Off the Map? A Cartographic Glimpse into Urban Students' Home Learning Environments

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OFF THE MAP? A CARTOGRAPHIC GLIMPSE INTO URBAN STUDENTS' HOME LEARNING ENVIRONMENTS

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Introduction

Although Home Learning Environments (HLEs) have been studied for decades, the COVID-19 pandemic has brought them renewed attention (e.g., Hawrot & Nusser, 2024; Azhari & Fajiri, 2022; Yates et al., 2021). During school closures, homes were expected to function as primary learning settings. However, questions arose globally about the readiness of these environments, particularly regarding preparation (e.g., professional development, online study materials, timetables, content rights) and equipment (Daumiller et al., 2023). Meta-analyses revealed that certain groups of students, especially those with special educational needs, those at risk of disengagement, and those from low socio-economic backgrounds or poor countries, did not receive the necessary support to advance their learning (Daumiller et al., 2023). This exacerbated the educational divide between privileged and underprivileged students (Moodley et al., 2022).

HLEs encompass both the emotional support that students receive at home, through activities and interactions with caregivers, and the material resources available to foster their development (e.g., Gregoriadis & Evangelou, 2022; Wirth et al., 2022). While previous research on HLEs has primarily examined the short- and long-term effects of parental support on young children (e.g., Lerhl et al., 2020; Toth et al., 2020), the needs regarding physical HLE of adolescents, especially those from disadvantaged families, have been understudied (Brachtl et al., 2023; Costa, 2024). This single case study addresses this gap by examining the physical HLEs of 10 students from a 'super-diverse' class in Brussels, a small global city typified by major socio-economic disparities (Vandermotten, 2014). Recognizing that physical learning space is intertwined with students' socioeconomic contexts, our analysis is underpinned by two key considerations: the characteristics of HLEs and how they affect equity in education.

Literature review

Physical Home Learning Environments

Central to this study is HLE, a multifaceted concept that points to a home context where students experience consistent opportunities to develop (e.g., the presence of educational resources, a stimulating family climate) (Gregoriadis & Evangelou, 2022; Lehrl, 2020). An HLE is characterized by relational and physical dimensions (Gregoriadis & Evangelou, 2022; Lerhl, 2022; Moodley, 2022; Niklas, 2015).

The relational dimension of HLEs refers to caregiver support (Hawrot & Nusser, 2024). For young children, this support can be fostered through stimulating activities shared with parents, grandparents, or siblings, as well as through quality caregiver-child interactions that engender a warm, responsive, and supportive environment (Krousorati, 2022). For older students, from secondary school onward, optimal caregiver support shifts to providing direct substantive or technical assistance with school tasks (Hawrot & Nusser, 2024). The positive impact of a supportive home environment is evidenced in numerous studies. Early home stimulation has long-lasting positive effects on children's overall cognitive development (e.g., Nampijja, 2018; Niklas et al., 2016), particularly in terms of numeracy and literacy performance (Lehrl et al., 2020, Wirth et al., 2022). These benefits even persist into secondary school and are independent of the quality of subsequent home stimulation and institutional influences (Lehrl et al., 2020; Melhuish et al., 2008). Moreover, cognitive stimulation at home has been found to help children overcome negative life experiences (Nampijja, 2018). While the relational dimension is crucial for young children (Krousorati, 2022), its importance diminishes with age as self-directed learning capacities increase (Costa, 2024; Hawrot & Nusser, 2024). As this study is conducted in secondary education, it is limited to the physical dimension of HLEs.

The physical dimension of HLEs encompasses various forms of space, stimuli, and time that encourage autonomous learning (Gregoriadis & Evangelou, 2022). More precisely, it refers to both the quality of learning spaces and the presence of resources for cognitive stimulation (Brachtl et al., 2023; Costa, 2024; Hawrot & Nusser, 2024). The positive effects of physical HLEs are substantial and multifaceted. For example, Brachtl et al. (2023) conducted a survey study among 353 German students, revealing that a student's positive perception of the physical HLE is related to enhanced well-being, improved concentration, reduced stress, and a more positive overall learning experience. Factors influencing this perception include a well-organized, supportive learning space, free of distractions, equipped with ergonomic furniture, and protected from noise. Costa (2024), for example, explored the perceptions of 28 English adolescents regarding their experiences with the physical HLE during the COVID-19 pandemic. She found that its quality, more specifically having dedicated workspaces and opportunities for privacy, significantly influenced students' self-reported learning motivation. Additionally, the interaction of specific physical environment characteristics further strengthened the link between the HLE and learning motivation.

Domains of Physical Home Learning Environments

The quality of a physical HLE is determined by three underlying domains.

Resources. The availability of a wide range of educational resources is essential for a high-quality physical HLE (Bradley & Putnick, 2012). Research indicates a strong relationship between the presence of educational materials at home, such as books and toys, and academic achievement (Tamis-Le Monda et al., 2019). Nowadays, the home context should include adequate ICT resources, for example a good internet connection, an ergonomic device (preferably a computer, possibly a smartphone), electricity for powering devices, and preferably a printer (Aschenberger et al., 2023; Costa, 2024; Hawrot & Nusser, 2024).

However, the digital divide, as a result of socioeconomic disparities, remains a concern in metropolitan cities (Charbonnier, 2020). According to 2023 data, 5% of households in Brussels do not have home internet access, a rate that is mirrored among single-parent households (Kalenga-Mpala, 2024). Moreover, one in ten households in the lowest income bracket (the first income decile) lacks internet at home. According to Kalenga-Mpala (2024), one-third of individuals without Internet access report lacking sufficient digital skills, while the high cost of internet connections and phones is also mentioned as a barrier. So, it is likely that not all students' homes will be equipped with the necessary ICT resources. Nevertheless, the devices and their functioning are important for accessing learning activities. Network failures and limited performance of mobile devices, or when students lack a private computer, may lead to fragmented learning time and impact student concentration (Yang, 2019).

Workspace. Although research has revealed that adolescents experience boredom as a severe consequence of isolation (Brooks et al., 2020), Arnou and colleagues (2020) advocate for a private space dedicated to schoolwork and separated from places related to leisure and family affairs. Unsolicited intrusions into the study area by others have been shown to contribute to both distraction and stress (Benson, 1988). Costa's (2024) research confirms that having a private space to study (e.g., a desk in their bedroom) allows students to concentrate and to feel productive. In contrast, those who have to share their workspace with others (e.g., shared desk) or adapt to household dynamics (e.g., working at the dining room table) exhibited more difficulty in concentrating. In case of sharing, Arnou et al. (2020) recommend safeguarding control over workspace by personalizing it, e.g., with personal belongings or symbolic markings, and making clear agreements with the other users. Empirical research further indicates that a dedicated, non-shared workspace optimizes overall learning experience, i.e., motivation, concentration and learning performance (Aschenberger et al., 2022). Yet for many young people, having their own room or even a quiet shared room seems like a luxury

as 21% of children aged 6-11 in the EU-27 live in overcrowded housing (Van Lancker & Parolin, 2020). In Brussels, 20% of the population faces similar housing conditions, affecting one-third of single-parent families and nearly half of parents with low educational attainment (Dessouroux et al., 2016). Another concern related to workspaces is that of distractions, which directly undermine concentration and create obstacles to learning, particularly in home environments (Yang et al., 2020). As a result, the strategic design of home study spaces that minimize distractions is advocated (Arnou et al., 2020). Costa (2024) identified several potential distractors in HLEs to avoid, such as smartphones, mirrors, makeup, and the internet, as a gateway to television series, games, and online shopping. Furthermore, students' physical posture, when studying at home, has been found to impact their concentration (Yang et al., 2020). Based on their impact study, Yang et al. (2020) recommend using appropriately sized tables and chairs, maintaining an upright sitting position, and ensuring the possibility to keep feet on the floor. The availability of ergonomic, work-compatible furniture is thus strongly recommended to promote a comfortable and healthy posture during homework (Aschenberger et al., 2022; Brachtl et al., 2023).

