture	30 m²/each	Suitable for integrated setup	—	—	One per street (town)	Municipal Civil Affairs Bureau

3 Methods: Exploration of a Community-Oriented Composite Sharing Model for Basic Education Facilities

3.1 Logic of Composite Sharing

The composite utilization of spaces for basic education facilities and community public services links the school teaching circulation with the daily life circulation of community residents temporally while connecting them spatially. Due to the safety requirements inherent in teaching environments, specific design techniques and management measures are required to clearly delineate the interface of usage rights between school personnel and surrounding residents. This dual-dimensional approach addresses temporal (Table 3) and spatial (Figure 4) separation to appropriately allocate educational and community functions.

Tab.3 Possible functional integration of fundamental education schools (time series)

Time Period	Teaching Days				Non-Teaching Days		
	6:00–8:00	8:00–15:00	15:00–18:00	18:00–21:00	6:00–8:00	8:00–18:00	18:00–21:00
Teaching Building and Specialized Classrooms		School Teaching Time	Evening Study Supervision during School Teaching	Professional Training in Community Education		Professional Training in Community Education	
Library and Lecture Hall		School Teaching Time	Community Services				Professional Training in Community Education
Sports Field	Open to Community	School Teaching Time	Sports Training and Open to Community	Open to Community	Open to Community		

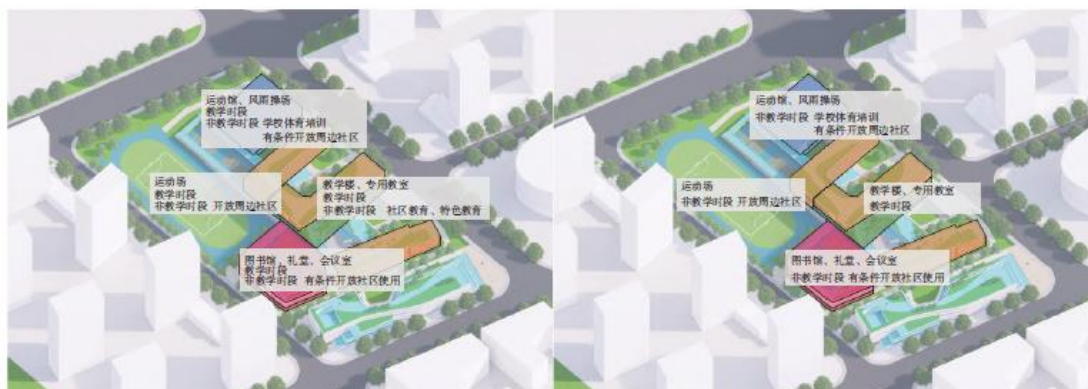|						
Gymnasium and Covered Playgrounds		School Teaching Time	Sports Training with Conditional Community Access	Conditional Community Access	Conditional Community Access	Conditional Community Access
Parking	Parent Drop-off Service	Priority Access for School Teachers	Parent Drop-off Service	Community Services		

Fig.4 Possible functional integration of fundamental education schools (spatial parallel): all functions in the left image, points 15-18 in the right image

3.2 Methods of Spatial Sharing

3.2.1 Sharing of Teaching Spaces

The transition to small-class (rotation) teaching in primary and secondary schools during the basic education phase reduces the spatial demands for classrooms. Public schools, after completing regular teaching tasks, implement distinctive and interest-driven extended education programs, often inviting parent groups with relevant professional backgrounds to participate in educational activities. This system mirrors vocational and higher education approaches, emphasizing holistic student development while fostering individual talents. The small-class teaching model brings the following changes to school spaces:

(1) Flexible Classroom Layouts and Storage Needs. The flexible desk and chair arrangements in small-class teaching increase the demand for student storage within classrooms. It becomes a common requirement to allocate fixed personal storage spaces in classrooms for items during inter-classroom movements.

(2) Workspaces for Rotational Teachers. The mobility of teaching teams in the small-class model creates potential demands for permanent workspaces for rotational teachers. These can be arranged inside classrooms or adjacent to them, depending on teaching circulation patterns and team structures.

