Schule als Hybrides System: From Education to Edu'action'

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Abstract

Hybrid architectural-pedagogical concepts, in which schools are understood as a kind of 'home base', transform school space into a 'hybrid space' that includes different user groups. By overlapping diverse and varied functions, "Schule als Hybrides System" can accommodate current social developments such as demographic change, diversity and inclusion, migration and technological trends (digitalization, artificial intelligence) and create innovative conditions for dealing with the requirements and effects of such change processes. "Schule als Hybrides System"[1] is created in a participatory process and is a suitable basis for education for sustainable development (ESD). It acts as an architecturally multidisciplinary integrator of structures, systems, processes and internal and external actors in the education sector. "Schule als Hybrides System" promotes integration and inclusion and creates space for new educational experiences and group-dynamic social developments. The results of this project can become the starting point for a new holistic architectural and pedagogical perspective on school and educational buildings. They also offer decisive architectural impulses and supplementary information for school building guidelines and provide innovative ideas for participatory neighborhood planning and urban development at the interface with society.

Keywords

Architecture, pedagogy, hybrid system, learning environment, sustainable development, edu'action'

1 Introduction

In the schools that are being envisioned and built today, the generations of tomorrow will receive their education. It is therefore important that architects and school space planners design the schools of today in such a way that they can successfully meet the challenges of the future regarding developments for a sustainable environment. Education, training and further education are increasingly focusing on holistic education not only for children and young people, but across all generations. The development of technology with digital media and networks is a key factor in this and ensures that learning and working spaces are opening and becoming more flexible. Learning and working are getting mobile, flexible in terms of time and location and individualized.

While numerous different pedagogical forms and didactic methods have been developed for schools, the architectural form of schools has usually still been virtually unchanged for decades. Many schools have reached the limits of their space, room structure and interior design in terms of today's requirements. The design of educational facilities remains a very complex issue in the 21st century, not least as a result of the global Covid-19 pandemic.

[1] School as a Hybrid System

Hybrid buildings can incorporate these trends by superimposing different functions. The terms 'hybrid' and 'hybridity' are understood in the built environment as an innovative, open possibility for design, expansion, development, renewal, overlapping, addition and superimposition (Fenton, 1985; Adam, 2018; Stöckmann, 2017). Buildings with multifunctional uses are often referred to as 'hybrid', even though they are merely an addition of functions, i.e., a mixed form of use.

Bhabha (2016), for example, describes a genuine hybrid space in his 'Third Space Theory': 'But for me the importance of hybridity is not to be able to trace two original moments from which the third emerges, rather hybridity to me is the ‚third space' which enables other positions to emerge.' Bhabha understands hybridity not simply as the combination of two things into a third, new something, as in technology or biology, but for him the consideration of 'cultural difference' and 'cultural translation' leads to the concept of the 'third space', which can open up between cultures and enable cultural negotiations and 'translations'.

In the context of my research, I define 'hybrid space' as a possibility and origin for change by providing free space for improvisation, innovation, experiments and new ideas of different actors. Hybrid space thus becomes 'more than the sum of its parts' (according to Aristotle: 'The whole is more than the sum of its parts.'), something unpredictably new emerges in the encounter and interaction. This distinguishes hybrid spaces significantly from multifunctional spaces and makes them interesting for educational institutions and schools in which creativity, individual activity, learning and community play a decisive role: through overlapping and encounters, hybrid architectural concepts could support integrative and inclusive pedagogical and didactic methods, which currently undergo a paradigm shift against the backdrop of heterogeneous student bodies. With its spatial possibilities, hybridity can open up schools to the outside world and utilize the potential of external actors and stakeholders from society, business, economy, and industry from real everyday life into the school.

2 The concept of "Schule als Hybrides System"

Hybrid architectural-educational concepts, in which schools are understood as a kind of 'home base', transform school space into a 'hybrid space' that includes various user groups. For example, rooms in the building for coworking spaces, a communal canteen, offers for health promotion and leisure activities, adult education, space for exhibitions, libraries or start-ups integrate the school and its educational mission into the socio-cultural, socio-structural and socio-economic environment and open up opportunities as a kind of 'creative SpielRaum' or creative leeway (Sedighi, 2018), as a meeting place and setting for educational networks with non-school stakeholders from society, industry and services in the immediate vicinity (Fig.1).

By superposing diverse and varied functions, 'schools as a hybrid system' can accommodate current social developments such as demographic change, diversity and inclusion, migration and technological trends (digitalization, artificial intelligence) and create innovative conditions for dealing with the requirements and effects of such change processes. It can support the paradigm

shift in social values towards sustainability, sharing ('sharing economy') and participation against the backdrop of the global goals for sustainable development of the UN Agenda 2030 (United Nations, 2015, UNESCO, 2014).