Indoor climate. Several researchers highlight the importance of indoor environment quality, determined by thermal comfort, indoor air quality, visual and acoustic comfort (Korsavi et al., 2020). In their study of UK primary schools, Korsavi et al. (2020) found that schools should address all four components, although discomfort in one area does not always result in overall discomfort. For instance, it appears that air quality is more determinant of the overall experience, to the extent that a better perception of air quality can compensate for excessive room temperatures. Likewise, Sadrizadeh et al. (2022) underline the importance of air quality in spaces where learning by (young) children takes place. Their review study confirms that poor air quality conditions hinder proper development. For example, poor values have been found to reduce students' vigilance, attention, memory and concentration, which ultimately

increases students' absenteeism and lowers their academic achievement. Specifically, students in poorly ventilated rooms perform worse on relatively simple tasks such as reproductive mathematics and language exercises, yet the adverse effects increase when more complex skills are required. Along with good air quality, moderately light and thermoneutral, between 19 and 22°C, spaces stimulate most cognitive activities (Xiong et al., 2018). Specifically, for HLEs, attractive interior space design and pleasant views also contribute to the overall environmental quality of the learning environment (Brachtl et al., 2023).

Recent studies show that incorporating greenery in learning environments can enhance indoor climate and benefit students. A natural green view positively influences learning experiences and achievements (Benfield et al., 2013). Similarly, experiments with green walls with living plants show improvement in indoor air quality by reducing carbon dioxide and ozone, although large numbers of plants are necessary to really make a difference (Cummings & Waring, 2020). The major gains are in cognitive performance (e.g., better attention), health (e.g., lower blood pressure), and well-being (e.g., reduced anxiety) (Danielski, 2022; van den Berg et al., 2017; Yeo, 2020). However, in their analysis Strife and Downey (2009) summarize that social inequality is often associated with environmental inequality, indicating that poor people and people of color are more likely to have limited access to open, green spaces. They explain this by the low incomes and consequently substandard housing in urban areas, that are rarely located near to parks and natural open areas.

An environment full of unwanted noise can negatively affect people's cognition, mood and health (McLean & Tarnopolsky, 1977). In classrooms, it is noted that poor acoustics can lead to unclear communication, ultimately reducing academic achievement. As such, classroom noise has been found to negatively affect students' memory, counting and reading skills (Yang, et.al., 2019) as well as productivity and concentration (Norlander et al., 2005). Accordingly, the same challenge of avoiding noise applies to a learner's home workspace.

Benson (1988) found that 38% of the sixth graders he surveyed experienced discomfort from general background noise when doing homework, due, for example, to vacuum cleaners, washing machines, sirens or music. Experiencing noise during home learning activities is particularly disruptive, affecting students' concentration (Bringula et al., 2021) and their overall learning experience (Brachtl et al., 2023). Nonetheless, Aristovnik et al.'s (2020) large-scale survey of more than 30,000 students in 62 countries during the COVID-19 lockdowns found that nearly half of the respondents lacked access to a quiet workspace.

Spatial inequality in Urban Schools

Strife and Downey (2009) draw clear parallels between social and spatial inequality: children growing up in poverty often suffer from limited access to quality space. Costa (2024) describes spatial inequality as "*gaps in basic resources of families needed to support home learning, the material divide*" (p. 11). Hence, the physical HLE is suggested to be closely linked to the socioeconomic context of young people. For example, 5% of European youth do not have a suitable place to do homework, 7% lack internet access, and 10.2% are deprived of adequate heating (Van Lancker & Parolin, 2020). In metropolitan areas like Brussels, these challenges are more pronounced, with nearly a third of residents living below the poverty line (Englert et al., 2023) and 34% of financially vulnerable households experiencing overcrowding, poor heating, and moisture or mold issues (Scientific Institute of Public Health, 2013). These conditions make it difficult for disadvantaged students to create a proper physical HLE (Arnou et al., 2020), leaving them struggling to find a quiet, distraction-free space for learning (Aguilar et al., 2020).

Researchers frequently noted that inequities in physical HLEs affect students' learning experiences and academic achievements. For instance, Andrew et al. (2020) found that children from poor families spent significantly less time studying at home compared to their more affluent peers. Brown-Wright (2012) posited that home-school dissonance, or the gap

between home and school environments, led to amotivation and academic cheating. Nampijja et al. (2018) examined HLEs in Uganda, where children are exposed to extreme poverty and poor health conditions. They found these conditions to negatively affect academic achievement, yet cognitive stimulation at home could partially compensate for these effects, a finding confirmed in other research (e.g., Hartas, 2012). Volk (2021), in turn, challenges the traditional and stereotypical binary view of home and school learning environments by showcasing how two Latino children and their families create opportunities in their homes and neighborhoods to strengthen literacy. This study demonstrates resilience in both students and their environments, despite spatial inequalities. Volk (2021) advocates that teachers confront their biases, understand the learning barriers created by classifying children and their environments, and actively learn from their students to better integrate the wealth of learning opportunities available in children's immediate environments into the curriculum.

In sum, addressing spatial inequalities of HLEs among students in urban schools becomes crucial for ensuring equitable learning opportunities.

Gaps in Physical Home Learning Environments research

Although HLEs have been widely studied in recent decades, major gaps remain in the scientific understanding, particularly of their physical dimension. First, most studies on the effect of HLEs on school experiences and achievement, typically conducted through surveys, have focused on young children, leaving the 15-18 age group understudied (Costa, 2024). However, research on adolescents is essential to tailor interventions (Toth et al., 2021). Second, researchers caution against drawing generalized conclusions that overlook cultural differences in home environments (Nag et al., 2024; Volk, 2021). Hence, there is a call for greater attention to the sociocultural context and a more nuanced, contextualized understanding of students' home learning experiences. Finally, research on physical HLEs has

largely focused on controllable institutional settings, such as study spaces in schools and campuses or blended learning environments, neglecting private contexts, which appeared particularly relevant during the pandemic (Brachtl et al., 2023).

This research responds to those gaps by providing in-depth, contextualized insights into the physical HLE of adolescents in an urban school in Brussels, putting following research question at the center: How is spatial inequality reflected in the physical HLE of students of a Brussels class/ school? Sub questions include:

- What physical characteristics of HLEs do students from an urban class report?
- In what ways does the HLE hinder or support the learning experience according to students?