(3) Diverse and Adaptive Spatial Needs. Small-class teaching entails varying and modular spatial

requirements. Conventional classrooms can be adapted or subdivided, for example, using movable partitions to separate a standard classroom into two smaller spaces for different teaching activities. Schools with surplus teaching spaces can establish flexible-use classrooms as needed.

(4) Community Access to Classrooms. Some small-class classrooms can be partially opened to the community. Design solutions should incorporate time-controlled, secure partitions between external spaces and regular classrooms to minimize disruptions to non-shared campus areas. Integrating community sharing models into design considerations can serve as a primary approach for educational space reform.

3.2.2 Sharing of Sports Areas

Efforts to open public school sports facilities to communities in Shanghai began in 2006 and have been fully revitalized post-pandemic. Current sharing models include granting fitness certificates to residents (e.g., Changning and Huangpu districts), digital platform-based user management (e.g., Jing'an, Pudong, and Minhang districts), or online reservation systems for gymnasiums. The sharing of campuses with the community leads to the following spatial impacts:

(1) Nighttime Usage Planning.The high demand for nighttime use of sports facilities by local residents necessitates time-specific planning and integrated design. With usage primarily concentrated after 5 PM, attention should be given to lighting requirements while minimizing light pollution for surrounding residents.

(2) Partitioned Time Management Interfaces. Shared sports venues require carefully designed time management interfaces to separate shared and non-shared spaces, ensuring secure boundaries between the core teaching areas and open zones. Horizontal (Figure 5) or vertical separations between teaching and sports zones enhance accessibility and minimize interference during shared usage.

Fig.5 Open sports ground design for a nine-year unified school (sports park open to citizens)

(3) Shared Facilities and Management Systems. Opening school sports venues to the community requires provisions for borrowing sports equipment, storing personal belongings, and accessing resting spaces. These needs call for dedicated, managed spaces outside the regular teaching zones, supported by digital tools for access control across different areas.

3.2.3 Sharing of Parking Spaces

The growing conflict between pedestrian and vehicular traffic in school campuses, as highlighted by a fatal incident at a primary school in Wuhan, underscores the need for shared utilization of parking spaces. Measures for resolving such conflicts involve two primary levels:

(1) Underground Pickup/Drop-off Systems to Alleviate Surface Road Congestion

In 2018, Ningbo Depai Primary School piloted an underground pickup/drop-off system to address peak-hour traffic congestion. This system uses an underground parking garage with designated lanes, significantly reducing surface-level chaos. Key considerations for shared parking designs include:

Underground Layouts: Incorporating pickup/drop-off halls and parking spaces directly connected to the halls through safe, streamlined pathways. The circulation should avoid overlaps with long-term parking routes and minimize blind spots to ensure safety (Fig 6).
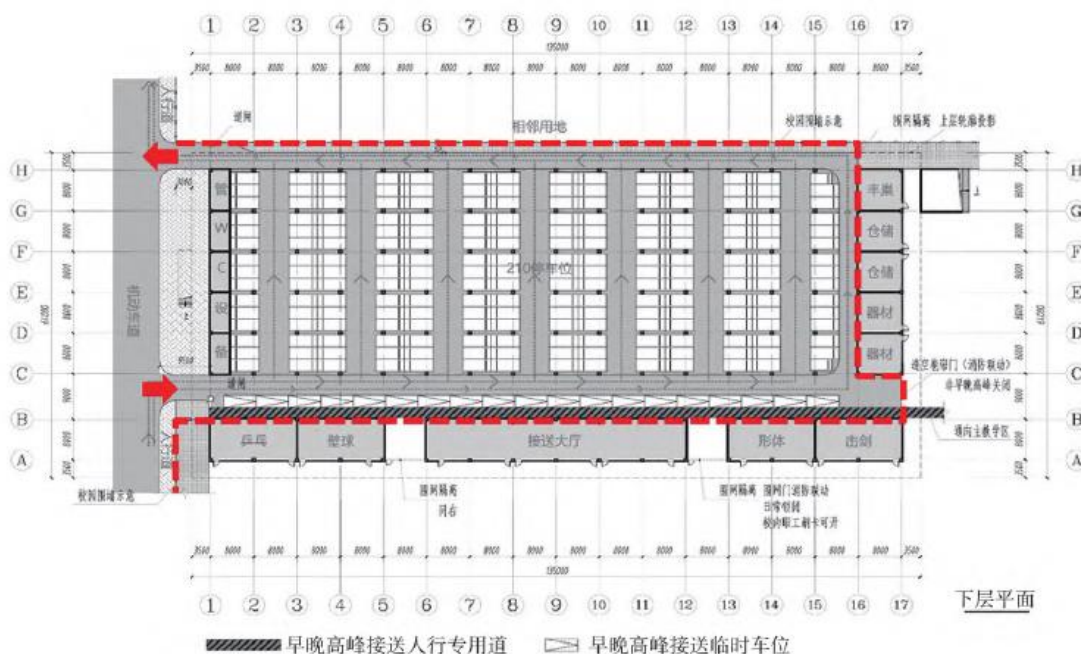
Fig.6 Student pick-up and drop-off system and long-term parking spaces in an underground garage of a selected school

