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School Outdoor Spaces as Urban Public Space Activators. Three Case Studies in Croatia

Marija Krajnović ¹ | Mia Roth-Čerina ² | Sanja Lončar-Vicković ³

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Abstract

In this paper, the authors provide an overview of schools' outdoor spaces. A brief analysis of their historical development is followed by a study of contemporary multifunctional use of school grounds primarily based on an interaction between the community and public urban spaces. Schools' outdoor spaces have lately been comprehensively researched in light of the effects of the Covid-19 pandemic on teaching as well as the long-standing awareness of the importance of eco-friendly living. Architectural elements of schoolyards of the early twentieth-century Open Air Schools, created to improve children's health, and the ensuing process of evolving school outdoor spaces beyond education, are detailed with a vision of connecting schools with the surrounding built environment. Through a comparative analysis of selected case studies in Croatia, the paper presents three examples of interaction between primary school outdoor spaces and urban public spaces. This interaction is a viable future trend in school design and urban planning in view of the reduction of accessible community areas with the aim of bringing education back to its origins in nature and urban public spaces.

Keywords: School outdoor spaces; urban public space; multipurpose use; school and community

Citation

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Los espacios escolares al aire libre como activadores del espacio público urbano. Tres estudios de caso en Croacia

Resumen

En este artículo, los autores ofrecen una visión general de los espacios exteriores de las escuelas. Tras un breve análisis de su evolución histórica, se estudia el uso multifuncional contemporáneo de los recintos escolares, basado principalmente en la interacción entre la comunidad y los espacios públicos urbanos. Últimamente, los espacios exteriores de las escuelas han sido objeto de una investigación exhaustiva a la luz de los efectos de la pandemia COVID-19 en la enseñanza, así como de la conciencia que existe desde hace tiempo sobre la importancia de una vida respetuosa con el medio ambiente. Los elementos arquitectónicos de los patios escolares de las escuelas al aire libre de principios del siglo XX, creadas para mejorar la salud de los niños, y el consiguiente proceso de evolución de los espacios escolares al aire libre más allá de la educación, se detallan con la visión de conectar las escuelas con el entorno construido que las rodea. Mediante un análisis comparativo de estudios de casos seleccionados en Croacia, el artículo presenta tres ejemplos de interacción entre los espacios exteriores de las escuelas primarias y los espacios públicos urbanos. Esta interacción es una tendencia futura viable en el diseño escolar y la planificación urbana, en vista de la reducción de las zonas comunitarias accesibles, con el objetivo de devolver la educación a sus orígenes en la naturaleza y los espacios públicos urbanos.

Palabras clave: Espacios escolares al aire libre; espacio público urbano; uso polivalente; escuela y comunidad

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1. Introduction

Learning spaces have transformed over time following the evolution of the teaching process and learning methods. Outdoor learning spaces, although present throughout the history of education, have steadily gained importance due to the modern society's lifestyle that keeps children indoors, reinforced by the need for technology that enables them to learn, gain information and communicate with friends from home. The ongoing Covid-19 pandemic amplified the emphasis on open spaces in school architecture following in the footsteps of the early 20th century Open Air School movement, created with the idea of preserving children's health during frequent outbreaks of tuberculosis. All these facts contribute to the complexity of 21st century school design that needs to connect ideas of open schools, outdoor learning and school community outreach with the necessities of protecting and safeguarding children within school grounds. With all the positive aspects that potential opening of schoolyards offers to the community, most often opposing positions arguing for children's safety or individual and legal interests prevail while neglecting the needs of children and the benefits of connecting with the community.

1.1 *Conceptual framework – school outdoor spaces and the educational context*

Authors define school outdoor spaces as all school areas that have not been covered by the school building while some authors divide outdoor spaces according to their purpose into general spaces and teaching area spaces (Auf Franić, 2004). In pedagogical theory, school outdoor spaces, especially schoolyards, have a significant role in a child's development and act as a spatial bridge between the natural environment and the school building (Bognar, 1993). The importance of school outdoor spaces has come to special prominence following the Open-air education movement at the turn of the 19th and 20th centuries, with a twofold origin: one stemming from public health concerns and the other from spatializing the pedagogical and philosophical ideas of Rousseau, Pestalozzi, Tolstoi or philanthropists' ideals of an upbringing in connection to nature (Roth-Čerina, Rister, 2021). Further studies show the benefit of connecting outdoor spaces to a child's development, for example, claiming that outdoor areas are extremely beneficial for children with autism (Hebert, 2002).

The advantages of using outdoor spaces in the teaching process are confirmed by numerous examples of research such as Malone&Tranter, 2003; Maynard&Waters, 2007; Rivkin, 1997, 2000; Mozaffar&Mirmoradi 2012; Christidou et al., 2013, Li & Sullivan, 2016. Children's play and activities in outdoor spaces are important for their psychophysical development, they positively affect students' socialization and their adaptation to the school environment while teaching in nature encourages understanding of natural processes (Bajbutović, 1981). Also, active outdoor learning stimulates all aspects of children's development more easily than in an indoor environment (Moore & Wong, 1997).

The relation between education, children and the city has been a recurrent theme in educational research, didactic theory and modern urban design. It can be observed through the use of the school ground as urban public space, or through the activation of urban public space as educational space. Defining necessary placement of playgrounds within urban public spaces as well as their distances from places of living, has been an integral part of post-WW2 urban standards (L'Architecture D'Aujourd'hui, 1949). At the same time, the importance and structure of school outdoor spaces has become a segment of spatial programmes of school equally important as the interior functional distribution (Roth, 1966) although usually remaining within fenced school grounds. Today's role of school outdoor spaces goes beyond exclusively educational aspects and develops a connection with the surrounding urban context and community thus erasing the border between the school spaces and the urban public spaces.

“Social surveys have shown that because children are now spending less and less time ‘playing out’, the school playground becomes correspondingly more important as a social setting for outside, ‘unofficial’ and self-directed activities.” (Blatchford and Sharp, 1994, page 33; Casey, 2003, page 18) The research issue of interaction between school outdoor areas and urban public areas has so far generated sporadic interest (Mayoral-Campa, E. *et al.*, 2021).

1.2 School outdoor spaces and the urban context

The city is an organism with a large potential of using urban space in education, especially in creative disciplines (Campos & Luceño, 2020). Changing the role of school outdoor spaces and their significance in school architecture and the teaching process has also changed their role in the context of publicly accessible urban spaces. The role of outdoor spaces in primary schools is more intense than in secondary schools. Furthermore, primary schools are evenly distributed throughout the urban area, making them accessible to a large number of people thus becoming ideal places for recreation and health of citizens. Accordingly, the focus of this article is on primary school outdoor spaces and their interaction with the urban environment.

Recent examples of 21st-century educational buildings show the potential for a stronger connection between school outdoor spaces and urban contexts, as confirmed by several school complexes in Croatia. Such interaction between school and urban spaces is enabled by *polyvalent use of space*. Polyvalent (multipurpose, multifunctional) means it is used by the community, students, and teachers (users of the school) without disrupting their basic educational function while meeting the planning, safety, and social requirements. This does not necessarily mean that such space is used at the same time by multiple groups of users. On the contrary, it primarily pertains to the scheduling policy for optimal use of outdoor facilities.

There are multiple benefits of activating and using the school and its outdoor spaces by the local community, as shown by numerous studies like Blatchford and Sharp, 1994, Burns, 2008; Green, 2021; etc. Trees provide shade and reduce field air temperatures, gardens increase biodiversity and provide additional educational opportunities for the environment, stormwater management systems help reduce floods and trails, and fields and play equipment are spaces for exercise and building social skills and engagement in the community (Green, 2021).

Community playgrounds can encourage better student learning outcomes, and research shows that views of green spaces can improve cognitive abilities, mood, and desire to learn (Li & Sullivan, 2016). Local communities with limited or non-existent park areas document higher temperatures and poorer air quality in summer. Also, people exercise less in areas without park areas close to home, while lack of access to parks is associated with an increased risk of heart disease, stroke, and obesity (TPL, 2021).