Figure 1: "Schule als Hybrides System" - more than a place of learning (Sedighi, 2022).

"Schule als Hybrides System" acts as an architecturally multidisciplinary integrator of structures, systems, processes and internal and external actors in the education sector. It forms a communal, identity-forming social space for the municipality and the urban quarter by superimposing and integrating a wide variety of institutions and private companies from all sectors (primary, secondary and tertiary sector). In this way, a new, agile center is created in the urban quarter and at the heart of society (Figure 2).

School is thus transformed from a pure place of learning into a 'place of living', where children and young people are no longer educated and taught separately from the rest of society with their teachers and caregivers, but where they experience real everyday life. Older people (e.g. childcare and homework supervision by senior citizens on the one hand and explanation of modern digital media by children on the other) can be integrated into hybrid concepts, as can parts of the family (e.g. coworking spaces) - there are few limits to the design here and schools can open up as much as possible, but boundaries must also be drawn where necessary (e.g. noise, safety).

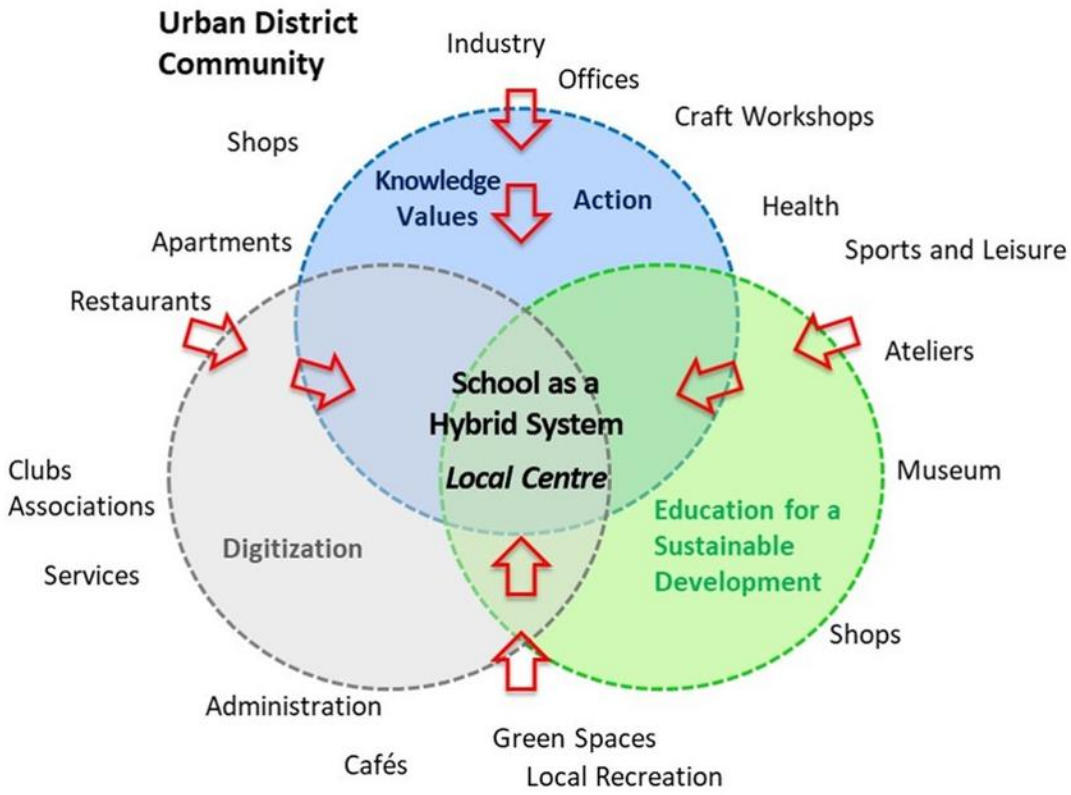

Figure 2: "Schule als Hybrides System" - creation of a multifunctional center in the urban quarter at the interface between education, sustainability and digitalization (Sedighi, 2023).

3 "Schule als Hybrides System": definition and objectives

"Schule als Hybrides System" is an intended form of hybridity and is based on differences, diversity, ambiguity and heterogeneity. It is variable, multi-layered and surprising and is only activated, shaped and developed by the different user groups. It includes the surroundings, consciously creates networks and transitions from a pure learning space to a hybrid living space (Fig. 2).

Some of the main objectives of "Schule als Hybrides System":

- expands the range of uses and opens up space for socio-cultural communication, improvisation and innovation,
- stands for an educational network of various stakeholders that goes beyond the school itself counteracts social and ethnic-cultural segregation in an integrative way,
- promotes inclusion and teaching concepts for heterogeneous groups of students,
- supports the transition from school to working life and offers holistic solutions for the training of highly qualified specialists and managers of the future,
- creates a reliable, stable learning and working environment in a kind of 'home base' and is therefore an interesting concept, especially for all-day schools,
- is adaptable and variable in terms of future social and technological challenges.