Peak Hour Adaptations: Morning drop-offs prioritize temporary stops near the platform, while evening pickups require designated spaces proportionate to demand. Teacher parking spaces are separated from pickup areas, ensuring proximity to pickup platforms.

(2) Functional Integration to Enable Off-Peak Community Parking

In densely populated urban areas, maximizing school land use often involves integrating sports fields with parking facilities. For example, raising sports fields to the second floor or semi-underground levels creates parking spaces in vertical dimensions. This approach balances cost efficiency with shared utilization. Schools like Shanghai Fengxian Middle School and Tongji

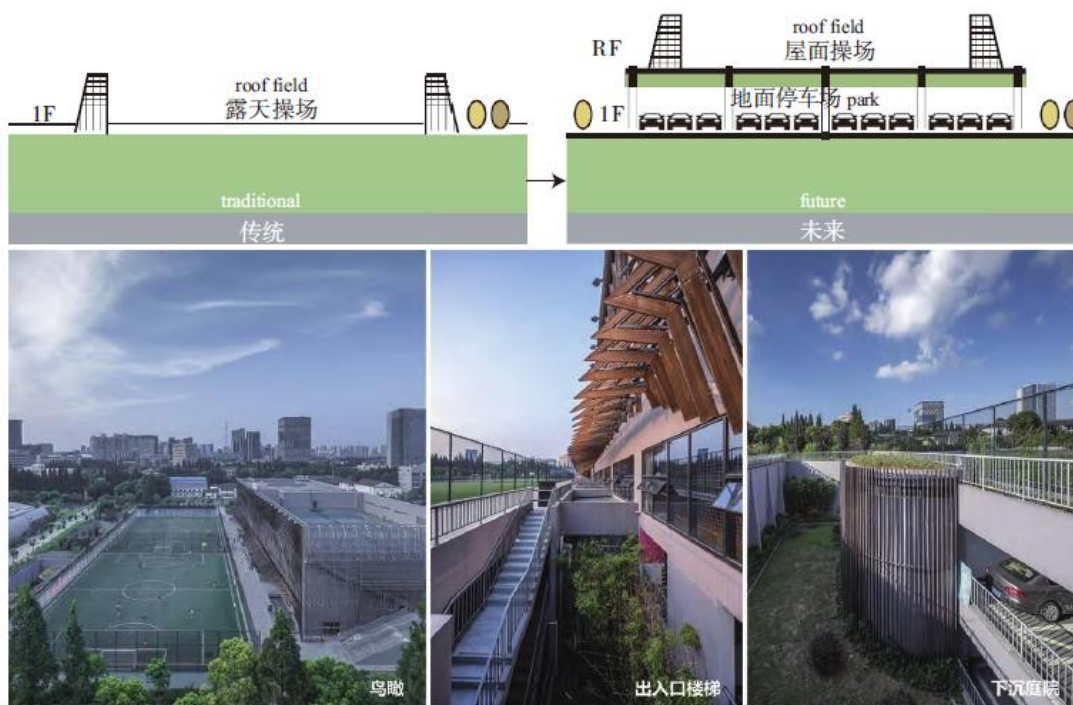University have successfully implemented similar strategies (Figure 7). Key spatial considerations include:

Fig.7 Functional integration and space sharing of Chifeng Road parking lot and sports ground in Tongji University

Traffic Flow Separation: Strict separation of routes for students and vehicles ensures safety during transitions to sports fields. Routes for internal personnel and community users should also be distinctly managed.