At the same time there are growing trends in some parts of the world that advocate children’s safety or individual and legal interests (Ball, 2002). However, they are more dominant in day-to-day functioning of schools than in school design that is usually oriented towards respecting the needs of children and the benefits of connecting with the community (Huang, 2012; Rooney, 2015). Advances in polyvalent use are sporadic but with the gradual loss of publicly accessible urban outdoor spaces, there are more examples of successful integration of school outdoor spaces with the city while maintaining a high level of student safety. “Schools are one of the few places left where parents feel it is safe to send their children” (PlayLink, 1999, pp. 5).

The program called *School Playgrounds Open to the Neighbourhood*, developed in Barcelona, fostered the opening of the playgrounds outside the school timetable and during the weekends. (Pía Fontana & Mayorga Cárdenas, 2017).

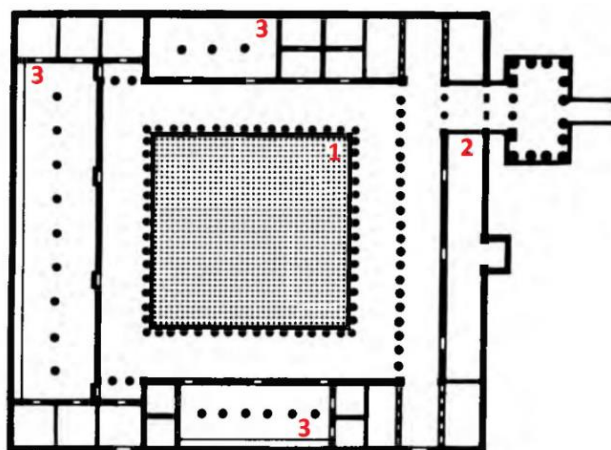
Another similar program of connecting schoolyards with a community was tested in the United States (model called “Community Schoolyard”) in 2020 by The Trust for Public Land (TPL) organization resulting in proposals for opening schoolyards to the surrounding neighbourhoods after school hours and on weekends. Using metrics like heat, water quality, physical activity, and mental health, TPL has identified 45 large school districts in nine regions of the United States that most urgently need the Community Schoolyards model (TPL, 2021). According to TPL’s report from 2021, by transforming underperforming, paved public schoolyards into green oases for the entire community and turning them into community hubs, many people would have the ability to access parks and open spaces within walking distance of their homes. However, only a small part of current public schoolyards meets the criteria for a community schoolyard. The reason for that limitation is the fact that, while some schools have been greening their schoolyards and others have opened their yards to the public after hours, very few did both (Green, 2021), which is important for multiple use to be successfully implemented.

Outdoor school spaces are in most cases the border area between educational and urban area, and their role should serve in both, educational and social field. In the next chapter, a historical overview of school outdoor spaces’ development will be presented where the transformation of outdoor school areas from a solely educational role to a more social and urban role is visible, with stronger integration between school outdoor spaces and urban public spaces.

2. An Overview of School Outdoor Spaces’ Development Through History

Urban public spaces and the natural environment have been in symbiosis with the educational process throughout history, albeit on a different level of intensity and use.

Figure 1. Outdoor space/atrium inside Gimnasium, Epidaurus, 1 – Inside courtyard (atrium), 2 – washrooms and bathrooms, 3 - classrooms



Source: Bajbutović, 1981

First forms of organized learning in Egypt, Babylon, India, and ancient Greece were usually carried out in natural environments, and religious or residential buildings. In ancient Greece, wealthier children were educated in the gymnasium, while general education took place in the palestra (Bajbutović, 1981). An integral part of the gymnasium was the outdoor space in the form of an atrium, which indicates the need for using outdoor spaces in the educational process already in the early stages of educational buildings’ development (Figure 1).

During the Roman Empire, education took place in a complex of thermal baths, which, in addition to closed spaces, also contained outdoor spaces for exercise, play, and recreation. Such spaces were used not only for education but also as public spaces for all citizens. Here, we still cannot talk about the term *school outdoor spaces* in the context of publicly accessible urban space, because the form of education within the school was not yet established. During the Middle Ages, the importance of outdoor spaces in the educational process decreased. There were no public schools, education was available almost exclusively to the clergy, and teaching took place within church buildings and monasteries (Dudek, 2000).

Although the founder of didactics, Czech educator Jan Amos Komensky did stress the importance of outdoor play and its developmental and educational role (Džambo, 1993.), it has not been a functional part of educational space until the emergence of modern educational theories in the late 18th and 19th century. School outdoor space design can thus be analysed from the 18th century onwards, when the traditional school was established. The spatial articulation results from the didactic process where teaching was organized in the form of a class-hour system with a frontal working method and a teacher at the front of the classroom. Traditional schools' outdoor spaces were designed largely as decorative spaces (although some schools-maintained vegetable gardens), not intended to be used in the teaching process or as spaces of children's socialisation.

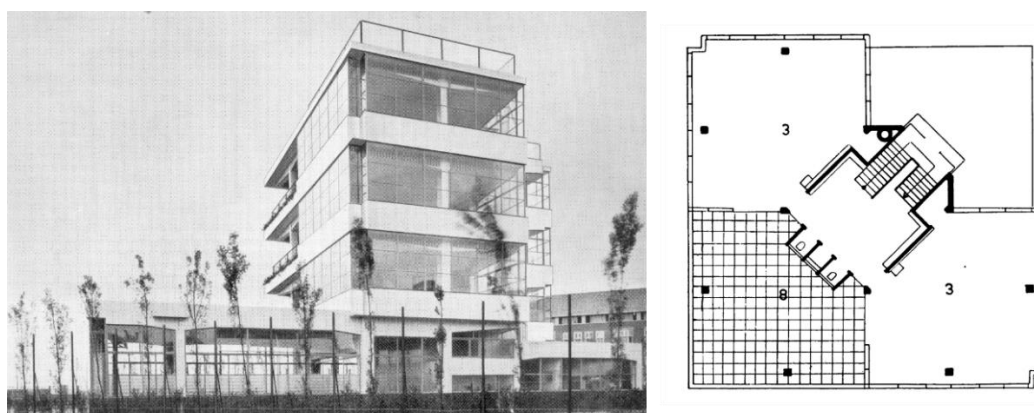
The traditional school building of the nineteenth century was designed similarly to other monumental public buildings located in prominent places in the city, even though having different functions (Hertzberger, 2000). Lack of outdoor spaces for play and recreation was specifically addressed by the open-air education movement at the turn of the century, and quickly became an essential part of the spatial vocabulary of the new school as documented by Alfred Roth (Roth, 1966). He described the relationship between architecture and pedagogy and the importance of the physical environment in the upbringing and education of children, converging ideas of educational movements from the early 20th century, which all stress the importance of outdoor learning and play, into the requirements of modern school space. After their designated decorative role, they started to have more educational roles, while also being recognized as fundamental in healthy child development.

Traditional school structures were criticized by various pedagogical movements in Europe. The Open-air education movement was one of the most significant pedagogical movements of the 20th century that emphasized the use of outdoor spaces in education, building schools in Europe and around the world (Cardellino, 2022). The drivers of these changes simultaneously evolved from pedagogical and philosophical origins as practiced in countryside schools aligned to Jean Jacques Rousseau's ideas on learning with and from nature, but primarily from widespread action on prevention of diseases and caring for children's health in cities. Open-air schools were therefore mainly established in a period of widespread danger of tuberculosis due to unhygienic living conditions, subsequently revolutionizing the architecture of schools (Roth-Čerina, 2011). Significant examples are the Charlottenburg Waldschule (1904), Uffculme Open-Air School Birmingham (1911), Open-air School Amsterdam (1930), Open-air school Suresnes (1931-1935) etc. (Chatelet et al, 2003). In all schools, the outdoor spaces are an integral part of the design, connected to the classroom space owing to major flexibility and adaptability in their design (Pía Fontana & Mayorga Cárdenas, 2017).