3.1 School as a hybrid system: education for sustainable development (ESD)

The educational concept for sustainable development (ESD) is based on openness, reflexivity, networked learning, future viability, vision orientation and participation and requires knowledge in the sense of information, understanding, skills, values and attitude (BMBF, 2017; Künzli-David, 2010; de Haan, 2008).

"Schule als Hybrides System" reinterprets learning, living and working in terms of 'quality education'[2] under one roof by transforming the different requirements in an adaptive form. It is a complex system with a multitude of interlinked processes. It creates a holistic cosmos in which, according to the principle of lifelong learning, not only knowledge but above all skills are imparted against the background of current and future social, technological, climatic and economic challenges (cf. BMBF, 2017; Künzli-David, 2010).

Through the interaction and coherence between 'education' and the 'built environment', a so-called 'creative SpielRaum' for social transformation and shaping the future is created in a "Schule als Hybrides System." This 'creative SpielRaum' is a hybrid space in which diverse and variable functions and different views, perceptions and ideas come together (Sedighi, 2018), so that it can provide a basis for the development and unfolding of innovative possible solutions and their implementation and is fundamentally important for the design of the educational environment and environmental education.

The overlapping of user groups, the integration of external actors and hybrid development spaces created for this purpose can promote the achievement of the global, sustainable development goals (United Nations, 2015), namely to motivate and empower students at an early stage to become integrated, critical and responsible members of our society and at the same time to sensitize all actors involved across generations to sustainability in a global context (BMBF, 2017; Künzli-David, 2010; de Haan, 2008; Forghani, 2001; Stiftung Bildung und Entwicklung, 2010).

Hybrid schools are not limited to a specific pedagogical approach but combine and complement the formal teaching mission of the school with non-formal and informal learning approaches, practice- and action-oriented from "education to edu'action'', making school a social place of learning.

3.2 School as a hybrid system: digitalization

Modern digital technology should always be available in every classroom but 'school as a hybrid' system offers variable possibilities for the implementation of diverse digital learning formats and hybrid learning concepts with an expanded range of rooms and an optimized room concept. There can also be tech labs or maker spaces for digitally oriented project work, programming and computational thinking, as well as informal digital learning environments such as a digitally

[2] As part of the "United Nations World Summit on Sustainable Development" in September 2015 (SDG Sustainable Development Goals, Agenda 2030), a total of 17 goals in five areas (People, Planet, Prosperity, Peace, Partnerships (ibid.)) were adopted for global sustainable development in a resolution of the General Assembly (United Nations, 2015). One of the most important goals (Goal No. 4) is "Quality Education" and means ensuring inclusive, equitable and quality education and promoting lifelong learning opportunities for all (ibid.).

equipped learning lounge, digital workplaces in the library or cafeteria, digitally equipped work niches and group rooms.

"Schule als Hybrides System" can also address and communicate digital topics in a way that is relevant to society and across generations by allowing different stakeholders, such as IT companies or IT start-ups, parents who work with digital media in coworking spaces, students and teachers, people from a retirement home and many more, to interact with and benefit from each other. This creates platforms for an interactive exchange between the various user groups with the opportunity to prepare students for their professional world in the digital future (Fig. 3).

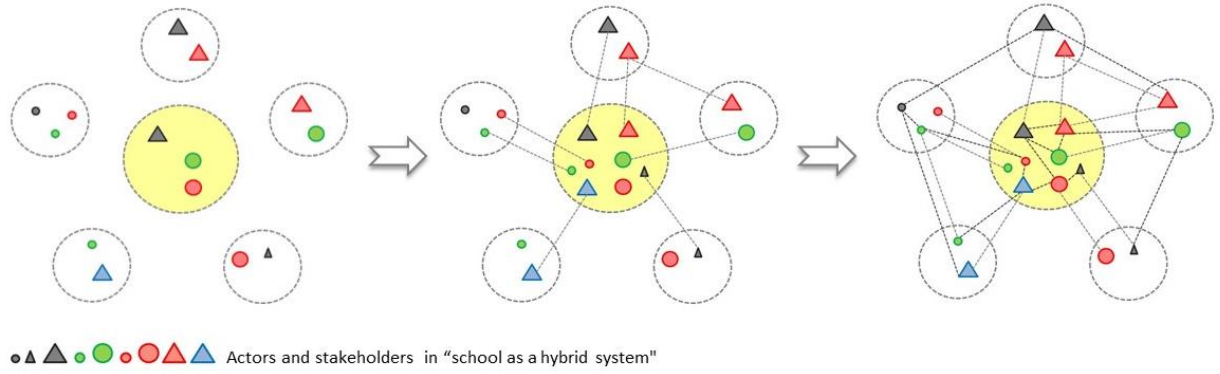

Figure 3: "Schule als Hybrides System" - Schematic representation and development process of an interactive networking platform (Sedighi, 2020).

