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Abstract Deutsch

Shanghai hat wohl die besten bzw. innovativsten Schulen in China und nahm als erste Stadt aus diesem Land an der internationalen PISA Testung teil. Bei der PISA Testung aus dem Jahre 2015 nahmen ausgewählte chinesische Städte, darunter Shanghai, teil und landeten in den Kategorien Mathematik, Lesen und Schreiben im internationalen Spitzenfeld. Allerdings schnitten die SchülerInnen Shanghais in der Kategorie kollektive Problemlösung durchschnittlich ab. Zum Vergleich befindet sich Finnland im Spitzenfeld sowohl in den Kategorien Mathematik, Lesen und Schreiben, als auch in kollektive Problemlösung. Die gemeinschaftliche Problemlösungs-Kompetenz ist in einer wissensbasierten Gesellschaft genauso wichtig wie Mathematik, Lesen und Schreiben. Um individuelles Lernen zu fördern als auch die sozialen Kompetenzen zu stärken, müssen die Arbeitsformen systematisch variiert werden. Ein Schulgebäude sollte diese breite Palette an Lernformen ermöglichen, unterstützen und sich an die unterschiedlichen Anforderungen anpassen können.

Diese Arbeit ist in drei Kapitel gegliedert. Im ersten Kapitel wird anhand einer textlichen Auseinandersetzung anhand von Literatur zu diesem Thema Anforderungen an Schulbauten, die für gemeinschaftliches Arbeiten ausgelegt sind erarbeitet. Dazu werden verschiedene Konzepte und deren Lösungsansätze untersucht.

Im zweiten Kapitel werden ausgewählte Schulen in Schanghai und Finnland analysiert. Im speziellen werden die Funktionsbereiche, die Verbindung zwischen den Lernbereichen, die Nutzbarkeit von Erschließungsflächen als informelle Lernräume und die Integration des Schulgebäude in die Nachbarschaft analysiert. Diese Analysen basieren auf einer grafischen Auseinandersetzung mit den Schulgebäuden. Die zentralen Fragestellungen für diese Auseinandersetzung sind: Wie sind Lernräume in den ausgewählten Schulen in Shanghai und Finnland derzeit umgesetzt?

Wie ist in den analysierten Schulen die Kommunikation beziehungsweise die Beziehung zwischen den Lernräumen/Lernbereichen respektive dem Schulgebäude und der Stadt umgesetzt?

Welche als informelle Lernräume nutzbare Erschließungsflächen sind in den ausgewählten Schulgebäuden vorhanden und welche Parameter werden benötigt damit diese Flächen zum Lernen nutzbar sind?

Im dritten Kapitel wird ein Entwurfsvorschlag für eine Volksschule auf einem konkreten Bauplatz in Shanghai erarbeitet. Dabei bilden die gewonnenen Erkenntnisse aus den ersten beiden Kapiteln die Grundlage für die Entscheidungsprozesse während des Entwurfsprozess. Der so entstandene Entwurf wird schließlich nach den gleichen Kriterien wie die Schulgebäude im zweiten Kapitel graphisch evaluiert.

Abstract English

Shanghai has probably the best or most innovative schools in China and was the first city from this country to participate in the international PISA test. Selected Chinese cities, including Shanghai, took part in the 2015 PISA test and ranked among the world's top performers in the mathematics, reading and writing categories. However, Shanghai's students scored average in the category of collective problem solving. By comparison, the Finnish schools are among the best in mathematics, reading and writing, and collective problem solving.

Collective problem-solving skills are as important in a knowledge-based society as mathematics, reading and writing. In order to promote individual learning as well as to strengthen social skills, there must be systematic variation in the modes of learning. A school building should be able to enable and support this wide range of learning methods and adapt to the different requirements.

This work is divided into three chapters. In the first chapter, requirements for school buildings that are designed for collaborative learning are elaborated on the basis of a textual analysis using literature on this topic. Different concepts and their possible solutions are examined.

In the second chapter selected schools in Shanghai and Finland are analyzed. In particular, the functional zones, the connection between the learning areas, the usability of corridors as informal learning spaces and the integration of the school building into the neighborhood are analyzed. These analyses are based on a graphical examination of the school buildings. The central questions for this examination are:

How are educational spaces implemented in the selected schools in Shanghai and Finland?

How is the communication and the connection between the educational areas resp. the school building and the neighborhood implemented in the analyzed schools?

Which corridors that can be used as informal learning spaces are available in the selected school buildings and which parameters are needed to make these spaces usable for learning?

In the third chapter, a design proposal for an elementary school on a specific building site in Shanghai is developed. The findings of the first two chapters form the basis for the decision-making processes during the design process. The resulting design is then graphically evaluated according to the same criteria as the school buildings in the second chapter.

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Danke!

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Thank You!

My Parents
My Brother and Sister
and Family and Friends

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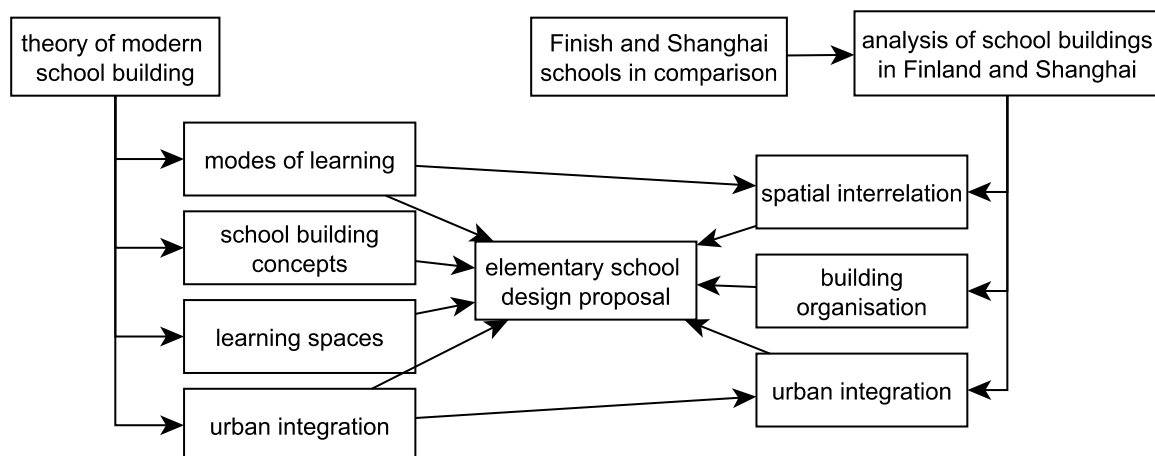
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Chapter 1: Introduction

1.1. Background and structure of the thesis

School buildings are the framework in which children are taught facts and skills. The children are taught a lot of knowledge, they learn mathematics, reading, writing and much more. In addition, it is increasingly important to practice collaborative problem-solving skills and to encourage autonomous learning. These skills are becoming more and more important in a constantly changing working environment that is strongly teamwork oriented. Therefore, educational models increasingly require a whole range of different teaching methods, which are alternated in rapid succession. In order to support this spectrum of teaching methods and their alternation, specifically designed room concepts are required. The flexibility of the learning areas plays a decisive role. This enables the spatial conditions to be adapted to different learning situations. In addition, there should be areas for expansion and differentiation in order to be able to implement room-extensive lesson scenarios. In order for the learning areas to be used jointly in an effective way, the connection between them is of importance. Shanghai's pupils are among the best in the world in the fields of mathematics, reading and writing. Finnish pupils are among the international leaders in the classical disciplines such as mathematics, reading and writing as well as in the subject of collaborative problem solving. Therefore, in this paper a selection of school buildings from Finland and Shanghai are compared. The school buildings are analyzed according to the following parameters: the integration of the school building with the local community, the organization of the school building, the arrangement of the learning areas and the connection or separation of the learning areas.

Subsequently, the results will be tested on the basis of a design of a primary school in Shanghai at a specific building site in Shanghai.



III. [1] Flow chart of the thesis structure

1.1. Glossary

OECD

Organisation for Economic Co-operation and Development

PISA

Programme for International Student Assessment. An attempt by the OECD to assess pupils internationally

Classroom Plus

a school design concept with enlarged classroom or a classroom with adjacent group work area

Cluster

a functional unit of 3-6 classrooms, group work rooms, teachers office etc.

Open learning landscape

a multi-functional space with open learning zones that span across all classes

"heart"

a common space in between classrooms for extending the teaching area or as communicative space

urban integration

integration of other educational functions into the school building

Functional conception

layout of functional categories of rooms

Spatial communication

the connection between rooms respectively spaces

Passive spatial-visual communication

a visual connection between rooms through windows, glass walls etc.

Active spatial-visual connection

a pedestrian access from one room or space to the other. For example a door or foldable wall.

1.2. A Brief comparison of Finland and Shanghai Schools

1.2.1. Collaborative problem solving as tested by PISA

The OECD PISA (Programme for International Student Assessment) rankings are a series of tests performed by a large sample of 15-year-old students all over the world. Among this series of tests, they measure skill levels in science, reading, mathematics and collaborative problem solving. In the year 2012, Shanghai was the first chinese city to take part in this test and instantly gained the top position in fields of science, reading and mathematics. In the follow up study 2015, Shanghai participated among a group of four major chinese cities and jointly they were ranked in the top section in the same three disciplines. Regarding the collaborative problem-solving skills, students from China are ranked average. In a post-industrial economy collaborative problem-solving skills are nonetheless crucial. As modern societies require people to collaborate with one another. This is where the comparison with Finland comes in. Finland was constantly ranked among the best in Europe and worldwide since the beginning of this rankings. And finnish students do not only rank high among the three classic-industrial major skills but also regarding collaborative problem-solving. In the 2015 ranking Finland in science, reading and mathematic where a bit disappointing, because they where not that excellent as in previous years. On the other hand it was the first year in which collaborative problem-solving was examined and there finnish students ranked high. They assessed how well students work together as a group as well as their attitudes towards collaboration. Indicators include the average performance of students in collaborative problem solving, the performance in problem solving relative to the performance in mathematics, reading and science, and the performance gap of boys who lag behind girls in all 52 economies who participated in this module. [26] [27] [28]

Interesting is how low the performance is in comparison to math, reading and science skills. This is an issue which has to be taken seriously, because of the changing work requirements where math, reading, science and collaborative problem-solving is equally important. This is due to the fact of the tendency of problems becoming increasingly complex that people have to collaborate in order to efficiently tackle them. In this context the gap between the collaborative performance of Chinese boys and girls is especially concerning. [26] [27] [28]

1.2.2. Comparison of Finnish and Shanghai school structure

Finnish schools operate according to the maxim that the potential of each student should be maximized. The focus is on supporting pupils and helping them maximize their potential. Every pupil should experience success and joy in learning.

The schools are mainly financed by public funds. This enables the state to control the development of the schools, mainly through information, support and funding. This system is based on nationally defined framework conditions and the core curriculum. Within this framework, the education providers have a relatively large degree of autonomy in the implementation of the curriculum. For example, schools can decide for themselves how large the class sizes are or the way they group students. As long as the basic functions laid down in nationally defined guidelines are fulfilled, schools can implement their educational programs according to their own visions. Teachers can decide on the teaching methods and materials themselves. The national core curriculum comprises objectives as well as the core contents of various subject areas. It also includes educational guidance. The curriculum also covers principles for a good learning environment, teaching methods and concepts of learning.

The education providers create their own curricula from the national core curriculum. This allows the curriculum to respond to regional requirements. [24]

The Chinese government believes in education as the basis for national development and modernization. This is why it assigns a high priority to education. The curriculum for basic education follows a holistic approach to personal development. It focuses on moral values and ideological education as well as intellectual and physical development. The national curriculum for primary and secondary education defines the framework conditions, the subject matter and the distribution of lessons. At the provincial level, the national curriculum is then adapted and implemented to local conditions. Based on the provincial curriculum, schools can develop and offer their own courses. Within China, Shanghai has long been a pioneer when it comes to educational reforms. Shanghai has often been given the opportunity to experiment with educational reforms before the rest of China. During the education reform of 1998, emphasis was placed on the active participation of students in the classroom. This is intended to promote their creativity and self-development and to help them reach their full potential. Schools were encouraged to develop their own curriculum. Museums and other "youth education bases" became an important part of the educational landscape.

Together with the development of the curriculum, teaching methods were reformed. The intention is to have more group work during the lessons. [25]

1.3. Methods of the study

The literature review focuses on educational environments in school design. Here different organization concepts are reviewed. Also different space offerings in a school building are discussed in detail.

For the case study a selection of six school buildings from Finland and Shanghai are analysed. The buildings will be examined regarding its conception and quality. There the focus is on the different educational spaces, their interrelation and the qualities of the spaces. Moreover, there will be descriptions of design parameters, urban inclusion parameters and possible adaptations. This Analysis will be done in a visual manner.

The design proposal tests the findings from the literature review and the analyses of the case study. A elementary school building on a specific building site in Shanghai is to be designed.

Chapter 2: The modern school design theory

2.1. A good learning environment

The study: “The impact of classroom design on pupils’ learning” is a multi-level, holistic analyse. [30] The authors themselves state that it is challenging to describe the impact of design on its users. Nevertheless, they have taken a radical new approach, where they did not start up with the measurable dimensions of heat, light, sound and air quality. But they started with the simple notion that users perceive a built environment as multi-sensory experience, which are then resolved in the users’ brain. Healthy, natural elements in the environment are particularly appealing. According to Roll, the positive reaction to the natural elements is “hardwired” in our brains. Furthermore, the interaction or adaptation of the environment was addressed. This is about the individual adaptation of the environment to our preferences. As a last parameter, the different levels of stimulation and how they affect the pupils were discussed. They developed three design principles:

- Naturalness: light, sound, temperature, air quality and links to nature
- Individualization: ownership, flexibility and connection
- Stimulation in an appropriate level: complexity and colours

The Naturalness principle refers to the physical conditions in a space. There are other studies which describe this factor in more detail. Regarding daylight, it is known, that it regulates the wake-sleep cycle of the human body. But how much daylight is the optimum for a learning environment is still an area of active research. Nevertheless, the Barrett et al. study found, that high quality of natural and electrical light in conjunction with no direct sunlight is the optimum. This is due to the fact that direct sunlight may cause a glare problem. About the classroom acoustics important metrics were described by Crandell and Smaldino and it was pointed out that the noise levels in classrooms are usually far from optimal by Picard and Bradley. Also, the ventilation rates are poor in many learning environments up to a point of health risk. [30]

The Individualization principle rates how well the space meets the needs of this specific group of children using it. In this regards the ownership element is how personalized and identifiable the classroom is. There are argues that intimate and personalized spaces are better for absorbing, memorizing and recalling information. Moreover, the children can develop a sense of responsibility if they feel ownership of their classroom. It is also found that if classrooms and hallways feature projects and products of children’s intellectual engagement this is promoting greater participation and involvement in the learning process. And the flexibility parameter is a measure how the room is adaptable to changing pedagogy and how well the room serves the needs of a particular age group. In order to allow different activities and serve diverse needs of the users within the classroom this space has to allow this flexibility. [30]

The last parameter of the individualization set is the connection parameter. This one describes how well one space is connected to the rest of the school. As

described by Tanner and Zeisl at al. clearly marked pathways to activity areas improve the utilization of space and performance metrics. In the Barrett et al. study they found, that all three parameters of the Individualization theme are significantly positive correlated. [30]

The third principle is the Stimulation. This relates to the vibrance and excitement of a learning environment. Within it the colour parameter is a collection of all the colour elements in a space. [30] The Complexity parameter describes how the different elements in a room are related to each other in order to generate either a visually coherent and structured or a chaotic and random environment. Focusing the attention is highly important for learning. This means an environment which allows focused attention and does not overload the children with visual features is especially important for young children. As children are still developing the ability to actively maintain task goals and ignore distractions. Furthermore, it is suggested, that the room colour has an effect on emotions and physiology. This can cause mood swings and an impact on performance. However the findings of the Barrett et al. study describe an intermediate level of this two parameters as optimum. This means high complexity and low complexity classrooms have scored poorly, while intermediate values of complexity scored highly. [30]

The findings of this principles and parameters in the Barrett et al. study have been weighted according to their proportion of improvement in pupils overall school grades. The most significant parameter was the Naturalness principle with together 49%. In it the daylight parameter with 21% is the most significant one. Temperature with 12% and Air quality with 16% are reasonable too. The second most important principle is Individualization which accommodates for 28% of the increase. Within it the Ownership with 17% is slightly more important than the Flexibility with 17%. The Level of Stimulation principle with 23% is still important too. It splits the parameters almost equally to Complexity with 12% and Colour with 11% of the increase. However, the parameters of sound quality, link to nature and connection as navigation issue have shown only minor impact. In terms of the individualization parameter it has been confirmed that a permanent individual display of artworks, photos and crafts are a good way to promote a sense of ownership. Moreover, they found that distinct architectural characteristics play a role in the perception of ownership. This can be a unique location, bungalow or separate building or also the shape of the classroom for example L-shape, T-shape. Also, small elements play their role here like embedded shelves for display, intimate corner, facilities specifically-designed for pupils or distinctive ceiling pattern etc. The classroom needs to reflect whether there is primarily play-based learning or more formal learning. For the play-based activities the room needs a variety of learning zones. Whereas in a formal set every student has to properly and easily see at the blackboard. This two combinations were mentioned because they are the predominant learning styles in the UK where this study is formulated. In other learning environments the conditions have to be specific for the main style. [30]

However, this view of the classroom, reduced to specific numerical values, is only of limited significance. It only depicts the status quo and derives numerical values within the range of variation of existing classrooms in the United

Kingdom. It is not a comparison of modern school building concepts which create a learning environment adequate to learn the different skills required in a contemporary working environment.

Secondly, the results themselves should be questioned. For example, it should be questioned whether the acoustics of the classroom are truly so irrelevant, or whether the tested classrooms have comparable acoustics. The realization that good lighting, a sufficient amount of fresh air and a comfortable temperature are important for a good learning environment is not surprising. These parameters should be a basic feature of any decent modern building.

2.2. Modes of learning

In today's economy, there is an increasing demand for creative thinking employees with teamwork and cooperation skills. The OECD agrees with this, which is why it has introduced the category of collaborative problem-solving into the PISA tests. To develop the necessary social skills, group work must be part of the curriculum. During group work, important skills such as conflict resolution, cooperation and the development of lasting bonds can be trained. For good teamwork, however, the ability to work independently is also required, so that the tasks can be split up. This must also be practised. This results in a range of learning modes such as, lecture, group work, self-study, etc., which together comprise the lessons.

Traditional frontal teaching refers to lessons in which all children in a class are confronted with the same subject matter and a single teaching method at the same time. But although a class of children has an almost homogeneous biological age, every child is different. Each child not only has its own interests, but also its own way of acquiring knowledge. For example, about 12% of the pupils focus on auditory learning, they are particularly good at remembering what they have heard. A larger part of 35 to 40%, however, learn best when they see something, i.e. are visual learners. For a further 30% a tactile strategy, in which they learn with their hands, for example by writing, is effective. The kinaesthetes, on the other hand, have to move while learning; they make up 15 to 20% of the pupils. [Doberer p.203] [31]

There is another reason why the concept of frontal teaching is suboptimal. In this form of teaching, knowledge is mainly brought to the learners from outside. However, this method overlooks the fact that self-initiative is much more successful for learning. It can be assumed that the immediacy of an experience is in direct correlation with the learning success. [31]

Experts assume that we only remember 20% of what we are told, so we only listen. At least 30% of what we see, but 80% of what we say or do ourselves. It is also interesting that we remember 100% of what we have done wrong in key situations. [Doberer p.205] Therefore it is important to create a secure framework

for mistakes and to trust the pupils with more self-initiative. This requires a variety of learning approaches whereby the focus is always on awakening the natural curiosity of the pupils. The frontal teaching, which is important for the introduction to the teaching content, should be supplemented by group work, independent learning and project teaching. The learning can in the best case take place in nature, computer-supported, with the help of books or through an artistic or emotional approach.

This multifaceted approach is considered the most promising by findings from the neurosciences as well as learning and developmental psychology. [31]

2.3. School design concepts

In order to meet the changed pedagogical requirements that a paradigm shift towards more collaborative work requires, school buildings must meet those demands. Consequently, the learning areas must allow variability in the use of different learning approaches and resources. In addition, they must allow diverse self-activity of the students. From a building design point of view, this means above all that sufficient areas and rooms must be created that can be used variably as a single unit and at the same time can be combined with each other. The aim is always to enable learning that allows a rapid change of social settings and methods during the course of the lessons. Social settings in this context mean studying on an individual basis, in small groups (two to four students) or in large groups (classes).

Under these premises three forms of building organisation have developed. This is not an exhaustive list of the organisational forms, these three are mentioned because they are now relatively widespread and well documented in pure and mixed forms.

In the organisation form "Classroom Plus" the classroom is noticeably enlarged or extended by an adjacent group room. The development area is also used as a learning space wherever possible. In contrast, the "cluster" form of organisation combines several learning rooms into one unit. It offers a wide range of different situations in the unit: classrooms, expansion rooms, group rooms, common "heart" etc. Thus, larger classrooms, differentiation and retreat rooms and a common multifunctional centre can be included. With this concept, zoning, transparency, acoustics and fire protection aspects play a major role in the use of the space. An "open learning landscape" is reminiscent of an open-plan office in which several classes learn and live together. In this open floor plan, individual areas are delimited for group work and input sessions. The whole space is structured by the demarcation of individual parts. [29]

2.3.1. Classroom Plus

According to the principle of organizing school in individual classes, only the individual classroom is adapted. This concept is based on an enlargement or extension of the actual classroom. As a guideline, with a class size of 25 pupils and a classroom size of 72 square metres or more, a significant improvement in the flexibility of classroom use for different learning activities can be assumed. This effect occurs because the size of the learning space allows a generous use of space, which in turn allows a differentiation within the classroom. In other words, different learning modes such as frontal teaching, group work and individual work can be realised rapidly within the classroom.

However, this does not necessarily mean that the classroom has to provide the entire space. For example, synergy effects can already be achieved if two adjacent classrooms are connected by a double-winged door or a flexible partition wall. Then the other classroom can be used in times when it is not in use. A group room can also be connected to the actual classroom. This is often implemented by placing a group room centrally between two classrooms. This creates the possibility of synergy effects, as this room can be used as an extension area from two sides. The connection of these rooms is of crucial significance. These partition walls are often equipped with doors and windows and/or extensive glazed walls. This helps to ensure an acoustic separation and at the same time to have a spatial continuum. This is crucial to enable different activities and learning configurations in the classroom and group room in parallel without losing sight of each other. The shared use of a group room by two classes also enables the teachers of those two classes to work together as a team.

However, the immediate proximity of the group room to the actual learning room seems to be essential, because in cases where the group room is not directly adjacent to the classroom, it is often only used as storage space.

Optionally, the learning and teaching area can be extended into the corridor area. The walls should be provided with sufficient windows or glass walls for the visual relations between the classroom and the corridor area.

Another variation of the Classroom Plus model is the possibility to divide a large room into different areas by means of mobile partitions. However, the difficulty is that these should be easy to handle and at the same time provide sufficient acoustic insulation. This is always a balancing act. [29]

2.3.2. Cluster

In the case several learning and teaching rooms with the associated differentiation, living and regeneration areas are combined into a clearly identifiable unit, one speaks of a cluster. More specifically, the following functions are usually integrated into a cluster: classrooms, group rooms, a common "centre", decentralised team rooms for the teachers, special education teachers and pedagogical staff, sanitary facilities, storage, secondary rooms and cloakroom. Clusters are often designed with direct access to the outside space or a balcony. This wide spectrum of functions creates a spatial framework that

offers a variety of situations as a learning environment. This spatial diversity of narrow to wide, introverted to open and individual and communal situations allows for a differentiated allocation of space according to pedagogical requirements in a very fast and precise way. Especially for working in small groups and as an individual, the possibilities offered by mutually usable classrooms, adjacent group rooms which are visually connected, communicative access and recreation areas, balconies, etc. are definitely an advantage. Even area-extensive types of lessons such as station work or simulation games and the like find a suitable environment. In this context, the concept of the "learning office" is sometimes integrated into a cluster. This "office" are workplaces for individual work by the pupils. Sometimes they can be personalised, usually with assigned storage per child, or they can be implemented in a non-personalised way. The "learning office" can be implemented as a dedicated room in a cluster or integrated directly into the common centre, the corridor zone.

Alternatively it can be incorporated directly into the classroom by complementing the school desks of the pupils with dedicated storage. Two to four dedicated workstations are usually grouped together. This grouping can subsequently be used as a starting point for group work. It is important to ensure that there is enough free space in the classroom to form a circle of chairs as a whole class, for example during input and discussion phases. If this is successfully implemented, a change of learning modes between individual work, small group work and large group can be made swiftly.

In most cases, all parallel classes are combined into a socio-spatial continuum. Usually three to six classes. If more classes are combined, there is a slight risk of overloading the common centre. If there are more parallel classes, a double cluster with a partial separation is usually recommended. An alternative model of clusters does not combine classes, but creates networks of subject areas, for example a cluster for languages, mathematics, natural sciences, etc. [29]

2.3.3. Open learning landscape

With the concept of the open learning landscape, the classroom is completely dissolved. Instead of the conventional classrooms, there are multi-functional open learning zones that span across all classes. These zones are particularly suitable for individualised and small group learning. In this open learning landscape, students and teachers choose a suitable location for the particular learning mode depending on the situation. Enclosed rooms are reduced to a minimum. The educational environment consists almost entirely of freely programmable space. Spatial elements provide the creation of different zones and areas. Often it is possible to designate differentiated areas for input areas, open learning areas and group rooms. This zoning and area formation can be implemented in a variety of ways. Fixed walls or glass walls are used as well as mobile partition walls. With mobile partition walls, students and teachers can define their own zones and design their learning and living environment. In the learning landscape, development areas and recreational spaces are dissolved into the overall environment and serve as communication zones. In order not to get lost in this large, open space, spatial units of usually three to four classes

are often formed, which then serve as a "home base". This concept of the Open Learning Landscape is especially designed for teaching models that aim at independent learning of the students. [29]

2.4. Other spaces in a school

2.4.1. Corridor as learning space

The corridors of a school can, despite strict fire safety regulations, serve to a certain extent as an extension area of the learning room. There are many possibilities to soften the sharp border between classroom and corridor. A classroom door that is always open is a step in this direction. From a building point of view, a classroom with one or more doors and windows or gall-walls to the corridor is a little more open. The dissolution of the boundary between classroom and corridor can be pushed up to a completely open spatial structure, which is then more oriented towards the image of a street in the city.

The corridor area can be designed in many different ways. It can be designed with conversation corners, recurring seating-table combinations or even with lounges. The dissolution of the boundary between classroom and corridor can be pushed up to a completely open spatial structure, which is then more oriented towards the image of a street in the city.

The corridor area can be designed in many different ways. It can be designed with conversation corners, recurring seating-table combinations or even lounges. Only aisle areas with a very high traffic volume, such as the entrance area of the school, cannot be used as learning or recreation areas.

These building measures are only of limited help if the classroom doors are then locked. Doors are sometimes set up in such a way that they can only be opened from the outside with the teacher's key. This is done with the justification that this is a protection against vandalism and amok. This protection is however an illusion, since both an eager vandal and the frenzied attacker will hardly be stopped by a locked door. If they really want to and are prepared for it, they can break down doors. Conversely, a locked classroom door before and during lessons destroys the sense of belonging and responsibility towards the facilities by the pupils. In addition, unlocked doors make it possible to start lessons more organically, because there are no traffic jams in front of the classroom door. A smooth transition between work and break phases can also be achieved in this way. [29]

2.4.2. Complementary space offer

Toilet facilities are a fundamental part of every building. For many students, central toilet facilities in the school are anxiety-stricken. These are hardly supervised and can almost never be controlled. In Finland, a decentralised

arrangement of single-room toilets in the learning and recreation areas has become established. This solution prevents vandalism and bullying in toilet facilities. Simply by not having more than one student in a single toilet room. Due to the decentralised arrangement with a clear allocation to a group of learning rooms, it is also possible for the students to take responsibility for these toilets.

An integration of a full-day offer in a school can be done in many different ways. For the consideration of a specific spatial integration of the all-day offer, a concept for the implementation is important. The biggest differences occur depending on the obligatory aspect of the all-day program for the pupils. Thus, a distinction is made between a mandatory, partially mandatory, open type of all-day school, as well as a half-day school with mandatory afternoon classes and a wide range of study groups. In the mandatory form, all pupils take part in the full-day programme. This offers the possibility of a deeper interlocking of teaching and supervision. Partially mandatory form means that not all classes of a school take part in the full-day programme, while open form means that the pupils are free to choose whether or not they accept the offer. Spatially, the all-day programme can either be integrated into the school facilities, whereby synergy effects are created, or it can be completely separated. In case of a spatial separation, there is an additional need for dedicated rooms. This can lead to a corresponding under-utilization of the school facilities and the additional care facilities. The separation is also temporal. Thus, school takes place in the morning and early afternoon, and after that an extra-curricular care offer is taken. These external offers are manifold. It can be tutoring with a private teacher, a music school, sports club, scouts, youth centre, after-school care, art classes, craftsmen, etc. In this separation model there are divided responsibilities and facilities.

On the other hand there is the integration model. The prerequisite for this model is that all pupils of the school must attend the programme. Then there is the possibility to introduce a rhythmic daily schedule, in which calm and active, concentrated and relaxing phases are distributed throughout the day. In order to implement this rhythmic system, a multi-professional team of teachers, educators, social workers and caregivers work together. This abolishment of the separation of classroom and day-care areas means that almost all rooms can be used for both activities. This way, for example, recreational and differentiation spaces in the learning and teaching areas can be used throughout the day. The common areas outside the actual classroom areas can also be activated for teaching together with low-threshold additional rooms such as exercise rooms, work rooms, open student laboratories, robotic stations, theatre stages and similar facilities that would otherwise be part of the space available for afternoon care. On the one hand, this multi-use allows a better utilization and an expansion of the available space. In order for this to work seamlessly, sufficient storage space must be available to keep the utensils for this versatile usage on hand. The teachers' rooms can also be combined with the rooms for the support staff. This is also an advantage for effective cooperation and team building.

This concept of integration of school and extracurricular supervision can also

promote non-intentional learning, in addition to the intentional learning that is otherwise strongly supported in school. With non-intentional learning is meant, not exclusively, but above all the learning of social behaviour in dealing with each other. The school building is a living space and as such the existing space must be usable not only for the purpose of formal learning. Multifunctional areas or a large amount of space is needed for learning, playing or resting. For example, the canteen can be combined with the assembly hall. Other functions are then linked to this room, such as food distribution, preparation kitchens, storage and cold storage room, waste disposal room and the like. But with this multiple occupancy, a social space is created, which is very interlocked with the life in the school and forms the social heart, so to speak. This space is not only a place to eat and drink, but also a place where pupils can meet, play and communicate. Here the performances of a play can take place or parties can be celebrated.

The connection between school and day-care centre can, with a solid spatial connection, lead to something better than the sum of the individual parts. At the same time spatial resources can be used more efficiently and an enriching environment for the pupils can be created. [29]

2.4.3. Subject rooms

The natural science subjects should complement each other in order to gain a deeper understanding of scientific methods. After all, the world is not ordered by subjects, but demands a holistic approach. The intertwining of scientific subjects to enable interdisciplinary perspectives is accompanied by a combination of theory and practice. The challenge is to learn how to convey the specifics of the respective subjects and at the same time learn the cross-disciplinary relationships. To achieve this, a mix of introductory lecture and own or guided experimentation seems to be promising. This experimentation can be done individually or in groups. The spatial environment must meet these requirements. This means no fixed tables or chairs, but rather movable furniture. Expensive and less robust high-tech equipment may be interesting for demonstrations, but in many cases independent experimentation with simple materials allows a more effective familiarization with scientific and technical concepts. Experience has shown that even in the field of chemistry up to high school graduation, all experiments can be carried out without any hazardous substances.

This raises the question of whether a special room with laboratory facilities should be set up at all. Alternatively a multifunctional workshop can be set up in which pupils can create, temporarily store and carry out experiments largely independently over a longer period of time. Also there are differences in the requirements for different school levels. For example, science lessons in the first six grades can take place in the regular classroom. As long as there is sufficient space in the learning area, a laboratory trolley, for example, can be used to allow pupils to experiment easily and independently, both alone and in small groups. In the upper school levels, due to the higher requirements, special classrooms should be provided for science lessons. A crucial factor

in the design of these rooms is whether groups of pupils are allowed to work independently on experiments, robots or other research set-ups. For this purpose, suitable safe areas must be provided. For example, this can be implemented as an experimentation hall, or integrated into the Common Centre as experimentation workstations. Other concepts are also possible. The most important thing is that access is made possible with low thresholds while at the same time guaranteeing a safe environment. Sufficient storage space for the interim storage of long-term projects must be ensured.