Social Theory of Space

The theoretical framework for this study is Henri Lefebvre's (1991) social theory of space, which seeks to understand social phenomena, especially in urban contexts, from a spatial perspective. Under his impetus, the interpretive framework of social theory evolves to include space as a new explanatory dimension alongside the traditional temporal one (Middleton, 2017). Lefebvre translated his theory, rooted in three philosophical standpoints, into his dialectical approach, comprising three components: (1) perceived space, referring to the physical and material aspects inherent in social practice (e.g., patterns, routines, use of space), (2) conceived space, which involves the mental and conceptual understanding of space (e.g., maps, designs), and (3) lived space, capturing the subjective and symbolic features that users associate with that space (e.g., memories, meanings) (Wiedmann & Salama, 2019). As of the 1990s, this "spatial turn" gained widespread support and was applied in various disciplines, such as urban studies (e.g., Tsibiridou, 2018), architecture (e.g., DuFour, 2021), anthropology (e.g., Löw, 2017), sociology (e.g., Katz & Csordas, 2003), geography (e.g., Orlove, 1993),

and education (Paulston, 1996). Drawing on this theoretical framework, the present study will identify material and subjective features that reflect spatial inequality in the physical HLE of students from an urban school.

Methods

Single Case Study Design

This study is set up as a single case study design to explore a real-world phenomenon that is difficult to access (Yin, 2018), notably grasping the genuine and comprehensive reality of HLEs of students in urban schools and their perception of its possibilities and limitations. Obtaining such personal information from young people, who may feel vulnerable sharing it, is challenging. However, the high level of relational commitment and trust established with a group of Greenland State School students by the third author of this manuscript, a dedicated teacher, enabled the safe and accurate collection of this data. Due to the unique and revelatory nature of the data this case provides, it has been selected for sampling (Yin, 2018).

The Brussels Greenland State School Case

The case examined in this study involves a final-year class in the vocational track of Greenland State School, a medium-sized Dutch-speaking secondary school in Brussels, which embodies the key characteristics of urban education (Milner & Lomotey, 2017, p. 15). First, this school is located in the Brussels metropolitan area, the capital of Belgium, which has a population of 1.24 million and an average density of 7,642 inhabitants per km². While Brussels is among the most prosperous European regions, stark disparities exist between different population groups, often concentrated in specific districts (Sacco et al., 2016). For example, the municipality of Sint-Joost-Ten-Node is home to 23,322 inhabitants per km², in contrast to Uccle, which has a lower density of 3,765 inhabitants per km² (Statbel, 2023).

Although Greenland State School is located in a less densely populated and more affluent part of the metropolitan area, the school predominantly attracts students from other parts of the city (85%), facing significant socioeconomic challenges.

Secondly, 37.6% of the Brussels residents are at risk of poverty or social exclusion, more than double the national average (Statbel, 2023). This reality is reflected in the student population at Greenland State School, where 97% of the 336 students score on at least one of the four indicators used by the Flemish government to assess educational risks. On average, students meet 2.86 of the four indicators, among the highest averages among Brussels secondary schools. More precisely, 84% of students live in neighborhoods where many peers are at least two years behind in school, 80% of students speak a language other than the school language Dutch at home, 68% of students receive financial support, and 48% of students have a mother with a qualification of, at most, lower secondary education. The school exhibits significant cultural diversity within its student population, with family roots in over 40 countries.

Third, the rapid demographic growth of the young population, along with an enduring teacher shortage has led to a deficit in school capacity (Hemmerechts & Kavadias, 2018; Spruyt et al., 2023). This resource scarcity impedes schools from meeting their educational objectives, resulting in 18% of secondary school students with a school delay of at least two years and 7% leaving school without attaining a secondary school diploma (Englert et al., 2023).

This case study was conducted during the COVID-19 pandemic. Throughout the lockdown periods, the school allowed students facing the greatest social and economic challenges, those with the least support at home, and those lacking adequate working space to attend school in person. The maximum capacity for this arrangement was half the population, allowing half of the students from each class to come to school while the other half participated in remote learning. As the preference for physical attendance grew, an increasing number of students, exceeding the maximum, attended classes in school, a situation that was tolerated by the

school team. The testimony of the involved teacher and third author of this manuscript provides in-depth insight into the context of home learning at the time of the study, midst of the COVID-19 pandemic. Tom states:

> *"One of the main challenges was the infrastructure the school provided us to work with as teachers. The lack of tools we were given made home learning very shaky. For us as teachers, there was no support from the school or the governing body to help us adapt to online teaching. They just handed us BookWidgets and said, 'Figure it out yourself.' There was also a problem with infrastructure and organization, that surfaced everywhere. This only deepened the divide. Students from challenging home environments became disengaged or dropped out, further disconnecting them from the learning material due to the disorganized teaching approach. Another glaring issue was the lack of proper computer infrastructure at students' homes. If they had a computer at all, it was often ancient and had to be shared among five kids. There was a plan to distribute computers, but not enough were available. So, during lockdown, I personally drove to the Netherlands to pick up second-hand PCs from friends of my parents. I managed to get 10. Through my father-in-law, I found five more at a charity, assembled them, and delivered them door-to-door. Despite this, most students were still following lessons on their smartphones from bed because they didn't know how to set up a computer. When I asked them to do research, it just wasn't feasible. It was a series of interconnected problems that only made things worse."*

Sample

The participants, in this study are final-year vocational students enrolled in the office work program. They are expected to graduate by the end of the year. The class comprises 11 students, of whom six boys and five girls. On average, these students display 3.09 out of the

four indicators of educational risk (home language, neighborhood, mother's education level, and financial situation), exceeding both the school average of 2.86 and the national average of 0.96. The average age of the class is 19.6 years, as only two students have not experienced any school delays. For nine of the students, this was not their first secondary school. They had changed schools once (n=2), twice (n=6), or three times (n=1) during their trajectory of secondary education. Experiences of failure are common among students in this school, particularly in vocational tracks, highlighting the need for a supportive learning environment with personalized attention to mitigate the risk of school dropout. Ultimately, ten students from this class took part in the study, as one student was absent during the data collection. Earlier in the school year of the study, just before the pandemic, this class participated in a photovoice study on urban students' perspectives on school connectedness in four Brussels schools (Author). The within-case analysis of that study provides in-depth insights into these students' school experiences. As they might contribute to a better understanding of the context of this study, they are summarized in the following paragraphs. First, the students in this class all value green space. The playground at their school, located in a wooded area, is considered a place that represents freedom. It is used for relaxation, rest, and meeting with friends. This green spot helps students to self-regulate, allowing them to alleviate stress from tests, exams, and the general pressures of school, as well as anger from school rules and discipline, which they perceive as too restrictive considering their age. Second, friendship plays a major role in their school life. They describe their social relationships among peers as crucial for a positive school experience: without friendships, their motivation to attend school would be much lower. Friends provide companionship, a sense of protection, and support, which helps them deal with bullying (e.g., from younger students looking down on their academic achievements) and other social challenges. Third, students are aware that their time at school is nearing its end. They are eager to complete this phase and pursue their future

dreams. Obtaining a diploma and the freedom that follows are highly valued. While some students are unsure about their future paths, they view school as a place where they acquire essential skills and values that will benefit them in their future lives.