Thanks to the familiar networks that have been created within the school, the barriers and obstacles from a social, socio-economic, cultural and technological (digital) perspective are better recognized, addressed and, if possible, overcome together through informative transparency. "Schule als Hybrides System" can thus help to decouple academic success from the social and economic background of the students and ensure more equal opportunities, especially for disadvantaged children and young people.

By integrating a large number and variety of stakeholders, it promotes an exchange of experiences and mutual learning effects that accelerate familiarization and the sensible and safe application of new digital developments in the education sector: "Schule als Hybrides System" acts as a catalyst for digital transformation.

4 Holistic architectural hybridization

The architectural development of "Schule als Hybrides System" as a form of school of the future has to do with the aspects of modularity, flexibility, multi-optionality, multifunctionality, optimization of use, temporary or permanent densification, transformation and digitalization. The hybridization of schools will meet with interest in cities, especially in urban centers and conglomerations, where there is a shortage of developable land, the price level is correspondingly

high, and a high building density is accepted. Here, architecture - as a physical supporter of performance, activity and social and cultural community - opens up the space for a new way of teaching and learning and creates a diverse learning and 'creative SpielRaum', a hybrid educational and experiential space.

For the architectural hybridization of a school, the structural, functional and design potential should be considered holistically (Fig. 4). Structural expansion options and space optimization are key aspects for the integration of new functions as well as the creation of different atmospheres through the conscious design of functional areas and the use of sustainable materials.

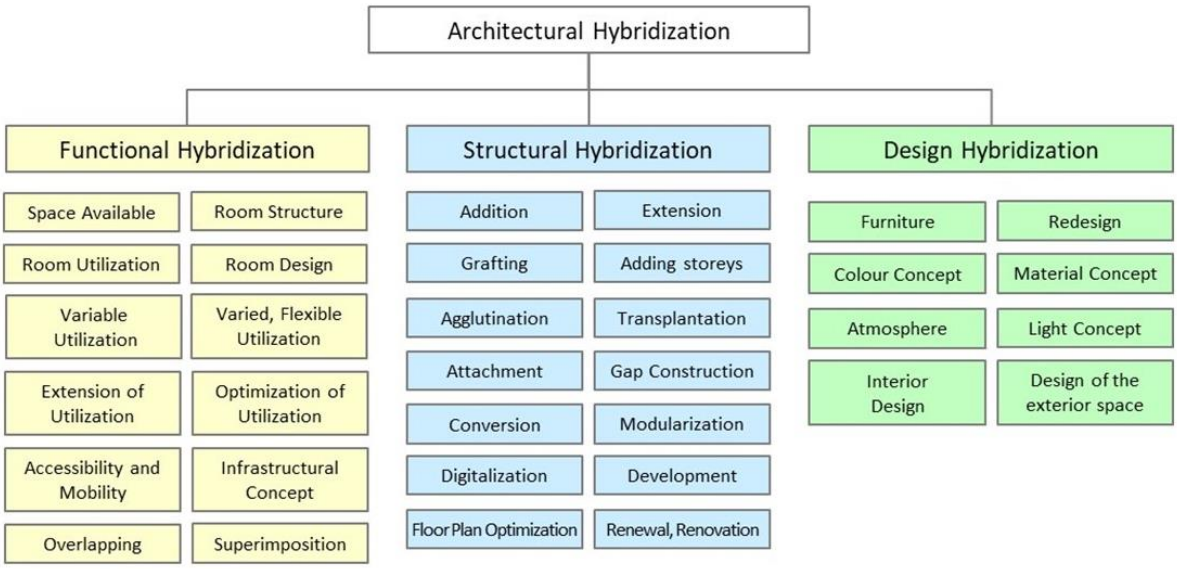

Figure 4: "Schule als Hybrides System": Holistic architectural hybridization (Sedighi, 2023).

Here, common rooms, infrastructure, separating and connecting sections, overlapping areas and places of connection and turning areas are just as important as a varied but safe access and development concept. The view is directed once from the outside in and once from the inside out in order to determine the clear positioning of the spaces in the three areas with the attributes 'private, semi-public and public'. If necessary, rooms are designed for larger groups and the rooms are converted, repurposed or extended.