However, multi-purpose rooms can not replace all special rooms, but there should always be a consideration whether a special room or rather a multi-purpose room is more suitable. A mixed form is also conceivable. For example, a music room that is fitted with sound insulation or a technical workshop with specific equipment for processing wood, metal, ceramics or electronics should not be a multi-purpose room. [29]

2.4.4. Teachers' room

The teachers' room is a work, meeting and storage room. But it is also a team room dedicated to teachers, school social workers, pedagogical staff, therapists and trainees alike. These areas for school staff do not necessarily have to be concentrated in a single room. The functional requirements for these rooms can be roughly divided into the categories of social exchange among the pedagogical staff, meetings with other colleagues or parents, individual work, filing, quiet retreat area.

Communication with colleagues can take place in a communicatively designed kitchenette, cafeteria or the like, ideally with an outdoor area designed as a terrace or balcony. This should give the teachers the opportunity to meet and exchange informally during breaks or teaching-free hours.

For meetings between teachers, meeting areas that can accommodate 4 to 6 people are to be provided. These can be located either centralized or decentralized in the team bases. At the same time, it is necessary to make sure that enclosed meeting rooms are made available for confidential discussions with parents.

Teachers need an undisturbed workplace, e.g. to prepare or follow up lessons. In half-day schools, teachers were often expected to work from home. This homeoffice leads to suboptimal conditions for the undisturbed work of the teachers in the school. In an all-day school this is simply not possible. These work areas can be implemented either through a pool of freely assignable, non-personalized workstations at a central location or through the integration of personalized workstations in the team stations of the class or subject room clusters. A balance must be weighed up between decentralized or central location, arrangement close to or remote from the pupils and personalized or non-personalized workstations.

The function of the filing system is, so to speak, a personal cupboard/trolley to store things temporarily. If a personalized work area exists, it makes sense to combine these functions spatially.

The rest area can be used essentially for regeneration from the sometimes very

stressful lessons.

No separate room needs to be created for conferences. Multifunctional areas can be used for this purpose, which are used for educational purposes during regular schooling.

The quality of the workplace at a school is of utmost importance. Good workplaces also ensure better teacher health and thus less absenteeism. [29]

2.4.5. Common areas

A school community must always be something that can be experienced, especially if there is more focus on individual or small group learning. In order to promote the school community experience, morning meetings, guest lectures, theatre and music projects and the like can help. Spatially a central common communication and movement space, a “heart”, is needed for this. This central “heart” can unite or be connected to a variety of functions. For example the following functions can be included: forum, foyer, cafeteria, library, self-study centre, retreat area, sports and movement areas, open space.

A separate assembly hall mainly serves as a place for events and presentations and is therefore rarely used in daily school life. Therefore a multi-use of this space is advisable, thereby serving as a forum, the “heart” of the school. A functional combination that is suitable for this is, for example, an assembly hall with canteen and stage. This way the forum can be used for assemblies, central meeting point, canteen, learning place, as well as for theatre and music performances. The stage can act as a link between areas and flexibly separate or connect them. In the Saunalathi School in Espoo Finland, for example, it is implemented in such a way that the heart of the school is connected to the music room via the stage. This allows the stage to be played from both sides. In addition, when the stage is closed and the rooms are separated, it can be used as a dance and movement space in this central location. [29]

2.4.6. Schoolyard or living space

Schoolyards offer a remarkably high density of different functional facilities. They are a natural space for movement, at the same time a social meeting place and rest area, nature and traffic space. The different functions fall into two categories, lesson-related zones and age-appropriate movement and recreation areas. The outdoor space used for lessons might incorporate theme-related work areas such as school garden, stone path or tree nursery. Open-use project areas such as work areas for art and technology lessons, a “green classroom” in which the care of plants by pupils takes place under the supervision of teachers, open-air stage or presentation path are also possible. For these outdoor classroom areas, however, water and electricity must be provided.

In the movement and recreation areas of the outdoor space, there can be a range of play and exercise equipment such as table tennis, swings, climbing walls and so on. In addition, areas used for physical education can also be used as play and movement areas during breaks. There should also be recreation areas for sitting and regenerating. For this purpose umbrellas, sunshades and benches

with or without work tables can be provided.

It is important for the design of the outdoor space to create a balance between movement, rest, meeting and retreat. Therefore it is crucial to zone the exterior space and to differentiate the different zones spatially.

The inconvenience of corridors leading through the outdoor space can be perceived as a luxury of experiencing nature. Tezuka argues that a school building must be functional, everything must remain pragmatic and people must have a feeling of security. But is it really a pleasant building when there is one little room per teacher, all rooms are connected indoor, nobody gets wet or has to leave the inside of a building, and everything is convenient and functional? Tezuka argues, that there is more to a pleasant feeling in a school building than a convenient, functional and efficient building. A connection to nature through the experience of wind, the weather is necessary. He once asked his audience during a lecture about school buildings and education at the OECD in Dublin, what is their favorite educational building in Ireland. The majority answered with the Trinity College in Dublin which is a old campus where one have to step outside every time one changes the room. He therefore states that people do not want to and do not need to be always protected. "It's not a question of efficiency. We as people are not machines. And we are not out of sugar." He continues that it is all about the direct experience of the weather and nature. As people love this "inefficiency". Moreover, he argues that the matter of efficiency shouldn't be the sole focus for school design, because also education is an efficient matter and pupils love what they are not allowed to do and for this has to be space. [3]

2.5. Urban integration of the school building

The school building can also be an important spatial resource for the community besides its function as a school. For example, evening classes can be set up in the school building for the further education of adults. Or sports clubs can use the sports hall for their training. Other possibilities include the canteen serving local residents, the extension of the library into a district library or the assembly hall open to local amateur play groups, music bands and the like.

At the same time, classes will be held outside the school building every now and then. For example to learn in the park or to visit a museum. In this way the school and the surrounding city will be intertwined without completely dissolving the boundaries. When partially opening the school building for external use, a clear boundary must be established between public and purely school use. For this, it is crucial that the public areas can be separated from the rooms used purely for school purposes. In addition, sanitary areas must be accessible from the public part and lockable storage cabinets in the public areas must be provided. The intertwining of the school building and the urban environment is about achieving as much openness as possible and as much seclusion as necessary. [29]

2.6. Summary of literature review

A school is a place where knowledge and skills are passed on to the next generation. Among the most important skills are not only mathematics, reading and writing, but also collaborative problem solving. This is also the view of the OECD, which has introduced a category on collaborative problem solving for the first time in its 2015 tests. In the last few PISA tests, Shanghai and Finland have consistently ranked among the world's top performers in the mathematics, reading and writing categories. In addition, Finland is in the top group in the collaborative problem solving category, while Shanghai is in the middle of the field. Therefore, in the next section some school buildings from Finland and Shanghai will be analyzed and compared.

From the literature review it becomes clear that collaborative problem solving skills can be developed as part of any lesson. Not only that, but it can also increase the learning success if implemented correctly. To this end, a wide range of teaching methods is used in rapid succession to support learning. However, this also means that the classical classroom cannot meet these requirements in the best possible way. A classroom designed for frontal teaching is spatially cramped and self-contained. The cramped nature of the classroom makes it difficult to switch quickly to another learning formation, especially if there are no extension areas in the immediate vicinity. Three concepts have emerged, which use different approaches to meet the requirements of a classroom with rapid change of learning formations. Mixed forms of these concepts are also possible. The concept of the cluster combines several classrooms, extension rooms, lounges, etc. into a spatially functional unit. The Classroom Plus model is based on an extension of the classroom by increasing the area or by adding a group work room. The third concept is the Open Learning Landscape, in which the enclosed rooms are reduced to a minimum and instead a wide variety of room situations are possible in a large room. These room concepts have some common features. In all concepts, several learning areas are grouped together to allow their joint use. The spatial relationship between the individual learning areas is of some importance in order to enable the joint use of several learning zones at the same time. Different spatial situations are created for the requirements of different learning modes. The corridors will be used multiple times as recreation, play and learning areas. For this purpose, the corridors are designed accordingly, transferred to a common center or completely dissolved into the learning room. In the analyses in the next section, the selected school buildings will be examined to see how the learning areas can be combined, how the spatial connections between the learning areas are implemented and how the corridor area is multiple used or dissolved.

Another interesting point seems to be the integration of the school building into the district. Especially the opening of the building for external uses and functions. Especially if the external use is aimed at independent lifelong learning and the formation of a community, this represents an added value for both the school and the neighborhood.

Chapter 3: An analysis of school buildings in Finland and Shanghai

3.1. Selection of school buildings in Finland and Shanghai

The selection of school buildings follows a weighted list of criteria. This catalogue contains different parameters which should ensure a selection of modern, innovative and well connected school buildings. Only school buildings built between 2007 and 2018 were reviewed in order to have as up-to-date a list of examples as possible. Furthermore, sufficient material on the school building had to be available to be taken into consideration. The assessments were based on a first rough review of the available material, whereby a distinction was made between "not applicable", "applicable" and "very applicable". Six school buildings were selected, three each in Shanghai and Finland.

The most important category of these was classroom innovation. This means how flexible the classrooms appear to enable lessons to be held in rapid changes of learning modes. The classrooms should not be looked at in isolation but in the context of the adjacent spatial structure. For instance, is it possible to combine learning rooms, are there additional learning spaces in the immediate vicinity or can the corridor serve as an extension of the learning area?

The second most important categories are urban educational functions and open learning spaces. The category urban educational functions describes whether the school exists as an isolated structure in a city district or if the school complex takes on additional functions. In other words, those city district functions that can also be used by non-pupils. This category mainly refers to kindergartens, district libraries and similar facilities. This integration ensures a richer interaction between the city district and the whole school complex.

The open learning spaces describe continuous spatial structures with strong connections between the areas. This is in particular concerned with those spaces that are not explicitly assigned to a specific group of learners. These spaces are important because they also allow for class or grade overlapping learning. They should also allow different group constellations, from self-studying students to small groups with work assignments to cross-class lectures.

The categories weighted with the lowest value are mixed-user function and design quality. Mixed-use function means whether one or more rooms can be used for a variety of purposes. This requires a certain amount of spaciousness to be able to accommodate more than only a single class. It also requires a not specified function assignment. This is especially important so that the furniture can be designed flexibly to allow a wide range of scenarios.

Design quality basically describes the sojourn quality in the rooms and the aesthetics of the school. Here it is especially about the naturalness of the surface materials applied. This is particularly important because people feel

more comfortable in an environment made from natural materials such as wood. The structuring of the surfaces and thus their stimulating effect also play a role. However, all these aspects should be in proportion and not get out of hand. The aim is to create a calming atmosphere in rooms which have a certain potential for self-appropriation and at the same time include slightly stimulating elements. The external appearance also falls into this category.

set of criteria	weight [%]	Saunalathi	Kariston	Tuupalan	Tongji	De Fu	Concordia
urban edu function	20	••	•	••	-	-	-
mixed-user function	15	•	•	•	•	••	•
classroom innovation	30	•	••	•	•	•	•
open learning space	20	•	••	•	-	•	•
design quality	15	••	•	•	••	••	•
built 2007- 2018	-	•	•	•	•	•	•

III. [2] List of criteria used to select school buildings from Finland and Shanghai

3.2. Analyse Methods

Different analysing methods are applied to these selected school buildings with regard to the learning locations in different scales. This is a brief overview about the methods applied. More detailed description can be found following this paragraph.

First, a data-sheet with basic information like location, architects, year of construction and that sort of thing is given. Furthermore, a graphical analysis of the functional conception is made to get an overview of the functional areas and their relation. This is followed by empirical analyse in a descriptive manner about the conception, urban integration and functional concept of the school building as well as the spatial and design concept of the educational spaces.

The organization and circulation, as well as usage and spatial communication, is treated by means of graphical analysis. This visual approach was chosen for better comparability between the different school buildings.

3.2.1. Functional Conception

The focus of the diagrams on the functional conception is the spatial constellation, room sizes and relations between the rooms — every colour in the plan represents a category of room usage. For this, the method developed by Hirtenlehner in his master thesis for the visualization of relationships between functional groups of school buildings is used. [cf. Hirtenlehner, 44-46] The base of the categorization of the individual spaces is their purpose of usage. These categories enhance the comparability between the school buildings. Because of the varying educational levels of the selected schools, these buildings do not follow the same spatial concepts. However, with these sets of functions, the focus is no longer on particular spatial programs, but on the conception of casual relations between categories of areas. The colouring of the areas allows varied interpretations, especially in the context of extensive usage regarding circulation areas or the foyer as educational spaces. Though, in open spaces, the border between regions designated toward different uses should not be decisive.

The classification concerning the eight groups is according to the following four main categories: shared educational spaces, educational spaces, common functions and usable area.

In the category shared educational spaces all those learning areas are summarized which are shared by the whole school such as: sports facilities, workshops or laboratories. Furthermore, this category is split into a literacy and a creativity part. The literacy section is targeting spaces in which pupils are becoming proficient in a set of skills and gain specific knowledge. Likewise, the creative part is about a genuine task like creating, playing music and discovering. Educational spaces are all generic areas for learning. This category is divided into an individual and a community section. The distinction is made on the basis of the different learning modes. The subcategory community contains the following functions: multifunctional area, break room, learning zone and group room. In the subcategory individual, the following functions are grouped together: classroom, educational space, appendix and areas like that. The separation allows comprehending the area ratio between enclosed learning environments and open multifunctional learning spaces.

Common functions include both neighbourhood functions such as kindergarten, music school or district library, under the subgroup urban, as well as administrative functional areas, in the eponymous subsection.

The cooperation between common urban functions embedded into a school building and its vicinity becomes visible by the location of these specific groups. The position of the administrative areas tends to be completely separated, centralized or decentralized.

The useable area contains spaces exclusively used as circulation or technical demands.

Listed below are all coloured groups with a shorthand description of the containing functional rooms.



[Blue dark] Shared education spaces — literacy

- sport area
 - gym
 - equipment room
 - gymnastics room
- therapy area
 - rooms for pupils with physical and psychical disabilities
 - rooms for psychical and social care
 - doctor's room
- specialist class
 - natural science class
 - humanities class
 - language class



[Blue light] Shared education spaces — creativity

- creative spaces
 - crafts room for textile/technical work
 - crafts room for specialized class
 - studio for art class
 - IT room
- hall / multifunction hall
- library / media library
- theatre / music room
- rehearsal room



[Green] Education spaces — individual

- classroom
- educational spaces
- appendix
- educational spaces for people with disabilities and special needs
- kindergarten and infant groups
- preschool class



[Green light] Education spaces — community

- multifunctional area
- learning zone
- break time area
- group room



[Pink dark] Common functions — urban

- community centre
- youth centre
- miscellaneous after-school functions



[Pink light] Common functions — administration

- school management / administration
- staff room
- teacher workstations
- team room
- archive
- teaching materials and copying room



[Yellow] Usable area — circulation

- entrance area
- hall and corridor
- stairs and elevator



[Purple] Usable area — technical

- technical rooms
- sanitary facilities
- economic areas
- caretaker's flat

3.2.2. Empirical-descriptive analysis — project and educational spaces

This descriptive method is based on a modified form on the method used by Altenmüller for the evaluation of school buildings. [cf. Altenmüller, 101]

The analysis first describes the circumstances and general conditions of the building's creation. Then the relationship between the building and the surrounding city is examined. A special focus lies on the integration of community learning facilities for lifelong learning into the urban fabric. This is also done on the basis of a site plan. In addition, the school grounds and the facilities located on them are described, such as sports ground, schoolyard, learning areas, etc. Then the building typology and the functional organization is explained. In addition, the spatial configuration and the design concept of the

learning areas are described.

conception of the school building

- development history
- social, economic and temporal context of the construction
- construction method

urban integration

- context of the school building
- integration of urban educational functions
- outdoor learning spaces and sports facilities

functional concept of the school building

- building typology
- functional organization, circulation and spatial relations
- potentials for mixed-use of areas

spatial concept of the educational spaces

- organization and features of educational spaces
- learning areas — spatial specifics and equipment
- flexibility — adaptability for a variety of learning modes

design concept

- transparency between related educational spaces
- potential of identification and adoption of the classroom/home base
- atmosphere and spatial experience — materials, colour, light, stimulation and

space density

- informal learning experience through the building design

3.2.3. Building organization and circulation

For this analysis, a method is used based on tools developed by Altenmüller [cf. Altenmüller, 102-106] in the course of her dissertation and adapted by Hirtenlehner [cf. Hirtenlehner, 48-51].

This presentation method provides an overview of the building organization and the course of the primary or secondary corridors. Expansions respectively upgrades of the corridors are highlighted in colour. This is done in order to show a holistic picture of the different qualities of the route through the building. In addition, areas of predominantly extracurricular or shared use are highlighted. For better comparability, the insights gained are abstracted to five pictograms. Listed below is the entire evaluation scale on organization and circulation with the corresponding pictograms.

Public appearance



introverted building



mostly introverted building



mostly extroverted building



extroverted building

Circulation



decentral entrance with direct access to building parts



decentral entrance with independent function units



central entrance with limited decentral access to independent building parts

Usage of circulation



small expansion of hallway to education area



medium expansion of hallway to education area



big expansion of hallway to the education area

Access to building parts



completely independent circulation



mostly independent circulation



limited independent circulation

Part for extern usage



low availability



medium availability



high availability

3.2.4. Usage and spatial communication

This analysis once again is a method based on tools developed by Altenmüller [cf. 2007: 102-106] in the course of her dissertation and adapted by Hinterlehner [cf. 2018: 48-51].

This scheme is mainly concerned with the communication between the learning areas. For this purpose, spatial-visual connections between the classrooms, marked in grey, and the educational areas in front of them, marked in yellow, or the learning rooms among themselves, are shown. A distinction is made between active and passive communication. In this context, active communication means that at this point, the separation of rooms can be overcome, thus creating an open, continuous learning area. For example, it could be a wide door or folding wall to another learning area. This separation can be actively changed.

Passive communication, as it is used here, is just a line of sight. It cannot be changed, or only to a limited extent, though it offers a permanent possibility for active communication. Examples are windows between learning areas or galleries.

The school buildings are qualitatively evaluated on the basis of this analysis, which is illustrated by the five pictograms. Listed below is the entire evaluation scale on usage and spatial communication with the corresponding pictograms.

Passive spatial-visual communication



no passive communication



low passive communication



medium passive communication



high passive communication

active spatial-visual communication



no active communication



low active communication



medium active communication



high active communication

circulation as educational space



no educational use of circulation



low educational use of circulation



medium educational use of circulation



high educational use of circulation

transparency



low spatial interrelation



balanced spatial interrelation



high spatial interrelation

connection of educational spaces



weak link of educational spaces



mostly functional link of educational spaces



spatial and functional link of educational spaces

3.3. Cases in Finland

3.3.1. Saunalahti School - Espoo

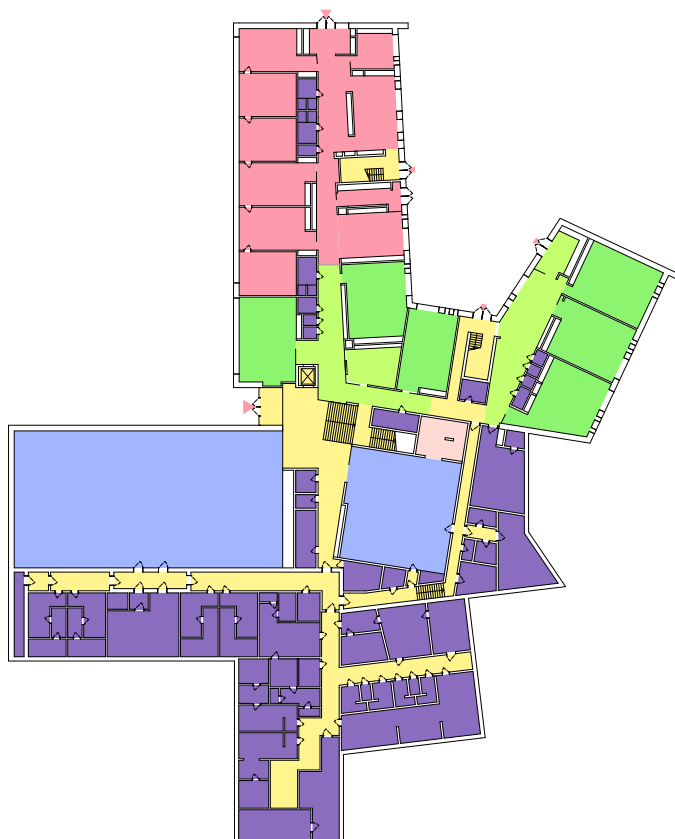


Ill. [3] outside view of Saunalahti school

Location:	Espoo / Finland
Year of completion:	2012
Architects:	VERSTAS Architects



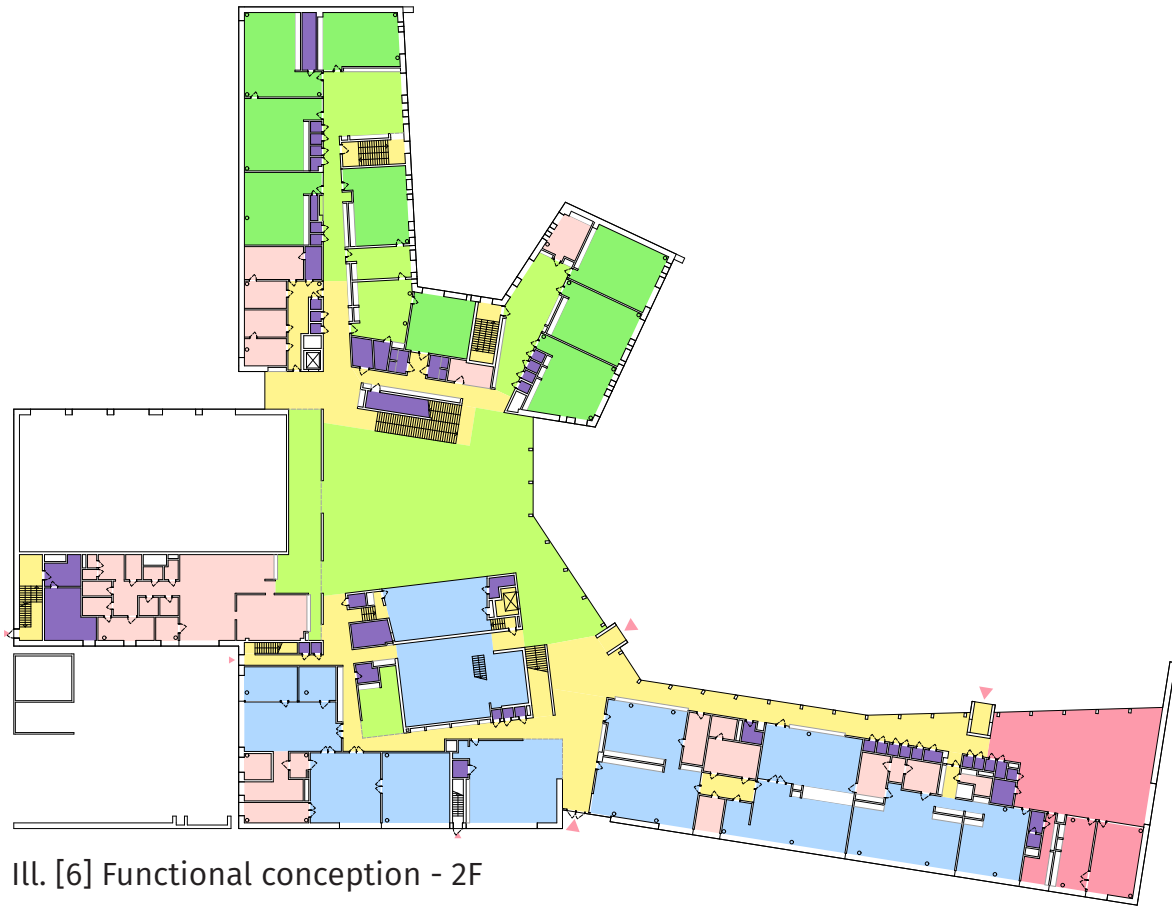
Ill. [5] site plan of Saunalahti school



Legend - functional conception

- Shared education - literacy
- Shared education - creativity
- Education spaces - individual
- Education spaces - community
- Common functions - urban
- Common functions - administration
- Useable area - circulation
- Useable area - technical

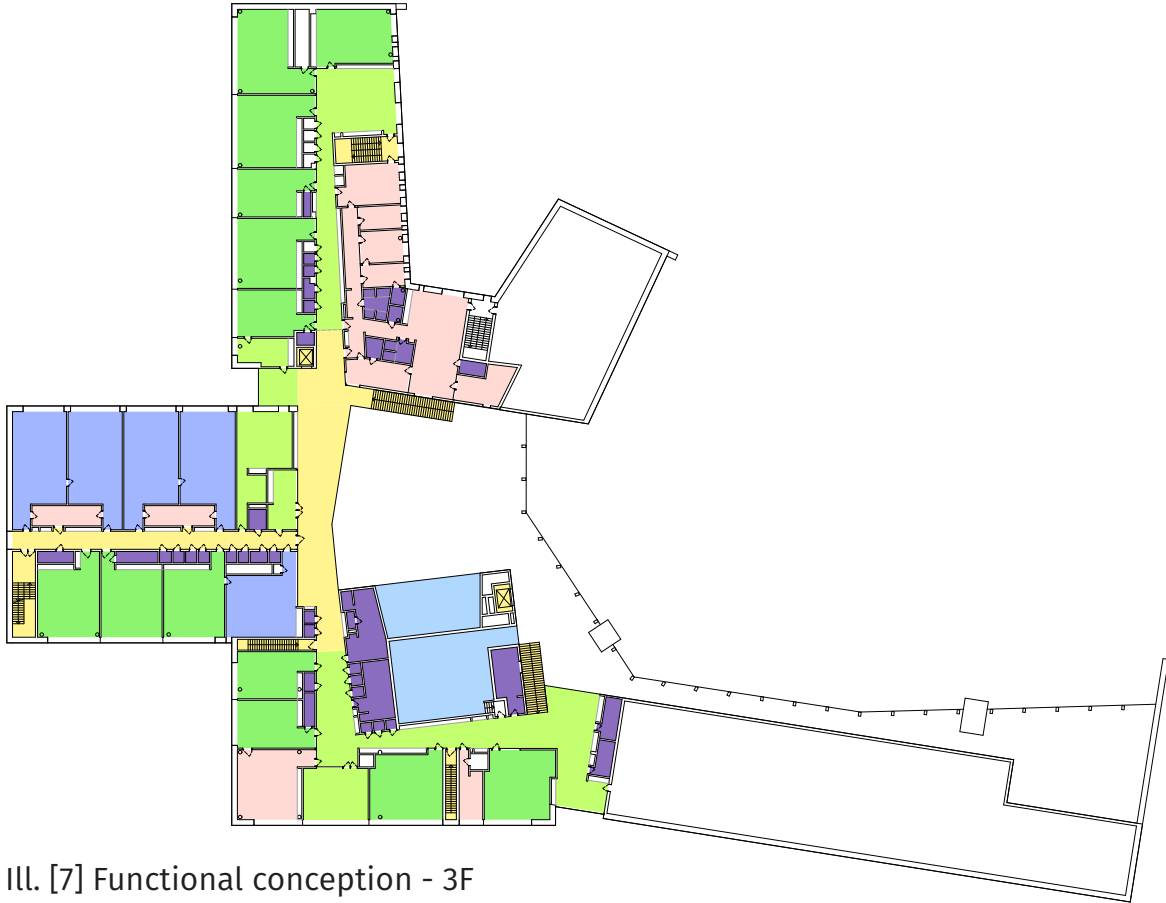
Ill. [4] Functional conception - 1F



Ill. [6] Functional conception - 2F

Legend - functional conception

 Shared education - literacy	 Education spaces - individual	 Common functions - urban
 Shared education - creativity	 Education spaces - community	 Common functions - administration
 Useable area - circulation	 Useable area - technical	



III. [7] Functional conception - 3F

3.3.1.1. Conception of the school building

Based on the pedagogical orientation this school offers facilities for a variety of learning forms as well as art, physical education and teamwork. The balance between learning and working with one's own hands is central. Art and physical education should contribute to good learning results and personal growth. In addition, the school building should become an integral part of the new housing estate that is being built around it. To achieve this objective, there are various district functions integrated.

A mixture of concrete and timber construction was chosen for the structure. The load-bearing elements consist of massive concrete walls supporting a wooden roof construction. [4] [5] [6] [7]

3.3.1.2. Urban integration

The school is part of a development area of the city of Espoo and is located close to the central square of this new residential area. Therefore, this school should enrich the neighbourhood with a wide range of services. In addition to a school for primary and secondary education, it also includes a daycare centre, pre-school, youth centre and a small library which is available for both

the school and the district. In addition, the gym is used by the local clubs and the playgrounds and sports fields on the property are used by the surrounding families. The architects say that the building has become a meeting place for the surrounding families.

The positioning of the buildings shields the yards from the road to the west and provides a safe environment. To the south, there is an open connection to the main square and surrounding residential areas. The outdoor facilities are divided by the building into several courtyards. The day-care centre and the area for primary education thus each have their own manageable outdoor area. The schoolyard for the older children is oriented towards the square. At this place, directly in front of the central hall, there is also an outdoor theatre. The sports and play facilities are scattered around the site. [4] [5] [6] [7]

3.3.1.3. Functional concept

The building's programmatic structure follows a progression from public spaces, via semi-public to increasingly private areas. The two main entrances, on the parking lot as well as on the courtyard side, are connected to the cafeteria, the central multifunctional space. Further entrances are located at the respective home areas plus the integrated community functions. This is especially useful



Ill. [8] assembly hall or “heart” of Saunalahti school



Ill. [9] classroom at Saunalahti school

for decentral access to the district functions. The cafeteria forms the "heart" of the school, where life takes place. It is both a place to linger as well as a learning room and with its adjoining stage, it is also used as a festival hall. Directly connected to it are the library, which also functions as a district library, and the music hall.

The daycare centre is located on the ground floor and has its own private courtyard with a separate entrance. The elementary school classes are also grouped around their own patio and also have their own small lobby. This concept offers these areas an element of privacy and safety without being completely separated. The secondary school is located on the upper floor around the "heart". The openness of the wing, which extends along the street to the west, creates a spatial continuum together with the central "heart". The workshops are located there and at the end of the wing is the youth centre. Along with the nearby side entrance, this creates a concealed space for young people. [4] [5] [6] [7]

3.3.1.4. Spatial concept of the educational spaces

The school is organised according to two different typologies. The elementary school area uses the cluster concept. In contrast, the secondary education

classrooms are lined up along a conventional corridor.

In the elementary school, three to four classrooms are grouped into a functional unit. In these units there are also additional areas as an extension of the classroom. These areas are designed as an enlargement of the corridor to a home area or as additional learning rooms. The classrooms and the additional learning rooms feature an active and passive spatial-visual connection to the expanded hallways in front of them. In this particular school building the active connections are doors and the passive connections are windows. However, in the cluster in the north-east wing one of the classrooms is disadvantaged because it is not directly connected to the home area. There is a spatial-visual connection to the expanded hallway, but this area does not have natural daylight. Therefore this area is only limited usable as a learning space. A spatial-visual connection to the home area, which can be used very well as a learning room, exists for most classrooms, but not for all. This can lead to restrictions in the usability of this learning area for the classes without visual connection, as it could lead to problems with the supervision of the children.

However, in the immediate vicinity of larger classes, there are also smaller learning rooms. These learning spaces are only connected via the general access area. Therefore, they cannot be entered directly. This in turn can lead to limitations in the usability of the extension learning space due to the difficulty of supervising the children. The situation is different in the east wing, with a better implementation of the expansion of the corridor to a home area. This area has natural daylight and a direct spatial-visual connection to all classrooms. Thus there is nothing in the way of a rapid variation of learning modes during the lessons.

In the area of secondary education, on the other hand, separate classes strung along a corridor are used. There are no assigned and nearby extension areas for the classroom. Instead, the canteen/"heart" and parts of the gallery can be used as learning rooms. Instead of the home bases, there is a lobby, which is somewhat distant from many classrooms. These spatial conditions can have a restrictive effect on the rapid change of learning modes. Still, the older students can move around the school building more freely.

In addition to its other functions, the "heart" is suitable as a learning room for individual practise or group work. Attached to this central hall are also the workshop studios for visual arts, textile, cooking, wood and metal, with a dedicated students work gallery. [4] [5] [6] [7]

3.3.1.5. Design concept

In the primary education area, almost all learning rooms have a window to the hallway. Yet, as already discussed, these corridors are deficient as learning spaces in some areas. There are no direct visual-spatial connection, like foldable walls or window or door, between adjacent closed learning areas. Direct connections are only between classrooms/closed learning spaces and extended hallways.