Free Institution for Education was established in Spain (founded by Francisco Giner de los Rios in 1876) and has been oriented towards 'new schooling' with notable outcomes in Spain (Benayas et al, 1991). *"Barcelona has been a pioneer in the introduction of new pedagogical models associated with schools, projected in relation to their exterior spaces. Notable references are the experiences of the Escuela Moderna founded in 1901 by the educator Francesc Ferrer Guardia and the Escola del Bosc (The School of the Wood) inaugurated in 1914, as examples of the integration with nature and the exterior as spaces of learning."* (Pía Fontana & Mayorga Cárdenas, 2017, pp. 121)

Open-air education movement influenced school design in Croatia as well. Criticism of urban schools was formulated in 1934 by Franjo Higy-Mandić, the founder of the National Forest School in Tuškanac, pointing out the inadequate courtyards in city schools responding to their representational role and adapted to the use of adults (Roth-Čerina, 2011). Lessons from the open-air education movement, as well as modern requirements for hygienic public and educational spaces, were formulated in examples of interwar schools built in Croatia, particularly those by Ivan Zemljak, Egon Steinmann, Zvonimir Vrkljan and others. At the same time, movements of reform pedagogy implied alternatives to the spaces catering to the traditional school system and ignited a redefinition of the spatial organization of school buildings, outdoor spaces included. School space was divided by function and purpose (Roth-Čerina, 2015) and outdoor spaces were increasingly becoming part of the public discourse on school building design.

Figure 2. J. Duiker, Open air school, Amsterdam (1930.), Outdoor classrooms located on the floors of the building



Source: Roth, 1966

During this period, the open-air classroom concept appeared (Figure 2), enabling children to have a more direct contact with the outdoors. *"In the beginning, the open-air classroom was completely arranged as a traditional one - the furniture, the blackboard, the seating arrangement, and the way of teaching corresponded to the traditional one, but limited by fictitious walls"* (Hansen-Schaberg, 2003, pp. 311).

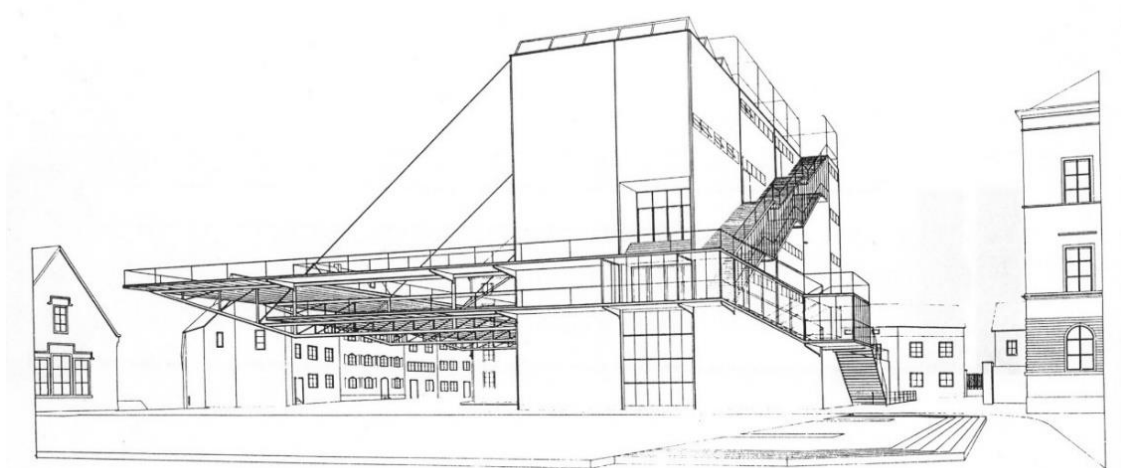
In this time, the urban role of school outdoor spaces was not in the focus, only their developmental and educational role was researched. But some initiatives from the beginning of the 20th century started to appear that treat public schools as centres of urban settlements. *"Schools are becoming community centres like churches used to be."* (Cannon Design; VS Furniture; Bruce Mau Design, 2010, page 115) Unlike schools in urban areas, outdoor spaces are more actively used as a learning focus in schools located in rural areas (Darmody, 2010).

The aims of creating healthy educational spaces aligned with modern tendencies in architecture. The CIAM association (Congrès Internationaux d'Architecture Moderne) organized congresses across Europe where architectural, urban, and other topics were discussed, promoting and defining the language of modern architecture. At the Athens congress in 1933, CIAM presented the principles of a "functional city" advocating urbanistically sound, functional, and economical construction and thus tried to solve the accumulated problems of housing in the then rapidly growing cities: unlawful construction, unhygienic conditions (Charter of Athens, 1933). Their thoughts came to the fore, especially after the Second World War during the reconstruction and construction of war-damaged cities (CIAM, 2021). The Athens Charter emphasized the connection between the school building and the context in the Housing and Recreation chapters.

The function of educational facilities was emphasized in the context of serving the local community and sharing sports fields and school sports halls with the community (Charter of Athens, 1933). The sharing of other outdoor facilities opened possibilities for additional research.

The convergence of goals stated through CIAM and those of a healthy, functionally zoned school can be illustrated through several paradigmatic examples of the time. The revolutionary design for the Peterschule girls' primary school in Basel by Hannes Meyer and Jakob Wittwer (Figure 3) from 1926, although not implemented, had a lasting influence on the architecture of schools in general, including the role of outdoor school space as an urban public space. The authors concluded that the planned school plot area of 1240m² was too small for the requested task and that the program of eleven classes, hall, art room, swimming pool, kitchen, and canteen, leaving only 500m² for outdoor playground areas for children, was inadequate. Therefore, they proposed developing the school vertically, allowing for a larger recreation area on platforms and roof terraces with plenty of sun and fresh air. Furthermore, they maximized the hanging platforms and freed the entire ground level from any enclosure, returning it to public use and enriching a dense historic urban fabric (Roth, 1966.).

Figure 3. H. Meyer and J. Wittwer, Peter's School, Basel (1926)



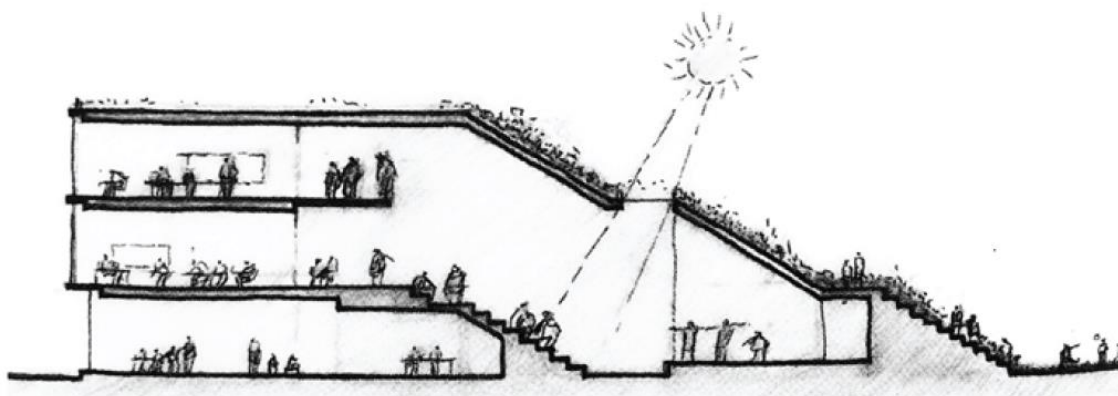
Source: Dudek, 2000

The schools built after the Second World War in Europe included lessons of interwar experiments, stressing – among other points – the importance of outdoor space. For example, British schools built after the war were mostly based on a model defined in the 1931 Hadow Report which emphasized the school's contact with the natural environment. Schools built after that scheme were more spacious, located in green areas with southern lighting, positioned on the edges of new suburban areas, and had the possibility of completely opening classrooms to outdoor spaces (Dudek, 2000). However, practice in Croatia showed that, while outdoor spaces of these schools were directly related to the teaching process, their potential was not optimally used. They were often oversized, and the playgrounds were unused because the needs of the school and other users were not taken into account during the design. (Stella, 1971)

An example of city regeneration with children and education are the playgrounds of Aldo van Eyck, a programme of more than 700 parks carried out in Amsterdam between 1947 and 1978, where the vacant and narrow, in-between open urban spaces were transformed and revitalized into places for children and places for play. Moreover, furniture design based on abstract and modular forms could turn play into an integrating activity (Pía Fontana & Mayorga Cárdenas, 2017).