Controlled Security Interfaces: Permissions for school and community access to parking spaces should be carefully controlled by time and user type, particularly during regular teaching hours, to mitigate security risks.

Harmonized Spatial Design: The composite use of spaces for sports fields and parking should maintain the campus's visual integrity. The minimum height for parking areas must meet clearance requirements while accommodating the heights of teaching spaces. Additionally, the integration of staircases, railings, accessible facilities, and fire exits introduces new design challenges.

3.2.4 Sharing of Campus Public Facilities and Campus Boundary Areas
Public service facilities within campuses, as well as campus entrances and walls, have the potential to serve the community.

(1) Auditoriums and Libraries: Auditoriums and libraries within schools are fundamental functional spaces. They are also important areas that can be opened to the community, enabling the composite use of educational facilities. To address the demand for openness and sharing of

such functions, the design process should prioritize placing auditoriums and libraries near the campus entrances. Additionally, orderly separations should be established between these spaces and the core teaching areas.

(2) Campus Walls and Urban Greenery: In campus planning, walls are generally required to incorporate greenery and display content related to the promotion of spiritual and cultural values. Analysis of groups associated with schools also reveals that the design of urban furniture and green landscaping near the campus can foster a deeper integration of educational resources with community resources, enhancing the overall quality of the community environment.

(3) Recessed Campus Entrances: Appropriately recessing campus entrances can provide more buffer space between school and urban areas, offering additional green space for the community. For example, Source Plan Company proactively allocated a 945 m² open plaza at the street-facing entrance of Shenzhen Hongling Experimental Primary School. This space not only accommodates the flow of parents during drop-off and pick-up times but also serves as an urban green pocket park on ordinary days [15].

4 Breakthroughs: Exploration of Implementation Path Difficulties and Strategic Responses
4.1 Designers Must Act as Coordinators to Facilitate Spatial Integration and Sharing of Basic Educational Facilities
There have been many innovative explorations in integrating and sharing spaces between basic educational facilities and community functions. Notable examples include the "8+1" Architectural Exhibition of the Futian New Campus Plan in 2002 and the "Towards a New Campus" initiative during the Shanghai Urban Space Art Season in 2021. These initiatives showcase the ability of architects and planners to manage diverse and complex requirements of school-community integration.

For the planning, renovation, and architectural design of basic educational facilities, designers must increasingly investigate possibilities for functional integration and shared use from both regional and user perspectives. This approach promotes efficient spatial utilization and fosters social cohesion. Designers must act as mediators addressing the core concerns of stakeholders, including responsible entities, users, and supervisory authorities.

For instance, during the unified planning and design of a nine-year integrated school and community cultural facilities in Pudong, Shanghai, despite extensive communication with supervisory authorities, concerns about time-sharing arrangements persisted. Supervisors recommended separate facilities for the auditorium (school) and the multimedia room (community cultural facility) per technical standards. This highlights the need for designers to undertake significant coordination efforts for integrated design projects.

社区开放出入口—架空操场　　　　　社区开放出入口—操场下方

Fig.8 Boundaries of rights and responsibilities across different temporal and spatial stages

4.2 Redefining Property Rights for Spatial Sharing: Establishing New Temporal and Spatial Responsibility Boundaries

4.2.1 Spatial Division and Time-Sharing Require Consensus and Systematic Agreements Among Diverse Stakeholders

Spaces for basic education are typically designated for public welfare and acquire urban construction land rights through allocation, primarily serving fundamental educational functions. However, as these spaces increasingly cater to community demands, their traditional rights and obligations expand—a development not always welcomed by schools and education authorities.