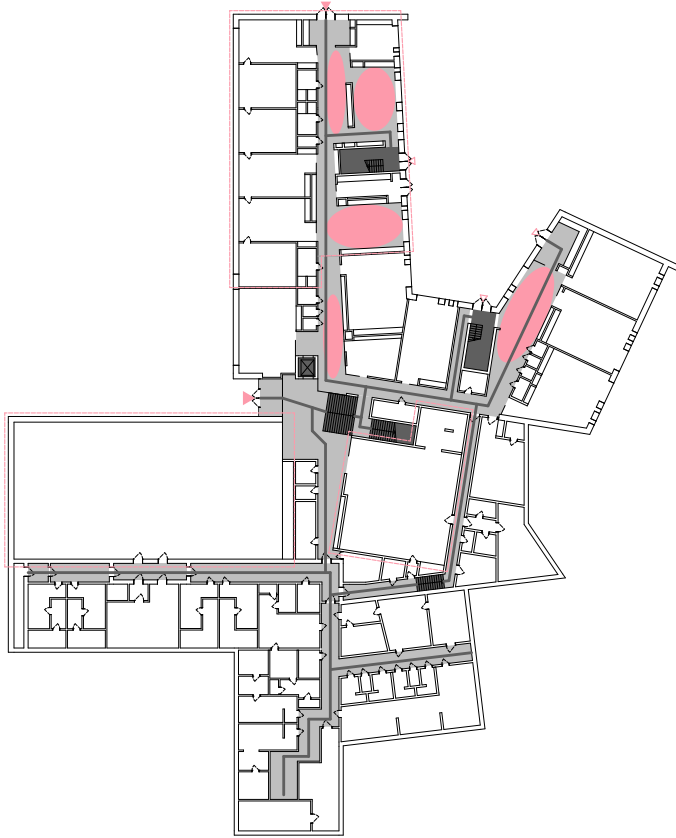
The classrooms are uniformly designed and therefore have little potential for creating identification. However, the clusters and other distinct building parts

provide their individual wall colours and thus provide potential for identification and belonging. In addition, the students work gallery also offers the possibility of personal adoption of the school building.

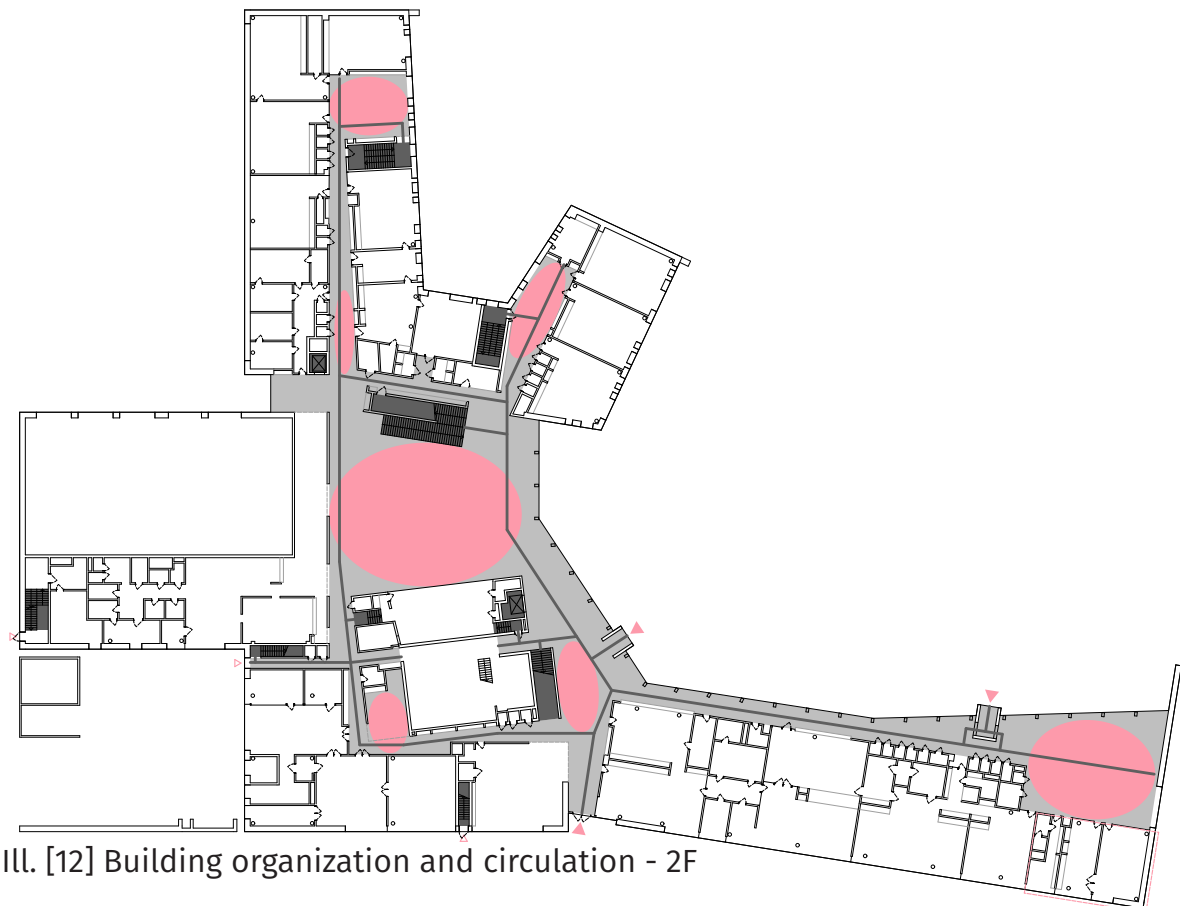
Most surfaces consist of wood, stone and brick. Together with the wall colours, a thoroughly stimulating atmosphere is created. Overall, the building appears bright and light, which is due in particular to the high ceiling of the central hall and the large glass facades. Spatially, the building offers a smooth transition from wide, open spaces to ever denser and enclosed spatial situations. [4] [5] [6] [7]



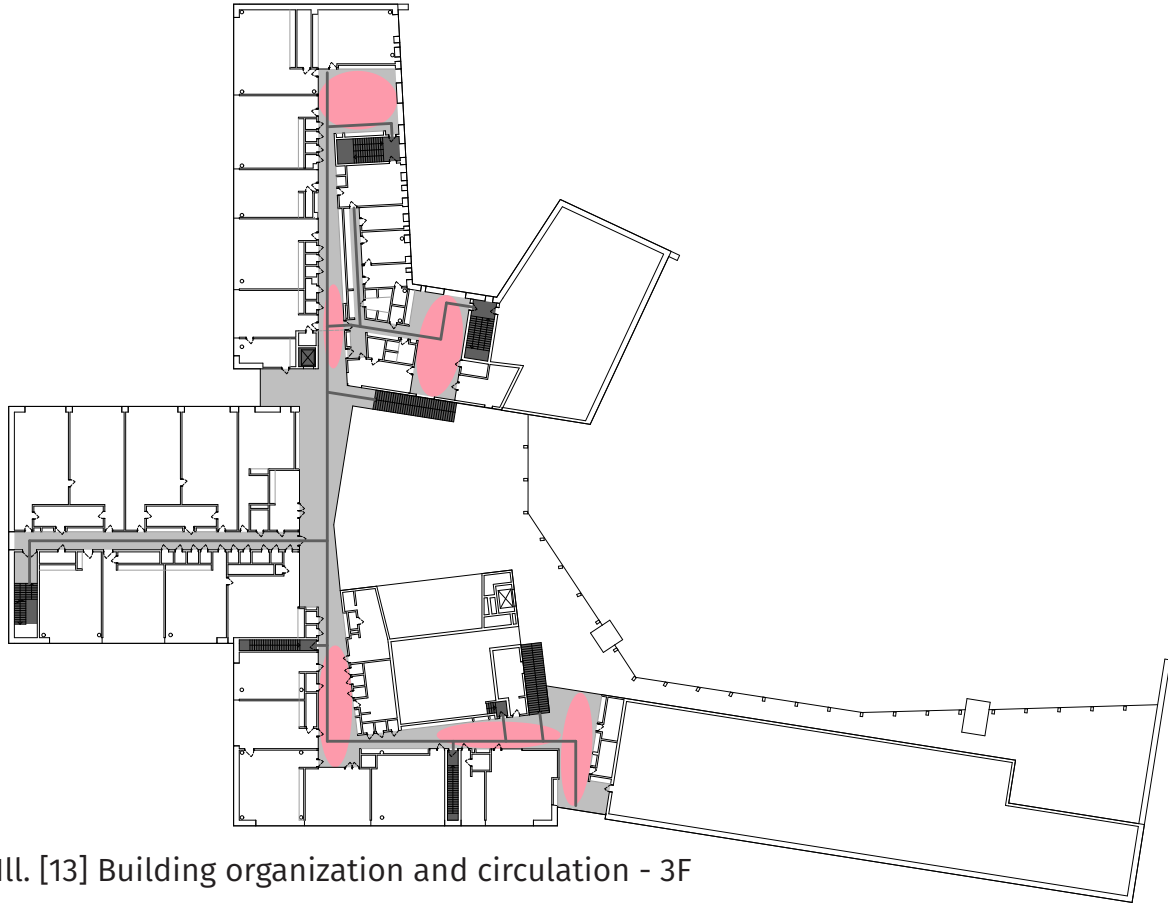
Ill. [10] assembly hall or “heart” of Saunalahti school



III. [11] Building organization and circulation - 1F



III. [12] Building organization and circulation - 2F



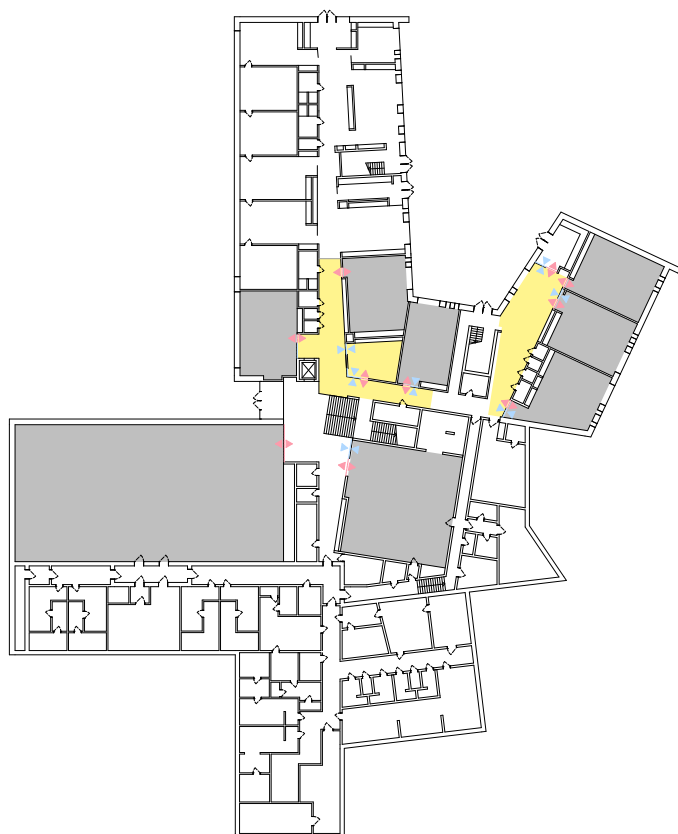
III. [13] Building organization and circulation - 3F

Legend - building organization

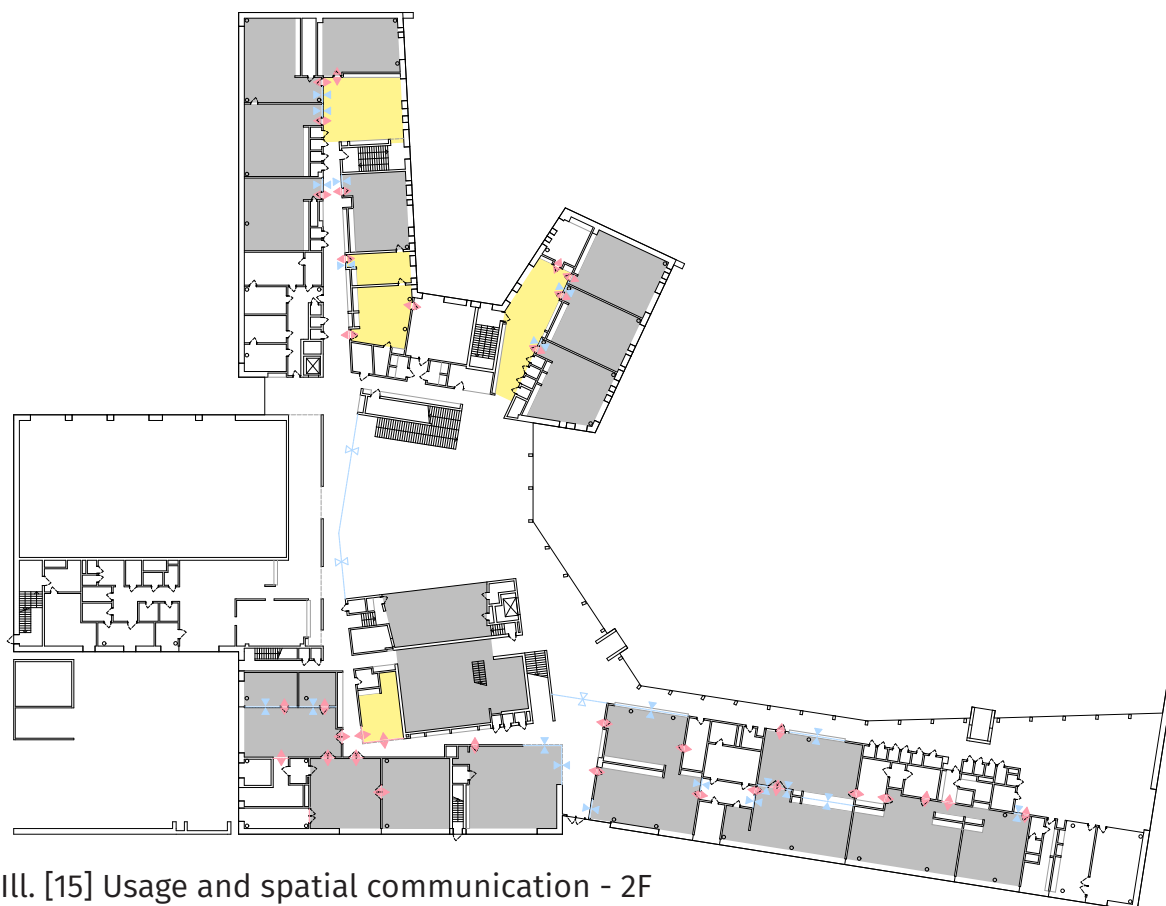
-  urban functions
-  circulation
-  main entrance
-  secondary entrance
-  circulation area
-  hallway expansion - possible learning space

Evaluation - building organization

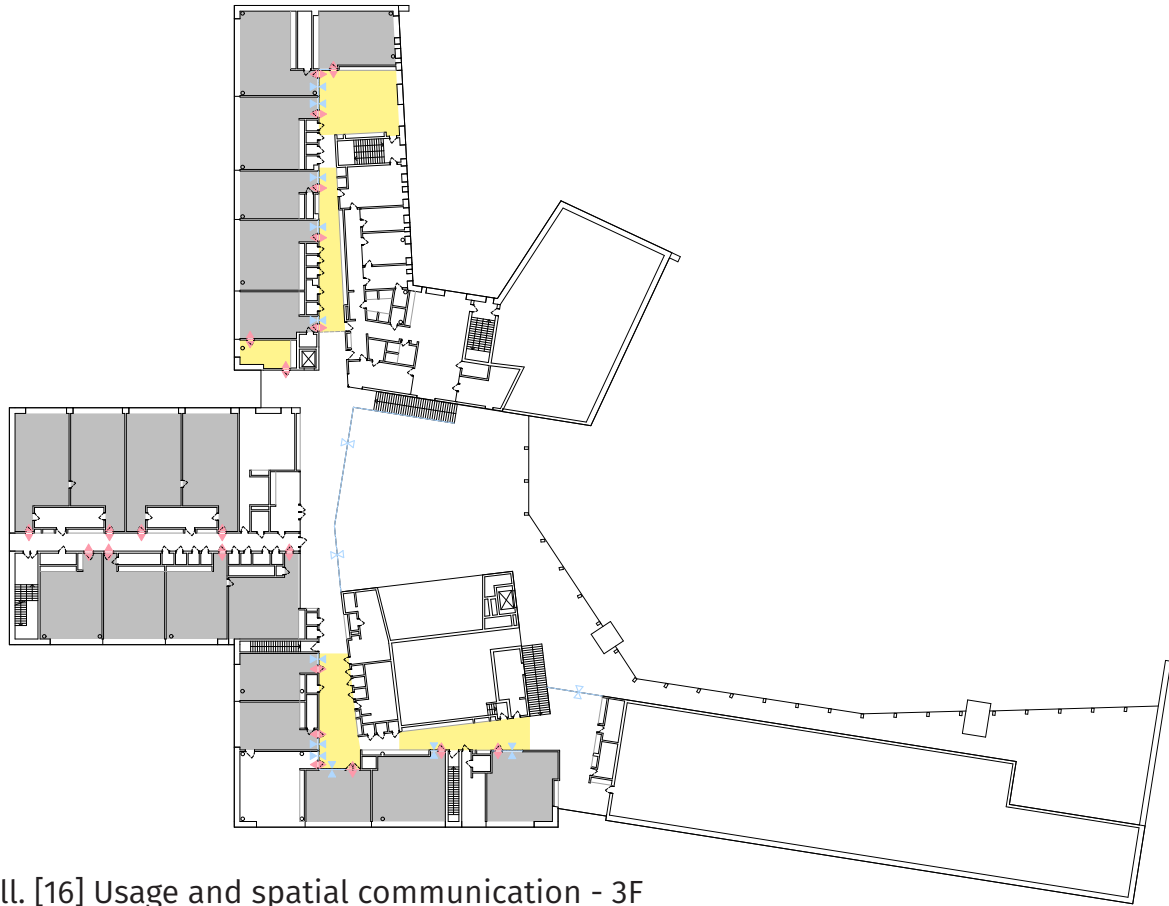
-  extroverted building
-  decentral entrance for direct access to building part
-  small expansion of hallway to educational area
-  mostly independent circulation
-  high availability of external functions



Ill. [14] Usage and spatial communication - 1F



Ill. [15] Usage and spatial communication - 2F



III. [16] Usage and spatial communication - 3F

Legend - usage and spatial communication

	education space		medium passive communication
	expansion of hallway usable as edu space		low active communication
	active visual-spatial connection		medium educational use of circulation
	passive visual-spatial connection		weak link of educational spaces
			medium spatial interrelation

3.3.2. Kariston päiväkoti school – Lahti



Ill. [17] Outside view of Kariston päiväkoti school

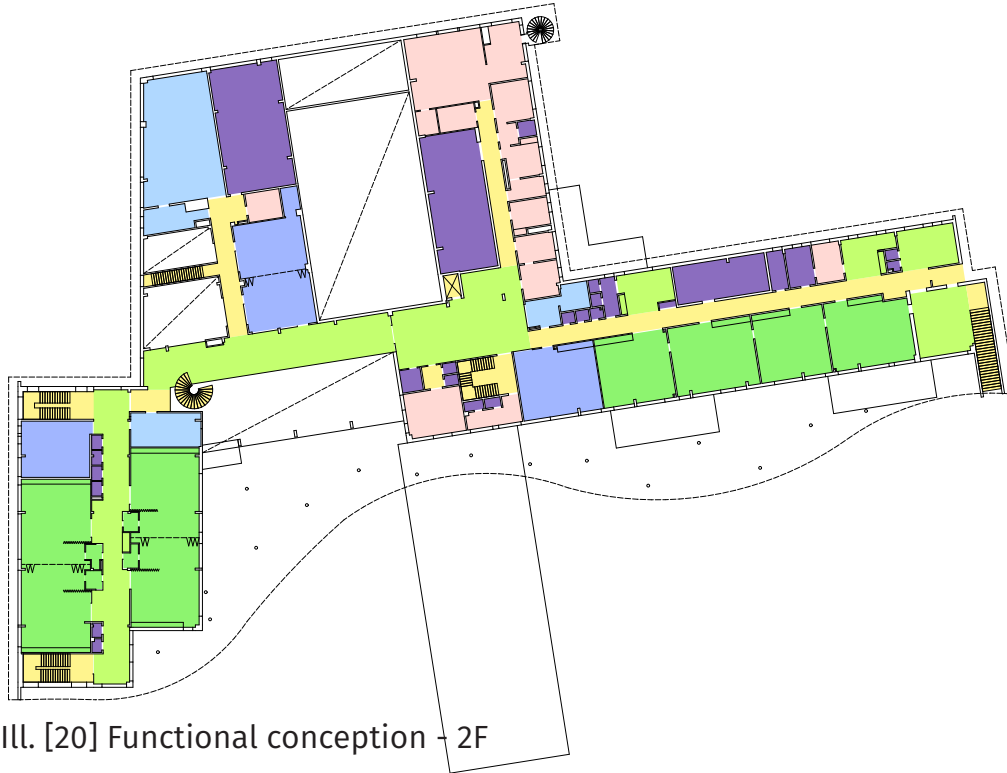
Location:	Lathi / Finland
Year of completion:	2010/2013
Architects:	Tilatakomo Architects



III. [19] Site plan of Kariston päiväkoti school



III. [18] Functional conception



Ill. [20] Functional conception - 2F

■ Shared education - literacy	■ Education spaces - individual	■ Common functions - urban
■ Shared education - creativity	■ Education spaces - community	■ Common functions - administration
■ Useable area - circulation	■ Useable area - technical	

3.3.2.1. Conception of the school building

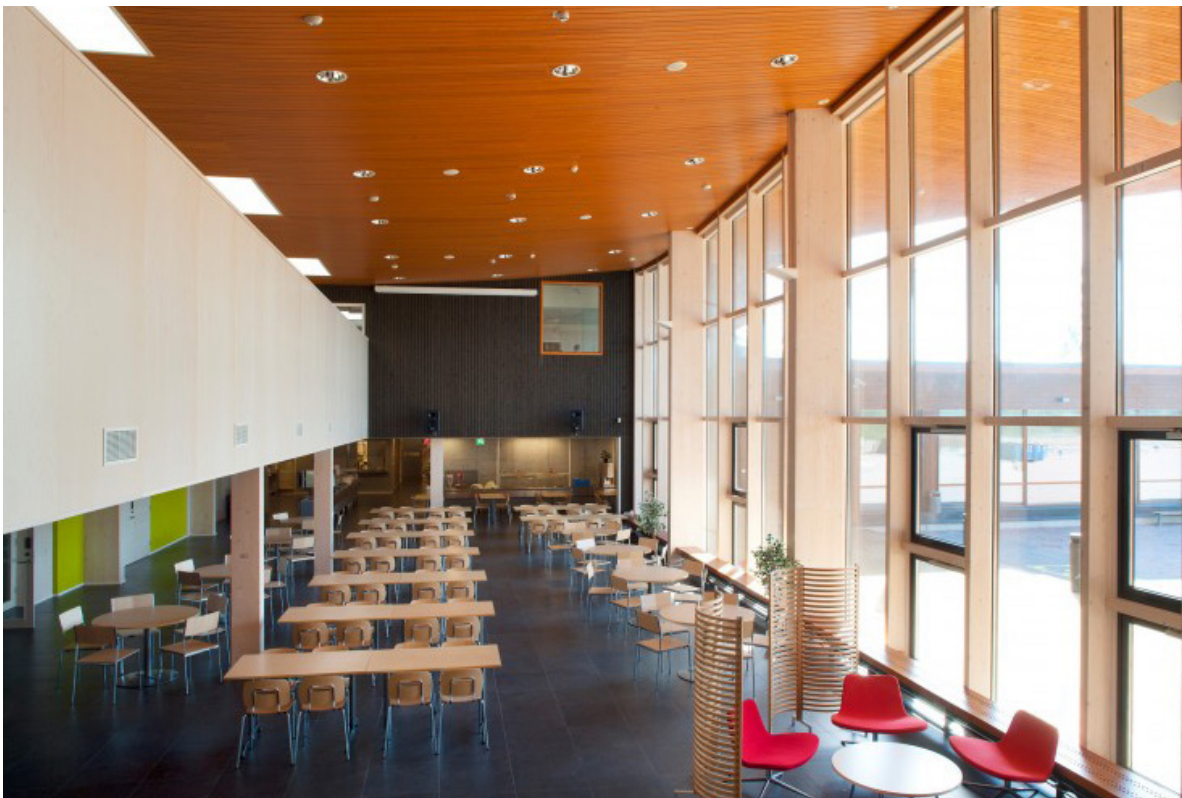
Karisto School is located in the east of the city of Lathi, a town in the south of Finland. Lathi is an important business location and with its approx. 120,000 inhabitants the eighth largest city in Finland. The school is located in the Karisto region in the Järvenpää district. This settlement area, Karisto, has an open building structure, mostly consisting of single-family houses with a maximum of two storeys. This results in a more rural than urban settlement pattern. The single-family houses are mostly made of timber. In the competition specifications it was already emphasized that this school should be built in

timber construction in order to better fit into the existing built environment. In the time the school was built, this settlement area was subject of an urban planning process. Thus some of the required urban services were integrated into the building. Furthermore, it was required to complete this building in two phases. Since it was assumed that the settlement structure would expand only slowly after the urban development. [2] [19] [20]

3.3.2.2. Urban integration

In the west of the building there is a small forecourt. Connected to it is the main entrance of the school, as well as the entrances for the community centre and the dental clinic. To the north the property is bordered by a road. In addition, there are two further side entrances in the north of the property, which are mainly used for deliveries and by the employees. To the east of the property are extensive meadows. The schoolyard and sports facilities are located in the south of the school.

This school building also includes the following urban facilities: Municipal centre, dental clinic, pre-school and kindergarten. Originally it was planned that the building would also include a public library. However, this was abandoned in the second project phase, as in the meantime the capacity of the library network of Lathi was sufficient. Instead, further and more spacious classrooms and the dental clinic were built. [2] [19] [20]



Ill. [21] Assembly hall / canteen of Kariston päiväkoti school

3.3.2.3. Functional concept of the school building

All functions find their place in one coherent building. It consists of four wings, which are connected by a common two-storey room, the assembly hall. In the northern wing are the municipal centre and the dental clinic, which both have separate access for independent use. In addition, the gymnasium and the theatre stage connected to it are located in this part. The sports hall with its dressing and changing rooms is located in a separate, self-contained area with its own entrance. This allows the external use of this area by clubs for all kinds of events and other activities, independent of school operations. The wood and metal workshops including changing rooms for handicraft lessons are located in this wing too. Above the workshops are the offices for the teachers, the administration and the health facilities of the school. Furthermore, the textile classes and project rooms are located on the upper floor of this wing. Now we look at the building part east of the assembly hall. The ground floor contains the day-care centre and the two pre-school groups. The area of the kindergarten is divided by two utility rooms respectively cloakrooms, which protrude from the building volume. These give each group direct access to the fenced-in outdoor area of the kindergarten.



Ill. [22] Corridor at Kariston päiväkoti school

On the upper floor of the eastern wing are the classrooms for grades one and two. At the eastern end of this floor there is a separate access to the schoolyard. The kindergarten on the ground floor of this wing as well as the classrooms on the upper floor are accessible via a central corridor.

The single-storey southern part of the building contains rooms for music lessons and a large room for art and science lessons, together with the associated ancillary rooms. This large room also has an assigned, covered terrace.

The western wing of the building contains four classrooms on each floor.

The central two-storey room, the assembly hall, acts as the social heart of the school and as a main distribution hub. This room combines a variety of different functionalities. The cafeteria is located in this large open space. Here the students can enjoy their lunch and chat with each other. The assembly hall is also used a great deal during lessons. The tables and chairs that serve as the cafeteria during lunchtime are used for working groups or self-study during the remaining time. For this purpose there are also seating groups with comfortable armchairs available.

Furthermore, this room houses the publicly accessible multimedia library with computer workstations for research work. In the gallery of the assembly hall, on the upper floor, only a limited number of seats are offered for self-study. [2] [19] [20]

3.3.2.4. Spatial conception of the educational spaces

The classrooms in the eastern part of the building are lined up along the southern facades and follow a conventional, closed arrangement. They cannot be combined. However, these classrooms are at least connected by glass doors. On the opposite side of the central aisle are the group work rooms and ancillary rooms. The central corridor does not qualify as an expansion of the learning area due to its narrow width and lack of daylight.

In the western part of the building two classrooms can be dynamically connected respectively separated by folding walls depending on the learning situation.

In these classrooms there are small glazed areas for self-study, working in small groups or as a workplace for the second teacher. In addition, there is one appendix in each pair of classrooms. The central aisle in this part gets a certain dynamic by the intrusion of the toilets and the glazed cubes for self-study.

The width of the corridor between the classrooms allows it to be used as an extension of the classroom. Especially during learning modes such as working in small groups of two to four children or independent learning, the aisle can be used as an additional space. The niches created by the toilets and the small additional rooms have a supportive effect and help to divide this large, elongated room somewhat. The niches also give the possibility to withdraw a little bit. Furthermore, there is a strong visual connection between the classrooms and the wide corridor in the form of generous sections of glass walls. This allows the teachers to keep a close eye on the children even when they are in the other room. Thus, this corridor represents a useful extension area for the classroom.