Promoting urban environment in school architecture is also visible in some works of Herman Hertzberger (Figure 4) like Montessori school in Delft (1960–66), Apollo schools of Amsterdam (1980–83), De Voogels school in Oegstgeest (2004), De Opmaat school in Arnhem (2004–07)) where he created “a series of interrelated places that configure the school as a micro-city” or “a wide range of intermediate spaces that question the idea of borders” (Mayoral-Campa, Pozo-Bernal, 2017, page 103/104). He puts a square in the heart of the school or designates the street as a place for learning thus identifying places of the school with the city. (Mayoral-Campa, Pozo-Bernal, 2017).

Figure 4. H. Hertzberger, De Opmaat school, Arnhem (2004-2007), section, sketch. The green roof of the school building accessible to the public



Source: Mayoral-Campa, Pozo-Bernal, 2017

Hertzberger's ideas of school as a micro-city were influenced by the schools of Hans Scharoun, through the projects in Darmstadt (1951), Lünen (1956–1962), and Marl (1957–1960). While Scharoun's schools were designed after an extended war period which required the city and society to be rebuilt by defining a school as a small-scale model of a city, contemporary schools in a highly developed and democratic educational environment are representing the civic centre of the city and society where community life revolves around the school (Sentieri-Omarrementeria, Verdejo Álvarez, 2017).

Recent years have placed the topics that had been extensively explored a century ago at the forefront of defining current goals in architecture, now addressing climate emergencies, ecological education, health concerns stemming from contemporary lifestyles as well as the social role of the school and well as learning landscapes promoting contemporary teaching, all affecting both indoor and outdoor spaces. Learning has been transferred to all parts of the school building, to all indoor and outdoor spaces as a result of new educational methods adapted to contemporary trends (*Primary School in Bad Blumau*, 2016). New models of interaction are developing, both outdoor and indoor spaces, or school outdoor spaces and the city.

In many neighbourhoods, access to schools and their outdoor spaces is still forbidden or restricted with fences and ramps for child safety purposes (Burns, 2008). Despite fences or other ways of protecting school spaces from vandalism, architects try to create connections between educational spaces and urban public spaces in different ways - by widening the sidewalks, reaching them from the interiors of buildings (Ferroni E.R.; Dietrich, A., 2008) (Figure 5.), or opening certain parts of the schoolyard to the community (Figure 6).

European School in Copenhagen (Figure 2) is an example of such interaction promoting new methods of designing educational institutions by integrating the school and the city through outdoor spaces located between the sports hall and the school building available to the public.

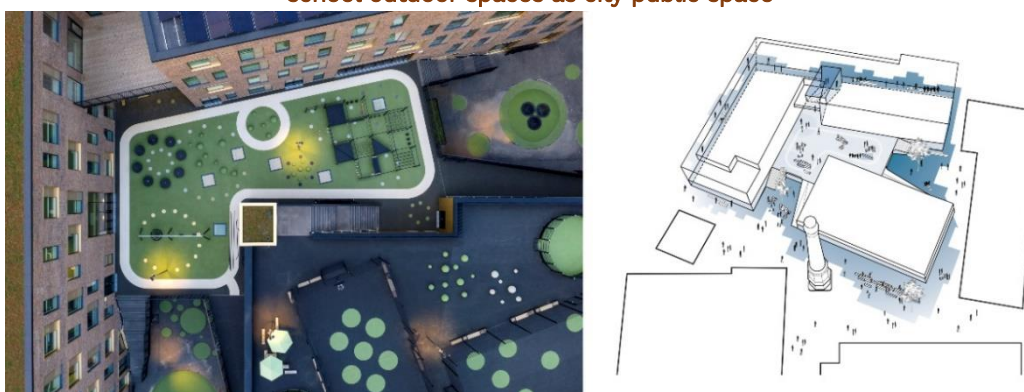
The sports hall is connected to the school with a landscaped roof on different levels containing spaces for recreation, activities, and playgrounds (*The European School Copenhagen / NORD Architects + Vilhelm Lauritzen Architects, 2019*).

Figure 5. Vilanova Artigas - Architecture and Urbanism School, Sao Paulo (1961-1968)



Source: Nelson Kon private archive

Figure 6. NORD Architects, Vilhelm Lauritzen Architects - European School Kopenhagen (2018), school outdoor spaces as city public space



Source: NORD Architects private archive, photo: Adam Mørk, Hampus Berndtson

The quality of interaction between the school's external and internal spaces in the 21st century has been recognized (Bobovec, Mateković, Rako, 2020) while the interaction with the urban public space develops with a lower intensity, often due to security and legal reasons. Several cases can be singled out as drivers of possible change: for example, in 2007, the American Architectural Foundation (AAF) and the KnowledgeWorks Foundation selected Rosa Parks School as the winner of the Richard's Riley Award for a community centre school that has become a national model of revitalizing an entire neighborhood through creative design (Cannon Design; VS Furniture; Bruce Mau Design, 2010). This trend is taking place in Croatia as well and selected schools designs are presented in detail in the case study section (Figure 7).

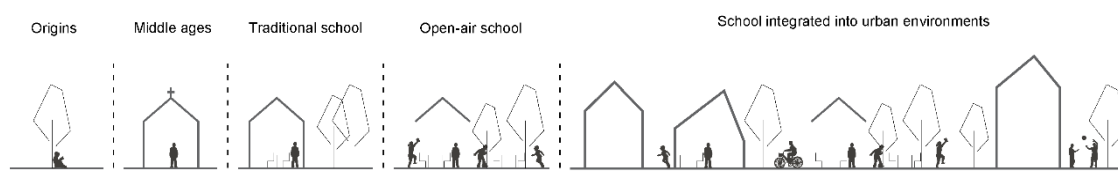
In the last few decades, the importance of outdoor spaces in school design has increased both within the educational process and in the interaction with the city. The turn of the 20th to 21st century saw the attention of schools as institutions increasingly focused on communal aspects, an expression of social ambition extending schools' reach from and a purely educational function to that of cohesion and inclusivity, followed by less restrictive legal and professional requirements for school buildings (Roth-Čerina, Rister, 2021) (Figure 8). Several schools built in the 21st century in Croatia serve as good examples of how to successfully create different types of high-quality interaction between school outdoor spaces and urban public spaces.

Figure 7. Mirela Bošnjak, Mirko Buvinić, Maja Furlan Zimmermann (x3m) - Žnjan Pazdigrad school, Split (2017) - atrium



Source: Bosnić+Dorotić private archive

Figure 8. Graphic presentation of the historical development of western civilization learning spaces



Source: authors, 2022

3. Interaction of School Outdoor Spaces with Outdoor Urban Public Spaces – Three Case Studies in Croatia

3.1 Study Area and Methodology

Authors have approached the subject of the social potential of primary school outdoor spaces within the urban context using an interpretive historical research method. In the first part of this paper, more than thirty relevant scientific and professional bibliographic units were reviewed, starting with sources within the field of architecture but also including sources from developmental psychology, urban sociology, legislature, and others. An overview of the school outdoor spaces' historical development was given, with emphasis on their dual (educational and social) role and significance in the community.