Prior to the start of the study, all students were informed about its purpose and design and provided their consent to participate.

Data Collection

In this study, data were collected using mental maps, which are cognitive representations of specific objects or places. These maps serve as a methodological tool to capture how individuals perceive, understand, and interpret their environment (Kitchin, 1994; Reuchamps et al., 2014). Mental maps are context-dependent and shaped by an individual's actions and instinctive connections to objects and people within that space (Kitchin, 1994). These mental representations of spatial reality (Breux & Reuchamps, 2011) encompass characteristics, perceptions, and imaginations of the environment (Lefebvre, 1991), revealing critical information through distortions or interpretations rather than meticulous accuracy.

More specifically, students in this study created cartographic representations in the format of drawings, depicting their mental maps of the HLE. Data collection took place at school in June 2020, during the COVID-19 pandemic between two lockdown periods. This context provided a unique opportunity for the teacher, a co-author of this article, to assess the quality of students' HLEs. The data collection process involved several steps. First, students received a brief explanation of drawing in perspective, distinguishing bird's-eye view and side view, and were shown examples of mental maps. They were then instructed to draw the place where they most often worked intensively at home during the lockdown, including the following elements:

- Identify the room or space (e.g., bedroom, desk, kitchen, living room).

- Sketch the furniture present.
- Indicate who else is present in the workspace.
- Draw the device used for classes or homework.
- Include any toys or entertainment items.

These instructions were written on the chalkboard for reference throughout the exercise, emphasizing student autonomy in deciding what and how to draw. Consequently, some students included textual annotations in their drawings. Once their maps were completed, a group discussion was conducted, in which students shared and explained their work, offering the teacher clearer insights into their perspectives. The teacher documented these explanations in fieldnotes, creating a dataset comprising 10 mental maps from 10 students, accompanied by the teacher's notes.

Mental mapping offers several advantages, including flexibility and openness (Reuchamps et al., 2014). It proceeds spontaneously and provides an original way to capture respondents' representations and interpretations of their environment, as it avoids predefined categories that might constrain responses. However, there are some limitations associated with this method: (1) not everyone can easily convert a mental concept into a cartographic representation, (2) interpreting drawings is inevitably subjective and can compromise internal validity, (3) participants may provide socially desirable answers, such as censoring depictions of poverty. These methodological concerns can be addressed by standardizing the conditions (Reuchamps et al., 2014). Mental maps should be created under similar material conditions: all participants should follow the same procedure (time, rules, type of paper), and instructions should be kept as simple as possible to enhance external validity. It is advisable to work with a homogeneous group within the same age and socioeconomic context. Systematic coding is essential, as is distilling a common model from the data to serve as a benchmark for comparison (Breux et al., 2010; Reuchamps et al., 2014).

Data Analysis

For the purpose of structuring the data, mental maps and teacher's notes were loaded into MAXQDA software. Both datasets were analyzed deductively, focusing on both (1) the features of a high-quality physical HLE, particularly resources, workspace, and indoor environment, and (2) Lefebvre's (1991) spatial dimensions, specifically the concepts of perceived, conceived, and lived space. Therefore, codes were described in a matrix formatted codebook (Table 1). Codes were assigned to elements on the drawings and to text fragments.

[Insert Table 1 here]

Results

The results are organized around the three domains defining the quality of a physical HLE, i.e., resources, workspace and indoor climate, as detailed in the literature review. For each domain, the material aspects of the spaces, as reported by the participants, are explained and enriched with exemplary descriptions of the complete physical HLEs. These examples are called 'home stories' and include students' factual descriptions and depictions, as well as their explained desires, ideas, and experiences, to comprehensively capture students' diverse use of space.

Resources

For all students in this case, a device that can access school-related information is considered an essential part of the HLE. Accordingly, the mental maps all include at least a smartphone or computer, sometimes both. Most students (n = 7) draw a computer as the indispensable bridge between home and school, in particular to access assignments, communication, study

materials, as well as online classes. To facilitate easy access to educational resources at home, the school provides, through the Digital For Youth program, free computers to its students. However, after all requested laptops for that school year were distributed, some lacunas remain. Three out of 10 students end up without computer for various reasons. Bilal, for example, had initially requested a computer through the program, but canceled it as he could borrow one from his uncle. This ultimately did not work out, leaving Bilal to use his smartphone. Another notable situation is Omar's, who insists to do schoolwork on the go. He states that "*with a smartphone, you can take classes anywhere*". Layla, on the other hand, did draw her new laptop in her room, but never managed to install it. She too indicates that she follows up on her schoolwork through her smartphone.

Tariq's Home Story. *One of the most comfortable spaces for schoolwork is that of Tariq: he has an entire floor to himself, with two private rooms. He proudly draws and describes that his work area is well-equipped with an Apple desktop computer and a PlayStation 4 console. This workspace also serves as a bedroom, with a closet, a bed and a clock. Tariq's second room is set up as a small living room with a kitchenette, toilet and a lounge area with Samsung TV. Both rooms have rooftop windows, letting in plenty of natural light.*

[Insert Image 1 here]

Workspace

The locations of students' workspaces at home vary widely. Tariq is the only student with an entire floor to himself, furnished like a small apartment. Naima, Nour, Bilal, and Zayd use their bedrooms as their primary workspaces for school. Other students do their schoolwork in shared spaces. For example, Layla alternates between her bedroom and the family kitchen,

while Sara and Kenza work in the living room. Omar lacks an adequate HLE, so he conducts his schoolwork outdoors.

Omar's Home Story. *Omar describes his HLE as a "prison," lacking a private, safe, and quiet environment. This situation forces him to flee his home and do his homework in outdoor public spaces, such as sports yards, streets and public transport. Omar describes being outdoors as liberty, with the smartphone allowing him to stay in touch with school. Yet, during the lockdown period, this escape route turns out to be suboptimal. He frequently misses classes, officially due to illness, but he actually misses the safe and structured school setting. He temporarily drops out.*

[Insert Image 2 here]

Within their workspace, only half of the participants sketch a table as helpful furniture for doing homework. Among them, Hamza and Kenza depict only a table with a computer, omitting the chair due to their chosen perspective but clarifying its presence. Nour, Naima, and Bilal consider their beds as their primary work furniture. For instance, Nour's drawing shows her laptop on the bed, alongside a closet and a large mirror, but without table. Sara, on the other hand, does her schoolwork on the living room sofa and positions her laptop on the low coffee table.

Sarah's Home Story. *Sarah doesn't have a space where she can work quietly, in seclusion for school. She works in her family's living room. There she has a sofa to sit on, and optionally a coffee table to put her laptop on. She has two sisters in elementary school and a baby brother at home. As the oldest sibling, Sarah is expected to take care of the baby when she is at home. He has a bed in the corner of the living room. Centrally positioned in her workspace is the television. This context makes it difficult for her to concentrate on schoolwork. Sarah is one of*

the few to detail her workspace's features, highlighting the balcony with a window running the length of the living room wall as a source of light and space.