In the northern part, the two project rooms are visually connected to the

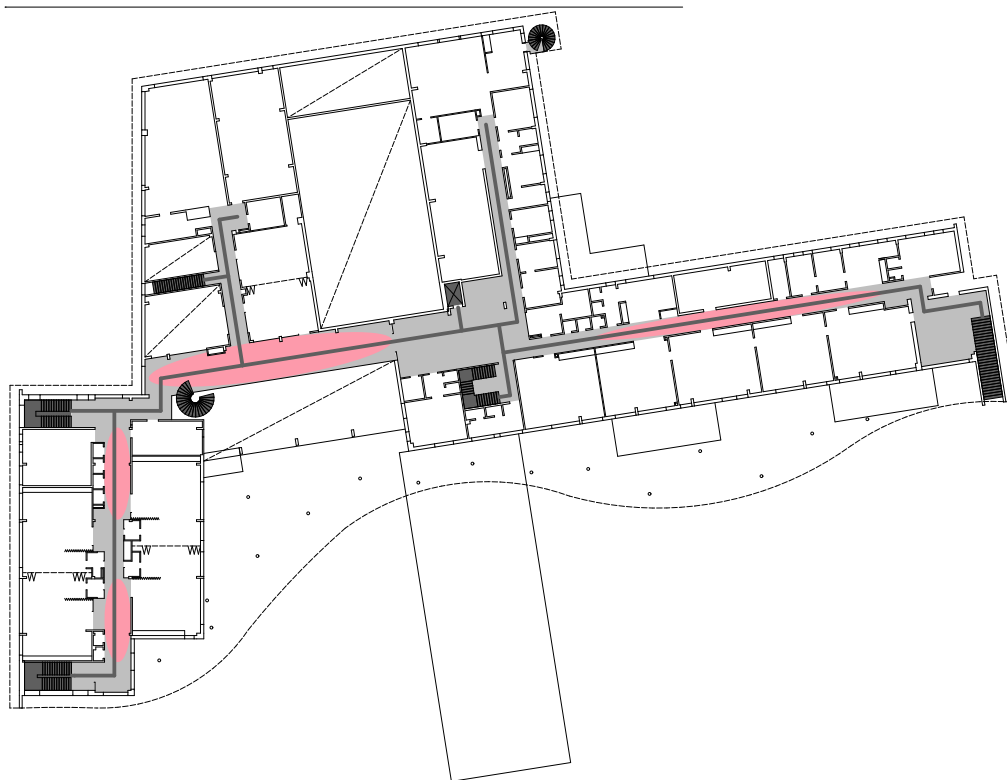
assembly hall by large panels of glass. The project rooms can also be combined with each other for various conditions. [2] [19] [20]

3.3.2.5. Design concept

The classrooms in the eastern part of the building have an active and passive spatial-visual connection between each other and the corridor. Between the classrooms there is a single-leaf glass door. To the corridor, these classrooms each have about two linear metres of fixed glazing and a single-leaf door. The calm feeling that the classrooms radiate comes from their tidiness. The white walls are just waiting to be appropriated and used as an display of the students' works. On the ceiling, the white painted visible beams have a patterning and slightly invigorating effect without attracting too much attention. Together with the generous window openings, this creates a pleasant, bright atmosphere. The same design aspects apply to the classrooms in the west of the building. With the folding partitions between the rooms and the sizeable fixed glazing to the central corridor, these classrooms have excellent active and passive spatial-visual connections. In the assembly hall, as in the other communal rooms, colours are used occasionally and enliven the otherwise bright and calm overall appearance. [2] [19] [20]



III. [23] Building organization and circulation - 1F



III. [24] Building organization and circulation - 2F

Legend - building organization

-  urban functions
-  circulation
-  main entrance
-  secondary entrance
-  circulation area
-  hallway expansion - possible learning space

Evaluation - building organization

-  mostly introverted building
-  decentral entrance for independent function units
-  small expansion of hallway to educational area
-  completely independent circulation
-  high availability of external functions



Ill. [25] Usage and spatial communication - 1F



Ill. [26] Usage and spatial communication - 2F

Legend - usage and spatial communication

-  education space
-  expansion of hallway usable as edu space
-  active visual-spatial connection
-  passive visual-spatial connection

Evaluation - usage and spatial communication

-  medium passive communication
-  medium active communication
-  low educational use of circulation
-  weak link of educational spaces
-  low spatial interrelation

3.3.3. Tuupalan Elementary School and Daycare Centre - Kuhmo

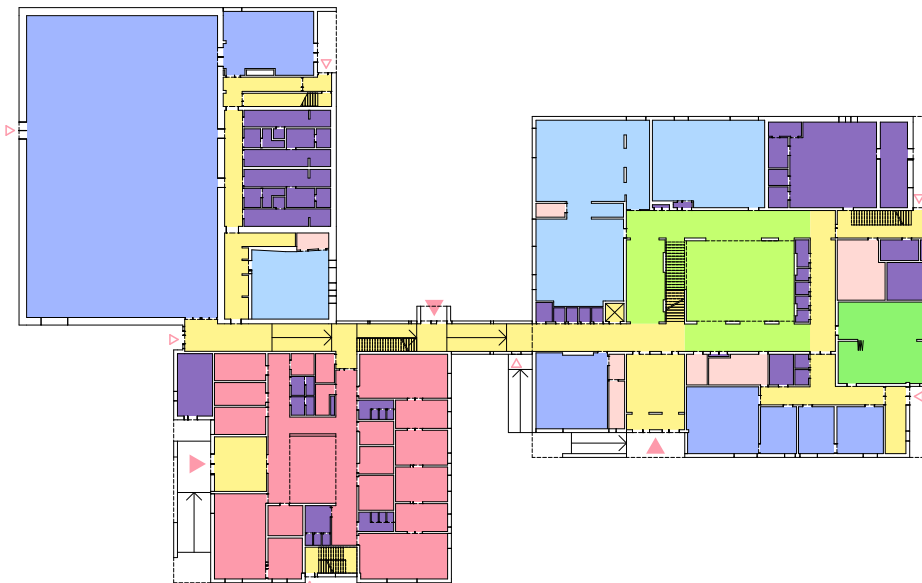


Ill. [27] Outside view of Tuupalan Elementary School and Daycare Centre

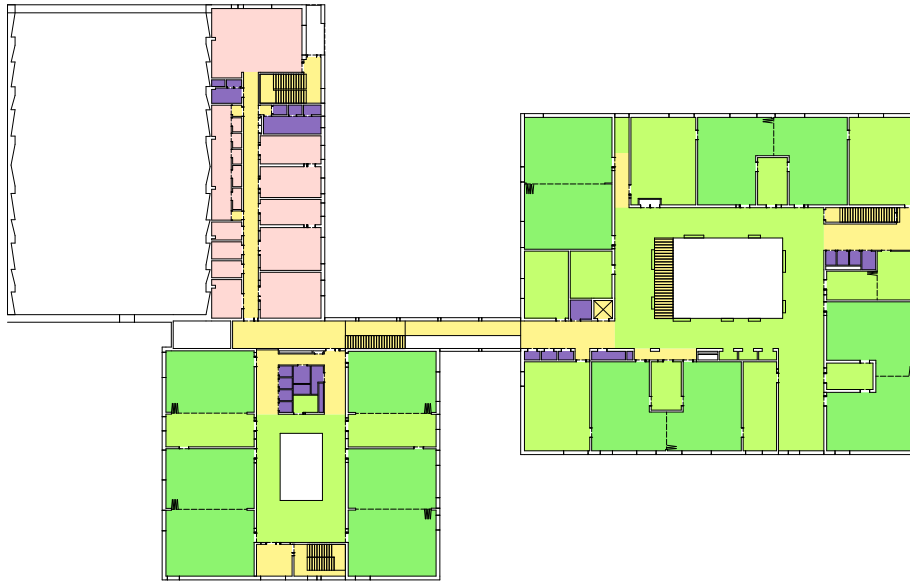
Location:	Kuhmo / Finland
Year of completion:	2018
Architects:	Alt Architects, Karsikas Architects



III. [29] Site plan of Tuupalan Elementary School and Daycare Centre



III. [28] Functional conception - 1F



III. [30] Functional conception - 2F

Legend - functional conception

 Shared education - literacy	 Education spaces - individual	 Common functions - urban
 Shared education - creativity	 Education spaces - community	 Common functions - administration
 Useable area - circulation	 Useable area - technical	

3.3.3.1. Conception of the school building

In Finland, the core curriculum has been developed more towards phenomenon-based learning, which requires a wide variety of learning methods and situations. This has resulted in changed requirements for the facilities of a school. In order to better accommodate this development, the Tuupalan Elementary School was newly built.

The structural framework of the school consists of massive CLT walls. This construction decision was made because in the same city the first CLT plant of Finland has opened. In Finland the know-how for residential buildings made of CTL was already available before. For larger spans, which are usually found in public buildings, there was no expertise yet. This pride in this construction method can be seen throughout the building. Wherever possible the glued wooden surface was left visible. The façade, as an example, was given a colourless coat of paint. The desire for this construction method came from the client. [10] [11] [12] [13]

3.3.3.2. Urban integration

The school complex was modeled after a small village and consists of several



Ill. [31] Roofed inner court Tuupalan Elementary School and Daycare Centre

two-story volumes.

With this, the building fits in as a transition element between the adjacent existing buildings. To the southwest is a block-like three-storey school centre from the 1950s. On the other side to the northeast are the compact one-story buildings of the small town museum. In this environment, the fragmented two-storey building volumes of the school act as a gentle transition. In the north the property is bordered by a road. To the southwest of the school there is a sports field and various playgrounds. The playgrounds for elementary school and kindergarten children are separate.

The kindergarten is located on the ground floor of one of the building volumes. This shares a covered inner courtyard with the school, which is located on the upper floor. There is a line of sight between the building functions, but no direct possibility to get from one functional area to the other.

Furthermore, the gymnasium is designed in a way that allows it to be used as a concert hall. In particular, the hall serves as a performance venue for the annual Khumo Chamber Music Festival. [10] [11] [12] [13]

3.3.3.3. Functional conception

The school complex is comprised of three building volumes. These building volumes are connected by a two-story corridor. One volume contains only

functions of the school. In another volume the kindergarten on the ground floor is mixed with classrooms of the school on the upper floor. The third volume contains the gymnasium and on the upper floor the administrative rooms and the teachers' offices.

The two buildings containing the school and kindergarten are both built around a covered patio. For the school, the inner patio is the social heart. Here the children meet and communicate with each other. This patio is suitable for learning and playing in small groups or for attending lectures in large cross-class groups. All rooms in this part of the building are accessed via this central room. In this building volume the special classrooms are located on the ground floor and the classrooms on the upper floor.

The second building volume with inner patio contains a kindergarten on the ground floor and a part of the school on the upper floor.

These two functions are clearly separated. The kindergarten has its own entrance and there is no direct route from the school on the upper floor to the kindergarten area. The inner patio is the central cross-group movement area of the kindergarten. On the upper floor the inner patio continues as a broad gallery. Here the pupils can spend their breaks and play. The classes in this area are also accessed via this room. Due to the openness of the inner patio there is a visual as well as a linguistic connection between the kindergarten and the school classes in this part of the building. This clear separation with a direct connection between kindergarten and school can make the transition easier for some children. [10] [11] [12] [13]



III. [32] Classroom at Tuupalan Elementary School and Daycare Centre



Ill. [33] Roofed inner court Tuupalan Elementary School and Daycare Centre

3.3.3.4. Spatial concept of the educational spaces

The school does not follow the extreme open office style interpretation of learning environments, but rather focuses on individual, self-contained classrooms. However, these can be combined to create different learning scenarios. The active spatial-visual connection between the classrooms was solved by sliding walls. The windows of the classrooms facing the corridor establish a passive spatial-visual connection with the rest of the school. Due to their width, these circulation areas can also be used as an extension of the learning area. In one wall of the hallway area there are even niches which allow the children to withdraw into a protected environment to learn, read or discuss, either alone or in small groups (2-3 children). Although the corridors are located deep inside the building, they have an ample amount of natural daylight as they are situated around the roofed inner courtyards. [10] [11] [12] [13]

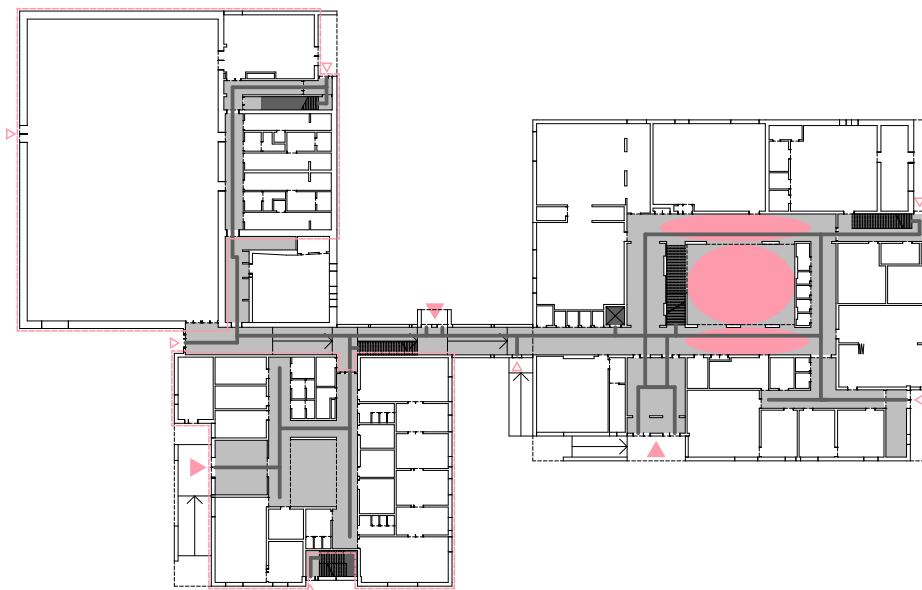
3.3.3.5. Design concept

As already discussed, there are many active and passive spatial-visual connections between the separate learning areas. Also the buildings themselves offer a passive spatial-visual connection between the floors with the covered inner courtyard at their core. As a whole, this small village of a school is a very clearly structured and interconnected building complex.

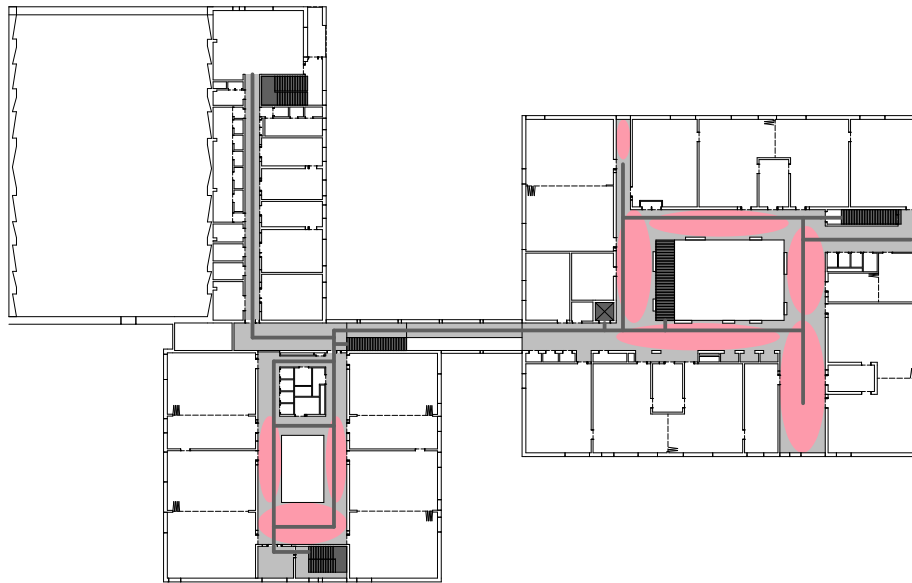
The learning areas are uniform in their form and design. Therefore the classrooms do not provide a basis for identification. Also elements for personal adoption are not visible in the building.

The surfaces all have a natural character. All wall surfaces are made of wood, the floors of grey carpeting and the ceilings are covered with beige fabric panels. Only in the roofed inner courtyard of the pure school building a green carpeted floor brings a little more colour into the everyday life of the school.

The soft or natural surfaces combined with the large windows in the classrooms create a bright and calming atmosphere. The covered inner courtyards with the light from above and their two-storey design have an almost sacral character. The contrast between the comparatively large and high covered inner courtyards and the lower and smaller classrooms also creates a level of excitement. [10] [11] [12] [13]



III. [34] Building organization and circulation - 1F



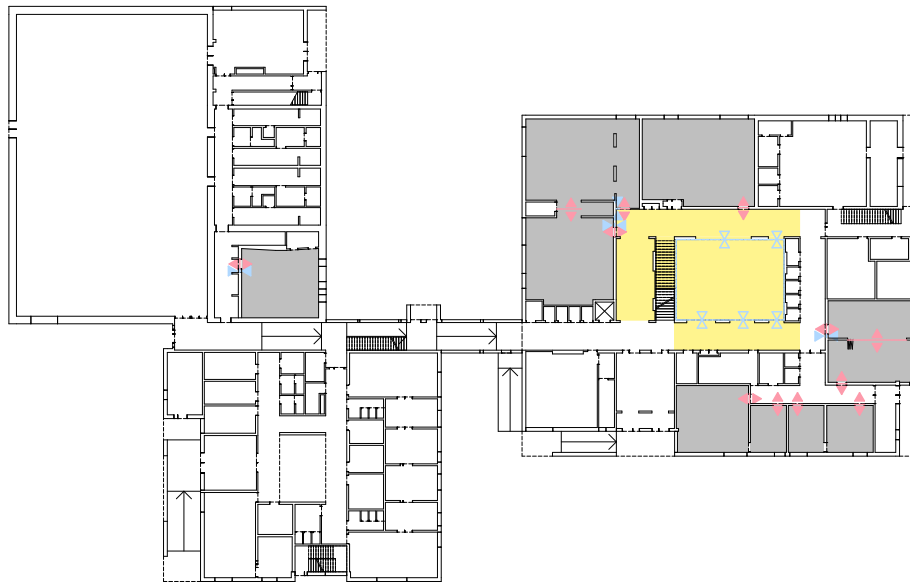
III. [35] Building organization and circulation - 2F

Legend - building organization

-  urban functions
-  circulation
-  main entrance
-  secondary entrance
-  circulation area
-  hallway expansion - possible learning space

Evaluation - building organization

-  mostly extroverted building
-  decentral entrance for direct access to building part
-  medium expansion of hallway to educational area
-  completely independent circulation
-  high availability of external functions



III. [36] Usage and spatial communication - 1F



III. [37] Usage and spatial communication - 2F

Legend - usage and spatial communication

	education space		medium passive communication
	expansion of hallway usable as edu space		high active communication
	active visual-spatial connection		medium educational use of circulation
	passive visual-spatial connection		spatial and functional link of educational spaces
			high spatial interrelation

3.4. Cases in Shanghai

3.4.1. Tongji University Affiliate Elementary School – Jiading / Shanghai

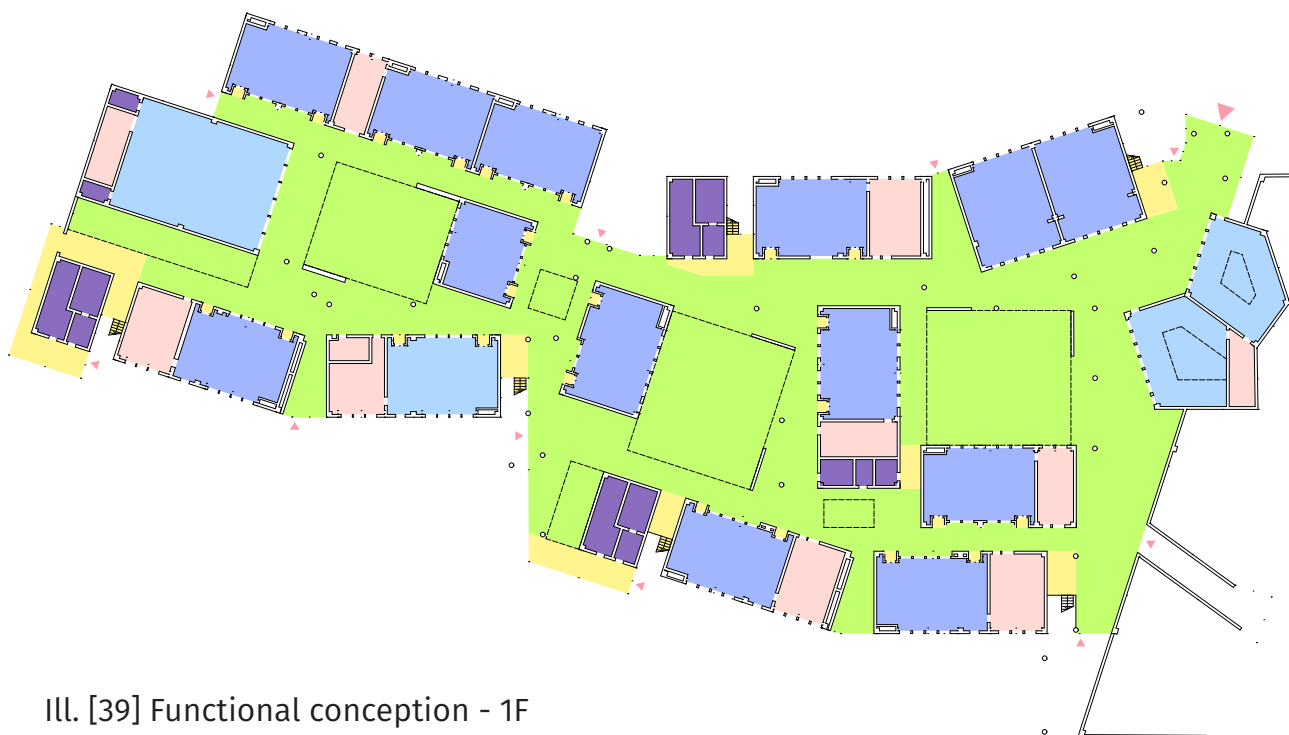


Ill. [38] Bird view of Tongji University Affiliate Elementary School

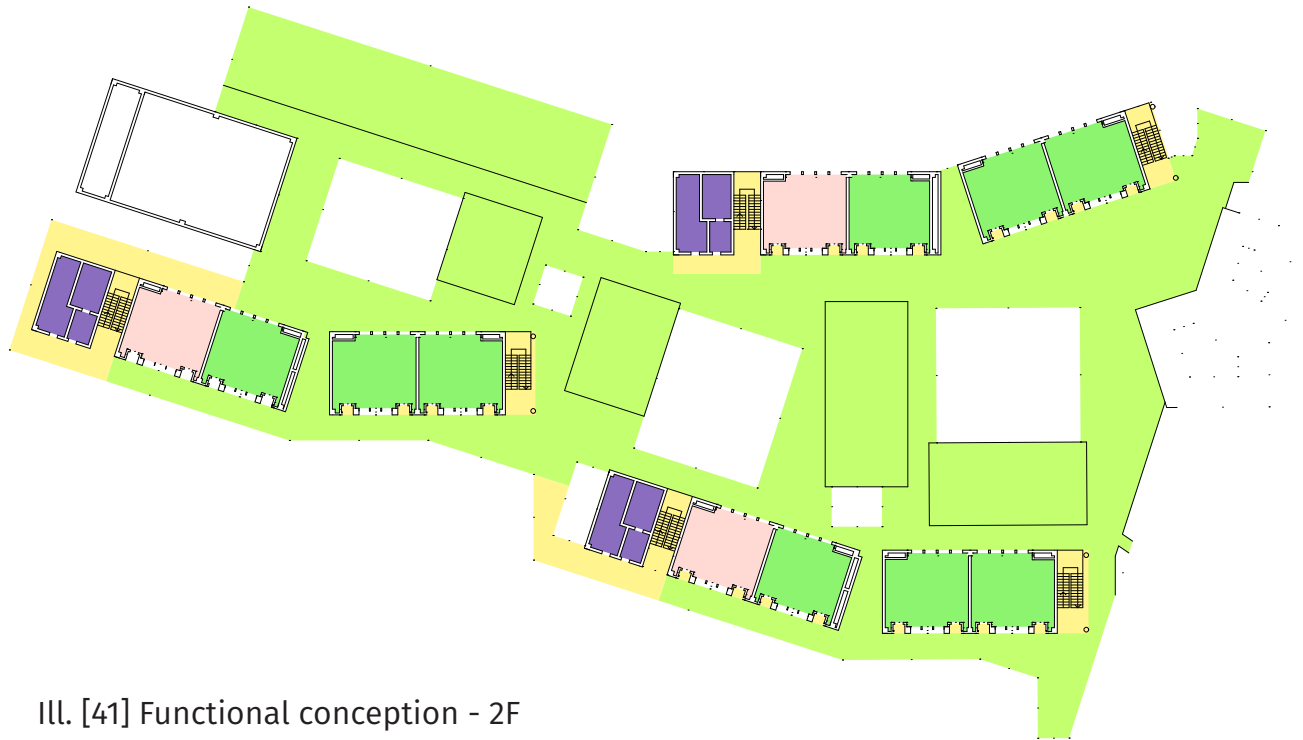
Location:	Shanghai
Year of completion:	2016
Architects:	Atelier Liu Yuyang Architects



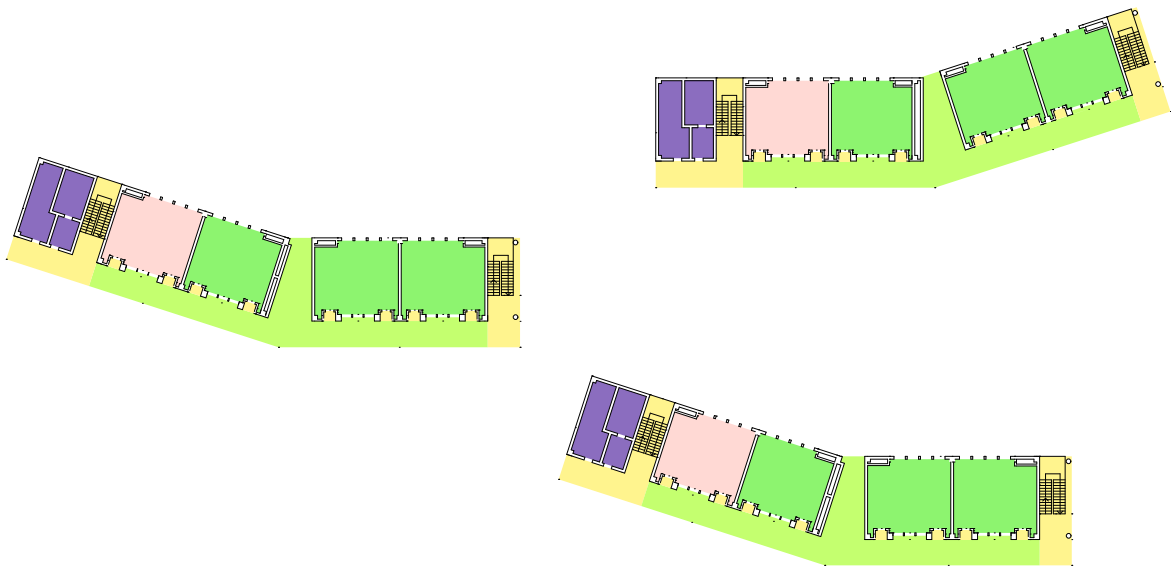
III. [40] Site plan of Tongji University Affiliate Elementary School



III. [39] Functional conception - 1F



III. [41] Functional conception - 2F



III. [42] Functional conception - 3F

Legend - functional conception

 Shared education - literacy	 Education spaces - individual	 Common functions - urban
 Shared education - creativity	 Education spaces - community	 Common functions - administration
 Useable area - circulation	 Useable area - technical	

3.4.1.1. Conception of the school building

Tongji University Affiliate Elementary School was jointly built by the Jiading District Governor and Tongji University, completed in the year 2016. The school has many cooperation partners from the business community such as Tongji University, SAIC Group or SAIC Volkswagen Group. The administration is carried out by Tongji University.

The construction consists of massive reinforced concrete walls, ceilings and roof. [8] [9]

3.4.1.2. Urban integration

This elementary school is located on the border of Shanghai and Jiangsu. There, in the Jiading district, is this development area called Anting new town. At the entrance of this area is the Tongji University Affiliate Elementary School.

On the east side of the property, there is a busy main road. To provide a buffer against this traffic the sports facilities are located on the east side.

The outdoor space provides the internal access to the different rooms. The central development is carried out via two superimposed distribution floors, which are structured by three cut-in courtyards. These yards create overseeable areas in the school. On the upper distribution level, there are playgrounds. They are also the roof of some subject teaching rooms.

There is no integration of urban functions. [8] [9]

3.4.1.3. Functional conception of the school building

Typologically this school resembles a small village with squares, courtyards and individual houses. The school is divided into several houses. One for



Ill. [43] Garden of Tongji University Affiliate Elementary School



Ill. [44] Inner courtyard at Tongji University Affiliate Elementary School

administration, one for the canteen and several houses dedicated to education. As mentioned before, three courtyards structure the buildings for learning. Each of the yards is corresponding to one subject area of humanities, science & technology and art. The common educational spaces are located on the ground floor, arranged according to their respective affiliation to a themed courtyard. The location of the classrooms is on the floors above. These are arranged in groups of three and are each supplemented by a teachers' room and a sanitary unit. These groups of classrooms on the upper floors are each accessed by two staircases leading down to the two distribution floors. Concerning the multiple usages of spaces, the multifunctional hall and potentially the outside space is available. [8] [9]

3.4.1.4. Spatial concept of the educational space

The grouping of three classrooms plus teacher's room, sanitary unit and extended development area corresponds to the typology of a cluster school. Due to its width and the addition of a trapezoidal area between two classrooms, the development area can be used as a recreation, regeneration and learning room. The seating wall in front of the windows of each classroom also contributes to the adoption of the hallway. They are 60cm deep and 60 or 30cm high. However, these widened hallways are designed as covered outdoor spaces. This can limit its use as a learning space as it gets too hot or too cold during the year. Therefore, the groups of classrooms have only limited flexibility in rapidly changing the modes of learning. Variation of the learning modes is mostly only

possible within the classroom.

There is mostly a direct connection between the special learning rooms on the ground floor and their preparation or storage chambers for teaching materials. [8] [9]

3.4.1.5. Design concept

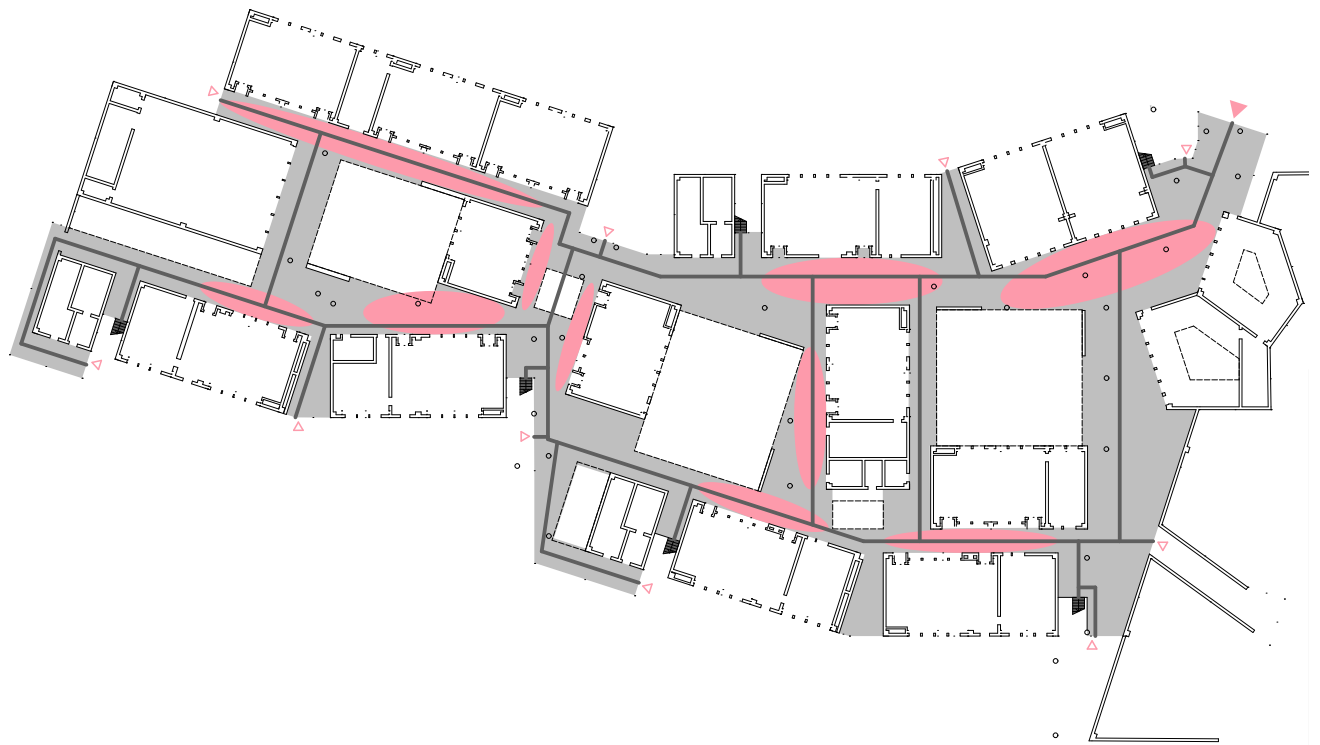
The exterior surfaces consist of sanded screed, exposed concrete, white and coloured painted plaster and aquamarine tiles. The colours are used to allow better orientation in the village-like structure. The walls in the classrooms are painted white and have wall pieces made of glass blocks. The music and moral education room are covered with wood on the floor and walls.

On the inside of the classrooms, there are no distinctive features. But on the outside of each classroom, there are two blackboards, which encourage personal appropriation as well as learning outside. The windows between the classrooms and the spacious arcades offer the possibility of passive visual communication between these areas. Each classroom has two doors. This makes it easy to extend the learning area to the outside corridor. However, as already mentioned, the quality of this arcades as a education space is questionable.