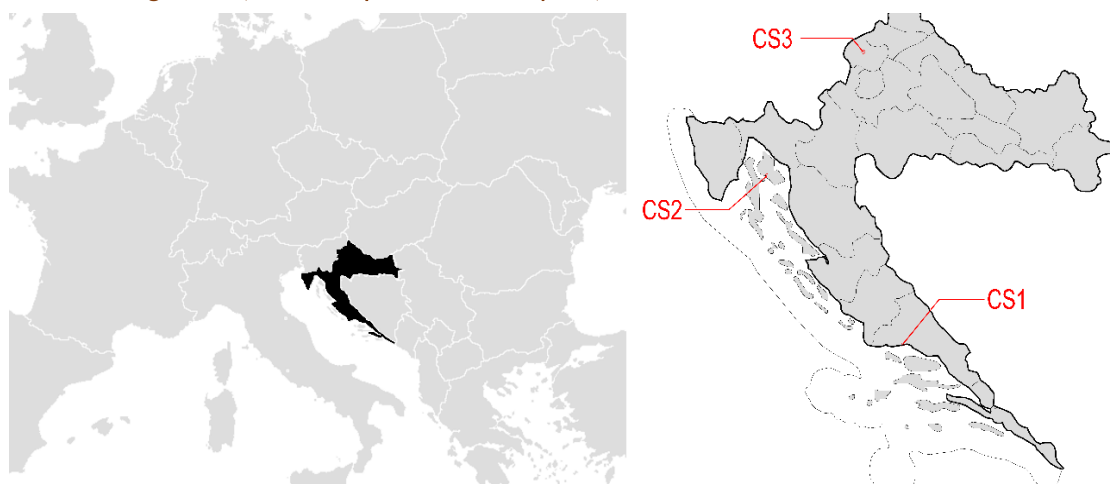
The approach to designing or redesigning contemporary primary school outdoor spaces in the 21 century focuses on integrating urban public and primary school outdoor spaces. Authors conducted research on this topic in Croatia based on three 21 century primary schools as case studies.

Today there are 880 primary schools in Croatia (Croatian Bureau of Statistics, 2022), with an educational system placing grades 1 to 8 (ages 7 to 14) in the primary school. About twenty new school buildings or quality interventions in school outdoor spaces were built after 2000 and are individually presented in books, architectural journals or professional websites, all accessible to the public. The main criteria for the selection of case studies were the quality of integration of school outdoor spaces and the surrounding urban context within school design. These main criteria were divided into several sub-criteria such as accessibility of the space to the public, added value to the neighbourhood, types of interaction between the school and public spaces, and ways of using multifunctional spaces.

On the basis of these criteria, three best examples were selected and later evaluated and compared, resulting in a detailed presentation of different ways of achieving successful interactions and overlaps between school outdoor spaces and urban public spaces.

Until now, there has been no detailed analysis of interaction between the school outdoor spaces and urban public spaces in Croatia. All three cases are located in different environments (Figure 9), they vary in size and design and illustrate three different types of a school's interaction with the urban context. It is important to point out that these case studies do not represent the majority of schools in Croatia, but they stand out for the quality of their interaction with the community and therefore represent a viable model for future school design and urban planning for various contexts.

Figure 9. a) Croatia's position in Europe, b) Locations of case studies in Croatia



Source: authors, 2022

Methodological pattern used for the analysis was focused on:

- *Basic data*

In this part, information about schools like location, year of the project/construction, outdoor area, authors etc. are given.

- *Urban environment*

In this part, the surrounding urban area was analysed, focusing primarily on the type of urban context and use of urban public spaces in the area before intervention.

- *Spatial characteristics of school outdoor spaces*

The second part of the analysis deals with the position, visibility and design of school outdoor spaces that can contribute to the community.

- *Outdoor school and urban spaces interaction*

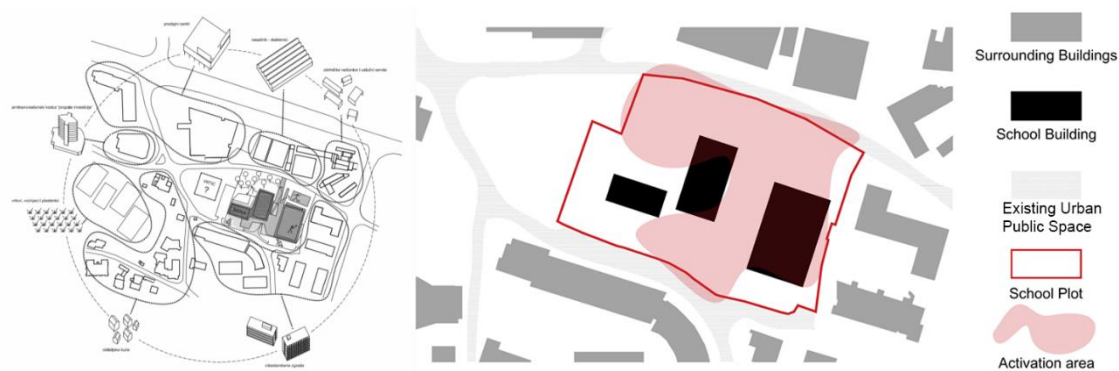
In this part of the analysis, it was important to detect what type of intervention in the outdoor spaces was made, which parts of the outdoor spaces were the activation area, what was the activation method used for the integration and what are the results of these interventions.

3.2 CS1 / Žnjan Pazdigrad School, Split

The primary school Žnjan Pazdigrad is located in the eastern district of the city of Split. The surrounding context is a highly heterogeneous, largely unplanned and unconsolidated area consisting of multi-apartment buildings, shopping centres, single-family houses with gardens and orchards, agricultural land, and artisan workshops, with – prior to the school's erection – no common public space other than the chaotic road network (Figure 10).

The 2009 architectural competition defined the need for a complex of a school and a kindergarten, in order to compensate for a lack of social infrastructure in the area. The winners of the competition were Mirela Bošnjak, Mirko Buvinić, and Maja Furlan Zimmermann of the studio x3m, and the school was ultimately built in 2017 after much community engagement.

Figure 10. Mirela Bošnjak, Mirko Buvinić, Maja Furlan Zimmermann (x3m) - Žnjan Pazdigrad school, Split (2017) – layout plan and graphic analysis



Source: x3m office archive, authors

The specific plot situated on a steep sloping terrain was the authors' impetus for developing a sequence of areas accessible to the neighbourhood, permeating the school in a new topography. A complex system of covered and opened squares with playgrounds and sports fields continue under, over and through the building, so that the school's spaces serve as a generator of indoor and outdoor activities and experiences.

Throughout the design process, the urban area obtained from the public (12.100 m²) became larger than the entire school plot (11.600 m²) thus offering the community an array of outdoor collective spaces. Separate volumes designed to accommodate various functions were linked on different levels by pedestrian walkways and thus successfully connected the north and south parts of the neighbourhood. The school is organically grafted while maintaining functional clarity. (Figure 11.) (*Osnovna Škola "Žnjan-Pazdigrad"*, 2018)

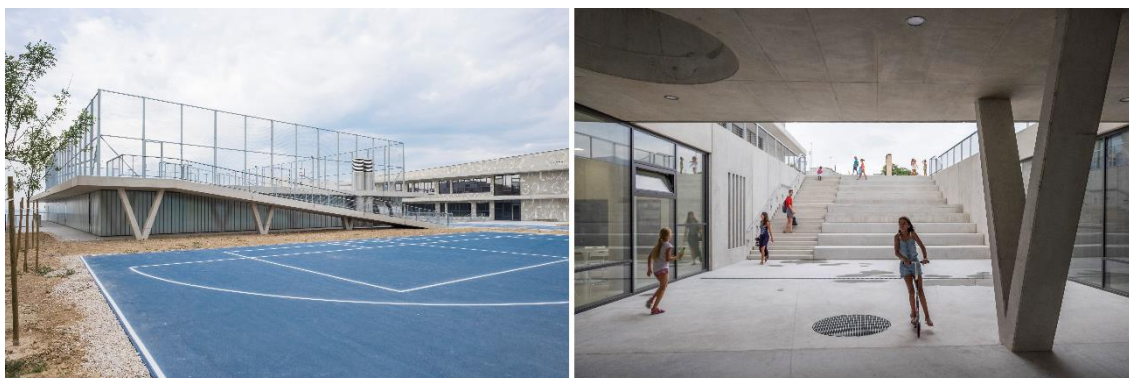
Figure 11. Mirela Bošnjak, Mirko Buvinić, Maja Furlan Zimmermann (x3m) - Žnjan Pazdigrad school, Split (2017) - section



Source: x3m private archive

Communal spaces within the school – the multipurpose hall, the library, the entrance to the sports hall – are placed adjacent to the open multifunctional spaces, connecting them to the neighbourhood and extending their possible uses while teaching spaces – classrooms, administration, services – are placed above or beneath them. Open sports fields on the roof of the tripartite sports hall are linked with the pedestrian walkways and can be used by all residents, additionally providing a vista of the sea (Glažar, 2018). Figure 12 shows school outdoor spaces available to the community.