In this context, the access and circulation areas play a vital role in clearly separating and differentiating the private, semi-public and public areas and ensuring the safety of the players (especially the underage students). At the same time, it is important that, in their role as 'traffic arteries', they connect all areas with each other in such a way that smooth transitions are created, and all players have free access to their areas as well as to the communal zones. Separation and switchability of the areas and sectors should, however, remain an integral part of the planning. The elements are selected and arranged in such a way that synergies can be created through combination and interaction.

Analogous to Reiß's VDAV model (Reiß, 1993; Reiß, 2008), the degree of hybridization can be specifically influenced in four dimensions, namely Variety, Diversity, Ambiguity and Variability,

depending, for example, on how many and how diverse and heterogeneous actors are brought in, how great the differences are, what dynamics and ambiguity are desired. This depends on the needs of the users and the analyzed usage profile of the respective urban district or community and can be adapted to the respective school type and age groups.

The increase in the number of players in the school and an increase in diversity inevitably lead to a functional expansion and the associated structural measures, adaptations and changes, which take on a certain hybrid form and shape using the hybridization principles. These in turn are designed and adjusted using the VDAV parameters. Changing each of these parameters simultaneously leads to a mutual interaction between the three hybridization categories 'functional', 'structural' and 'design' (Fig. 4). For example, by integrating new functions in the school, new spaces are added in a monolithic, agglutinative, modular or chain-like manner according to architectural hybridization principles, and different zones and areas are created that can be realized with design measures in both the interior and exterior spaces with a high aesthetic quality. The number of rooms is increased, the structure and arrangement of the rooms and the utilization concept are adapted with regard to multifunctionality, new key architectural elements are added, the entire access and circulation concept is modified, the number of stairwells is increased, separate sections and hybrid levels are developed and expanded and switching and turning areas are added.

The active hybridization of a school in terms of space, room structure, room use and room design according to the VDAV-principle leads to a transformation and development. An innovative, hybrid system grows out of a classic school building with structures that not only integrate technologies, processes and actors, but which themselves act as a designer and integrator ('3rd pedagogue') and thus form a 'common whole' that promotes and demands the relationship, connection, interaction and interplay of the players. Architectural hybridization can be planned vertically and/or horizontally in a mobile, temporary manner as well as in a permanent form.

4.1 Design hybridization

The design aspect plays a significant role in the interaction between the various hybridization categories. Design hybridization includes spatial planning aspects as well as a harmonious arrangement of rooms and an optimization of areas based on the multi-optionality of functions and uses. The focus is not only on the design of the function(s), but also on the design of the form and its construction and materiality as an interpretation of the implementation of the new, hybrid usage spaces, which can also be integrated into the context of an existing school as a planned development and extension concept. The targeted use of a variety of sustainable and environmentally friendly materials can emphasize the character of the rooms, define zones, create a haptic effect, stimulate concentration with light and play of color and thus successfully support the learning process. The design of the shape and size of a room can also have a considerable influence on the way it is used and its functional effect.

A well-thought-out color scheme in combination with comfort and variable lighting design helps to increase the motivation and performance of the students and further actors. The use of

convertible furniture and equipment also has a strong influence on the design of hybrid spaces and thus the way they are used.

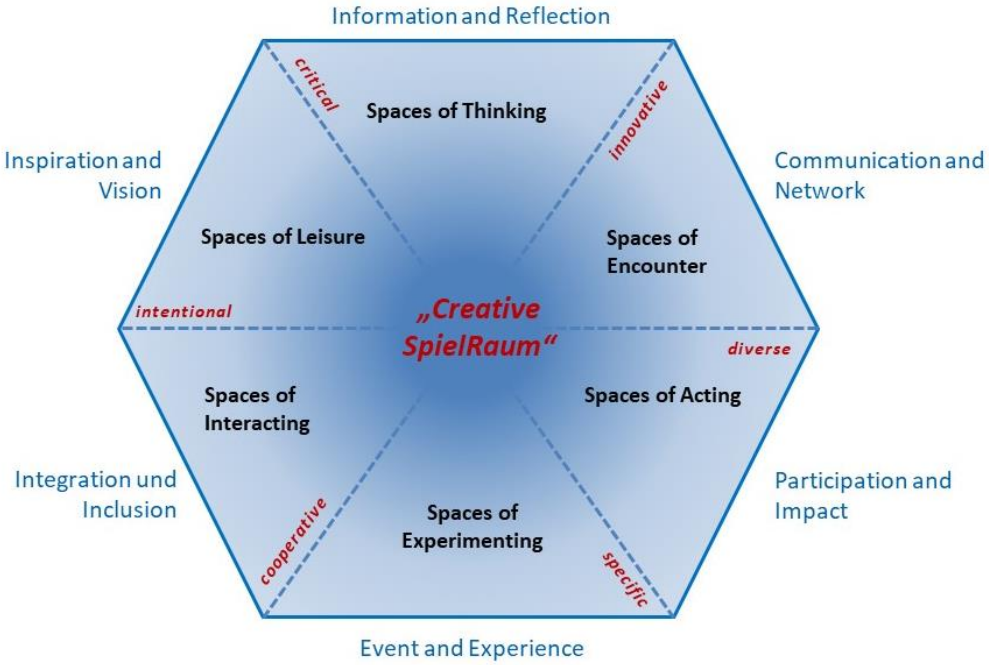

Figure 5: "Schule als Hybrides System" as a 'creative SpielRaum' (Sedighi, 2023).