[Insert Image 3 here]

Bilal's Home Story. *After school, Bilal works for a Brussels hospital. For the little time he has left, he can do schoolwork on the bed in his bedroom. Although he does not have to share this space, he does not feel invited to study there. He expresses the following: "You [the teachers] had it easy during the lockdown in your gardens, but if I stretched my arm, it was out the window." His mental map shows a bedroom with a closet, bed and TV on a small table in his room. Central to his bedroom is a dumbbell table, making him the only student with sports equipment.*

[Insert Image 4 here]

The mental maps indicate that students with their own workspace, excluding Omar, Kenza, and Sarah, tend to personalize their spaces in various ways. They incorporate elements reflecting their personal interests. For instance, Bilal and Hamza include sports-related items, while Tariq and Zayd have integrated a game console into their bedrooms. Naima, Layla, and Nour have brightened their rooms with decorative items like lamps, pillows, blankets, and mirrors.

Nour's Home Story. *Nour does her schoolwork in her bedroom, using her laptop in bed. The room is furnished with a large closet and one large and two smaller mirrors. She enjoys looking good and prominently includes her makeup items on her mental map. Her drawing*

also highlights her appreciation for room decoration, showcasing a colorful floral blanket and bright pillows.

[Insert Image 5 here]

***Hamza's Home Story**. Hamza draws only his table, with his desktop computer, keyboard and mouse at the center. Alongside is a cabinet for paperwork, decorated with a few action figures and a cup he once won with Tae Kwon Do. The prominent place his computer gets in his mental map is not surprising. Hamza writes and reads a lot in his spare time. His ambition is to become a writer.*

[Insert Image 6 here]

Indoor climate

Participants emphasize light and views as crucial qualities of their HLE. Several students include windows in their mental maps, such as Tariq's rooftop windows and Sarah's large window with a balcony. Even Omar, lacking an indoor workspace, draws the sun as a light source. Students who have a scenic view from their workspace, often from higher apartment buildings, explicitly consider this an asset.

***Kenza's Home Story.** On her mental map, Kenza sketches her ICT materials, including her smartphone, laptop, and television, on her desk. Unlike the other participants, who mostly drew floor plans of their workspaces, she illustrates her view from her desk. This perspective emphasizes "the light and colors coming from the sky" that enter her workspace through the window. The glass door beside her work table leads to a balcony high above the city.*

[Insert Image 7 here]

Especially views of greenery prove important to students. The green environment of the school is by students unanimously identified as beneficial to their school experiences. They relate it to stress-relief and to self-regulating capacities. Bilal refers in his comments to the lack of a garden in his HLE. In turn, Layla emphasizes the importance of greenery by drawing plants in her workspace and coloring them.

Layla's Home Story. *Layla combines a small bedroom with a workshop in the kitchen. In that shared space, she draws plenty of flowers and plants. She colors them to emphasize their importance. Layla received a computer from the school, but she was never able to install it. She worked on her smartphone and on a friend's laptop.*

[Insert Image 8 here]

Discussion and Conclusion

The main purpose of this single case study is to gain insight into the physical HLE of students in a Brussels school with a highly diverse socioeconomic and cultural student population. It explores how this environment affects their learning experiences, either positively or negatively. The study highlights the significance of three key domains in the students' descriptions and explanations of their physical HLE: resources, workspace, and indoor climate. These findings confirm the multi-faceted nature of the physical HLE (Brachtl et al., 2023; Costa, 2024; Hawrot & Nusser, 2024).

This research is unique on two levels. First, it takes place in an urban school where poverty is prevalent among a large share of the student population. By capturing the perspectives of these students, we gain a more contextualized understanding of the domains relevant to their

experiences, addressing the need to better grasp sociocultural differences in home environments (Nag et al., 2024; Volk, 2021). Secondly, the timing of this study is particularly noteworthy. Data were collected between two lockdown periods during the COVID-19 pandemic, a time when students and teachers were forced to integrate schooling more fully into their home environments. This integration highlighted for both students and teachers the critical role of HLEs (Hawrot & Nusser, 2024). While assessing the quality of HLEs might typically be perceived as intrusive, the pandemic created a unique context that made such inquiries both necessary and relevant. Additionally, the intensified reliance on home learning during this period heightened awareness of the importance of having a conducive learning space at home.

In the domain of resources, all students have a device with which they can access the internet and thus the study materials on the school's learning platform. Despite the Greenland State School's considerable effort to provide each student with a personal computer, three students in this class work exclusively on their smartphones. This is due to various reasons such as being unable to do schoolwork at home, failing to install the laptop, or missing the opportunity to borrow a computer. These students experience significant difficulties in making adequate and successful efforts for school at home. Costa (2024) attributes this to the lack of ergonomic comfort provided by smartphones compared to computers, though other contextual factors affecting motivation should be considered in future research.

In terms of workspaces, we observe significant differences among students: some have their own bedrooms, while others do homework in shared spaces or even outdoors. Although no one has a dedicated space for schoolwork, it can be assumed that the latter group, about half of the students, are particularly disadvantaged by being more frequently exposed to distractions from household members who use simultaneously the very same space (Arnou et al., 2020; Benson, 1988). Many students proudly showcased personal touches in their study

spaces, such as game consoles, televisions, mirrors, or makeup. However, Costa's (2024) research indicates that precisely these items are distractors to learning. Moreover, only half of the students have access to a table and can work in an upright sitting position, which is crucial for concentration (Yang et al., 2024). Students who do have a desk and chair did not provide additional information on the ergonomic quality of the furniture. In sum, it can be concluded that the participants are highly exposed, as to all characteristics of the workplace, to multiple levels of distractions and other hindering conditions for concentration and work focus. Furthermore, the results provide insight into the indoor climate of the HLEs. Natural light, views, and greenery are frequently noted in the mental maps, as these elements are visibly present for students. Their absence, however, is verbally reported during class discussions, particularly when it is experienced as a problematic issue for the participants. Students identify views of greenery as a major lever for finding serenity. This finding aligns with prior literature indicating that greenery positively impacts young people's well-being, cognitive performance, and health (Danielski, 2022; van den Berg et al., 2017; Yeo, 2020). Remarkably, despite the substantial differences in physical HLEs among the respondents, none of them can rely on an optimal situation. In fact, in each of the domains, there are quality features that not a single student in this case refers to. For example, in terms of resources, no student reported having books at home. None of the students has a dedicated workspace for study, and all students face distractions in their HLE. And regarding the indoor climate, not a single student was found having a natural green view. This finding of spatial shortcomings can be explained by the compromised socio-economic home context of the student population in this case, confirming the link between spatial and social inequalities, arguing that people with a low socioeconomic status have less access to open, stimulating and green spaces in urban environments (Strife & Downey, 2009). Researchers (e.g., Andrew et al., 2020; Brown-Wright, 2012) warn that the major challenge lies in mitigating the effects of

deficient physical HLE on students' learning experiences and their academic achievements. The results from this study, particularly situations like Omars who drop out or Bilal experiencing demotivation when fully reliant on their HLE, underscore this concern. This suggests that a poorly equipped or unhealthy HLE transfers social disadvantage into an educational one, thereby reinforcing and widening the existing divide. This finding aligns with previous research suggesting interrelationships between social, spatial, and educational divides (Costa, 2024; Strife & Downey, 2009).