Figure 12. Mirela Bošnjak, Mirko Buvinić, Maja Furlan Zimmermann (x3m) – Žnjan Pazdigrad school, Split (2017) – integrated outdoor school and urban public spaces

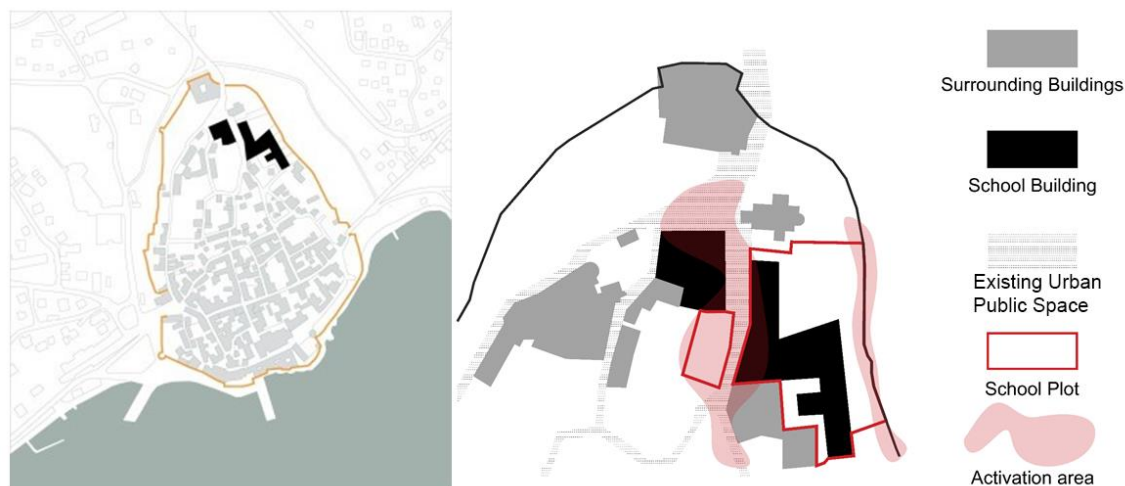


Source: x3m private archive, photo: Bosnić+Dorotić

3.3 CS2 / Sports Hall and Fran Krsto Frankopan School, Krk

“The outdoor space of the school and the hall, the outdoor space of the city, the outdoor space between public, private, historical and contemporary is the key of this project” (I. Turato, personal communication, August 23, 2022).

Figure 13. Randić-Turato, “Fran Krsto Frankopan” school and Turato Architecture, Sports hall, Krk (2005, 2012/2013) – layout plan and graphic analysis

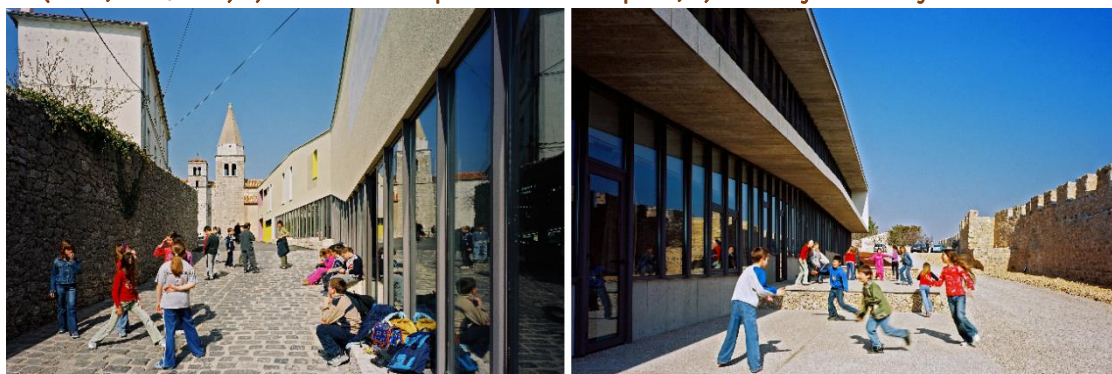


Source: Turato Architecture private archive, authors

Primary school “Fran Krsto Frankopan” is located on the north-eastern edge of the historic core of the city of Krk (Figure 13). The school uses the existing elements of the city – the street, the square, and the city wall and thus activates the surrounding urban context. Before the school was built, the street and the square had been only occasionally used as improvised parking lots (*The Hall Story*, 2013). The once derelict city wall was reconstructed as part of the school construction project. In this way it forms an integral part of the revitalization of the northern city gates, creating an inseparable whole with the school complex and monastery. (*Osnovna Škola Krk*, 2017).

The street and the square were activated and the city wall revived. The public space was transformed into private space and vice versa. In this way, the boundaries between the public space and the school grounds were removed and thus the school became an integral part of the city (Figure 14).

Figure 14. Randić-Turato, “Fran Krsto Frankopan” school and Turato Architecture, Sports hall, Krk (2005, 2012/2013) a) Public Street space as school space, b) school yard as city wall activator

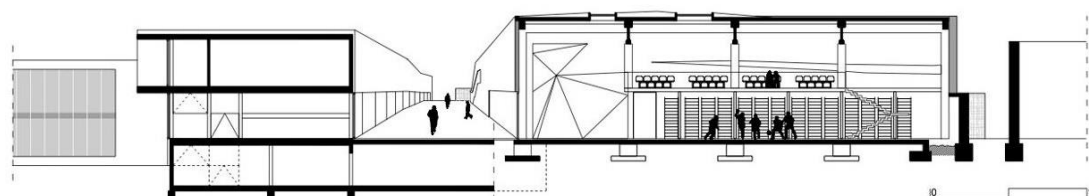


Source: Robert Leš private archive

The school building follows the axis of the street along its east-facing façade. Its outdoor area (Figure 11) forms an interstitial street between the school and the city wall. In addition to the existing building, a small "cloister" was created in the western part of the site, containing a garden with indigenous Mediterranean herbs and plants as well as a break space for students, designed as a reminiscence of the Mediterranean urban courtyards (*Osnovna Škola Krk*, 2017).

School's public facilities can easily serve external users outside of school hours due to the separation of the classroom wing next to the courtyard and the wall and the placement of the public facilities along the street. The indoor common spaces follow the flow and geometry of the streets, with ramps, a stand, and galleries providing an extension to possible public use. The placement of the classrooms next to a more private area, on the other hand, provides security for students who are protected by the city wall.

Figure 15. Randić-Turato, “Fran Krsto Frankopan” school and Turato Architecture, Sports hall, Krk (2005, 2012/2013) - section, Street between the school building and sports hall