From the community perspective, user bases are broad and demands are diverse. For education authorities requiring shared spaces, communication is challenging, and management costs are high. Establishing a broad consensus and systematic agreements between the community and education authorities is fundamental for advancing spatial sharing and multifunctional use.

4.2.2 "Internet+" Development Facilitates the Formation of Systematic Agreements

The development of spatial sharing in basic educational facilities benefits from the maturity of IoT-enabled smart city technologies and the establishment of comprehensive personal credit systems.

IoT technologies supported by "Internet+" advancements enable rapid, cost-effective resource utilization and provide foundational tools for secure space management, including remote monitoring and intelligent AI recognition.
Personal credit systems based on big data and third-party platforms facilitate quick credit evaluations and user profiling for shared-space users, ensuring effective regulation of shared spaces.

4.2.3 Changes in Space-Sharing Models Require Clear Responsibility Boundaries During Specific Sharing Periods

Space-sharing models in basic education are driving a transformation from traditional static functional zoning to dynamic "campus + community" integration. However, education management authorities prioritize student safety, necessitating a dual approach: "strict internal

safety fencing" and "limited external openness."

Spatial planning and architectural design must employ different spatial combination models to separate internal and external uses without over-restricting spaces. Flexible time-based spatial sharing, supported by "Internet+" technologies, enables seamless security management. Additionally, institutional frameworks should define responsibility boundaries during specific sharing periods to clarify stakeholder obligations and safeguard students' rights.

4.3 Functional Integration Redefines School Demands: Collaboration Between Campuses and Communities

4.3.1 Diverging Perceptions of Spatial Development Needs Between Education and Planning Authorities

Education authorities demand ever-expanding basic educational facilities to meet growing requirements for well-rounded education. In contrast, planning and natural resource management authorities impose stricter land and construction controls, prioritizing efficient land use, particularly in urban centers. Disparities between the two authorities persist. As shown in Table 4, planning resource guidelines for land control on the left contrast with education authorities' requirements for school land use on the right. Education authorities generally set higher land-use indicators, with increases typically ranging from 15% to 40%.

Tab.4 Differences in indicators of different standards

	Shanghai Control Detailed Planning Technical Guidelines (2016) Shanghai Residential District Standards (2019)								Standards for the Construction of Ordinary Primary and Secondary Schools (2004) Shanghai Social Affairs Land Use Guidelines (2010)							
	Kindergarten 390 people		Primary School (5-Year Program) 1125 people		Junior High School (4-Year Program) 900 people		High School (3-Year Program) 1200 people		Kindergarten 15 classes, 390 people		Primary School (25 Classes) 1000 people		Junior High School (24 Classes) 1080 people		High School (24 Classes) 1200 people	
	Main Urban Area	Outside the Main Urban Area	Main Urban Area	Outside the Main Urban Area	Main Urban Area	Outside the Main Urban Area	Main Urban Area	Outside the Main Urban Area	Central Urban Area	Outside the Central Urban Area	Central Urban Area	Outside the Central Urban Area	Central Urban Area	Outside the Central Urban Area	Central Urban Area	Outside the Central Urban Area
Land Use for Construction (m²)	5192	6490	17 416	21 770	15 736	19 670	21 440	26 800	6490	7198	20 467	24 616	23 612	27 585	26 801	31 293
Land Use per Student (m²)	13.3	16.6	15.4	19.3	17.4	21.3	17.9	22.3	16.6	18.4	20.4	24.6	21.8	25.5	22.3	26.0

While planning departments base basic infrastructure on regional population data, education authorities consider the actual population needing education, often allowing for flexible space allocation. When minimum class requirements cannot be met, education departments expand coverage by leveraging nearby facilities.

In cases where land cannot be expanded, planning authorities may allow flexible development intensity to optimize planning while adhering to construction regulations. However, addressing

growing demands for well-rounded education requires more than spatial expansion. Functional diversification through community integration and sharing offers potential solutions.

4.3.2 Collaboration Mechanisms Between Schools and Communities Are Essential

As the integration of education and community functions deepens, the reach of well-rounded education expands from schools to communities. The networked dissemination of educational resources supports individualized learning development.