In summary, variable equipment and furniture, intelligent color concepts, controllable lighting concepts and design of the hygiene concept, room comfort, coziness and atmosphere and their multifaceted interplay are decisive to develop 'space as a 3rd educator.'[3] The combination and interaction of these design elements with functional and structural measures for hybridization creates individualized learning areas, spaces for encounter, spaces for thinking, spaces for action, spaces for communication, spaces for experimentation, 'swarming zones' and 'strolling areas', but also space for resting, pausing, lingering and leisure. In this way, learning space becomes a hybrid living space, namely 'creative SpielRaum' (Fig. 5), which develops continuously and dynamically through the active involvement of the stakeholders: according to the motto 'from education to edu'action''.

5 "Schule als Hybrides System": planning process and implementation

When planning and implementing a "Schule als Hybrides System", a large number of participating institutions has to be included, different organizational forms of cooperation must be integrated, architectural-pedagogical and infrastructural aspects considered as holistically as possible and socio-spatial relationships must be established. School and external, non-school educational

[3] If the 'room as a third pedagogue' (Loris Malaguzzi (Knauf, 2017)) is to take full effect, the form, function, and design of the rooms must first be phased and matched to positively stimulate learning behavior and increase and support learning motivation.

institutions, industrial companies, service providers and public and private institutions should all become part of the "Schule als Hybrides System".

"Schule als Hybrides System" integrates non-school stakeholders and their needs into the school space. This results in synergies, e.g., in the provision and use of restaurants, quiet rooms, shared event and meeting spaces, multifunctional areas and digital equipment. This type of integration poses structural, cultural, and architectural challenges (e.g., digitalization, acoustics, spatial demarcation, code of conduct).

When planning for a 'school as a hybrid system,' it is essential to meet specific conditions, consider prerequisites, and set up agreements. Specifically:

- A variable and flexible usage structure should be created.
- Limited rights of use must be possible.
- No derivation of property rights from the intended rights of use should be possible.
- The ownership structure and the boundaries of the facility (private, semi-public, public areas) must be clarified.
- The surrounding open space of the building(s) in the transition to the public space must be defined.
- The surrounding open space can/may also be used flexibly by the various stakeholders.
- The participatory and active role of the stakeholders in the neighbourhood/community is crucial for the controlled and targeted hybridization of a school. This is why
  - 'school consumers' should become active space and learning 'prosumers',
  - concepts for school space are created experimentally by the actors themselves,
  - the interplay between their own actions and the actions of the other stakeholders involved can be 'felt' and understood,
  - the corresponding actions and procedures can be observed, experienced, and tested.

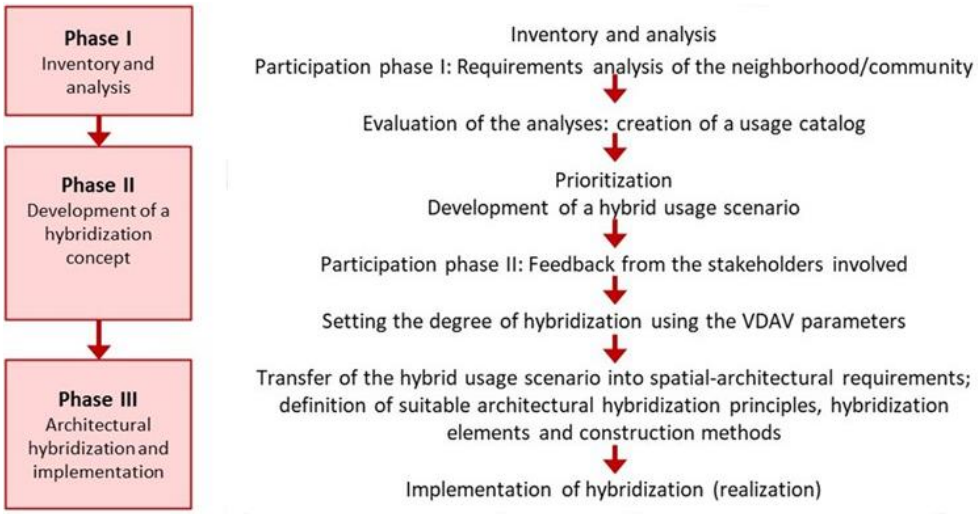

Figure 6: "Schule als Hybrides System": holistic planning and implementation process of the architectural hybridization (Sedighi, 2015; 2023).