Source: Turato Architecture private archive

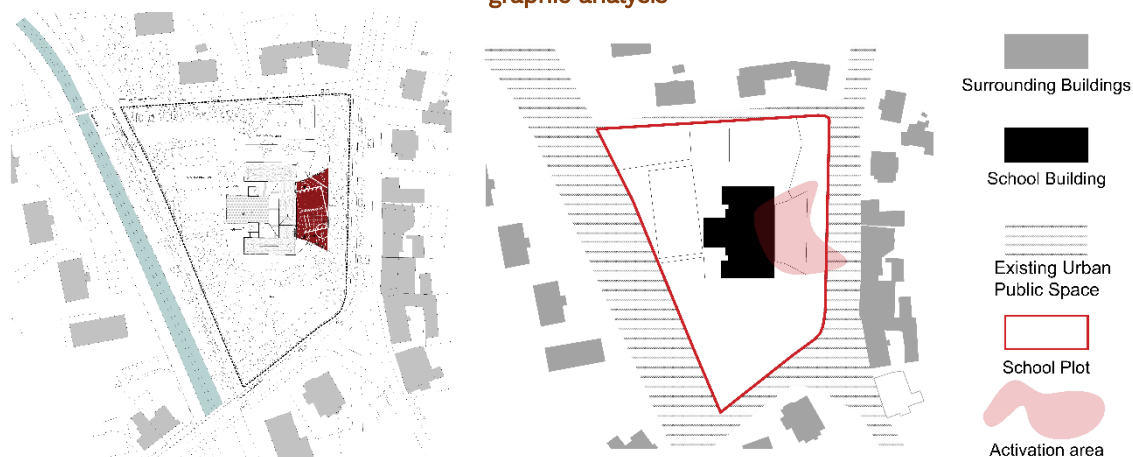
The multipurpose sports hall was built later in 2012 and is located next to Krk's monastery square. It is not only associated with the school but also serves for civic activities and public events. The contemporary square in front of the sports hall simultaneously provides a focus for the entrance to the historic church. The hall is connected to the school building by an underground walkway, and the school's outdoor sports fields are located in a vacant street lot with gardens, further activating the street as an interstitial space between the school and the playground (Figure 15). The school, the hall, and the square form a public space sequence that can function as a secular or sacred pedestrian area (*Dvorana i Trg u Krku*, 2017).

Both use the existing urban patterns, scales and materials, but interpret them in a contemporary collage adding a new meaning. “The entrances to both buildings are not really located in front of each other, but rather integrate part of the public street as a sort of shared and ambiguous entrance space to both buildings” (Alcolea, 2013, page 18). Even before the construction of the hall, the school had already generated a greater flow of people through the old town, while the hall defined and complemented the town square with two churches and two monasteries.

3.4 CS3 / Ljudevit Gaj School, Krapina

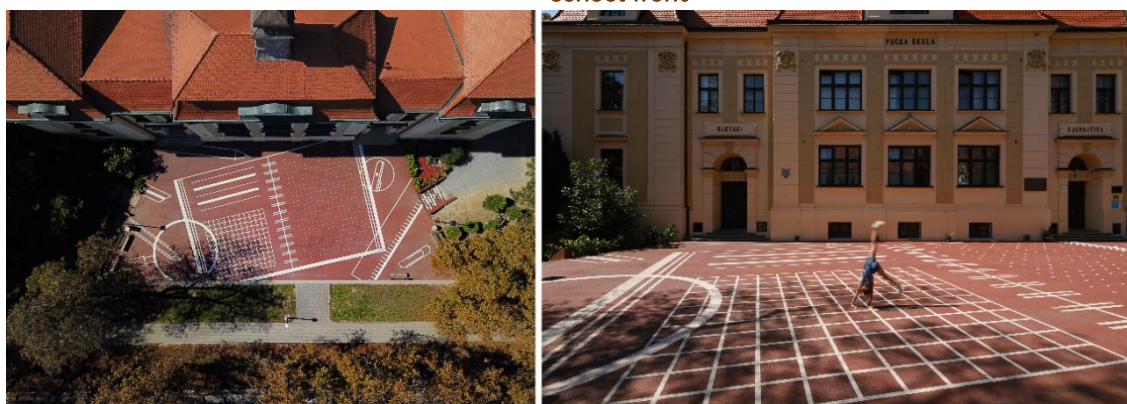
The primary school Ljudevit Gaj is located in the centre of Krapina, a small town in central Croatia. The school building itself is a neo-baroque landmark close to the city park. However, the open space leading to the main entrance was worn out and uninviting. The square in front of the school building did not originally function as an urban space, nor was it designed to promote public use. The intervention now promotes its informal use and utilizes graphic interventions that serve an extracurricular sports function but also stimulate a more intensive use in the neighbourhood (Figure 16).

Figure 16. MVA + Jan Pavlović, Ljudevit Gaj School Square, Krapina (2017-2020), layout plan and graphic analysis



Source: MVA private archive, authors

Figure 17. MVA + Jan Pavlović, Ljudevit Gaj School Square, Krapina (2017-2020), a) aerial view, b) school front



Source: MVA private archive, photo: Jure Živković

The authors of the square design were architects Mikelić Vreš Arhitekti (MVA) in collaboration with Jan Pavlović. Construction went on from 2017 to 2020 when the new square was completed. The school square has an area of 450 m² and showcases the potential of reactivating the existing school outdoor spaces through high-quality architectural interventions. After reconstruction, the size of the square was retained. Increased activity in the area can be attributed to a good-quality design. The square is characterized by a monolithic red surface where play and lounge areas are marked with line graphics in the form of basic school equipment - notebook, pencil, eraser, ruler, pencil sharpener, magnifying glass, and a paper clip - making it obvious that the square is primarily a school area (Figure 17). The architectural redesign of the square created a framework for pupils' outdoor activities and social contacts before and after class, representing an interactive space between the school and its surroundings (*School Square Krapina*, n.d.).

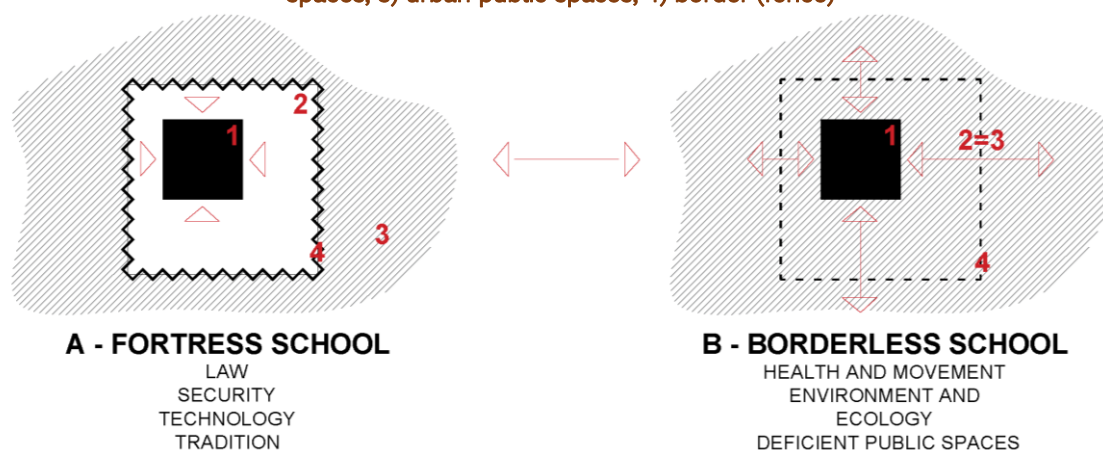
4. Discussion and Results

Several factors influence the design of school the outdoor spaces and the interaction of these spaces with urban public spaces. Current legislation mandates safety and security and requires the construction of a fence around the entire school complex. Growing dependence on technology compels children to spend more time indoors.

As a result, the importance of outdoor spaces becomes even more obvious. Environmental awareness leads to an emphasis on the need for a greater variety of school outdoor spaces including the emphasis on the school plot. This process has been accelerated by the Covid 19 pandemic, where new opportunities for outdoor and off-campus education are increasingly coming into focus in public urban spaces.

The major obstacle to a greater interaction between school outdoor spaces and urban public spaces is the safety of children. "Fortress schools" are separated from urban space by fences and high-security regime with poor use of outdoor spaces, that are rarely used after school hours or serve solely for educational purposes. In the 21st century, new educational methods are being developed and the importance of outdoor spaces in school design has been highlighted both within the educational process and in the interaction with the city. Therefore, school outdoor spaces are now being transformed into "borderless schools" (Figure 18) intended to serve multiple purposes within their communities.