Relying solely on educational authorities to bear all or most responsibilities is unrealistic and unnecessary. By integrating community services, market-based personalized training resources, and "Internet+" research-based learning resources, dispersed facilities can form networks or chains to address space shortages. This is particularly crucial for improving physical education and quality education spaces in urban centers.

For example, communities often require shared use of libraries and auditoriums. By aligning with community resource allocations, schools can release land for other teaching and cultural spaces, achieving professionalized resource management and optimizing spatial efficiency. As shown in Figure 9, this dual interaction between schools and communities enhances resource utilization and supports broader educational reforms focused on holistic student development and innovation.

Fig.9 Cultural and sports venues and community cultural spaces that can be shared by communities and schools (jointly operated)

4.4 Redefining Educational Spaces Through Community Characteristics: Integration and Symbiosis Between Campuses and Communities
4.4.1 Community Characteristics Drive Holistic Education

As educational quality trends toward a balanced baseline, holistic education increasingly relies on resources from communities and parent networks. Community facilities and research institutions provide services that help schools nurture students, shaping regional characteristics in education, innovation, and community services. These characteristics will become key drivers of regional

development and school specialization.

4.4.2 Basic Educational Facilities Promote Learning-Oriented Communities
Learning-oriented cities and communities are central to the Party's 20th National Congress goals of enhancing continuing education and building a lifelong learning society. The goal is to create universal lifelong learning systems that enable learning for all, anytime and anywhere. For example, Hangzhou's Caihe Second Primary School integrates with its community under the concept of "the school in the community, the community in the school." By sharing educational resources through diverse channels, the school fosters universal, lifelong, and intergenerational learning. In Shanghai, however, community education systems have yet to fully explore the potential of integrating basic educational spaces and resources. In February 2023, Shanghai recognized nine exemplary learning-oriented communities, which primarily relied on community schools, residential committees, museums, and other public venues. Few initiatives leveraged basic educational facilities or involved parent networks, leaving room for further development.

5 Summary
Basic education facilities are the hope for cultivating the future builders of cities, and land planning and construction management for these facilities are of particular concern to governments at all levels and society. Against the backdrop of stock renewal, the key issue explored in this paper is how existing basic education facilities in the main urban areas can address the contradiction between quality education cultivation in the context of the explosive growth of science and technology information and the limited space increment. At the same time, basic education serves as the foundation for social equity, and outstanding educational resources within a region have become a symbol of the region's development quality. How to achieve high-quality integration of educational resources and benefit large areas is also a problem that faces urban planners and architects.

In combination with the mutual needs of community functional integration and spatial sharing for the development of basic education, as well as the need for cultivating students' quality education and the development of learning-based communities for local residents, breaking through relevant resource co-construction and sharing can lead to communities benefiting from educational brands, thereby realizing regional output and optimizing the quality of regional education. At the same time, considering the particularity of safety management at the basic education stage, while achieving integration and sharing, relying on related smart city management methods for orderly open management of campus spaces, and exploring configuration models for educational spaces, sports areas, parking spaces, lecture halls, libraries, and other comprehensive service spaces, as well as surrounding campus areas, based on different combinations of time and space, can provide valuable reference for the planning and renewal of future campuses.

Moreover, due to the ongoing issues related to management responsibilities and operational models of functional integration and space-sharing of basic education facilities with communities in the practical operation phase, it is still necessary to deeply consider the operational management models during the planning and architectural design stages, in order to better

implement the comprehensive education model of co-construction and sharing.

Notes
① The standard for the main urban area in 2019 was expanded compared to the standard for the central urban area in 2004, mainly including the extended areas such as Minhang and Baoshan. For land use standards within the inner ring road of the main urban area, calculations can be made at 60% of the general land use standard, and for the area between the inner and outer ring roads, calculations can be made at 80% of the general standard. Relevant documents include: Shanghai Municipal Engineering Construction Code: Standards for Public Service Facility Settings in Urban Residential Areas and Residential Districts DG/TJ 08-55—2019/J 10059—2019; Shanghai Municipal Engineering Construction Code: Construction Standards for Ordinary Primary and Secondary Schools DG/TJ 08-12—2004.

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