Awareness of this dynamic and the value of space among school teams is crucial for shaping equitable educational policies and practices. To achieve this, schools should adopt a holistic approach to HLEs that extends beyond simple, measurable solutions like providing computers. Instead, the focus should be on broad, structural improvements, such as (1) partnering with parents to reduce home-school dissonance (Brown-Wright et al., 2013) and to enhance cognitive stimulation at home to offset physical limitations in the HLE (Hartas, 2012), (2) collaborate with local communities to bolster resources within students' broader home environments (Volk, 2021) and (3) to implement a practical, equitable homework strategy. Concurrently, as in Volk's (2021) study, signs of resilience are evident among the students. For example, Kenza expresses enthusiasm about the bright living room where she settled for her schoolwork, Nour furnishes her own bedroom and experiences a sense of catharsis and calm, Layla enjoys the greenery and flowers in her shared workspace, and Sarah, despite her turbulent workspace and family commitments, achieves the highest scores in the class by working extra hard. Further exploration to shed light on the drivers and conditions for these coping strategies is, however, advisable.

Limitations and Future Research

While this study offers unique insights into the physical home learning environment (HLE) of students in underprivileged contexts and their experiences, several limitations should be considered. First, this study is exploratory in nature, aiming to provide an initial understanding of students' physical HLEs in urban schools, as little information is available on this to date. To ensure an in-depth understanding of the genuine home context of the students at Brussels' Greenland State School, a single case study was chosen. However, this design limits the ability to generalize the results beyond this particular case (Yin, 2018). Follow-up research is necessary to identify patterns across contexts, which can be achieved by comparing multiple cases or collecting data from a larger sample (Quintão et al., 2020). Second, data are collected through the mental map method, complemented by a classroom discussion where students explained their drawings. Yet, mental mapping provides insight into the cognitive representation of a space (Reuchamps et al., 2014), but it cannot fully capture all domains of the physical HLE, especially the noise or air quality dimensions of the indoor climate. Moreover, while the method reveals the characteristics of the physical HLEs, it does not capture the students' interpretations or their subjective experiences of using them. Although the classroom discussion provided some additional insights in this regard, follow-up research would benefit from more in-depth, information-rich flanking data collection methods. Among the possibilities are narrative interviews, in which students describe their experiences in a storyline that they structure according to key elements or turning points that matter to them (Nohl, 2010; Schütze, 1983), or photo-elicitation, in which they take pictures of features that affect their schoolwork and explain them in an interview (Minthorn & Marsh, 2016). Finally, while this study primarily focuses on students' perceptions, we recommend that future research should incorporate perspectives from teachers or parents as well. This approach would facilitate data triangulation, offering a more comprehensive and reliable depiction of the reality within the studied context (Sincer et al., 2019).

Conclusion

In sum, our findings indicate that the students' physical HLEs in this Brussels case, in terms of resources, workspace, and indoor climate, do not meet the quality requirements necessary to provide a stimulating, concentration-promoting learning environment. The findings of this study have important implications for educational practice, especially in urban schools serving disadvantaged communities. Our advice to schools is layered. First, school teams should gain a comprehensive understanding of their students' home contexts. This study demonstrates that students are able and willing, under safe conditions, to accurately portray and discuss their physical HLEs. With such information, school teams can create the conditions that keep homework achievable for students. Thereby it is crucial to recognize and support the resilience of students and their families, empowering them to find creative solutions. Additionally, it is critical to discuss with parents the school's expectations and the challenges their children face in meeting them, so they recognize the importance of providing supportive study conditions at home. Finally, we recommend that schools establish partnerships with municipalities and local social organizations in disadvantaged neighborhoods that offer collective learning spaces (Le Galès, 2002). This initiative would enable students to access quiet, well-equipped learning environments, thereby decreasing the impact of disadvantages in their physical HLEs on their overall learning experience and academic performance.

References

Author

Aristovnik, A., Keržič, D., Ravšelj, D., Tomaževič, N., & Umek, L. (2020). Impacts of the COVID-19 pandemic on life of higher education students: A global perspective. *Sustainability, 12*(20), 8438. https://doi.org/10.3390/su12208438

Arnou, C., Cornelis, G., Heymans, P. J., Van Den Driessche, M., Elen, J., & UGent, M. V. (2020). Hoe creëer je thuis een krachtige leeromgeving? https://www.researchgate.net/publication/340815867_Hoe_creeer_je_thuis_een_krachtige_leeromgeving

Aschenberger, F. K., Radinger, G., Brachtl, S., Ipser, C., & Oppl, S. (2022). Physical home learning environments for digitally-supported learning in academic continuing education during COVID-19 pandemic. *Learning Environments Research, 26*(1), 97–128. https://doi.org/10.1007/s10984-022-09406-0

Azhari, B., & Fajri, I. (2022). Distance learning during the COVID-19 pandemic: School closure in Indonesia. *International Journal of Mathematical Education in Science and Technology, 53*(7), 1934-1954. https://doi.org/10.1080/0020739X.2021.1875072

Benfield, J. A., Rainbolt, G. N., Bell, P. A., & Donovan, G. H. (2015). Classrooms With Nature Views: Evidence of Differing Student Perceptions and Behaviors. *Environment and Behavior, 47*(2), 140-157. https://doi.org/10.1177/0013916513499583

Benson, R. (1988). Helping Pupils Overcome Homework Distractions. The Clearing House: A Journal of Educational Strategies, *Issues and Ideas, 61*(8), 370–372. https://doi.org/10.1080/00098655.1988.10113974

Brachtl, S., Ipser, C., Keser Aschenberger, F., Oppl, S., Oppl, S., Pakoy, E. K., & Radinger, G. (2023). Physical home-learning environments of traditional and non-traditional students during the COVID pandemic: Exploring the impact of learning space on

students' motivation, stress and well-being. *Smart Learning Environments, 10*(1), 7. https://doi.org/10.1186/s40561-023-00222-4

Bringula, R., Reguyal, J. J., Tan, D. D., & Ulfa, S. (2021). Mathematics self-concept and challenges of learners in an online learning environment during COVID-19 pandemic. *Smart Learning Environments, 8(*1), 1–23. https://doi.org/10.1186/s40561-021-00168-5

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *The lancet, 395*(10227), 912-920. https://doi.org/10.1016/s0140-6736(20)30460-8

Brown-Wright, L., Tyler, K. M., Stevens-Watkins, D., Thomas, D., Mulder, S., Hughes, T., Stevens-Morgan, R., Roan-Belle, C., Gadson, N., & Smith, L. T. (2013). Investigating the Link Between Home–School Dissonance and Academic Cheating Among High School Students. *Urban Education, 48*(2), 314-334. https://doi.org/10.1177/0042085912469203

Charafeddine, R., Gisle, L., Van der Heyden, J., Tafforeau, J. (2013). Gezondheidsenquête 2013. Rapport 4: Fysieke en sociale omgeving. Wetenschappelijk Instituut Volksgezondheid. https://www.sciensano.be/sites/default/files/fysieke_en_sociale_omgeving.pdf

Charbonnier, E. (2020) Covid-19: an amplifier of Educational Inequalities? Institut Montaigne Paris, https://www.institutmontaigne.org/en/blog/covid-19-amplifier-educational-inequalities

Costa, A. R. (2024). The physical dimensions of the home learning environment and its impact on young people's learning motivations. *Cogent Education, 11*(1), 2322862. https://doi.org/10.1080/2331186X.2024.2322862

Cummings, B. E.; Waring, M. S. (2020). Potted plants do not improve indoor air quality: a review and analysis of reported VOC removal efficiencies. *Journal of Exposure Science & Environmental Epidemiology, 30*(2), 253–261. doi:10.1038/s41370-019-0175-9.