In a holistic planning process for "Schule als Hybrides System", structures must be adaptable, experimentally usable, expandable according to the agglutinative principle expandable or reducible and/or divisible, generally convertible and variable. The following steps are essential when preparing, planning and implementing a (model) project "Schule als Hybrides System" (Fig. 6):

- Inventory and analysis of the projected school and the urban quarter/community as the basis for developing a usage profile.
- Participation phase I - Surveys, workshops, interviews to analyze the needs of the neighborhood/community.
- Evaluation of the surveys/feedback - development of a usage catalog.
- Prioritization against the background of pedagogical, architectural, and economic preconditions.
- Creation of a diverse and multifaceted usage scenario.
- Participation phase II - feedback from the stakeholders involved.
- Design of the degree of hybridization based on selected parameters of the usage scenario.
- Transfer of the usage scenarios into spatial-architectural requirements with suitable architectural hybridization elements, tailored to the given district/municipality.
- Implementation of the hybridization process (realization).

The detailed inventory distinguishes between the three categories 'school and architectural space', 'school and pedagogy' and 'school and society' and focuses on a needs analysis (participation phase I), a comprehensive analysis of the location and the architectural school typology. The analysis and target-oriented evaluation of the inventory forms the basis for an initial idea of a desired and necessary range of rooms, room program and room catalog for the school. This is then evaluated and prioritized - also in further interactive feedback loops with the stakeholders - with regard to the implementation possibilities and taking into account the functions and spatial concepts as well as the educational, architectural and economic framework conditions.

In the next step, an interdisciplinary team of architects, urban planners, representatives of the responsible building authority, educators and social pedagogues and other stakeholders 'translates' this prioritized space catalogue into an individual, site-specific hybrid usage concept or usage scenario[4] this prioritized space catalog into an individual, site-specific hybrid usage concept or usage scenario that includes at least the four functional areas of 'learning formats', 'services and community activities', 'skills and competencies' and 'networking and cooperation' (Fig. 7).

What such a hybrid usage scenario looks like in detail can differ significantly depending on the location. "Schule als Hybrides System" always follows an individual, location- and stakeholder-specific usage scenario that is tailored to the current needs of the respective district/community and its stakeholders. For example, health, sports and leisure facilities can be integrated into the school, as can workshops, coworking spaces and start-ups (Fig. 1). The function fields can be expanded and complemented as required.

[4] The composition of the team naturally depends on the respective project and the municipality or city and may include other experts and stakeholders.

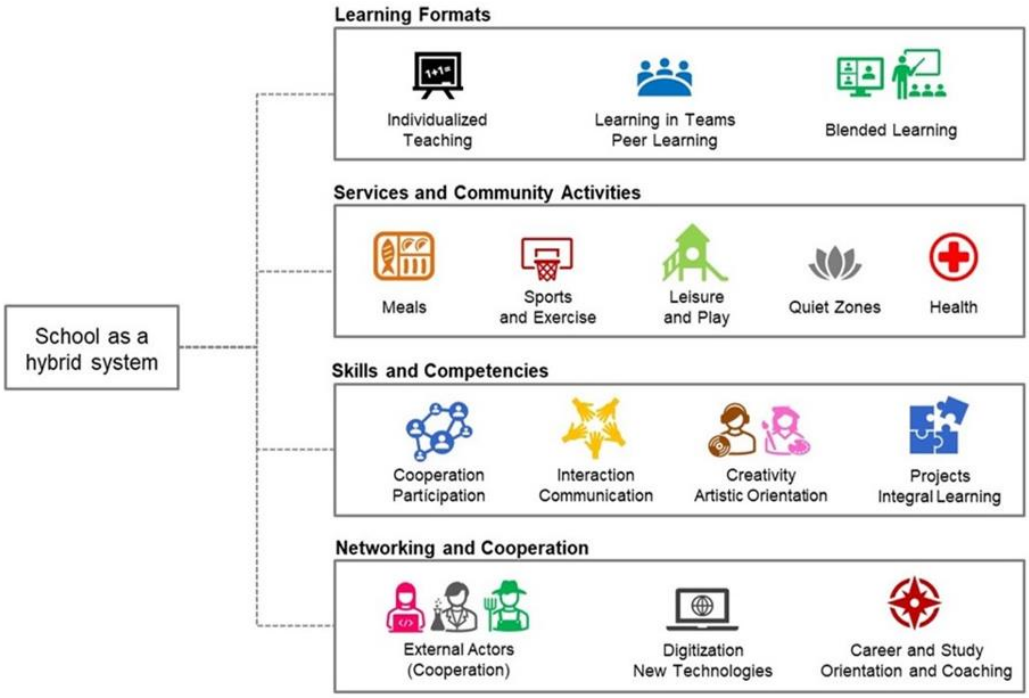

Figure 7: Hybridization process: exemplary categorization of functional fields for the creation of an individual and specific usage scenario for "Schule als Hybrides System" (Sedighi, 2022).