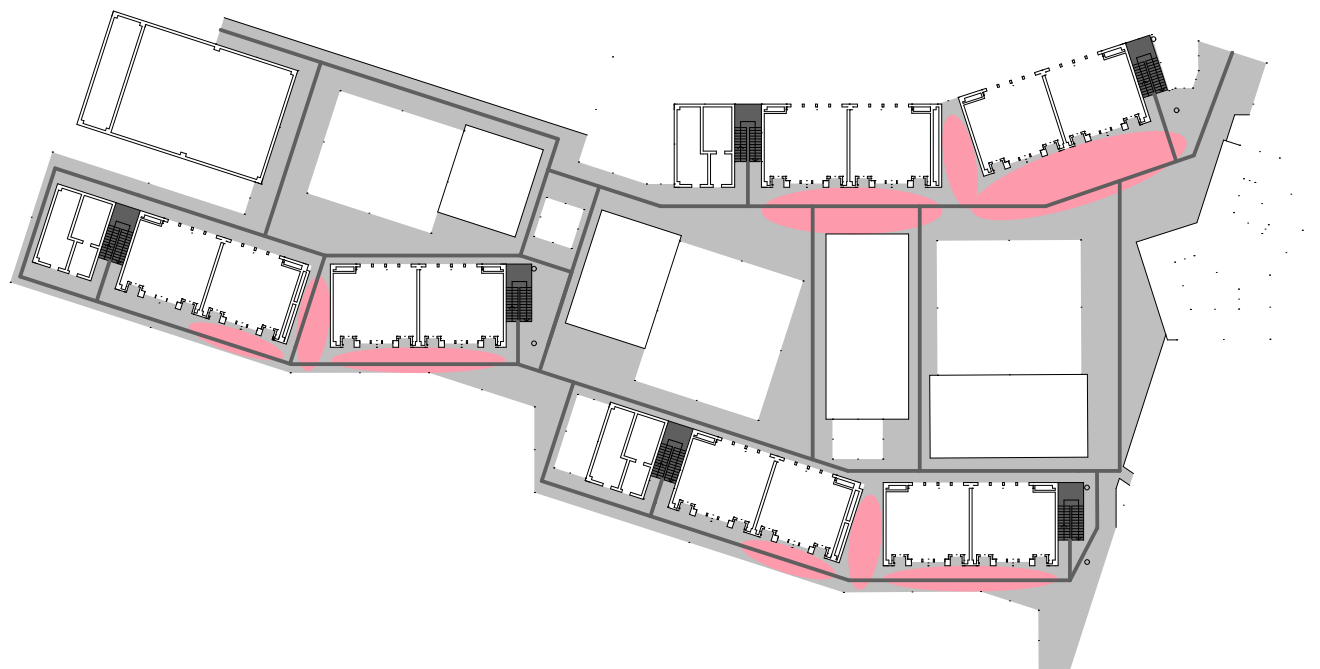
The supply of light in the classrooms is very good. There is a window band to the north and south. In front of the southern windows, there is shade from the covered arcade. This should prevent unpleasant glare on the work surfaces. There are skylights in the pentagonal music and moral education rooms. These make these rooms seem almost sacral, which is very stimulating. How stimulating the regular classrooms are depends on the decoration by the users. Architectural means of stimulation were not found in these rooms. The small and dense spaces between the courtyards on the ground floor invite to explore and discover. This can be a very inspiring break area. [8] [9]



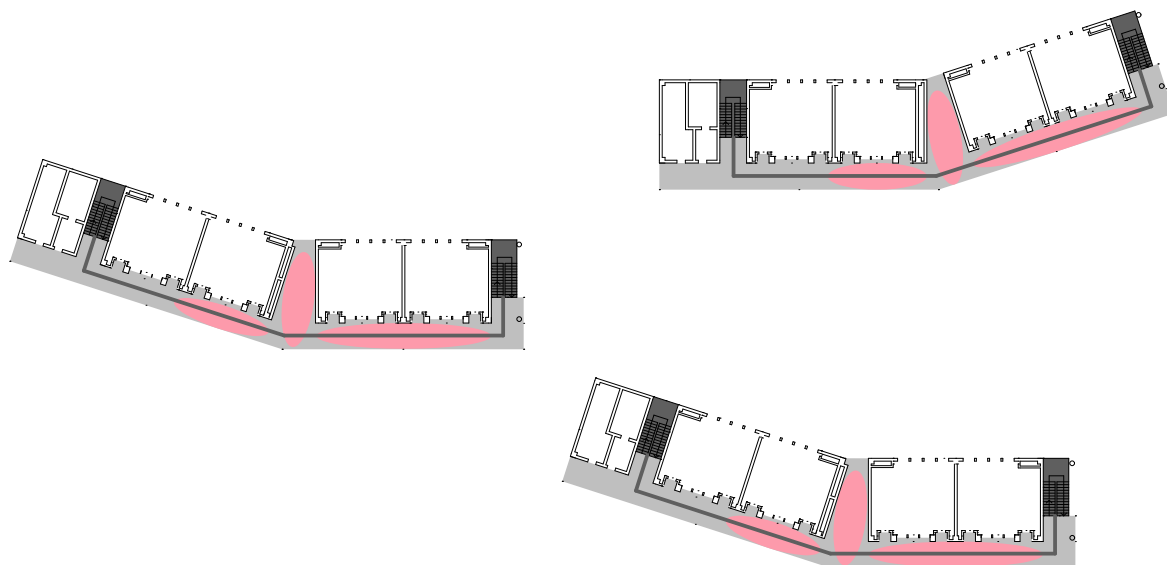
Ill. [45] Corridor at Tongji University Affiliate Elementary School



III. [46] Building organization and circulation - 1F



III. [47] Building organization and circulation - 2F



III. [48] Building organization and circulation - 3F

Legend - building organization

-  urban functions
-  circulation
-  main entrance
-  secondary entrance
-  circulation area
-  hallway expansion - possible learning space

Evaluation - building organization

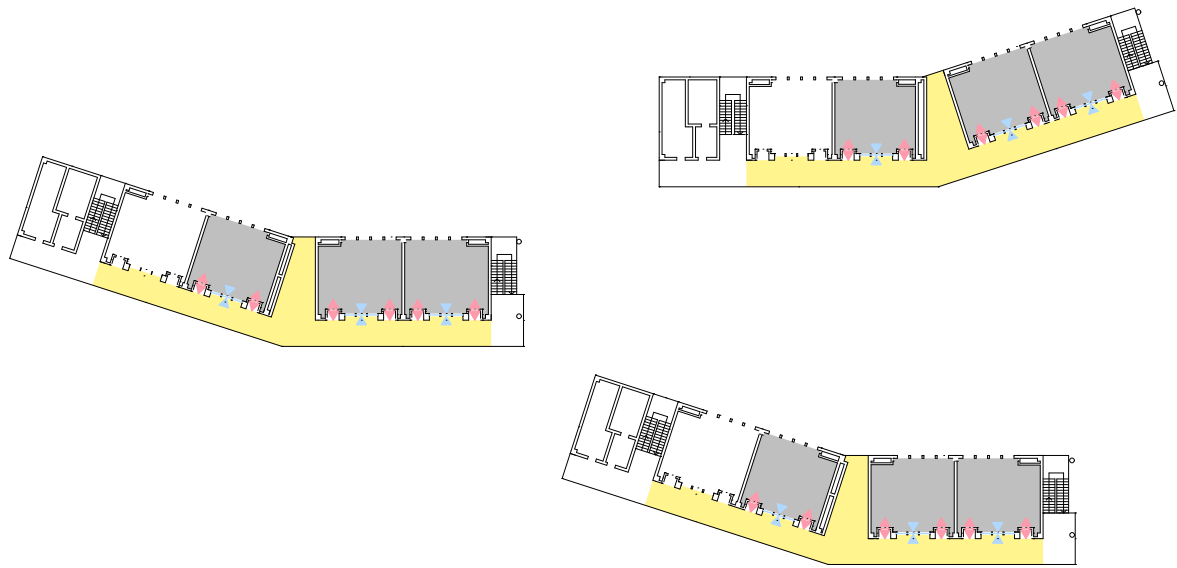
-  introverted building
-  no urban function
-  small expansion of hallway to educational area
-  no urban function
-  no urban function



III. [49] Usage and spatial communication - 1F



III. [50] Usage and spatial communication - 2F



III. [51] Usage and spatial communication - 3F

Legend - usage and spatial communication

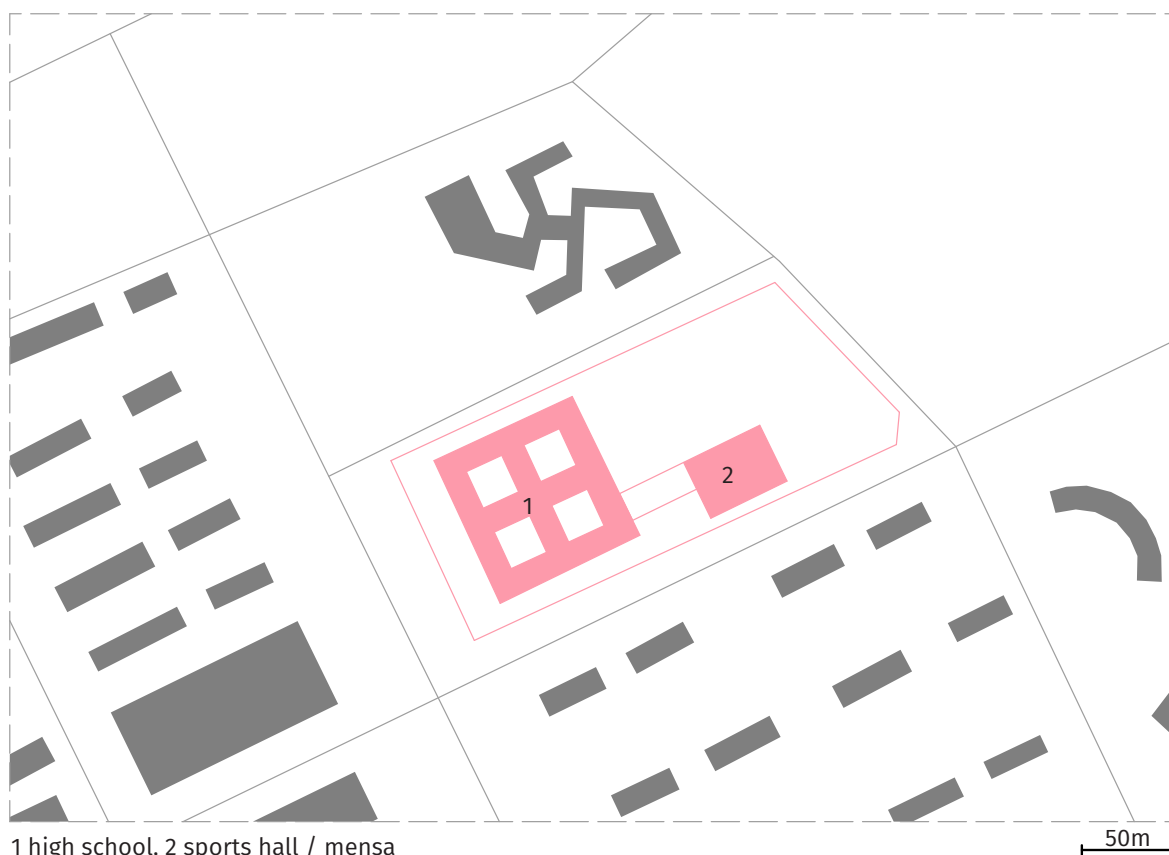
	education space		medium passive communication
	expansion of hallway usable as edu space		low active communication
	active visual-spatial connection		low educational use of circulation
	passive visual-spatial connection		weak link of educational spaces
			medium spatial interrelation

3.4.2. Xincheng De Fu Road Junior High School – Shanghai

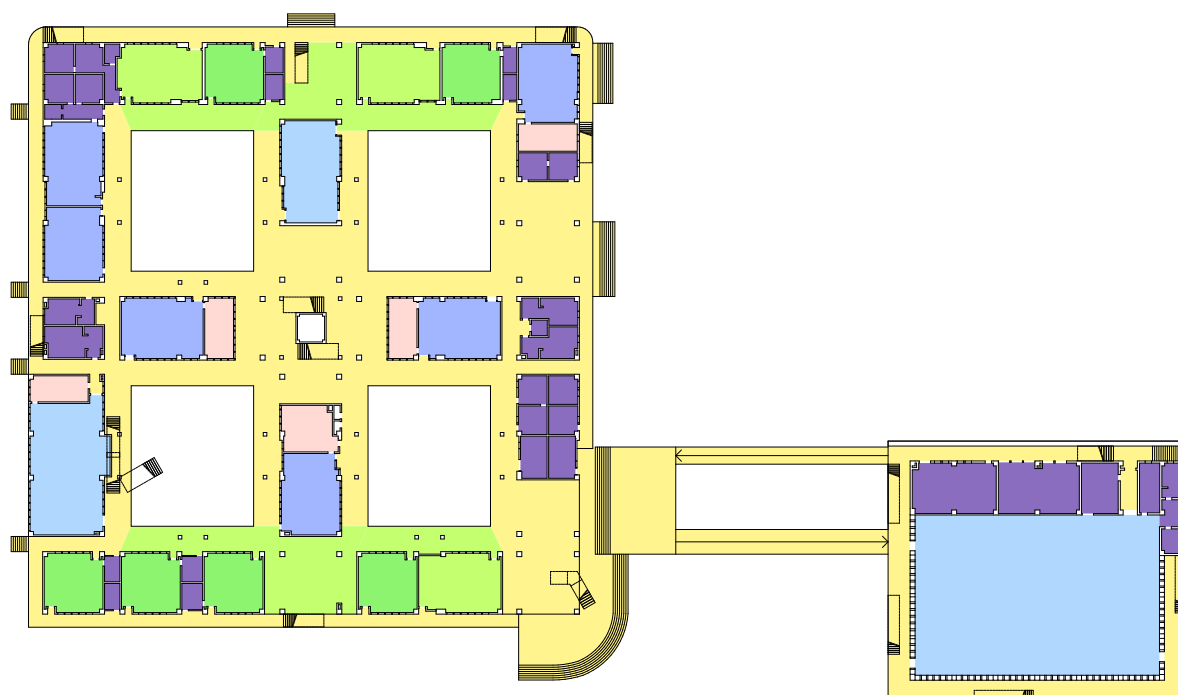


Ill. [52] Entrance of Xincheng De Fu Road Junior High School

Location:	Shanghai
Year of completion:	2016
Architects:	Atelier GOM



Ill. [54] Site plan of Xincheng De Fu Road Junior High School



Ill. [53] Functional conception - 1F

Legend - functional conception

 Shared education - literacy	 Education spaces - individual	 Common functions - urban
 Shared education - creativity	 Education spaces - community	 Common functions - administration
 Useable area - circulation	 Useable area - technical	

3.4.2.1. Conception of the school building

This Junior High School is located in the Jiading District, which is in the northwest of Shanghai [school location: 31.3578615, 121.2456870]. Jiading belongs to the outskirts of this megacity and has a more suburban character. Parts of it are development areas that are transforming very fast. New districts are arising. The construction method is based on the Chinese timber frame tradition. [14] This means: the wall does not directly support the roof, but a wooden construction takes over the load-bearing function. Afterwards the space was filled in. In Shanghai traditionally dry clay was used for this purpose. Deriving from this tradition, the Yincheng-School consists basically of a reinforced concrete skeleton construction. Annotation: I could not find any construction plan, but the pictures and the axonometry of the supporting structure suggest this assumption. The walls within this skeleton are filled with dry clay, as it is customary in traditional Shanghai buildings.

Unfortunately, I only could find a plan of the ground floor. But the ground floor plan gives enough hints to discuss the whole building.

Now a last word, why I choose this school as an example. It is because of its extraordinary architecture, based in tradition but modern in form, function and appearance. [15] [16] [17] [18]

3.4.2.2. Urban integration

The school is located between two major roads to the east and west of the school grounds. The De Fu Road in the east gives its name to both this school and the De Fu Elementary School which is located in the north of the property. In the south there is a minor road called Hongde Road. In the middle of this minor road is the school's main entrance and parking lot. This is intelligent in that it avoids traffic jams on the main roads in the mornings as parents bring their children to school. Also, the side road is a little safer than the main roads to get on a bike or scooter.

The main entrance is a real showpiece. It is accentuated by a two-storey covered outdoor space, additionally made more dynamic by a sloping ceiling which extends from the 2nd floor to the level of the 3rd floor. Due to this upward opening, the building looks like a blanket which is being lifted and you have to slip under it in entering. A gesture that suggests you are hooded in a secure environment. Best thing a school can offer.

The main building is located on the western edge of the site and is separated from Zongsheng Road by a green stripe. In the eastern part of the property are the sports facilities and the gymnasium.

The surrounding area is dominated by residential buildings. In the east there is undeveloped agricultural land and a canal. In the southwest there are a number of buildings with shops and restaurants.

The school does not have any district functions that it incorporates into its structure. [15] [16] [17] [18]

3.4.2.3. Functional concept of the school building

The school complex consists of two buildings:

One for the classrooms, teachers' rooms and the associated ancillary rooms.

Another one for the gymnasium and the canteen.

These two buildings are connected by two bridges. However, because base of the auxiliary building is half a floor lower than the main building, the bridges are with a slope. Lifted ramps, so to say. These bridges connect the first floor of the main building with the gymnasium on the first floor and the second floor of the secondary building. At the same time, these bridges serve as roofing for the path on the ground floor, from the main building to the gymnasium and for the ramp to the cafeteria in the basement of the annexe building.



III. [55] Classroom at Xincheng De Fu Road Junior High School

The main building is structured by four courtyards. This courtyard configuration is inspired by the Chinese character Tian, an ancient term for heaven that is opposite to earth. The courtyards with their grass, trees and bushes give the students a feeling for the four seasons, the time that passes with sunrise and sunset and the nature in which they are embedded. Around the courtyards there are roofed corridors which connect the individual rooms. The normal classrooms are oriented north-south and the special classes for subject-specific lessons are oriented east-west. Each of the school's learning rooms has windows on both of their long sides to allow enough light into the room and to offer a visual link with the rest of the school. The square classrooms each have their own cloakroom. [15] [16] [17] [18]

3.4.2.4. Spatial concept of the educational spaces

The classrooms are interesting because of their square form. Most school buildings have rectangular classrooms with a clearly defined orientation towards the blackboard on the broadside. A square classroom, at least formally, resolves this clear orientation of frontal teaching. On the other hand the plans show a blackboard and rows of tables and chairs aligned with it. On a picture, however, we can see children sitting in groups of tables and working together. A square room has no direction and therefore does not dictate the configuration of the



Ill. [56] Hallway at Xincheng De Fu Road Junior High School

room. The formal resolution of the direction of these classrooms is at the expense of the size of the room. The size of a square room is limited by the depth that light can penetrate. Just because there is no possibility to extend the room in one direction without leaving the square.

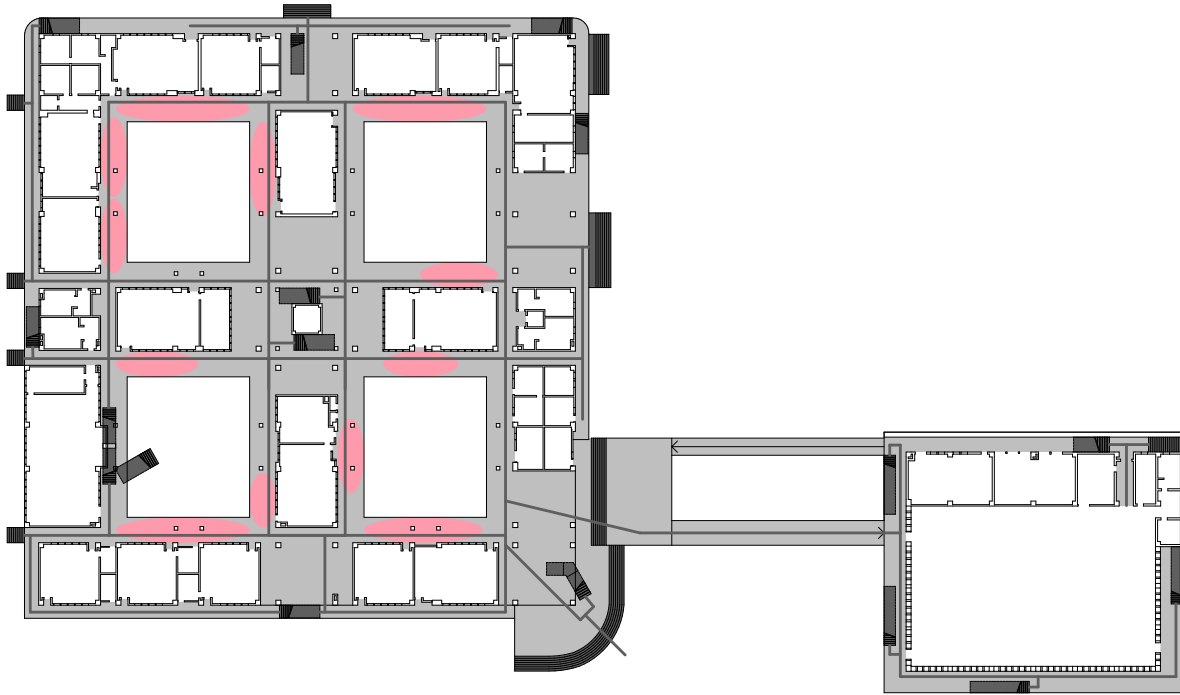
However, this abolition of hierarchy is rather theoretical in nature, since the introduction of doors and windows on two opposite sides has again resulted in a hierarchy.

The different learning rooms are clearly separated from each other, but are connected to the corridor and the courtyards by many windows. The pupils and students can go and run (if they are allowed) along the corridors and in the courtyard. This is very important to get to know each other. It helps to form a feeling of belonging together. Especially in Chinese culture this is first priority. The courtyards can also be used as a learning space, if the weather permits. For rainy weather, there are many different special learning rooms and the classrooms are also to be used. This configuration provides a scheduled change between the rooms. [15] [16] [17] [18]

3.4.2.5. Design concept

The design of the entrance situation with its dynamic form invites students — metaphorically spoken — to slip under the roof and into the secure space of the school. This dynamic continues inside and outside. The continuously walkable roof surface invites to take a stroll on it. The ramp-shaped roof parts connect the different heights of the roof. These roof ramps also appear on the inner and outer facades and structure them in a dynamic way. The wall surfaces on the outside are kept in light grey throughout. This creates an aesthetic reminiscent of the safety and durability of rocks. The inclined supports further enhance the dramatic overall impression.

Inside, the white finish dominates the appearance. This enables the users to create their own interior style. However, the ceiling with its visible beams of the supporting structure has a somewhat stimulating effect. The perimeter to the corridor respectively the courtyard areas is provided with a large number of openings with windows and doors. This creates a direct connection to the exterior space, which represents nature. At the same time the wide canopies and the circulation area on the floors above create a sun protection. According to the architects' calculations, this prevents unwanted reflections on the work surfaces while at the same time providing good lighting. This openness and brightness creates a free and friendly atmosphere in the interior. [15] [16] [17] [18]



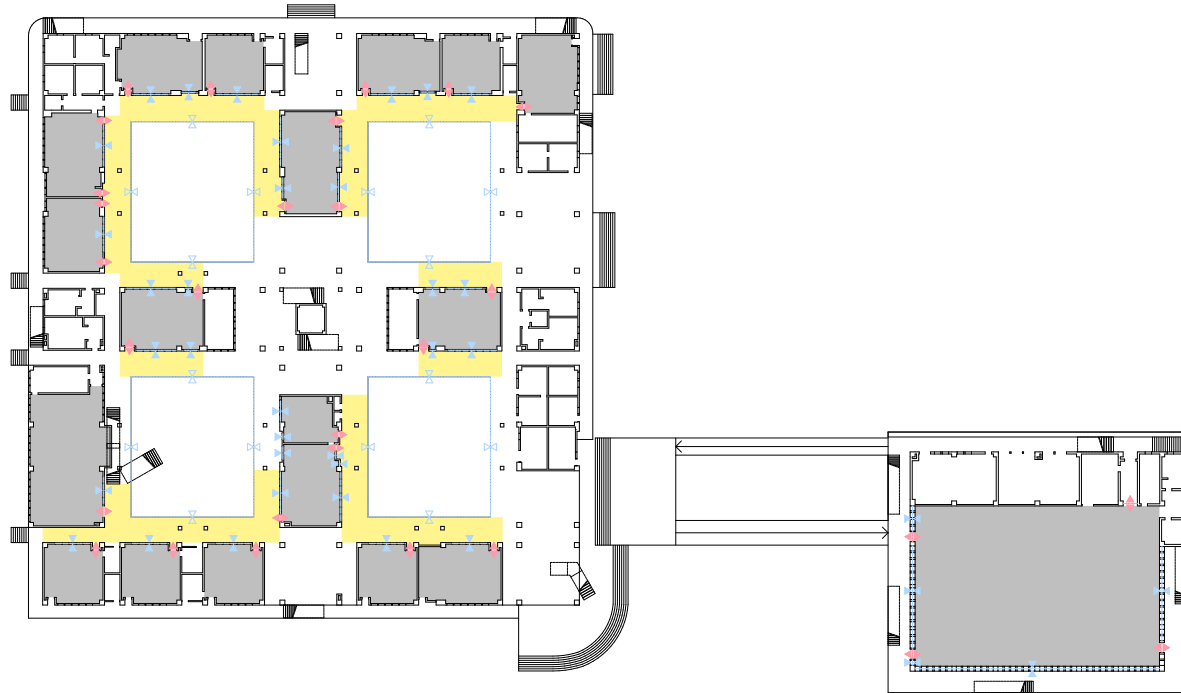
III. [57] Building organization and circulation - 1F

Legend - building organization

-  urban functions
-  circulation
-  main entrance
-  secondary entrance
-  circulation area
-  hallway expansion - possible learning space

Evaluation - building organization

-  extroverted building
-  no urban function
-  small expansion of hallway to educational area
-  no urban function
-  no urban function



III. [58] Usage and spatial communication - 1F

Legend - usage and spatial communication

-  education space
-  expansion of hallway usable as edu space
-  active visual-spatial connection
-  passive visual-spatial connection

Evaluation - usage and spatial communication

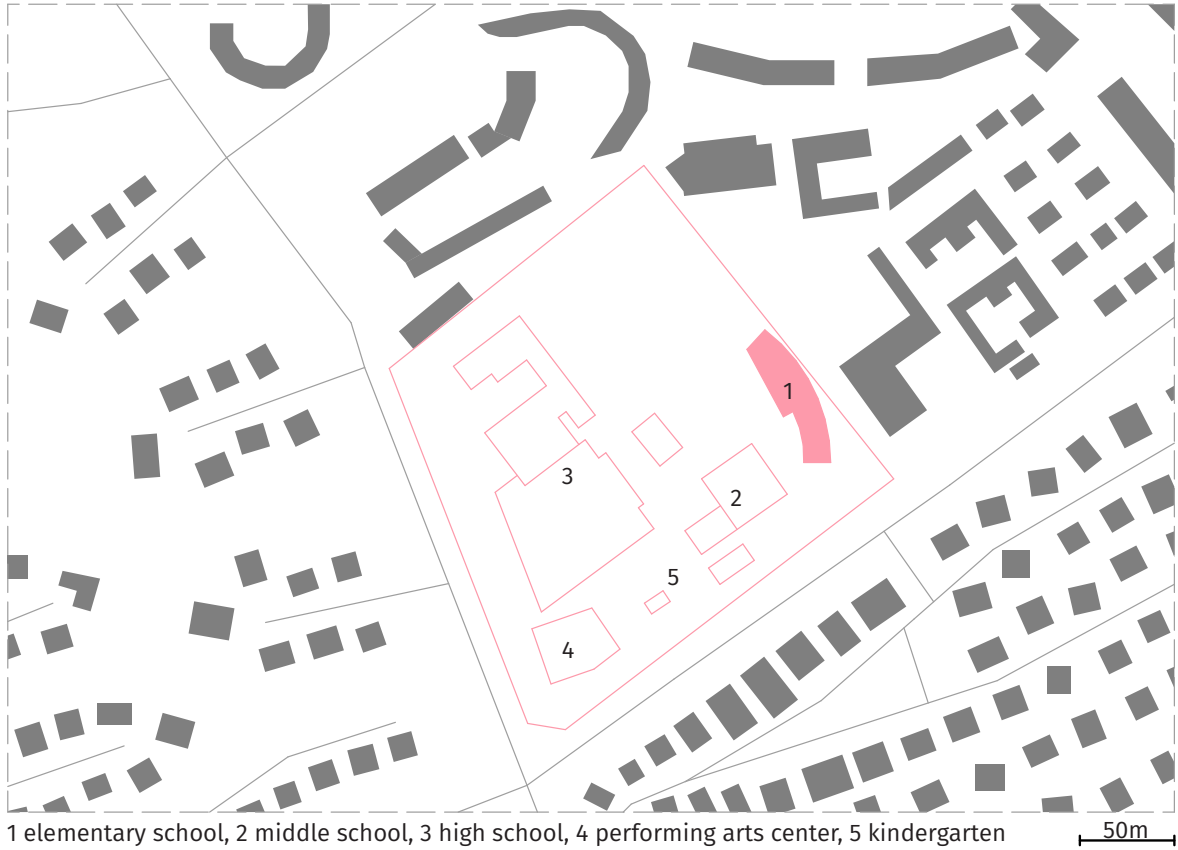
-  medium passive communication
-  low active communication
-  low educational use of circulation
-  weak link of educational spaces
-  high spatial interrelation

3.4.3. Concordia International School – Shanghai

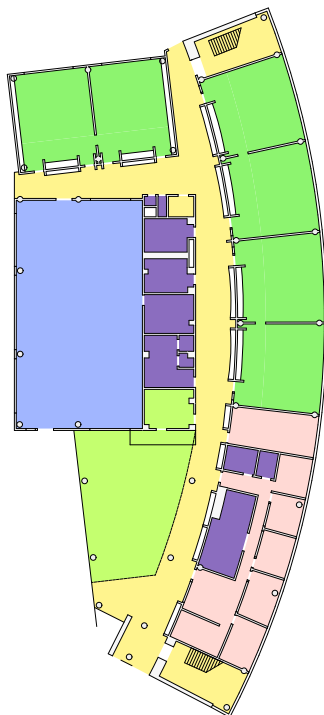


Ill. [59] Entrance of Concordia International School

Location:	Shanghai
Year of completion:	2007
Architects:	Perkins Esterman Architects



Ill. [61] Site plan of Concordia International School



Legend - functional conception

- Shared education - literacy
- Shared education - creativity
- Education spaces - individual
- Education spaces - community
- Common functions - urban
- Common functions - administration
- Useable area - circulation
- Useable area - technical

Ill. [60] Functional conception - 1F

3.4.3.1. Conception of the school building

Concordia International School is a private school run by the Lutheran Church-Missouri Synod, a Christian denomination in the USA. Nevertheless, it is not necessary to belong to this or any other denomination to attend this school. The school was founded in 1998 and has been growing continuously since then. The school offers kindergarten and all levels of education from elementary school to high school. The buildings on the campus house the individual schools. For this analysis the focus is only on the building for the Elementary School, which was completed in 2007. As a private school it is financed by school fees and donations. [21] [22] [23]

3.4.3.2. Urban integration

The school is located in the Pudong District in Shanghai. More precisely between Jinzangxincun Residential District and Zhangjiang Town.

The campus of Concordia International School Shanghai is organized in five buildings. The largest area is occupied by the high school in the western part of the property. The school's Performing Arts center is situated in the southwest. The Elementary School is located at the eastern end of the campus. The Middle School is placed between the High School and the Elementary School. The sports facilities of the school center are located in the northern part of the campus. There is also a kindergarten on the campus for the children of the surrounding area.

In the north of the campus is the Shanghai Pinghe School and a hotel. A few blocks of flats are located in the east of the campus. In the south and west are a large number of single-family houses. [21] [22] [23]

3.4.3.3. Functional conception

Preliminary remark: Unfortunately I only found the ground floor plan of the primary school building. But that should give a relatively precise impression of this school.

In the centre of the primary school building is the gymnasium around which the remaining rooms are fanned out in an arch. The arched rooms are oriented to the northeast. The other side, which is dominated by the gymnasium, is rather block-like in its design.

The main entrance is located at the southern end of the arch. The entrance hall or assembly hall mediates between the arched rooms and the block-like gymnasium. This central hall is a multi-storey room with a gallery on the upper floor. A glass façade borders the hall. This room serves as cafeteria of the building and for assemblies of the school. The hall is also an appropriate space for a wide range of activities. Here one can play and dance during the breaks. Also more quiet activities such as learning alone or in smaller groups can take place here, due to the good lighting of this high and bright room.

Right next to the entrance hall in the arched part are the rooms for the administration, teachers and the headmaster of the school. There are two

entrances and an internal circulation in this part. The offices are situated in relatively small rooms.

The two staircases are situated at the northern and southern end of the arched section.

The classrooms are lined up along a corridor in the northern part of the arch. Two further classrooms are located to the north of the sports hall. The corridors have an interesting shape and in some places are wider than necessary. However, they are suboptimal for cross-class communication, or at least not better than any other corridor where the classrooms are lined up. The opposite side of the corridor from the classrooms are ancillary rooms of the school and the gymnasium. This is rather a hindrance for cross-class communication. [21] [22] [23]

3.4.3.4. Spatial conception of the educational space

All classrooms are strung along a corridor and connected via it. Those classrooms that are fanned out in the arch form have a door and a window to the corridor. Through this window, views in and out are granted and it represents a passive spatial-visual connection. The northern classrooms feature two doors but no window to the corridor.

The classrooms are connected directly with a door in groups of two.

Each classroom is almost square in size. For the interior design the classrooms have a service unit. This has similarities with a kitchen unit as it consists of



III. [62] Assembly hall at Concordia International School



III. [63] Hallway at Concordia International School

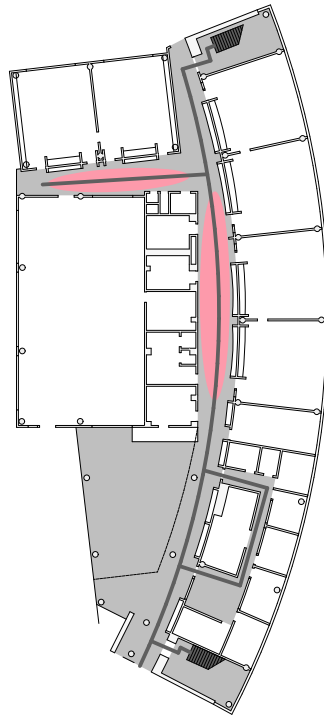
kitchen base units and kitchen wall units. Two washbasins are also part of the service unit. This service unit seems to be mainly used as a tea kitchen and storage space for teaching utensils.