Danielski, I., Svensson, Å., Weimer, K., Lorentzen, L., & Warne, M. (2022). Effects of Green Plants on the Indoor Environment and Wellbeing in Classrooms—A Case Study in a Swedish School. *Sustainability, 14*(7), 3777. https://doi.org/10.3390/su14073777

Daumiller, M., Rinas, R., Schoon, I., & Lüftenegger, M. (2023). How did COVID-19 Affect Education and What can be Learned Moving Forward? A Systematic Meta-Review of Systematic Reviews and Meta-Analyses. https://doi.org/10.31234/osf.io/g4smq

De Blander, R., Vandenbroucke, A., Marissal, P., & Wayens, B. (2024). Analyse de la faisabilité et l'opérationnalité d'un recensement des logements inoccupés en Région Bruxelles-Capitale. Microsoft Word - LI_GlobaleSynthese_FR050324_Hugo_08_03_24_lv (bsi.brussels)

Dessouroux, C., Bensliman, R., Bernard, N., De Laet, S., Demonty, F., Marissal, P., & Surkyn, J. (2016). *Housing in Brussels: diagnosis and challenges.* BSI synopsis. https://doi.org/10.4000/brussels.1353

DuFour, T. (2021). *Husserl and spatiality: a phenomenological ethnography of space.* Routledge. https://doi.org/10.4324/9781351116145

Englert, M., Girès, J., Unger, J., & Yannart, M. (2023). Welzijnsbarometer. Brussels rapport inzake armoede en sociale gezondheidsongelijkheden 2023. Observatorium voor Gezondheid en Welzijn van Brussel-Hoofdstad - Vivalis.brussels. https://www.vivalis.brussels/sites/default/files/2024-03/Welzijnsbarometer-2023-NL.pdf

Gregoriadis, A., & Evangelou, M. (2022). Revisiting the home learning environment: Introducing the home learning ecosystem. *Australasian Journal of Early Childhood, 47*(3), 206-218. https://doi.org/10.1177/18369391221099370

Hartas, D. (2012). Inequality and the home learning environment: predictions about seven-year-olds' language and literacy. *British Educational Research Journal, 38*(5), 859–879. https://doi.org/10.1080/01411926.2011.588315

Hawrot, A., & Nusser, L. (2024). The home environment during the COVID-19 pandemic and changes in learning enjoyment and learning effort: A study of German lower secondary school students. *Children and Youth Services Review, 158*, 107481. https://doi.org/10.1016/j.childyouth.2024.107481

Hemmerechts, K., & Kavadias, D. (2018). Bijgaand rapport. Visies van stakeholders uit het Nederlandstalig Onderwijs. Perspective Brussels.

Kalenga-Mpala, R. & Wautelet, A. (2020). *Focus IBSA 30: Les Bruxellois et les Bruxelloises à l'heure du numérique: accès aux TIC et leur utilisation.* Brussel: Institut Bruxellois de statistique et d'analyse. https://www.docu.vlaamserand.be/sites/default/files/2021-04/Focus-30_FR.pdf

Kalenga-Mpala, R. (2024). *De Brusselaars en de digitale wereld. Brussel:* Brussels Instituut voor statistiek en analyse. https://bisa.brussels/sites/default/files/publication/documents/ICT-Huishoudens_2024v1.pdf

Katz, J., & Csordas, T. J. (2003). Phenomenological ethnography in sociology and anthropology. *Ethnography, 4(*3), 275-288. https://doi.org/10.1177/146613810343001

Korsavi, S. S., Montazami, A., & Mumovic, D. (2020). The impact of indoor environment quality (IEQ) on school children's overall comfort in the UK; a regression approach.

Building and Environment, 185, 107309. https://doi.org/10.1016/j.buildenv.2020.107309

Krousorati, K., Gregoriadis, A., Tsigilis, N., Grammatikopoulos, V., & Evangelou, M. (2022). Introducing the Home Learning Environment Questionnaire and examining the profiles of home learning environments in Greece. *Frontiers in Education, 7*, 987131. https://doi.org/10.3389/feduc.2022.987131

Le Gales, P. (2002). *European cities, social conflicts and governance.* Oxford, Oxford University Press.

Lefebvre, H. (1991). *The production of space.* 1st ed. Oxford, OX, UK: Blackwell.

Lehrl, S., Evangelou, M., & Sammons, P. (2020). The home learning environment and its role in shaping children's educational development. *School Effectiveness and School Improvement, 31*(1), 1-6. https://doi.org/10.1080/09243453.2020.1693487

Löw, M., & Goodwin, D. (2016). *The Sociology of Space: Materiality, Social Structures, and Action.* New York: Palgrave MacMillan.

McLean, E. K., & Tarnopolsky, A. (1977). Noise, discomfort and mental health. A review of the socio-medical implications of disturbance by noise. *Psychological medicine, 7*(1), 19–62. https://doi.org/10.1017/s0033291700023138

Melhuish, E. C., Phan, M. B., Sylva, K., Sammons, P., Siraj-Blatchford, I., & Taggart, B. (2008). Effects of the home learning environment and preschool center experience upon literacy and numeracy development in early primary school. *Journal of Social Issues, 64*(1), 95–114. https://doi.org/10.1111/j.1540-4560.2008.00550

Middleton, S. (2017). Henri Lefebvre on education: Critique and pedagogy. *Policy Futures in Education, 15*(4), 410-426. https://doi.org/10.1177/1478210316676001

Milner, H. R.IV, & Lomotey, K. (2017). *Handbook of urban education.* Routledge.

Moodley, C., Seerane, T., & Gravett, S. (2022). Learning at home for Grade 1 learners in disadvantaged communities: Insights from the Sandbox@Home COVID-19-response intervention. *South African Journal of Childhood Education, 12*(1). https://doi.org/10.4102/sajce.v12i1.1046

Nag, S., Vagh, S. B., Dulay, K. M., Snowling, M., Donolato, E., & Melby-Lervåg, M. (2024). Home learning environments and children's language and literacy skills: A meta-analytic review of studies conducted in low- and middle-income countries. *Psychological Bulletin, 150*(2), 132-153. https://doi.org/10.1037/bul0000417

Nampijja, M., Kizindo, R., Apule, B., Lule, S., Muhangi, L., Titman, A., Elliott, A., Alcock, K., & Lewis, C. (2018). The role of the home environment in neurocognitive development of children living in extreme poverty and with frequent illnesses: A cross-sectional study. *Wellcome Open Research, 3*, 152. https://doi.org/10.12688/wellcomeopenres.14702.1

Niklas, F., Cohrssen, C., & Tayler, C. (2016). Improving preschoolers' numerical abilities by enhancing the home numeracy environment. *Early Education and Development, 27*(3), 372–383. https://doi.org/10.1080/10409289.2015.1076676

Nohl A-M (2010) Narrative interview and documentary interpretation. In: Bohnsack R, Pfaff N and Eller W (eds) *Qualitative Analysis and Documentary Method in International Educational Research.* Opladen: Barbara Budrich Publishers, pp.195–217.