Economic aspects are just as important for implementation in practice as a fundamentally positive attitude and acceptance of the community or neighborhood. In addition to a clear pedagogical concept, the participation of the various stakeholders, e.g., parents/custodians, students, teachers, and extracurricular partners, is particularly important. In this way, "Schule als Hybrides System" can best succeed as an element of sustainable and participatory neighborhood or community development.

Important prerequisites for the successful implementation of a concrete (model) project "Schule als Hybrides System" are:

- Acceptance and openness of the neighborhood/community and the land/building owner towards the "Schule als Hybrides System" concept.
- Active participation of stakeholders in the planning process (participation phase I).
- Pedagogical concept and mission statement.
- Integration into the development plan of the neighborhood/community.
- Financing concept and planning.
- Holistic digitization concept.
- Involvement and cooperation of stakeholders during implementation (participation phase II).

The general and specific framework conditions of schools can be identified as contextual factors. General, for example, is the school legislation of the respective country, specific is the neighborhood surrounding a school and its socio-economic structures.

The process of hybridization also gives rise to numerous architectural, educational, and legal issues. These include the rights and obligations of the actors and stakeholders and the necessary regulations on safety, monitoring, access options and usage behavior. In a corresponding project, the following architectural, educational, legal, and economic framework conditions, and in particular the rights and obligations of the actors and stakeholders, should be given special consideration:

- Compliance with applicable legislation and regulations (e.g., school legislation, building regulations).
- Compliance with the guidelines of the neighborhood/community and the owner/operator.
- A joint body responsible for managing and monitoring the system.
- Regulations on usage behavior.
- Clear regulations regarding assumption of liability.
- Regulations on security and monitoring.
- Adequate access options and (technical) infrastructure.
- Cost-benefit ratio.
- Partly limited rights of use.

Reliable compliance with the agreements about the use by different user groups must be guaranteed, and it should not be possible to automatically derive corresponding ownership or appropriation rights from the intended usage structures. This is particularly important to ensure the safety of students and other actors.

Targeted synergies are created in such a hybrid usage scenario. This turns the school into a place of skill and action and a networked, interactive, and agile place of education and digital participation for all. "Schule als Hybrides System" is not a final product but is constantly evolving in a dynamic process.

The main prerequisite for a pilot project is a municipality or urban district with stakeholders who are in favor of such a project (new school construction or renovation and modernization of an existing school) and agree to actively support it. With a team of experts from the fields of architecture, education, and administration and with the active participation of as many stakeholders as possible (municipality, residents, school, and non-school stakeholders), the various phases of preparation, planning, implementation, and evaluation of "Schule als Hybrides System" could be realized together.

6 Application scenarios

The research results presented provide the basis for a first experimental implementation and testing of "Schule als Hybrides System". A specific monitoring process with a defined and scientifically underpinned parameter matrix and suitable monitoring tools should be developed by an interdisciplinary team for this purpose. "Schule als Hybrides System" can be used universally,

regardless of a school's pedagogical guiding principle, but the concept could demonstrate its advantages particularly well in certain scenarios, especially in a pilot project.

After disasters such as floods, 'schools as a hybrid system' could quickly and easily make essential functions of affected cities and communities available again in the affected areas in a central and possibly temporary building, especially if implemented with cost- and time-efficient modular construction. Building on the parameters of variety, diversity, ambiguity, and variability, "Schule als Hybrides System" can also contribute to the rapid integration of people who come to us from crisis and disaster areas.

The concept also offers innovative and flexible options for the transformation of schools into all-day schools in line with Goal 4 of the UN's 17 global sustainability goals (United Nations, 2015) - Quality Education - for integrating a corresponding all-day offer beyond pure teaching.
In rural areas, 'schools as a hybrid system' can contribute to the revitalization and attractiveness of a village as a new center and represent a crucial factor for the influx of new families.

In densely built-up urban districts, a combined renovation and hybridization of existing schools offers new options for future-oriented and cross-generational participatory densification strategies. The concept of "Schule als Hybrides System" is transferable to other educational buildings such as colleges and universities and to public buildings in general.

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