Figure 18. Outdoor school spaces 21st transformation, legend 1) school building, 2) school outdoor spaces, 3) urban public spaces, 4) border (fence)



Source: authors, 2022

In view of the fact that the number of public parks and vacant urban spaces has declined, planners take advantage of existing resources, erase the boundaries between school outdoor spaces and the city, and create interaction between these spaces transforming the fortress school of yesterday into a borderless school of tomorrow. A crisis in urban planning could be another motif for developing new methods of the school outdoor space design as well as the opportunities for their interaction with the public space of the city. Primary schools, evenly distributed throughout the urban area, accessible to a large number of people of all ages are potentially ideal places for the connection of the school and the city. The selected case studies in Croatia show several directions of successful integration of schools and the city that can be reinterpreted in other areas. For the three schools, authors have analysed four groups of data – basic data, data on urban environment, spatial characteristics of school outdoor spaces and outdoor school and urban spaces integration.

Basic data

All three case studies were built in the 21st century and are located in different environments and varying in size and design. Basic data are presented in Table 1.

Urban environment

The first case study, the Žnjan Pazdigrad School in Split, is located on the outskirts of a large city. It is characterized by a heterogeneous, unplanned and unconsolidated area with no common public space that shares its outdoor space with the city and community. The second case study, Fran Krsto Frankopan School in Krk, is located inside medieval city walls and activates the existing urban public space for school use. The third example, Ljudevit Gaj School in Krapina, deals with the existing school space in the centre of a small town that evolves into an active shared community space following reconstruction.

Spatial characteristics of school outdoor spaces

Outdoor spaces of Žnjan Pazdigrad School in Split are positioned in many areas of the school plot, and some are on the top of the school building accessible from the surrounding area. Outdoor spaces are differentiated by scale, shape and position. In the second case study, Fran Krsto Frankopan School in Krk, outdoor spaces are not used only in the school plot, they spread across the street thus activating the street and the square including some private outdoor areas, positioned in an intimate zone with the city wall and are connected to the classrooms. The third example, Ljudevit Gaj School in Krapina has open areas, but isolated from the classrooms and at the same time open to the street and the surrounding urban area.

Outdoor school and urban spaces integration

The first case study, the Žnjan Pazdigrad School in Split is integrated with the community through design and location of the outdoor facilities and no fences between the school area and public area. The second case study, Fran Krsto Frankopan School in Krk, involves urban context through design and location of the outdoor facilities and school building, and the third case study, Ljudevit Gaj School in Krapina, activates the urban context through school square “acupuncture” with colour accent and graphic design.

Based on the selected case studies of Croatian primary schools, the authors defined three main principles of interaction between the contemporary school’s outdoor and urban public spaces, focusing on the dissolution of boundaries between them. These principles are (Figure 19):

1. School outdoor spaces activation principle

The design of new schools treats school’s outdoor spaces as urban public spaces with the aim of creating new urban areas whilst protecting childrens’ areas by creating parallel use and delineated regimes of use.

2. Urban public spaces activation principle

The design of new schools treats existing urban public spaces as school outdoor spaces with the aim of activating the existing inactive urban areas and transforming the urban pulse

3. Focal points' activation principle

This approach applies to redesigning existing schools. It targets the selected school outdoor areas - focal points - with the aim of activating school outdoor spaces for multifunctional use by the school's users and the local community through smart intervention.

Figure 19. Graphic analysis of interaction between the contemporary school's outdoor and existing urban public spaces presented in three case studies in Croatia



Source: authors, 2022

Although they start with a different context or activation method, the results and use of space after designing or redesigning school buildings and complexes are the same in all three case studies – *active and integrated public and school space*.

A comparative analysis of three case studies is presented in Table 1.

Table 1. Comparative analysis of three case studies in Croatia

	CS1	CS2		CS3
Basic data				
School	Žnjan Pazdigrad school	Fran Krsto Frankopan school and sports hall		Ljudevit Gaj school square
Location	Split	Krk		Krapina
New design/ Redesign	New	New		Redesign
Year of project / built	2009.-2017.	School 2005.-2014.	Sports Hall 2012.-2013.	2017.-2020.
Outdoor spaces area	12100 m ²	Public space – no data		450 m ²
Authors	Studio x3m / Mirela Bošnjak, Mirko Buvinić and Maja Furlan Zimmerman	Randić-Turato Architecture	Turato Architecture	Mikelić Vreš Architects (MVA) + Jan Pavlović
Urban environment				
Type of surrounding urban area	Heterogeneous, unplanned and unconsolidated area with no common public space	The edge of the historic core, close to the derelict city wall. Street and the square only occasionally used.		Small city, close to the city park

Public urban space before intervention	No public space in the area that could be used	Inactive public space, occasionally used as parking lots	School square used only for school purposes
Spatial characteristics of school outdoor spaces			
Position	Positioned in many areas of the school plot, and some are on the top of the school building available from the surrounding area.	Not only in the school plot, but they also spread across the street thus activating the street and square. Private outdoor area is positioned in intimate zone with the city wall connected to the classrooms.	Open areas, isolated from the classrooms and at the same time close to the street and the surrounding urban area.
Visibility	Visible from the street	Divided from the street by school building and the wall	Visible from the street
Design	Open, covered, introverted, extroverted	Introverted, open	Open, extroverted
Outdoor school and urban spaces integration			
Type of intervention	The design of new schools treats school's outdoor spaces as public spaces with the aim of creating new urban areas	The design of new schools treats public spaces as school outdoor spaces with the aim of activating the existing inactive urban areas	The redesign of existing schools activates school outdoor spaces for multifunctional use by the school's users and the local community.
Activation area	Playground, school square, platforms, passage	Square, street, city wall	School square
Activation method	Design and location of the outdoor facilities, no fences between the school area and urban public area	Design and location of the outdoor facilities and school building	Focal points' activation through school square "acupuncture", color accent, graphic design
Results after intervention	Active integrated public and school space	Active integrated public and school space	Active integrated public and school space

Source: authors, 2022

5. Conclusions

This paper presents research on the role of primary school outdoor areas in connecting school spaces with urban public spaces and differentiates principles of their mutual interaction.

An overview of the development of outdoor spaces in school architecture provides insights to their transformation through history following the evolution of the teaching process and learning methods as well as their position in the urban matrix. Architectural elements of schoolyards of the early twentieth-century Open Air Schools, created to improve children's health, and the ensuing process of evolving school outdoor spaces beyond education, are detailed with a vision of linking schools with the surrounding built environment. Special attention is given to the evolution of school spaces in light of the effects of the Covid-19 pandemic and long-standing awareness of the importance of environment-friendly living.

Contemporary school design emphasizes the importance of outdoor spaces, their role in the upbringing and education of children. They serve as models for understanding the relationship between human and nature and the impact of buildings on the environment. Furthermore, examples show the capacity of school complexes to act as activators of community life by creating shared spaces overlapping schoolgrounds with urban public space and treating them as an integral part of the urban fabric.

Through a comparative analysis of selected case studies in Croatia, this paper presents three successful examples of interaction between school outdoor spaces and urban public spaces. They prove that integrating urban and school spaces is possible while not compromising security, social and legal aspects in the process. However, it must be noted that high quality school outdoor space designs are often the result of an individual architect's effort rather than the result of design briefs or a systematic approach towards planning school outdoor spaces in Croatia.

Three case studies present different types of defining an interaction between schools and the urban matrix. Two of them deal with new schools' design and the third one deals with the reconstruction of existing schools. In the first case, architects designing new schools consider their outdoor spaces as urban public spaces from the beginning of the design process thus creating new urban areas. In the second case, architects incorporate the existing urban public spaces in the design of new schools' outdoor spaces with the aim of activating the derelict urban areas. The third option deals with redesign of the existing schools' outdoor spaces that enables their multifunctional use by the local community, following focal points' activation principle.

Considering the reduction of accessible communal areas, these different types of interaction between the school and its surroundings illustrate feasible future trends in school and urban design thus bringing the education process back to its original locations, nature and urban public spaces.

Authorship

Marija Krajnović: Conceptualization and design of the research, Methodology, Formal analysis, Graphic analysis, Investigation, Writing – original draft, Writing – review & editing. Mia Roth-Čerina: Conceptualization, Investigation, Writing – original draft, Writing – review & editing. Sanja Lončar-Vicković: Conceptualization, Methodology, Writing – original draft, Writing – review & editing.

Conflict of interest: The authors declare that there is no conflict of interest.

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