There is an open shelf in front of each classroom. This serves as a coat rack for the students of this class. Above these shelves there is still space for the exhibition of the works of art that were made by this class. The aisle area is not used as an extension of the classroom. The corridor is also not exactly suitable for this purpose. There is no zoning of this long aisle. As a result, one would not know exactly where to sit down. The corridor is relatively wide with a width of three to four meters, but its walls are constantly occupied by coat racks and doors. Also the lighting is not very good and the spatial-visual connection is, because of its positioning, not designed for a quick expansion of the learning area to the aisle. Especially because the position of the spatial-visual connection makes it difficult for the teachers to keep an eye on the pupils in the classroom and on the corridor at the same time. [21] [22] [23]

3.4.3.5. Design concept

The classrooms have a bright and friendly atmosphere. Enough light comes into the classroom through the generous glass fronts and fills it with pleasant daylight. The walls are painted in bright and friendly colours. This contributes greatly to the friendly and pleasant learning atmosphere. At the same time the walls also serve as a display for various learning materials, student works and

decoration. The floor covering is a dark carpet and the coffered suspended ceiling is kept in neutral white. The classrooms are neatly organised. They offer a friendly atmosphere with enough light for a pleasant learning environment. The change of the learning modes frontal teaching, group work, self-study can only take place in the self-contained area of the classroom. There are no immediate extension, additional or alternative rooms directly adjacent to the classroom to rapidly adapt the spatial setup to the learning modes. [21] [22] [23]



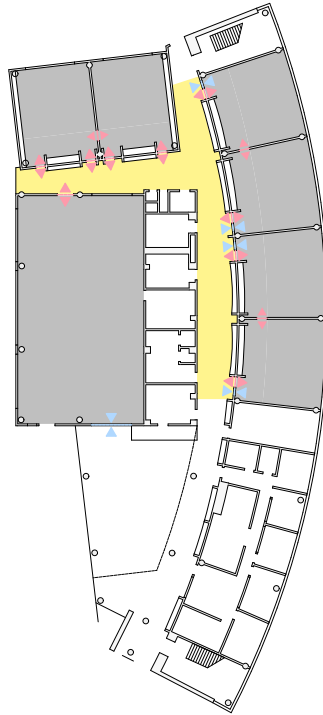
Ill. [64] Building organization and circulation - 1F

Legend - building organization

-  urban functions
-  circulation
-  main entrance
-  secondary entrance
-  circulation area
-  hallway expansion - possible learning space

Evaluation - building organization

-  introverted building
-  decentral entrance for direct access to building
-  small expansion of hallway to educational area
-  completely independent circulation
-  high availability of external functions



III. [65] Usage and spatial communication - 1F

Legend - usage and spatial communication

-  education space
-  expansion of hallway usable as edu space
-  active visual-spatial connection
-  passive visual-spatial connection

Evaluation - usage and spatial communication

-  low passive communication
-  medium active communication
-  no educational use of circulation
-  weak link of educational spaces
-  low spatial interrelation

3.5. Conclusion and discussion of the analysed school buildings

3.5.1. Urban integration

The integration of additional functions into the school building or the school campus is of considerable benefit to the neighborhood. This can be a catalyst for the further improvement of a neighborhood.

In Shanghai I could hardly find any school buildings with integrated urban integration. This could also be due to the relatively small number of school buildings in Shanghai for which I have found information. The school buildings in Finland, unlike in this case study, do not all have integrated urban functions. This distortion comes from the criteria catalog that was used to select the schools. However, Finnish school buildings seem much more open to the integration of additional functions that benefit the neighborhood. In Shanghai I could only find the Concordia International School, which has a kindergarten on its campus. The integration of urban planning functions into the school building or campus was implemented throughout by means of a decentralized access system which could be reached from outside. In addition, the external functions, with one exception, are housed in a lockable area. The buildings or parts of buildings that contain these external functions can thus be opened and used independently of school opening hours. An exception is the Saunalathi School, where the integration of the youth center and the library is not separated from the rest of the school premises. This makes independent use more difficult, since opening for a certain out-of-school function also means opening the entire school building.

External school functions should be housed in a separate area with a connection to the rest of the school that can be closed. In addition, external functions should be accessed decentrally, i.e. have their own independent entrance. This clear separation, which allows an opening and connection to the school, makes the building more flexible in its use.

3.5.2. Building Organization

The analyzed school buildings in Finland differ from those in Shanghai in the design of the access routes. Finnish school buildings have aisles only in the interior, whereas those in Shanghai have aisles mainly outside. In Shanghai, the corridors are covered throughout. This difference can be explained by the different climatic conditions, which in Shanghai make it possible to reach the learning areas through a roofed outdoor space all year round.

Selected corridors in Finland in all analyzed school buildings and in Shanghai in the Tongji Affiliated Experimental Elementary School are equipped in such a way that they can be used as an extension of the learning areas and as a common space. This allows pupils and teachers to extend the learning area to these areas if necessary. It should be noted, however, that the examples analyzed all

have closed classrooms and thus require explicit corridor areas. With an Open Learning Landscape or a cluster with a common center, the pure aisle area could be reduced, or it could be reused mostly as aisle area, learning area, recreation area, etc.

3.5.3. Spatial communication between educational spaces

The physical and visual connections between learning rooms promote the rapid expansion of the educational area over the entire surface. This is especially helpful in learning modes that involve group work or independent work.

Different solutions were found for these connections. Large glass walls as well as windows are a common means of creating passive visual communication between rooms in the analysis set. These connections are especially useful to keep visual contact with the rest of the class in a group or self-study phase. Narrow glass strips next to the classroom door, on the other hand, bring almost no additional benefit. In addition, active pedestrian connections between learning areas are important to support a rapid change of learning modes. The easiest way to do this is with a single-leaf door. Together with a generous glass wall or several windows, a strong connection between the learning areas is created. Folding partitions are another way of connecting learning rooms. These offer the advantage that several rooms can be used individually or as one large room. However, they do not provide a direct line of sight between the learning areas, unless they are designed as folding glass partitions.

Saunalahti School - Espoo



extroverted building



decentral entrance for direct access to building part



small expansion of hallway to educational area



mostly independent circulation



high availability of external functions



medium passive communication



low active communication



medium educational use of circulation



weak link of educational spaces



medium spatial interrelation

Kariston päiväkoti school – Lahti



mostly introverted building



decentral entrance for independent function units



small expansion of hallway to educational area



completely independent circulation



high availability of external functions



high passive communication



medium active communication



high educational use of circulation



weak link of educational spaces



low spatial interrelation

Tuupalan School - Kuhmo



mostly extroverted building



decentral entrance for independent function units



medium expansion of hallway to educational area



completely independent circulation



high availability of external functions



medium passive communication



high active communication



medium educational use of circulation



spatial and functional link of educational spaces



high spatial interrelation

Tongji School – Jiading / Shanghai



introverted building

no urban function



small expansion of hallway to educational area

no urban function

no urban function



medium passive communication



low active communication



low educational use of circulation



weak link of educational spaces



medium spatial interrelation

Xincheng De Fu Road School – Shanghai



extroverted building

no urban function



small expansion of hallway to educational area

no urban function

no urban function



medium passive communication



low active communication



low educational use of circulation



weak link of educational spaces



high spatial interrelation

Concordia School – Shanghai



introverted building



decentral entrance for direct access to building



small expansion of hallway to educational area



completely independent circulation



high availability of external functions



low passive communication



medium active communication



no educational use of circulation



weak link of educational spaces



low spatial interrelation

Chapter 4: Design proposal for an elementary school in Shanghai

4.1. Assumptions for the design of an elementary school in Shanghai

For the design of an elementary school at the chosen location in Shanghai some assumptions have to be made regarding the organization of the school. These would in practice be derived from the requirements of the school to be planned, but for the purpose of this thesis the following assumptions should apply. The elementary school should be designed for 500-600 pupils of grades 1-6. The pupils should be grouped into classes of about 18 pupils. The lessons will be implemented through a variation of different learning modes in rapid change. The learning rooms are to be designed according to this flexibility of the teaching methods. The classrooms are organised as clusters, which allow for inter-grade learning. For this purpose, several classes from different age groups will be combined in a cluster. In these clusters, strong spatial-visual connections between the learning areas are to be ensured in order to incorporate the joint use of different spatial situations into the lessons. It is important that the corridors in the clusters also serve as recreation, learning and play areas, i.e. become a common space. The sanitary facilities are to be integrated into the cluster as decentralized individual toilets in order to avoid bullying in the toilets. The canteen can serve food for the children in several shifts. At the same time, this room is to serve as a learning and recreation area for the rest of the day. Festive activities should also be able to take place in the cafeteria. In order to integrate the school building into the neighborhood, a district library is to be created, which will have its own decentralized access. This library should be housed in a separate part of the building. This will enable the library to be used independently of the school. Nevertheless, the library should also be connected to the school and become part of it. Furthermore, the gymnasium should be available for external sports clubs. The clubs can then use the gymnasium for sports activities or dance outside school opening hours. For this purpose, the gymnasium and the associated cloakrooms and shower facilities must be accessible independently of the rest of the school.

4.2. Design proposal concepts

The layout of the school building follows the idea of a small village. There is a main house for gatherings respectively as common meeting place. Also there are small houses with special functions and four learning houses where the pupils have their "home". Each learning house is accommodating grades 1 to 6, with the lower 3 grades on the 1st floor and the upper grades on the 2nd floor. This results in clusters for grades 1-3 and 4-6, with the closed rooms within the clusters being reduced to a minimum. Instead, there is one large room that allows for a variety of spatial configurations. Spatial delimitations are realized with some single glass walls, folding partitions and shelves on lockable castors. This allows the spatial situations to be reconfigured again and again and adapted to changing needs. The clusters on the 1st floor are more self-contained, but have direct access to the garden. The idea here is that the pupils of the lower school levels only enter the outside space and use the garden under supervision. The clusters on the upper floor for the upper grades, on the other hand, are designed for a deeper integration of interior and exterior space. Pupils should have the opportunity to move freely in the interior and covered exterior space of the upper floor. This gives them more freedom of movement because they can stay on the learning balcony that spans the cluster. The openness to the outside space on the upper floor offers the advantage that the boundaries of the floor clearly limit the freedom of movement of the pupils within the covered outside space.

No separate rooms are planned for natural science subjects such as chemistry and physics. These lessons are also to take place in the clusters and will be supported by laboratory trolleys if necessary. The experimental set-ups in the elementary school are not elaborate or dangerous, so they can be easily implemented in the clusters. Storage space is provided in the cluster for stowing the required utensils. The subjects music, as well as textile and technical works have dedicated rooms. This is mainly due to the expected noise development during these teaching units. These classrooms are located in small buildings on the 1st floor.

The gymnasium, the mensa or assembly hall, the district library and the administration are located in a building facing the street. The district library is designed in such a way that it is well connected to the school and can optionally be used separately. With this design, different usage scenarios are possible. The library could be used by neighbors and pupils at the same time. If this is not desired, staggered opening hours can be implemented for the different user groups. For example, the library could function as a district library in the morning and evening and as a school library in the afternoon. The library has three access points for this purpose. A decentralized entrance from the street to ensure that the library can be used as a district library independent of the school. One access to the clusters for integration into the school operation and one access to the assembly hall to enable the shared use of this space as a reading room. The height of the gymnasium includes the basement and 1st floor. Thus it

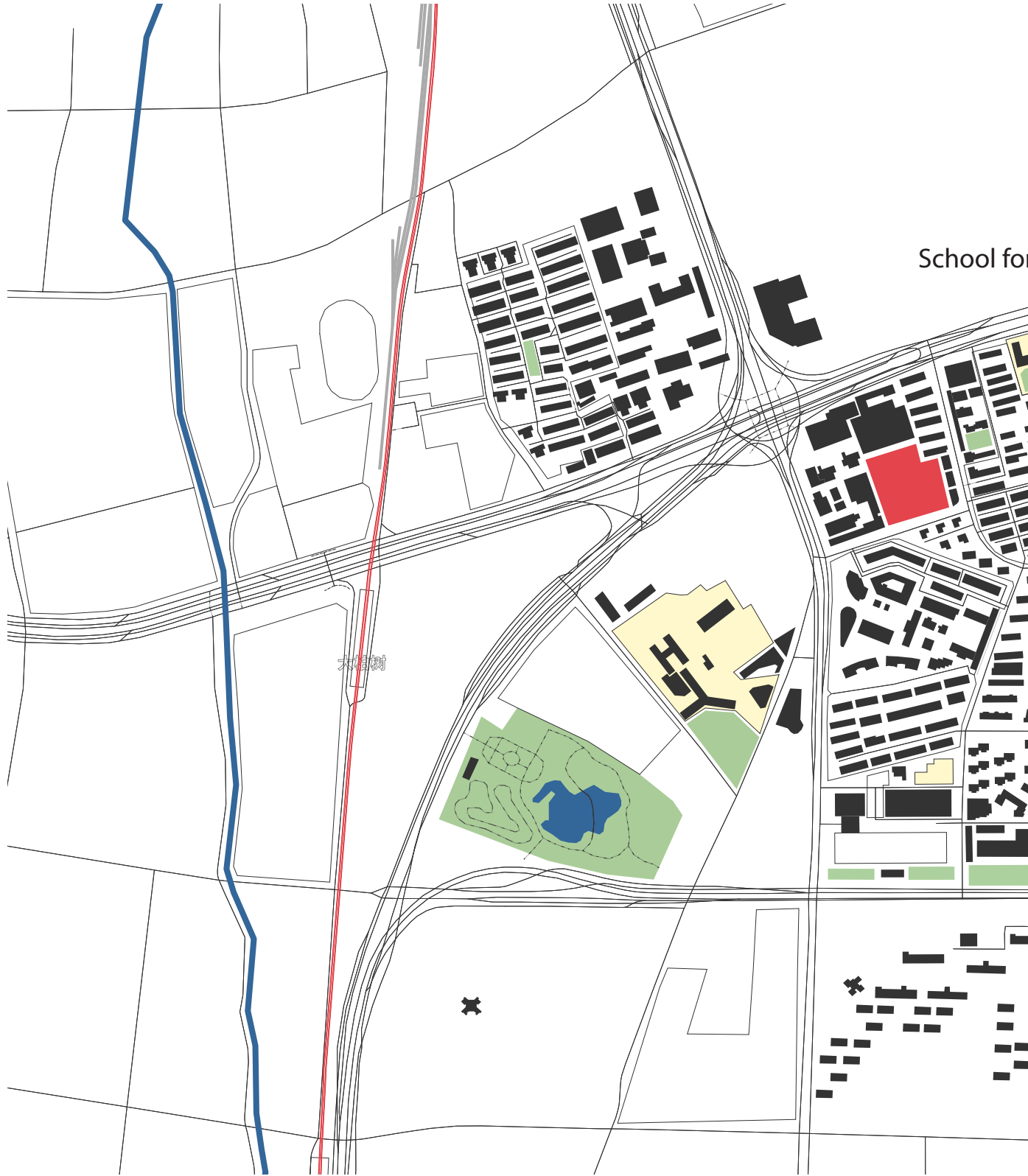
protrudes from the ground. Along the street façade and the entrance hall there are large windows, so that the gymnasium can be seen when passing by. The gymnasium and the associated cloakrooms, showers and toilets are designed in such a way that they can be used when the school is closed. Local clubs can use the gymnasium for sports or dance after school hours. The area of the gymnasium can be used externally without the rest of the school being accessible.

The canteen is located on the upper floor of the main building. The food is prepared in a kitchen in the basement and is transported to the cafeteria by an elevator to the food counter. In the canteen, food is eaten in four shifts. Two shifts would also be possible, but this would be at the expense of furniture for use as a learning or recreation area and reading room during the rest of the school day. The cafeteria / assembly hall could also serve as a seated event location for the entire school. For this purpose, the tables can be moved via the freight elevator to a storage room in the basement.

The administration is located on the second floor of the main building.

4.3. Design proposal

4.3.1. Site plan - overview



Ill. [66] site plan - overview



4.3.2. Site plan - up close



Ill. [67] site plan - neighborhood



4.3.3. First Impression

As you walk towards the school, you can either take a look into the lower lying sports hall or into the city district library. The district library acts as a link between internal and external people. It is, so to speak, the hinge that additionally interlocks the school with the neighborhood.

The main entrance is marked by the protrusion of a roof. This makes it clear where the entrance is. Behind this roof of the main entrance are the parts of the school grounds that are not covered: a courtyard, garden and other open spaces. The actual rooms, such as classes and teachers' rooms, are accessed exclusively through these open spaces. It is warm enough in Shanghai all year round that there is no need for heated corridors. In addition, the students should be able to feel the changing seasons on their own skin and not always find the same climatic conditions. The school complex is inspired by the image of a small village, with its individual houses and courtyards.

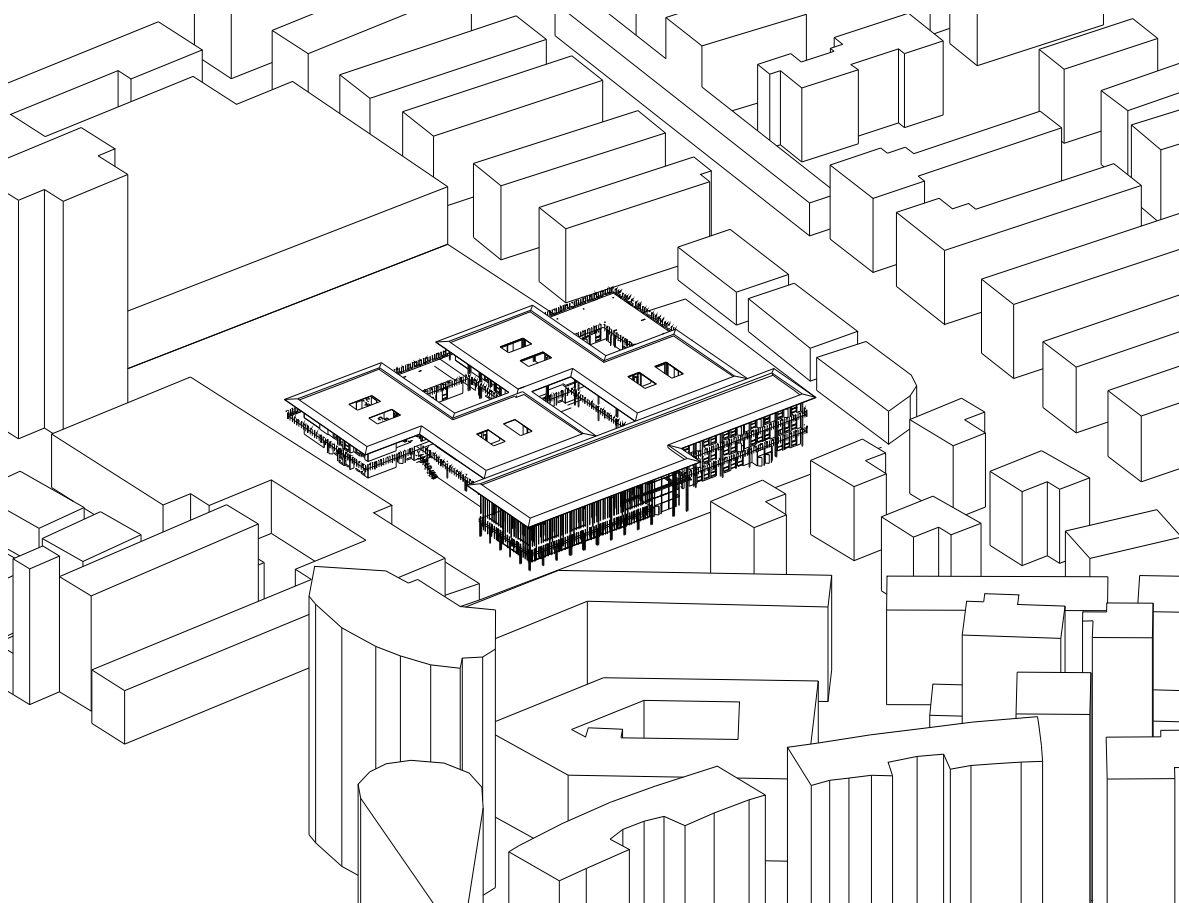
The normal classrooms are grouped into four houses or blocks. Each block has four classrooms on the ground floor. Between these classrooms there is an interior space that serves as a common learning and play area for the classes of the house. On the top floor of each house there are three classes and also a learning and playing terrace. These terraces can be equipped with roofing, shading and planting. These terraces can also be divided into zones that allow different activities at the same time.

To the classrooms themselves: These consist of one room that can be divided by folding partitions. Some classrooms have a folding partition and are placed next to each other so that the wall between them can be removed. The various possibilities of separation and opening allow a quick change of different learning and play activities. The room sizes can be quickly adjusted depending on how much space is needed at any given time. A room situation that is optimal for frontal teaching can be suboptimal for group work or individual work. For this reason, the rooms are designed to be flexible and allow a wide variety of situations. This flexibility is realised in the interaction of folding partitions, learning niches and several learning areas outdoors. The direct connection of the outdoor rooms (courtyard, garden) to the houses also stimulates additional learning and play situations.

The arrangement of the four houses divides the outdoor space into four smaller areas, one of which is designed as a courtyard and serves as a meeting place for larger groups, while another area is intended as a garden. On the one hand, these outdoor areas should have sufficient planting to provide shade and, on the other hand, give the pupils the feeling that their school is standing in the middle of a clearing in the forest. On the other hand, the outside space should also be inviting for playing and learning. A pavilion for music lessons in the garden is a solitaire.

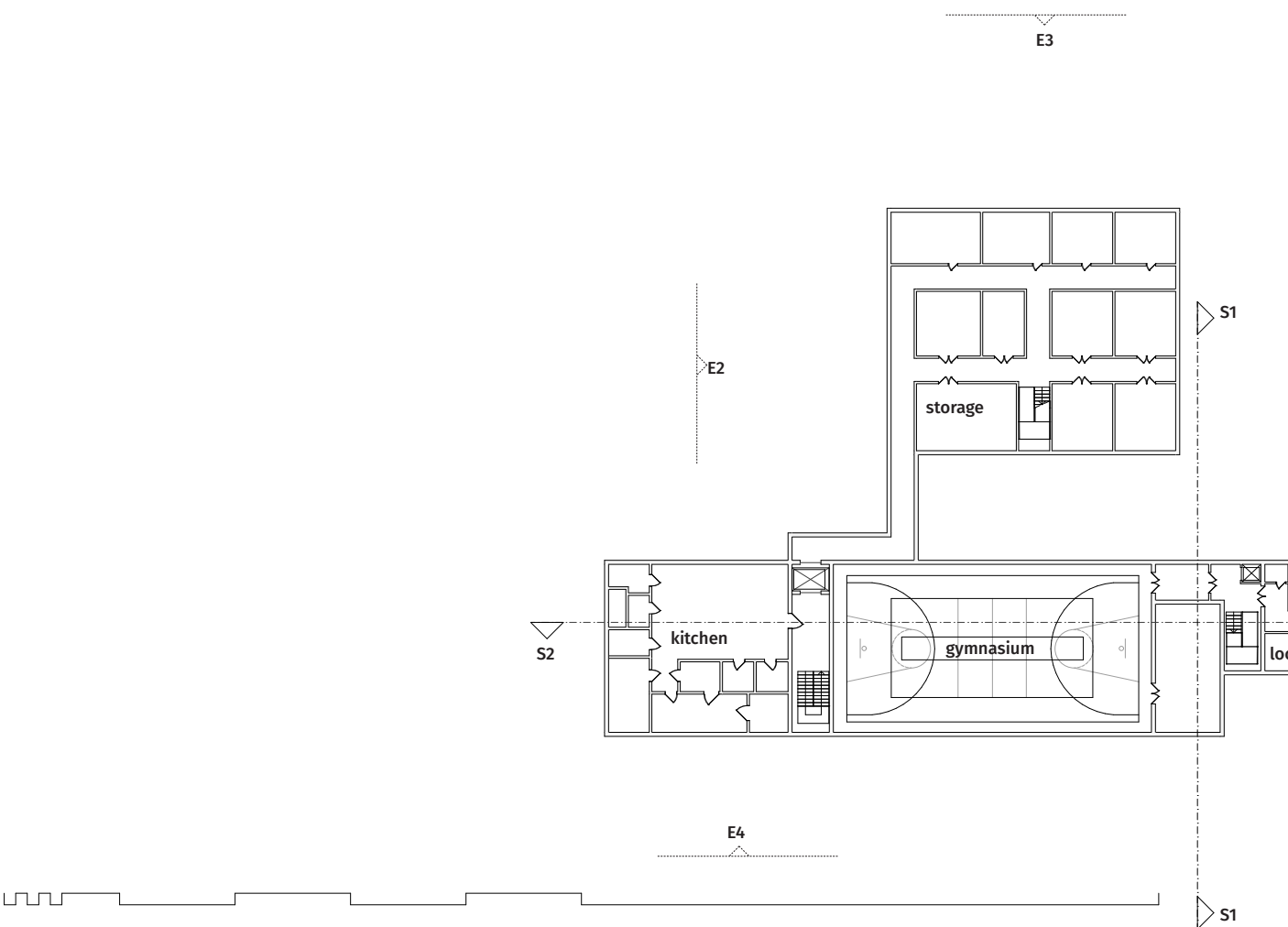


Ill. [68] street view

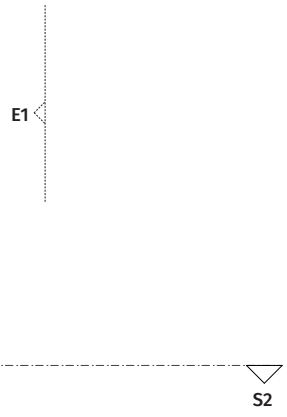
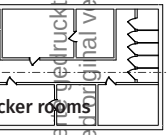


Ill. [69] birdview axonometry

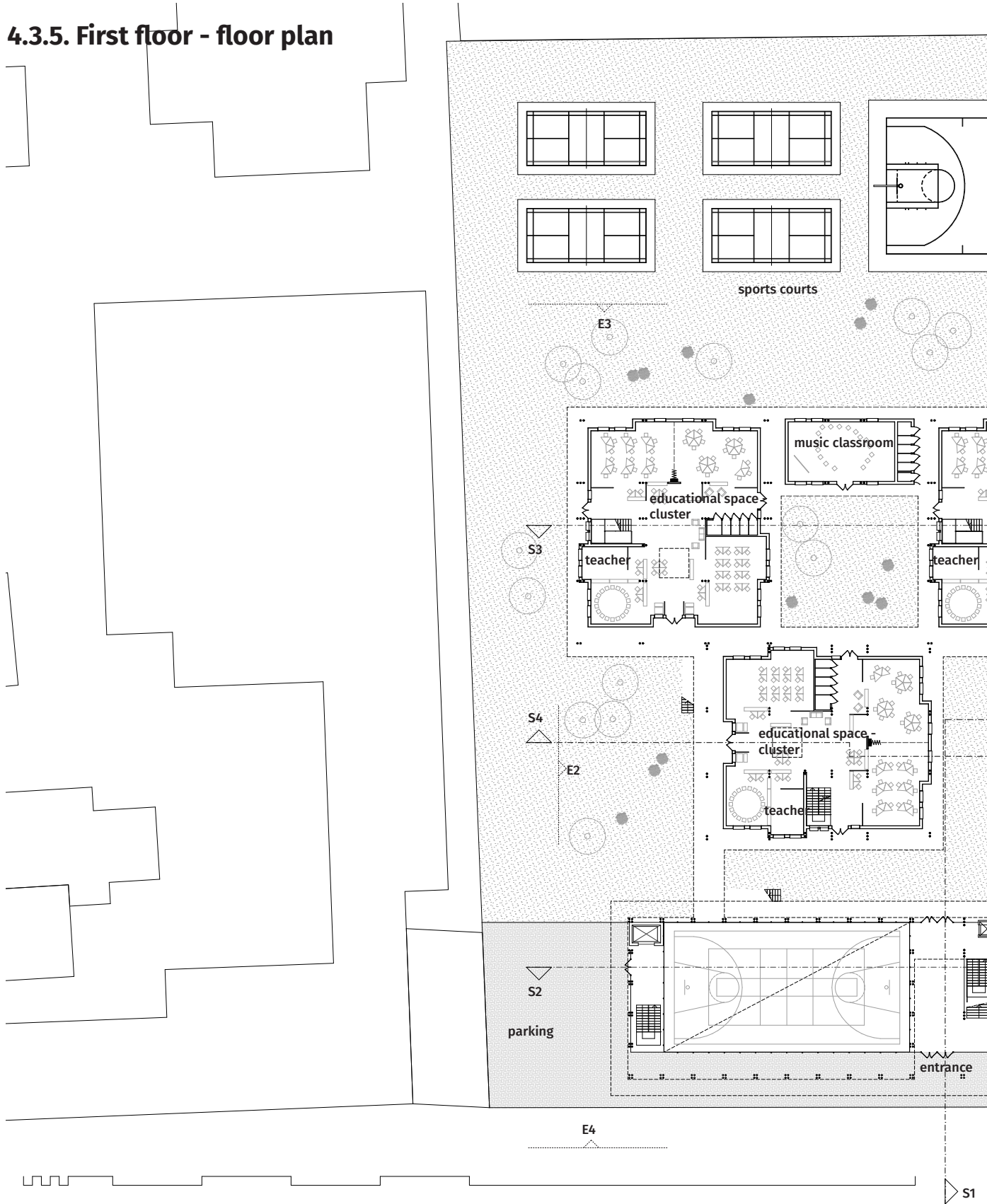
4.3.4. Basement - floor plan



Ill. [70] basement floor plan



4.3.5. First floor - floor plan



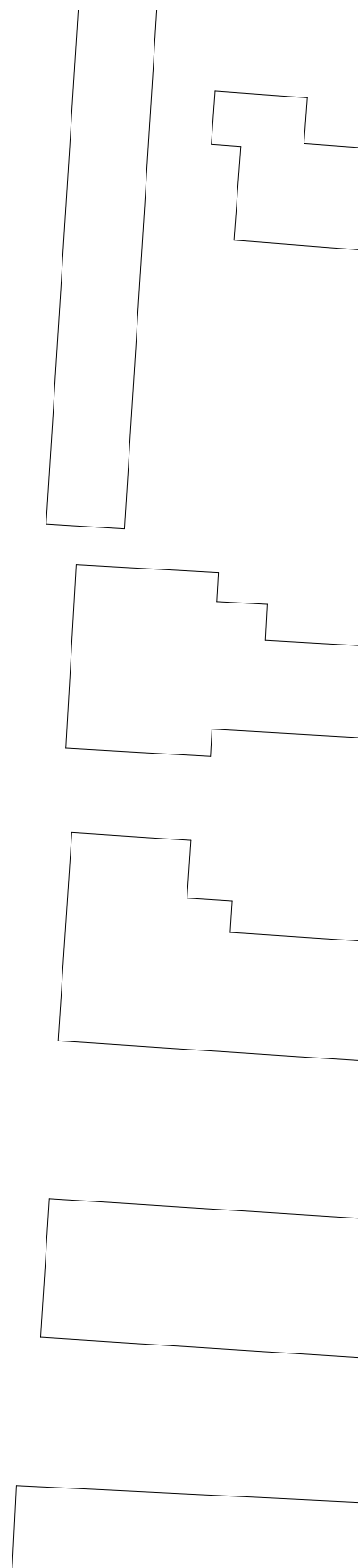
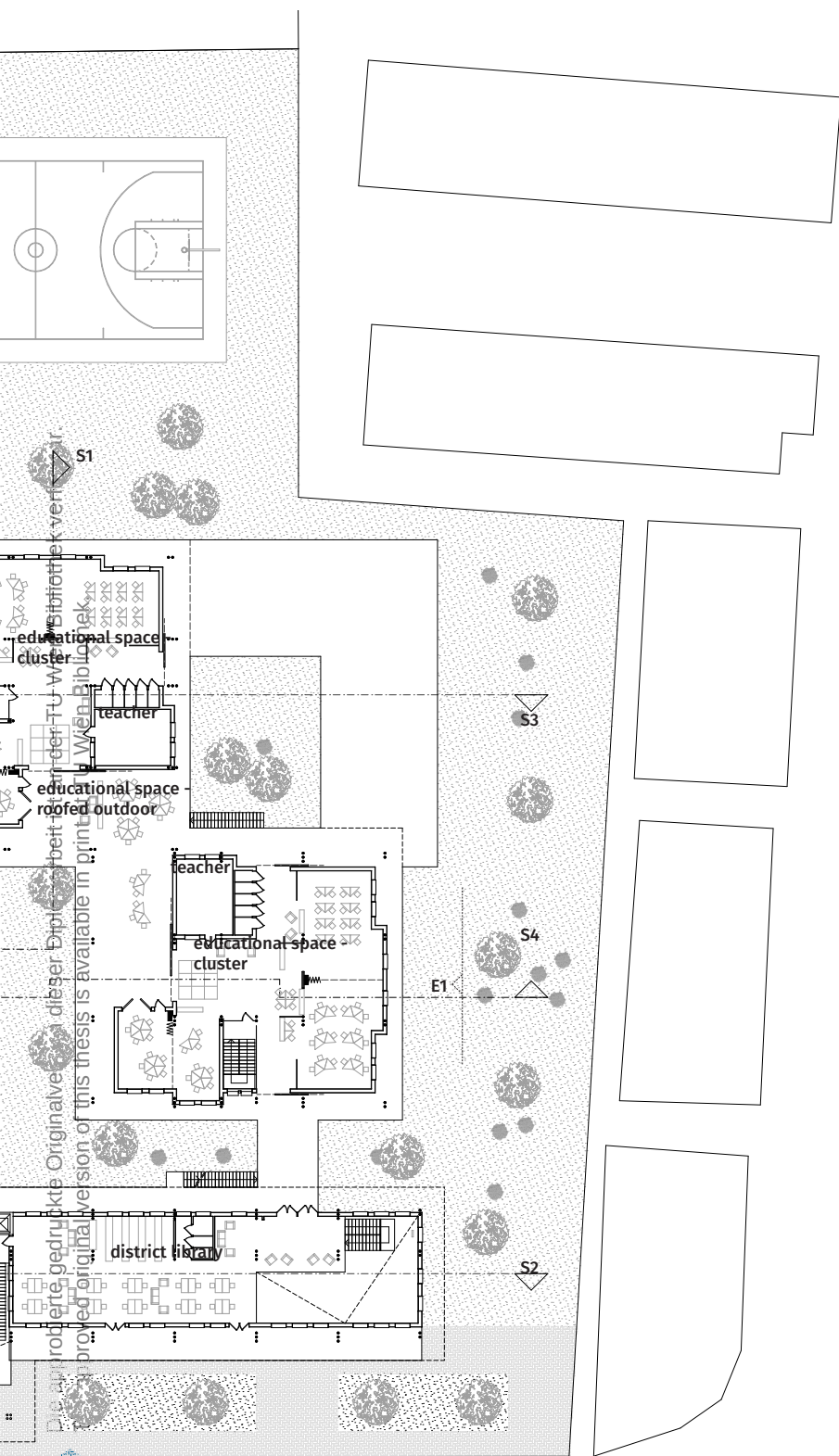
Ill. [71] 1st floor plan