Norlander, T., Moås, L., & Archer, T. (2005). Noise and Stress in Primary and Secondary School Children: Noise Reduction and Increased Concentration Ability Through a Short but Regular Exercise and Relaxation Program. *School Effectiveness and School Improvement, 16*(1), 91–99. https://doi.org/10.1080/09243450500114173

Orlove, B. (1993). The ethnography of maps: the cultural and social contexts of cartographic representation in Peru. Cartographica: *The International Journal for Geographic Information and Geovisualization, 30*(1), 29-46.

Paulston, R. G. (1996). *Mapping Multiple Perspectives.* Research Reports of the University of Pittsburgh Social Cartography Project, 1993-1996.

Quintão, C., Andrade, P., & Almeida, F. (2020). How to Improve the Validity and Reliability of a Case Study Approach? *Journal of Interdisciplinary Studies in Education, 9*(2), 273-284. https://doi.org/10.32674/jise.v9i2.2026

Sacco, M., Smits, W., Kavadias, D., Spruyt, B., & d'Antrimont, C. (2016). BSI synthesenota. De Brusselse jeugd: Tussen diversiteit en kwetsbaarheid. *Brussels Studies, 98*.

Sadrizadeh, S., Yao, R., Yuan, F., Awbi, H., Bahnfleth, W., Bi, Y., Cao, G., Croitoru, C., De Dear, R., Haghighat, F., Kumar, P., Malayeri, M., Nasiri, F., Ruud, M., Sadeghian, P., Wargocki, P., Xiong, J., Yu, W., & Li, B. (2022). Indoor air quality and health in schools: A critical review for developing the roadmap for the future school environment. *Journal of Building Engineering, 57*, 104908. https://doi.org/10.1016/j.jobe.2022.104908

Schütze, F. (1983) *Narrative Repraesentation kollektiver Schicksalsbetroffenheit.* In: Laemmert E (ed.) Erzaehlforschung. Stuttgart: J.B. Metzler, 568–590.

Sincer, I., Severiens, S., & Volman, M. (2019). Teaching diversity in citizenship education: Context-related teacher understandings and practices. *Teaching and Teacher Education, 78*, 183-192. https://doi.org/10.1016/j.tate.2018.11.015

Spruyt, B., Van Droogenbroeck, F., Siongers, J., & Kavadias, D. (2023). Het lerarentekort kritisch bekeken vanuit internationaal vergelijkend perspectief. *Tijdschrift voor Onderwijsrecht en Onderwijsbeleid, 2022-2023(september-oktober)*, 19-27.

Strife, S., & Downey, L. (2009). Childhood Development and Access to Nature: A New Direction for Environmental Inequality Research. *Organization & Environment, 22*(1), 99–122. https://doi.org/10.1177/1086026609333340

Tamis-Le Monda, C., Luo, R., McFadden, K., Bandel, E. T., & Vallotton, C. (2019). Early home learning environment predicts children's 5th grade academic skills. *Applied Developmental Science, 23*(2), 153-169. https://doi.org/10.1080/10888691.2017.1345634

Toth, K., Sammons, P., Sylva, K., Melhuish, E., Siraj, I., & Taggart, B. (2020). Home learning environment across time: The role of early years HLE and background in predicting HLE at later ages. *School Effectiveness and School Improvement, 31*(1), 7-30. https://doi.org/10.1080/09243453.2019.1618348

Tsibiridou, F. (2018). An Ethnography of Space, Creative Dissent and Reflective Nostalgia in the City Centre of Global Istanbul. In: Pardo, I., Prato, G. (eds) *The Palgrave Handbook of Urban Ethnography.* Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-319-64289-5_23

van den Berg, A. E., Wesselius, J. E., Maas, J., & Tanja-Dijkstra, K. (2017). Green Walls for a Restorative Classroom Environment: A Controlled Evaluation Study. *Environment and Behavior, 49*(7), 791-813. https://doi.org/10.1177/0013916516667976

Van Lancker, W., & Parolin, Z. (2020). COVID-19, school closures, and child poverty: a social crisis in the making. *The Lancet Public Health, 5*(5), 243-244. https://doi.org/10.1016/S2468-2667(20)30084-0

Vandermotten, C. (2014). *Bruxelles, une lecture de la ville. De L'Europe des marchands à la capitale de l'Europe*. Brussels: Editions de l'Université de Bruxelles, Collection UBlire.

Volk, D. (2021). Constructing Literacy Spaces in Low-Income Homes and Communities: A Study of Two Latino First Graders and Their Families. *Urban Education, 56*(1), 61-90. https://doi.org/10.1177/0042085916677348

Wiedmann, F., & Salama, A. M. (2019). Mapping Lefebvre's theory on the production of space to an integrated approach for sustainable urbanism. In M. E. Leary-Owhin & J. P. McCarthy (Red.), *The Routledge Handbook of Henri Lefebvre, The City and Urban Society* (1ste dr., pp. 346-354). Routledge. https://doi.org/10.4324/9781315266589-36

Wirth, A., Stadler, M., Birtwistle, E., & Niklas, F. (2022). New directions in the conceptualization and operationalization of the home learning environment. *Journal of Educational Psychology.* https://doi.org/10.1037/edu0000749

Xiong, L., Huang, X., Li, J., Mao, P., Wang, X., Wang, R., & Tang, M. (2018). Impact of indoor physical environment on learning efficiency in different types of tasks: A 3 × 4 × 3 full factorial design analysis. *International Journal of Environmental Research and Public Health, 15*(6), 1256. https://doi.org/10.3390/ijerph15061256

Yang, X., Zhao, X., Tian, X., & Xing, B. (2020). Effects of environment and posture on the concentration and achievement of students in mobile learning. *Interactive Learning Environments, 29*(3), 400–413. https://doi.org/10.1080/10494820.2019.1707692

Yates, A., Starkey, L., Egerton, B., & Flueggen, F. (2021). High school students' experience of online learning during Covid-19: *The influence of technology and pedagogy. Technology, Pedagogy and Education, 30*(1), 59-73. https://doi.org/10.1080/1475939X.2020.1854337

Yeo, L. B. (2020). Psychological And Physiological Benefits Of Plants In The Indoor Environment: A Mini And In-Depth Review. *International Journal of Built Environment and Sustainability, 8*(1), 57-67. https://doi.org/10.11113/ijbes.v8.n1.597

Yin, R. K. (2018). *Case study research and applications: Design and methods (Sixth edition)*. SAGE.

Footnote

To the school and all participants, a pseudonym was assigned.