4.3.6. Second floor - floor plan



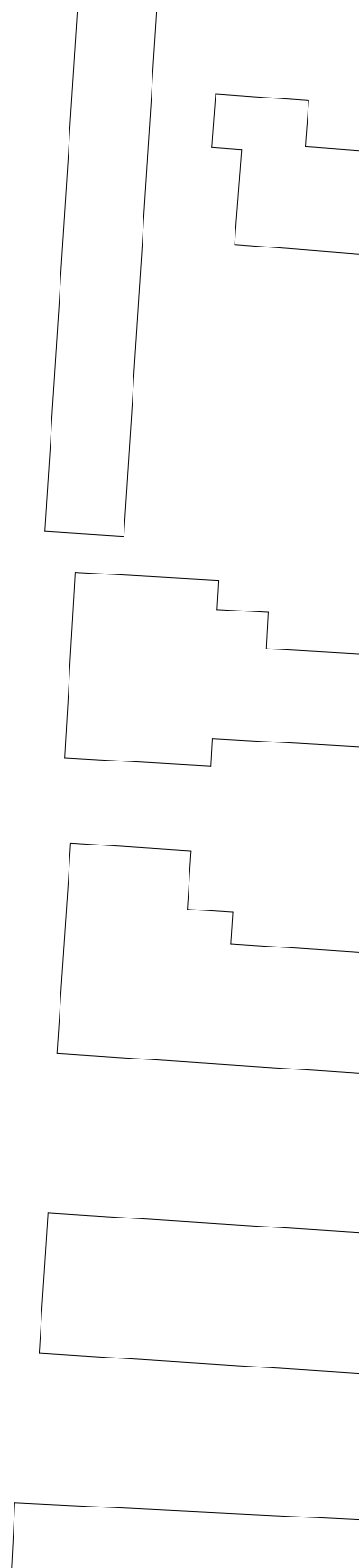
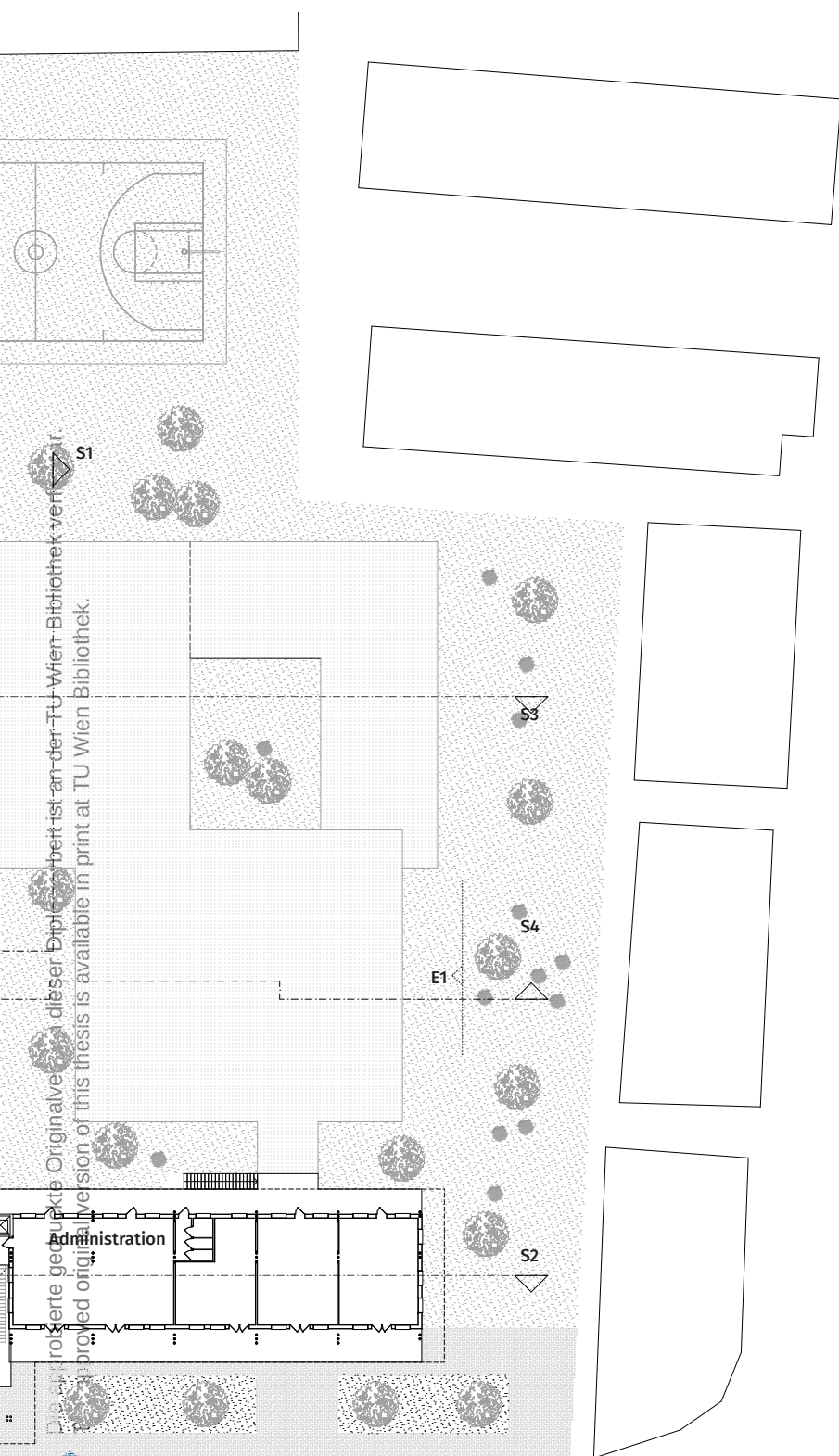
Ill. [72] 2nd floor plan



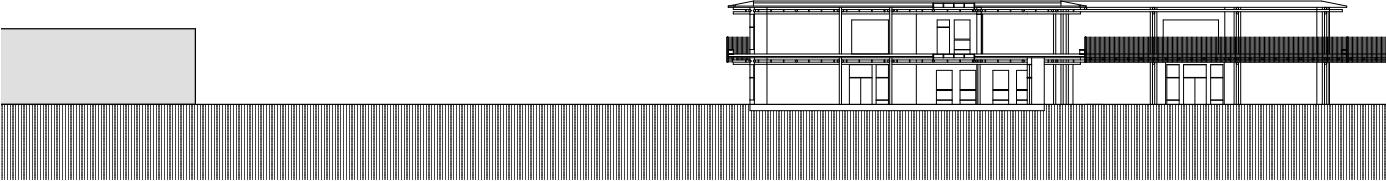
4.3.7. Third floor - floor plan



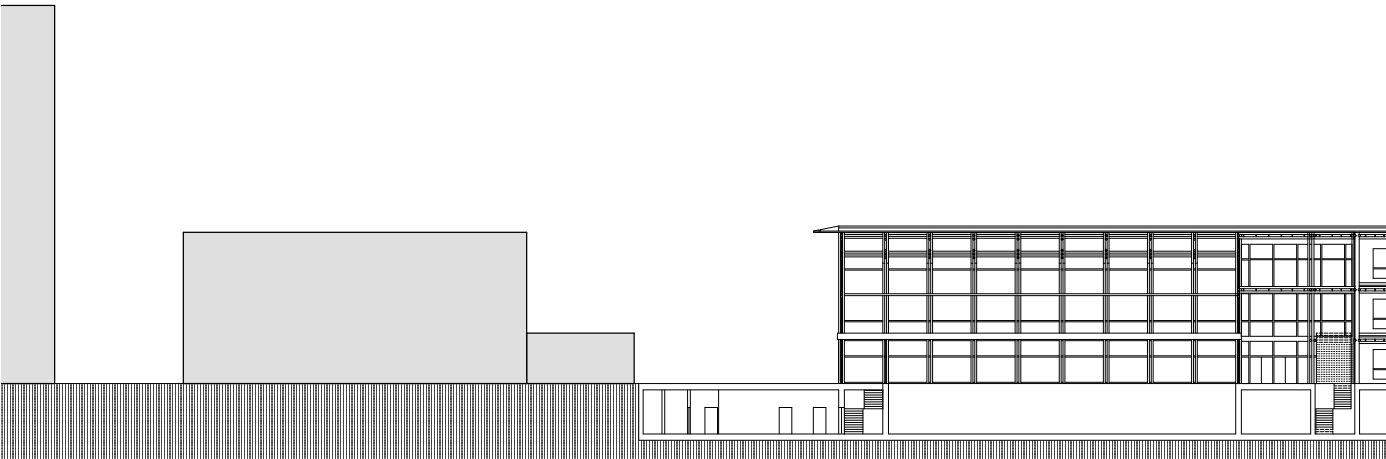
Ill. [73] 3rd floor plan



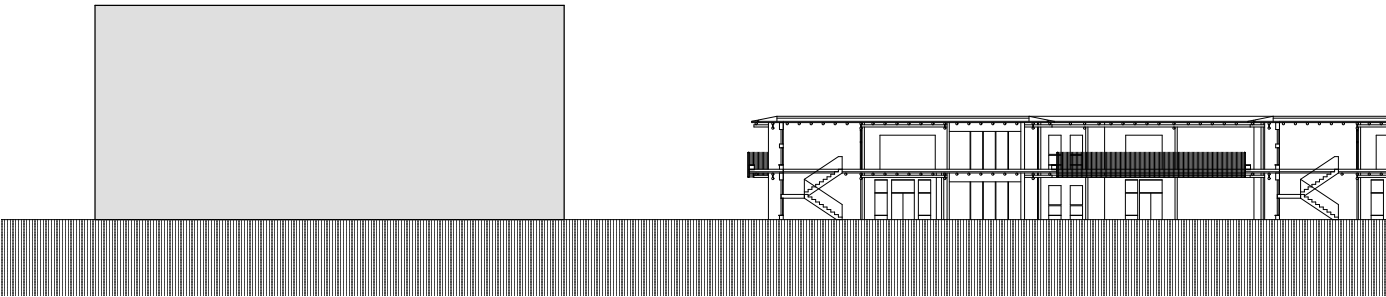
4.3.8. Sections



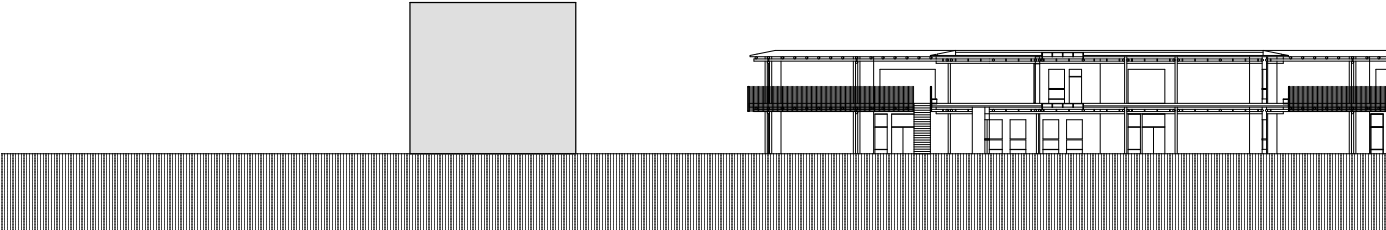
S1



S2

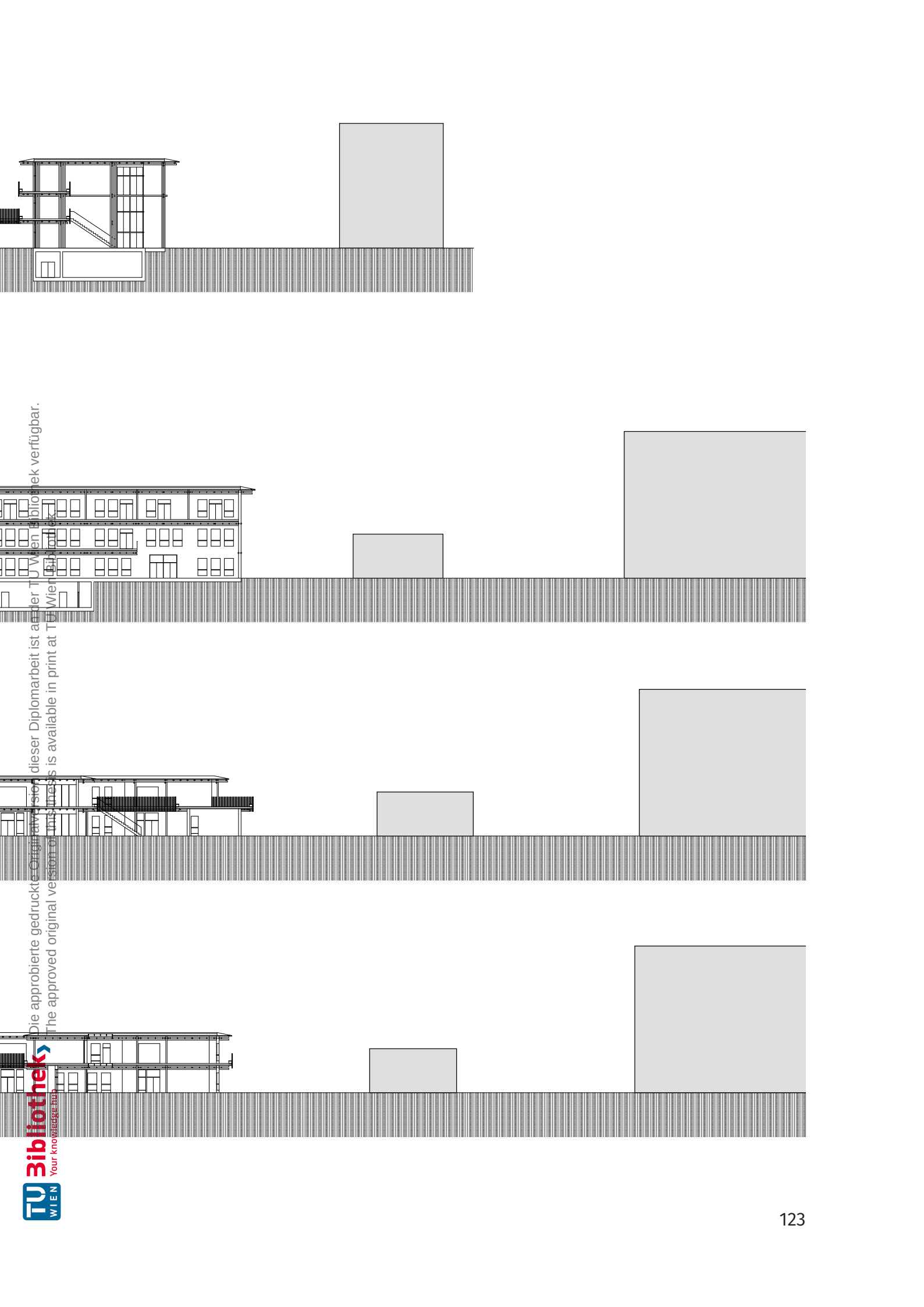


S3

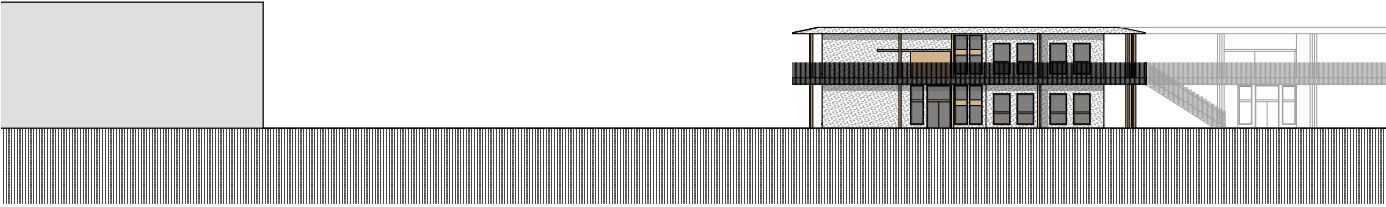


S4

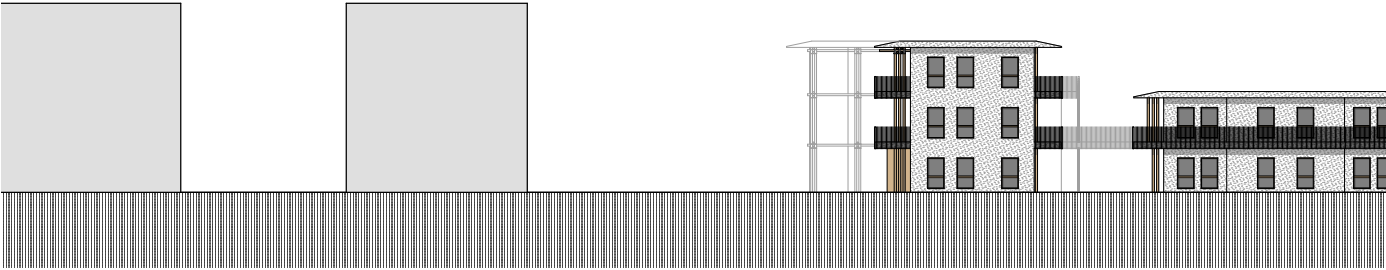
Ill. [74] Sections



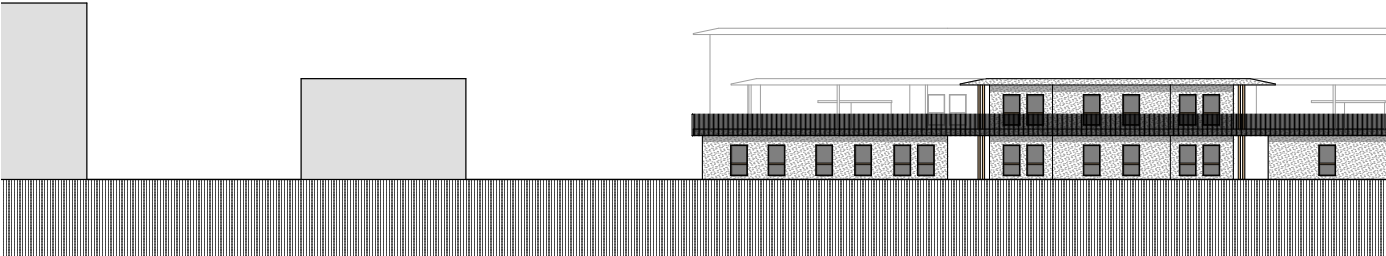
4.3.9. Elevations



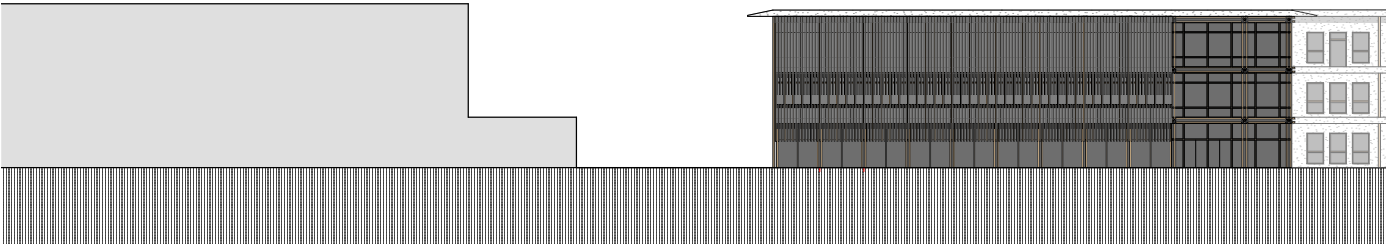
E1 - west elevation



E2 - east elevation

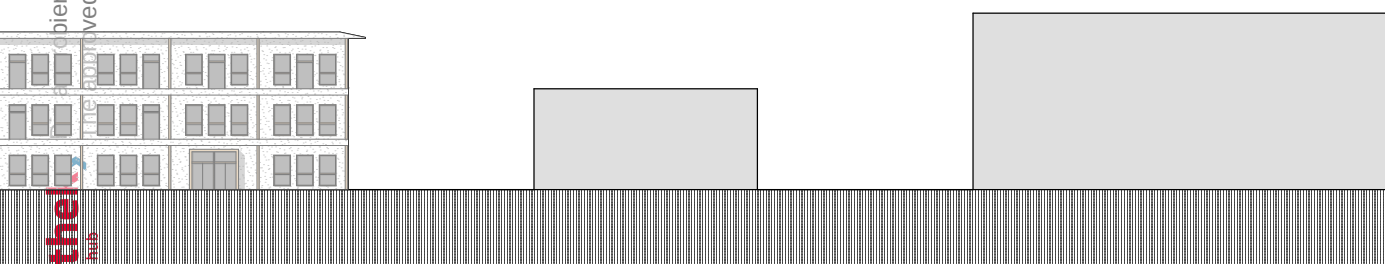
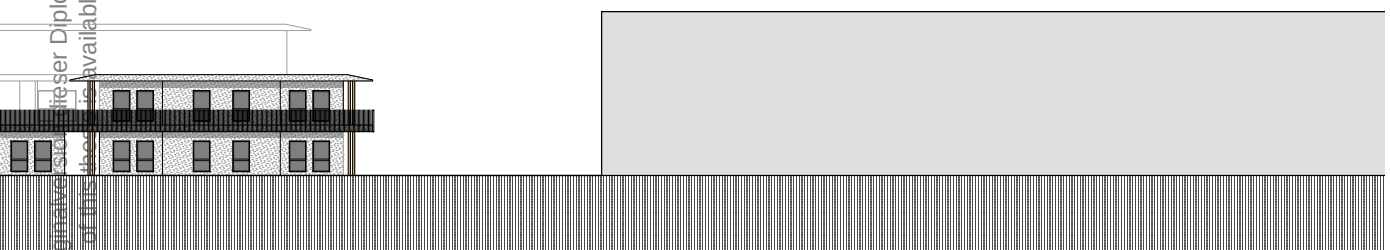
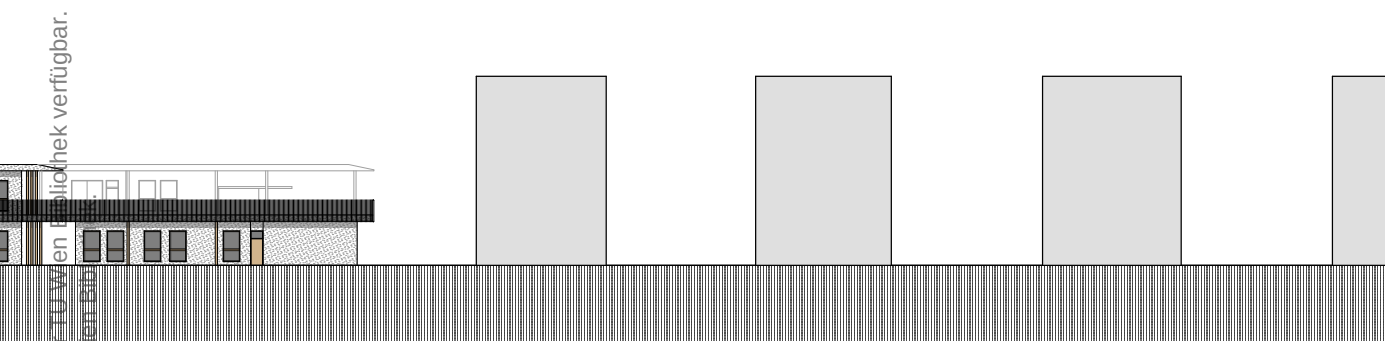
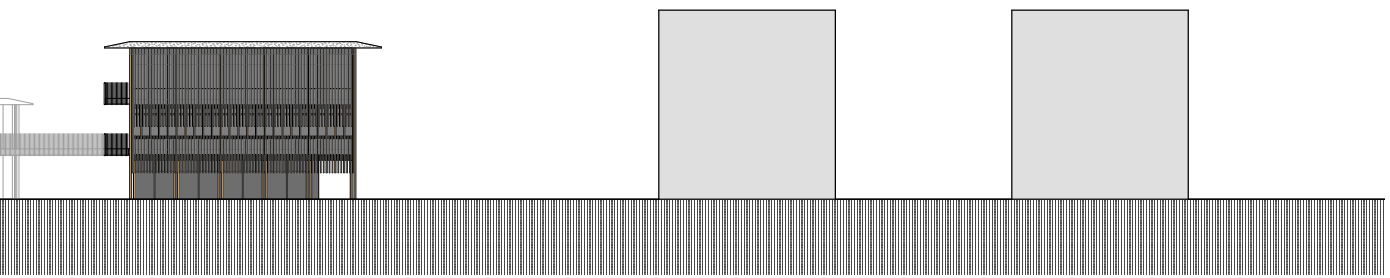


E3 - north elevation



E4 - south elevation

Ill. [75] Elevations



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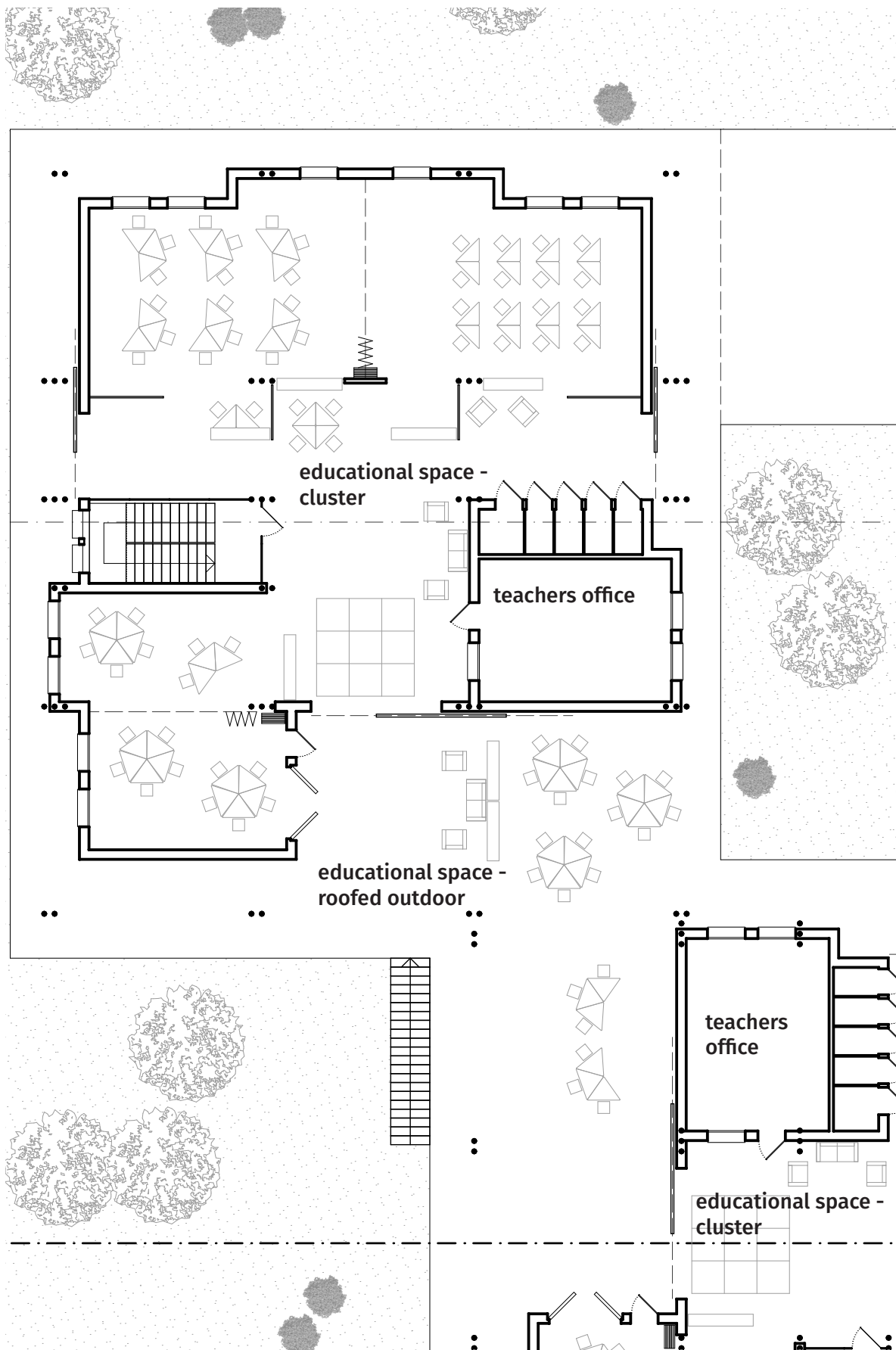
4.3.10. Cluster



Ill. [76] in the roofed outdoor learning space

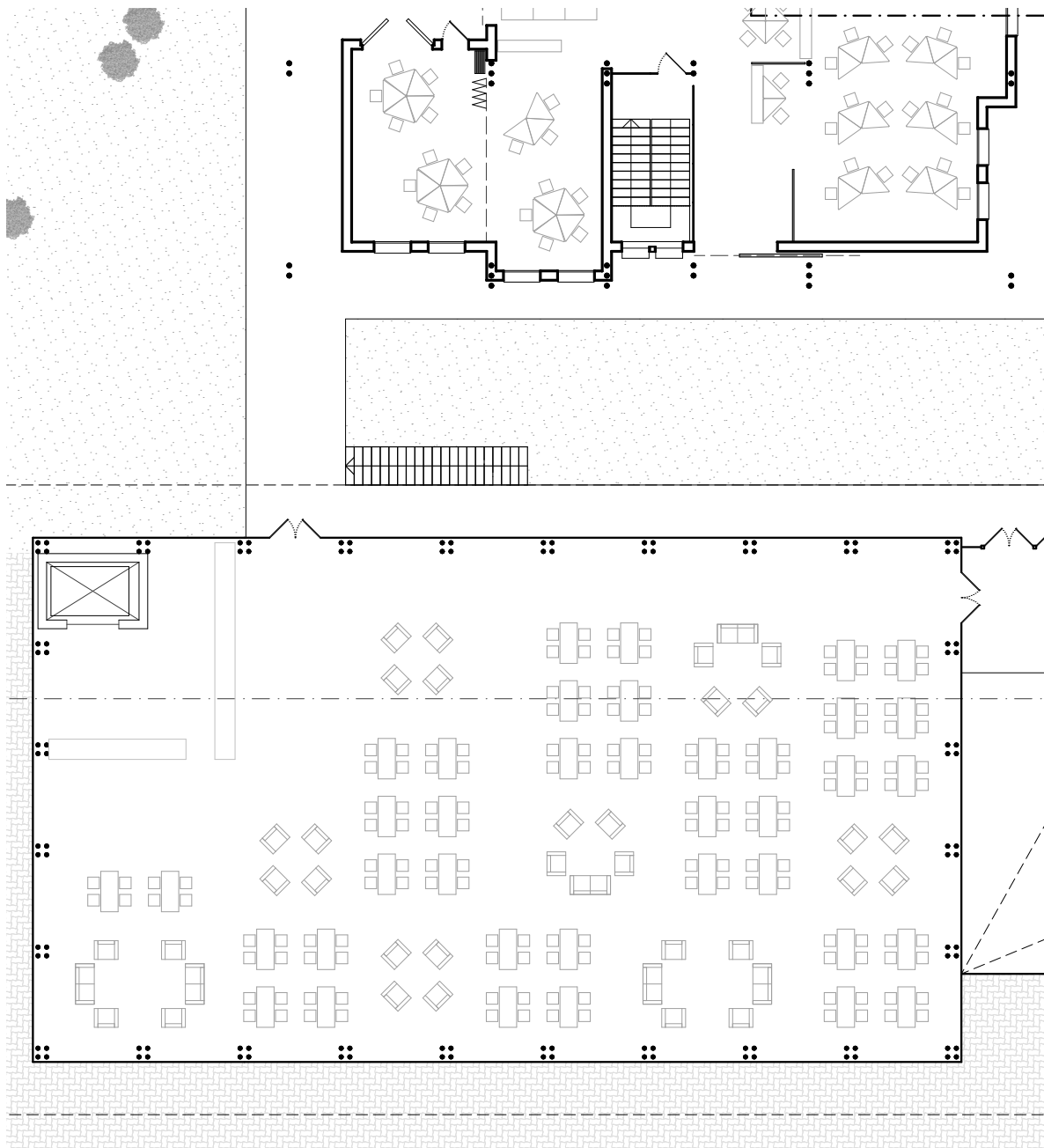


Ill. [77] in between the cluster buildings



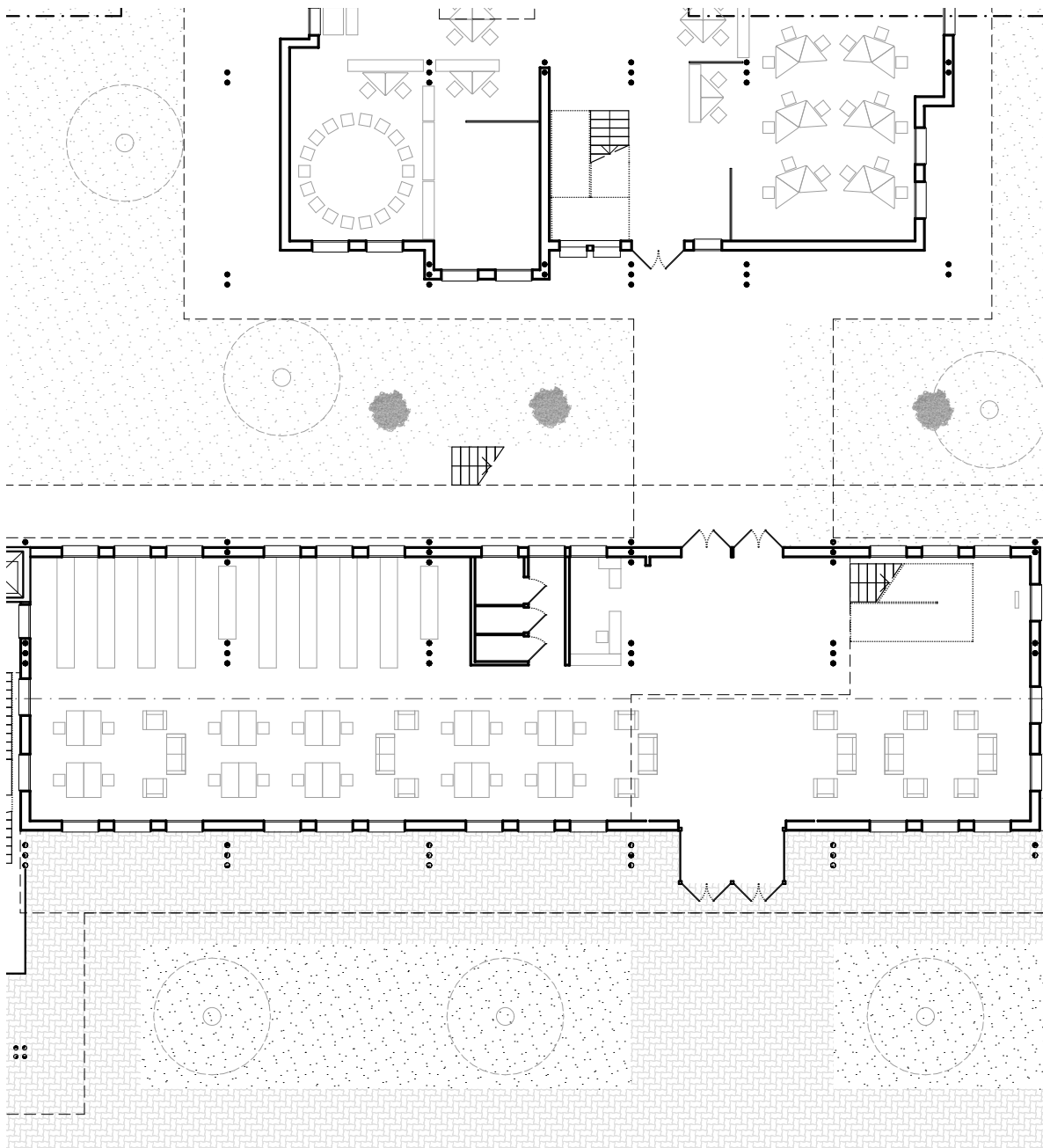
Ill. [78] floor plan of 2nd floor cluster building

4.3.11. Aula and mensa



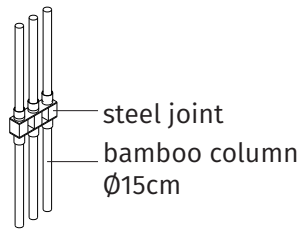
Ill. [79] aula and mensa

4.3.12. District library

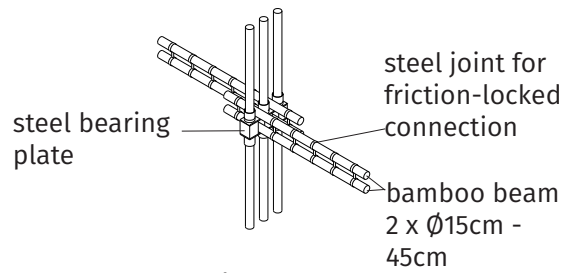


Ill. [80] district library - 1st floor

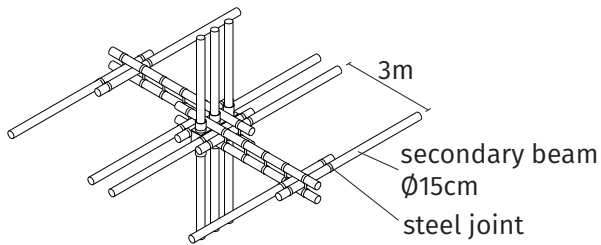
4.3.13. Construction details



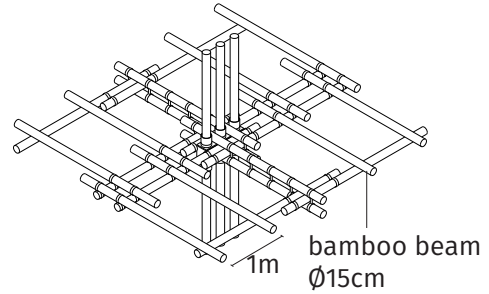
column joint



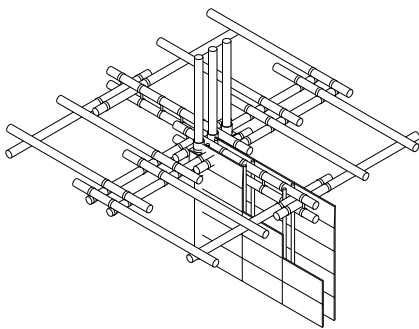
main beams



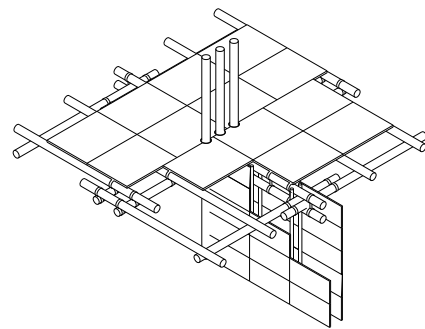
secondary beams



beams



wall cladding



floor slab

Ill. [81] joinery

1 - Balcony

outside	
Floor covering water permeable	30mm
Spacer	20mm
bituminous roof sealing	5mm
gravel	80mm
polyethylene foil	2mm
wood-based materials	80mm
outside	
bamboo construction	525mm

2 - Wall

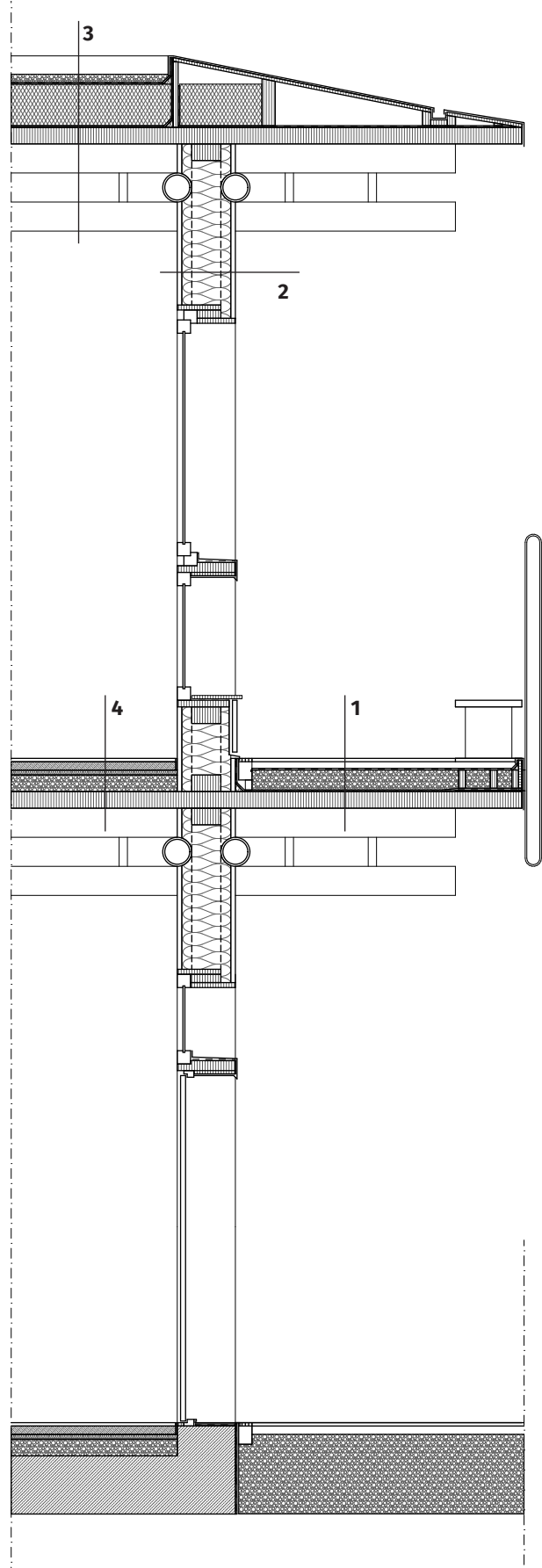
outside	
plaster	5mm
plaster base plate	10mm
square timber - thermal ins.	50mm
bamboo support - thermal ins.	175mm
square timber - thermal ins.	50mm
medium density fibreboard	12mm
inside	

3 - Roof

outside	
gravel	80mm
bituminous roof sealing	5mm
thermal insulation	250mm
polyethylene foil	2mm
wood-based materials	80mm
inside	
bamboo construction	525mm

4 - Floor

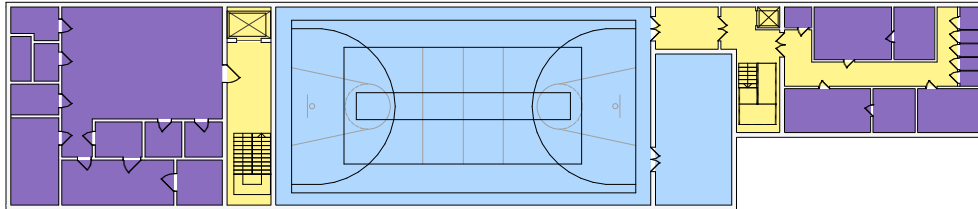
inside	
flooring material	20mm
cast plaster floor	50mm
polyethylene foil	2mm
footstep sound insulation	30mm
polyethylene foil	2mm
fill	100mm
floor slab	80mm
inside	
bamboo construction	525mm



Ill. [82] guiding detail

4.4. Analyse of design proposal

4.4.1. Functional conception of designed proposal



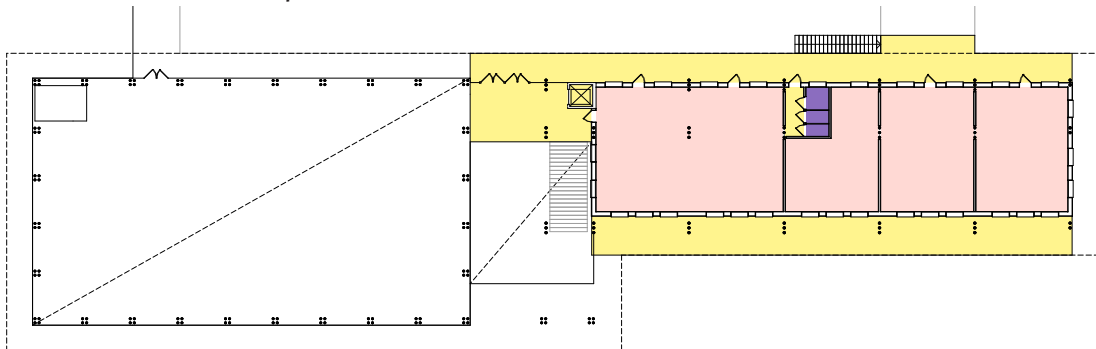
Ill. [83] Functional conception -1F



Ill. [84] Functional conception 1F



Ill. [85] Functional conception 2F

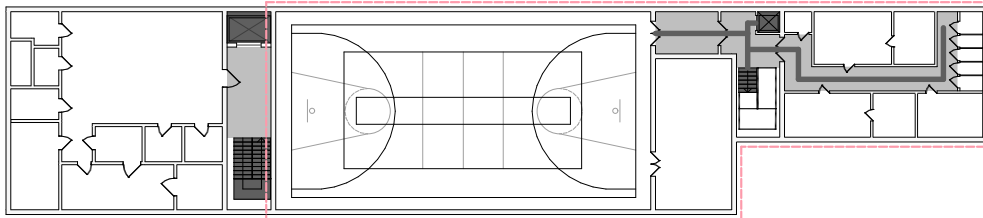


Ill. [86] Functional conception 3F

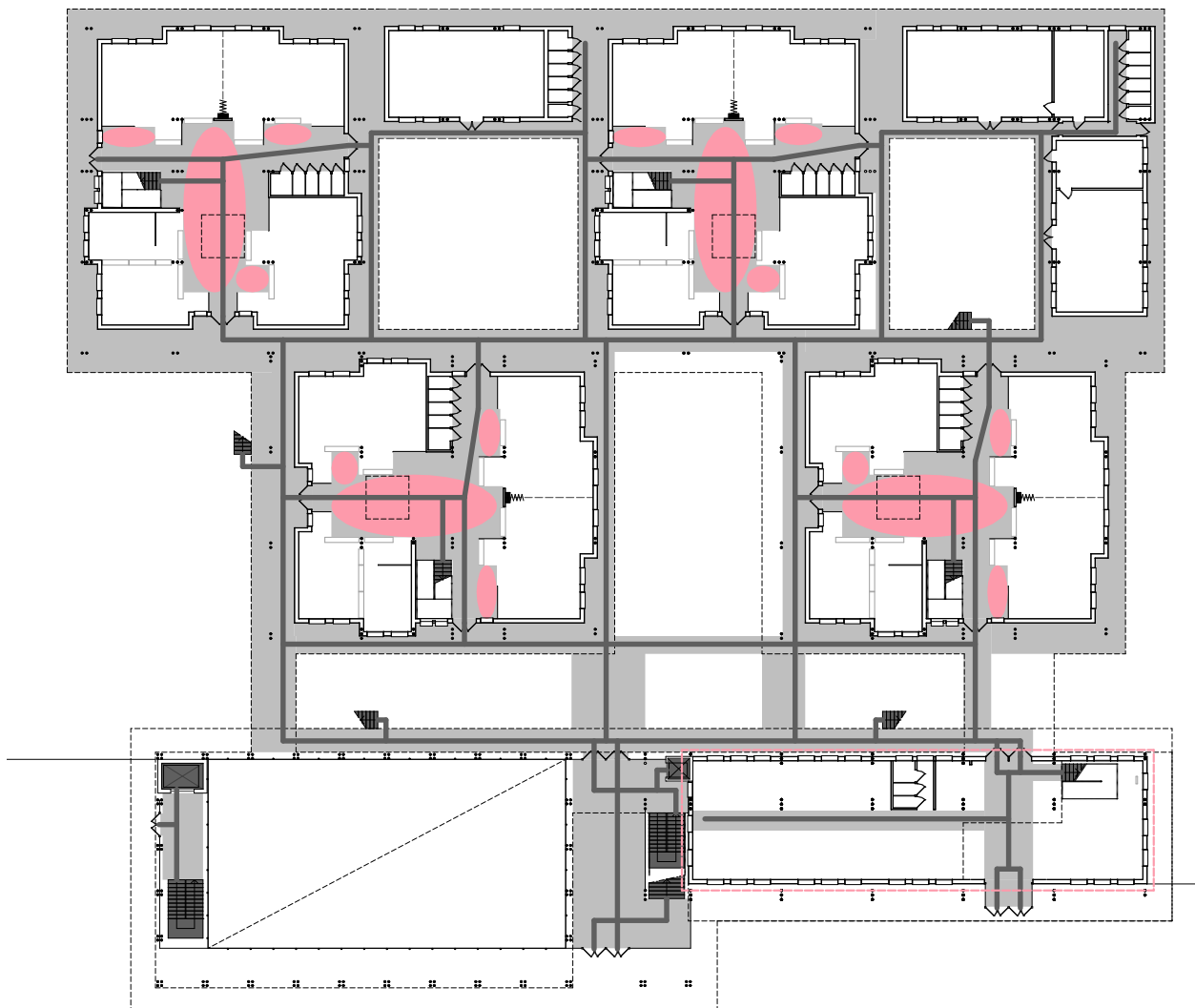
Legend - functional conception

Shared education - literacy	Education spaces - individual	Common functions - urban
Shared education - creativity	Education spaces - community	Common functions - administration
Useable area - circulation	Useable area - technical	

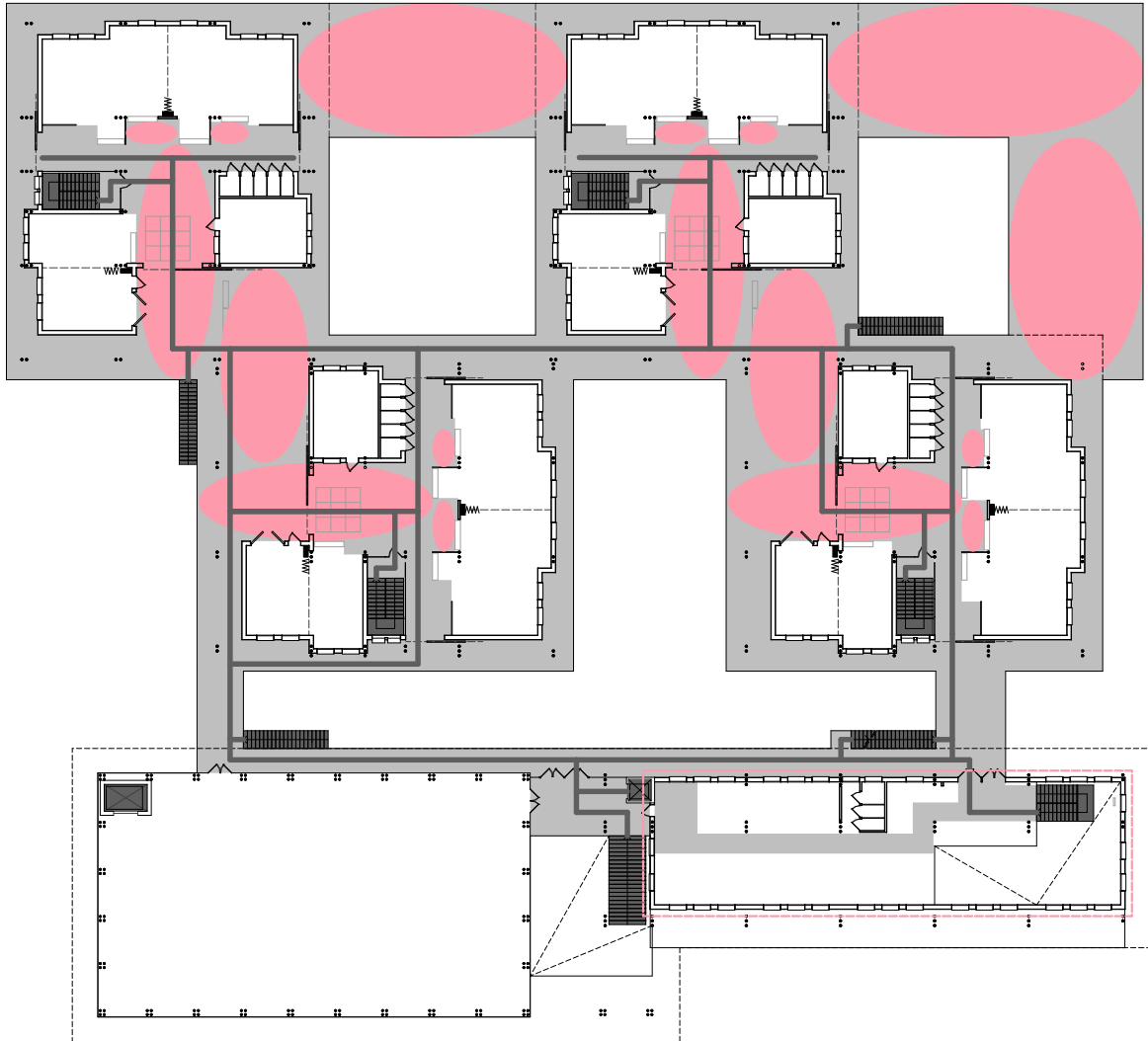
4.4.2. Building organisation of designed proposal



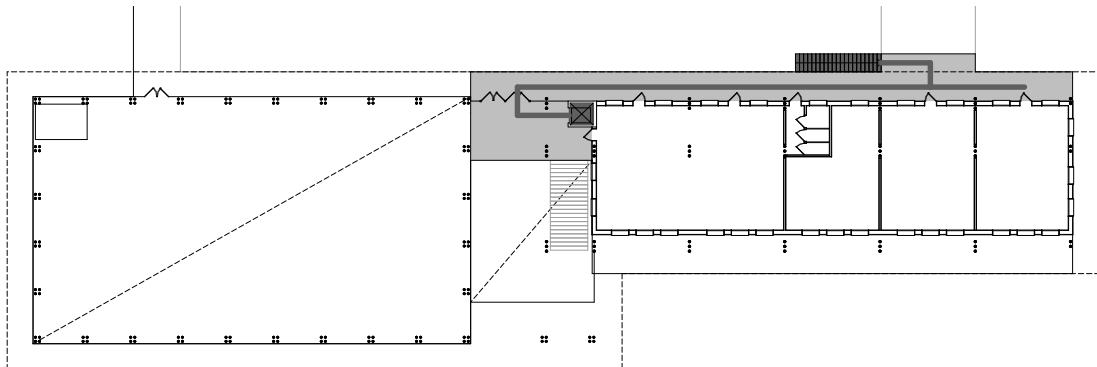
Ill. [88] Building organization and circulation -1F



Ill. [87] Building organization and circulation 1F



III. [89] Building organization and circulation 2F

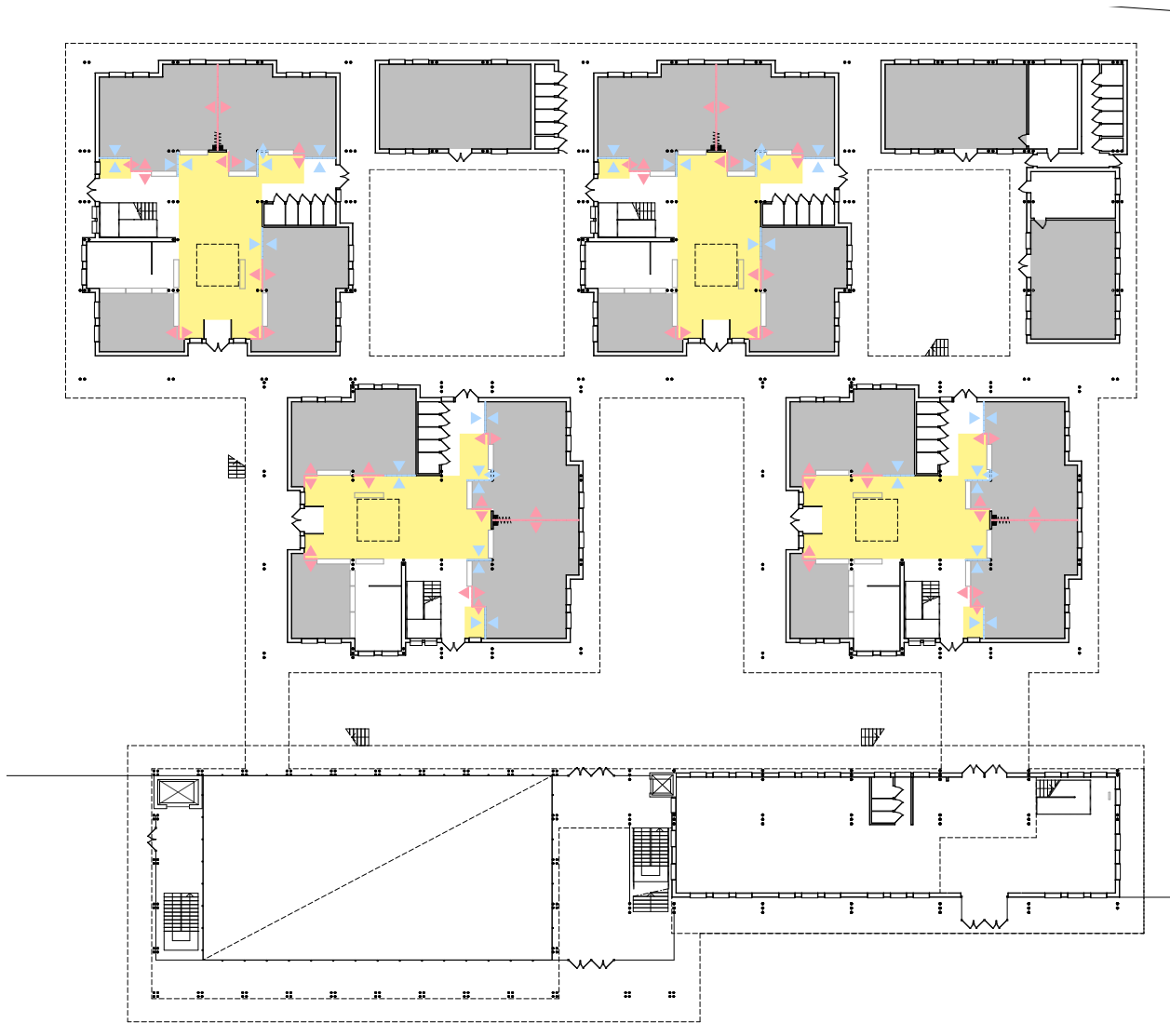


III. [90] Building organization and circulation 3F

Legend - building organization

- urban functions
- ▶ main entrance
- circulation area
- circulation
- ◻ secondary entrance
- hallway expansion - possible learning space

4.4.3. Usage and spatial communication of educational spaces of designed elementary school



III. [91] Usage and spatial communication - 1F



III. [92] Usage and spatial communication - 2F

Legend - usage and spatial communication

	education space		active visual-spatial connection
	expansion of hallway usable as edu space		passive visual-spatial connection

Chapter 5: Analyse of the design proposal for an elementary school in Shanghai



extroverted building



decentral entrance for independent function units



big expansion of hallway to educational area



completely independent circulation



high availability of external functions



high passive communication



high active communication



high educational use of circulation



spatial and functional link of educational spaces



medium spatial interrelation

Urban Integration

The integration of additional functions into the school building benefits the local neighborhood in particular. An additional offer for self-learning or physical activity can have a positive effect on further personal development and community building in the neighborhood. The use of functions of the district by the school, such as museum, park, etc., is desirable. However, this is not evident in the architecture of the school building.

The planned elementary school in Shanghai integrates a district library that can also be used as a school library and the gymnasium is designed in such a way that it can be used outside school hours. These externally accessible parts of the building are each self-contained. The district library has a decentralized entrance to allow independent use during school hours. The gymnasium and the associated rooms such as the cloakroom, showers and equipment room are accessible via the main entrance. This area is only available for external use outside school hours. Therefore, the rest of the school can be locked from the central entrance so that only the gym area can be opened. Overall, the school appears very extroverted. The building along the street allows a brief view of the gym in the basement and the district library completes the front of the building.

Building organization

In the drafted school, the primary access is provided by covered outdoor

spaces that connect the individual buildings. The classrooms are organized in clusters. In these clusters, the corridors are widened to form a common center and can be used as learning or recreation areas. On the upper floor, the clusters are connected by wide roofed outdoor spaces. These can be used as additional learning or recreation areas due to their width, equipment and connection to the clusters.

Spatial communication between educational spaces

In the clusters, the individual learning zones are connected by a common center, which can be used as an additional learning and recreation area. This common area can also be used for cross-year cooperation between students. The learning areas are separated from the common center by individual glass partitions and shelves on lockable castors. These glass partitions allow a visual connection between the learning areas, i.e. a passive visual-spatial connection. With this visual-spatial connection, lessons can be effectively spread over several learning areas. The shelves on lockable castors are supplemented by folding partitions to delimit the learning areas. This allows the learning area to be dynamically adapted to the requirements of the lessons. But this configuration is also effective as an active visual-spatial connection between the learning areas. Larger gaps in the separation by the shelves allow the direct passage from one learning area to the other. The folding partitions can be opened and closed to provide either one large continuous learning area or two smaller ones. On the upper floor there are also generous connections to the covered outside space. These are implemented as doors and sliding walls. Thus the learning areas have an active visual-spatial connection both inside and outside. The learning areas inside and outside can thus be used together effectively.

Chapter 6: Conclusio

Various learning modes are used in combination to promote knowledge, creativity, social intelligence, teamwork and problem-solving skills. These modes are for example: frontal teaching, group work, project work and self-learning. In order to meet the requirements of these different learning modes, suitable premises are required. As shown in the Literature Review, there are several concepts of how to implement learning spaces that meet these diverse requirements. These concepts have some similarities. The concepts imagine the learning areas to be combinable and jointly usable. For this purpose they establish spatial relationships that manifest themselves as doors, windows or folding partitions and the like. Both a visual relationship and a passable connection are important. The corridors are either dissolved into the learning area or are upgraded to a learning and recreation area. Finally, various room situations are made available for the different learning modes.

In addition, the integration of neighborhood functions into the school building can have a positive effect on the school and the entire neighborhood. In this way, resources of the school building can be made available to the residents for self-learning and/or sports activities. Conversely, the school can benefit from a community of neighbors and take advantage of other offerings in the district. Following the literature review, six school buildings located in Finland and Shanghai were analyzed. The learning areas were mainly organized into classrooms. However, there are also some situations, in all analyzed Finnish schools and the Tongji Affiliated Experimental Elementary School, in which the aisle area is also designed as an extension of the learning area. Doors and large glass walls are used as a connection between the classroom and the corridor, which is designed as an extension of the learning areas. Large windows or glass walls between the learning areas help to share these areas effectively, as eye contact can be maintained at all times. Folding partitions were only occasionally used to separate classrooms or classroom and smaller group work space. The integration of urban functions into the school building is mainly achieved by a separate, self-contained building section or a separate building on the campus. Together with a decentralized access to this part of the building, these functions can be operated independently of the school day.

The design of an elementary school at a location in Shanghai tries to implement what has been learned from the analyses as a proposal. For this purpose, a district library was integrated into the building, which was housed in a self-contained building part with a decentralized entrance. Thus, it can be operated independently from the school or be connected to the school. The gymnasium and its ancillary rooms were designed in such a way that they can be used safely outside school opening hours. The rest of the school does not have to be opened. The learning areas are organized in clusters with strongly connected learning zones. The clusters for higher grades are connected to each other with intermediate meeting zones where students can learn, play and relax together.



Ill. [93] street view with main entrance middle, district library entrance right



Ill. [94] section perspective of the entrance hall

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