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Learning Spaces and Well-being: What is Happening in France

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The impact of space and furniture on children starts to be taken into consideration in the mid 19th century, in France. New legislation changes the face of the school and the reflection around architecture and learning spaces. Nowadays, learning spaces are an important part of the school design: numerous studies have demonstrated the impact of space on learning abilities, cognitive performances or well-being. In this piece, we are trying to explain the French point of view, and the goals to achieve regarding the relationship between space, architecture and happiness – as a holistic approach of well-being and performance – at school.

In France, the architecture of the learning spaces starts to be looked at in the middle of the 19th century. Before that, the school is where the teachers are. There are no dedicated spaces to learn. With the new legislation of Guizot, and then Jules Ferry's, the face of the school changes: new pedagogies appear and transform the space (Châtelet, 2008). This is the first time that one takes into account the impact of space and furniture on students. Several guidelines are published to help the designers create spaces and furniture according to the health of students – there was a lot of short-sightedness and scoliosis due to bad light and fixed tables (Châtelet, 2008). From the early 1920's, theories about health and school spaces spread, until the World War II and the reconstruction forced the country to design cheap, simple and efficient school buildings. Up until the early 1970's, there are no recommendations about health and the impact of spaces on children. After that, one has seen an important movement denouncing the inhuman buildings and willing to experiment new pedagogies to enhance students' performance (Foster, 2004). By transforming the nature of spaces, authorities thought that the uses of space would change. Unfortunately, the experiments were not continued, and the classrooms were reshaped into rectangular spaces (Foster, 2004). Nowadays, digital tools lead to question the model of French schools. One says (Maybe change this) that to make active pedagogy count, one needs spaces 30% bigger than they are now (Derouet-Besson, 1998; Freinet, 1953). Studies have shown that learning spaces designed to support active learning and the use of digital tools increased the performances of students (Brooks, 2012). Following the steps of foreign research, French research laboratories are trying to assess and experiment with new spaces and the impact on well-being and quality of life.

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Perspectives

At a starting point for the work of our laboratory was the statement that digital tools will not change or enhance usage if not supported by appropriate space design. Directly related to this was the question of the role played by the school in students' life. Indeed, schools are known to be places where one learns, but what is learning regarding the sciences of education? One can say it is to acquire the knowledge of something by the exercise of the intelligence, memory and appropriate gestural mechanisms (TLFI, definition I.A.1.a.). Learning is to modify one's behaviour regarding the situations one is in (Reynal & Reunier, 1997). These situations are either pedagogical (Brousseau, 1988; Houssaye, 1988), social (Montessori, 1958) or physical (Edwards, 2002; Rezeau, 2001). Several studies have shown that learning is polymorphous, based on different types of intelligence (Gardner, 2006), and therefore the configuration of spaces is to be adapted (Scott-Webber, 2004). Because moving has an impact on learning by stimulating the brain activity (Kilbourne et al, 2017), the spaces as they are known – rows of chairs and tables in front of a board – have to change. In the last one hundred years, educationalists from several countries pointed out the impact of space use on children linked with new pedagogies (Montessori, 1958; Pourtois & Desmets, 2015; Steiner, 1922). Although their theories are mainly based on the layout of classroom to support active learning, there are some recommendations about colour, light, and hygiene. Based on works from Australia (Fisher, 2005), United-Kingdom (Barrett et al, 2015;

Architecture & Design Scotland, 2015) and United States (Scott-Webber, 2004), the laboratory has been trying to point out a series of learning situations and their appropriate settings. Narrowed down to six, the learning situations can be named as follow: collecting, receiving, making, collaborating, playing and sharing. These situations can either be related to one space or several, and can coexist in time and in space. Therefore, they need particular settings, alone or combined, that have impacts on architecture, layout and furniture.

Regulations

As said above in this article, spaces have to transform in order to meet the needs of new pedagogies and ways of learning. Saying that, one has to underline the primary importance of spaces that meet the physiological and safety needs, before even thinking about new uses (Maslow, 1954). In France, the architecture of schools has been ruled by guidelines and recommendations from the 19th century. First focused on light and hygiene (Toulier, 1982), the buildings are deeply questioned after the World War II and the massive reconstruction period which created inhuman spaces (Knittels & Castets-Fontaine, 2015). For the first time, the built environment is comprehended – besides the social and pedagogical environments – as a significant part of learning space design (Cleveland & Fisher, 2013). Nowadays, the majority of schools are refurbished based on the new environmental legislation or fire regulations, without taking into consideration the needs for learning. Worse, it is common to teach in schools built before the World War I. Added to this, since the PISA studies show that 23% of the children in France feel like outsiders in their schools (2017), it seems urgent to look into the impact of architecture on a new level: the well-being and quality of life for all the users in schools.

Fundamental needs

The Organisation for Economic Cooperation and Development (OECD, 2009) defines the school climate through six factors: the quality of buildings, relationships between users, moral level and involvement of teachers, order and discipline, violence and involvement of students. The built environment is one of the four determinants of health, with genetics, behaviours and the healthcare system (Déoux, 2010), known as such by the World Health Organisation (WHO). Lately, a report from the University of Salford, directed by Peter Barrett has highlighted the impact of the environment on students' performances (Barrett et al, 2015). Based on more than a hundred classrooms, the study has shown that air quality and temperature represent 28% of the significant criteria influencing students' performances. On the other side, colour and light combined represent 33%. This holistic study highlights the general impact of architecture on performances, taking into account the feeling of ownership and individualisation.

Our laboratory is trying to study more deeply the impact of air quality on the well-being of students, with several partners (AirJin, AirParif). The indoor air quality has been, indeed, proved to be an issue regarding cognitive functions in office workers (Allen et al, 2016) and productivity (Antikainen et al, 2008). On the other hand, the sick building syndrome (SBS) is more and more a public health concern (Fisk, 2002). Last year, the laboratory – supported by the Caisse des Dépôts et Consignations – put together an experiment at five schools, trying to understand the behaviour of users during the day, regarding air quality and temperature (Lab Education, 2017). By putting a small box measuring COVs, humidity and temperature, we were able to measure the variations during day and night over several weeks. Although it is not now possible to link the results with students' performances, the boxes showed that temperature, as well as COVs rates did not reduce overnight. One explanation is the use of space: it is forbidden, invoking safety and security, to allow for opening windows during the night. It resulted in teachers and students starting the day in a hot room, with a rate of COVs above WHO regulations (World Health Organisation, 2016). The study of Environment Health Perspectives (EHP), from Harvard, indicates that cognitive activities are better done at a low rate of COV exposure, and particularly the capacity to resolve complex problems, to understand a piece of information or to focus (Allen et al, 2016). One can be concerned the rate of exposure to COV or CO2 is a consequence of deficit in learning capacities because of its link with temporality in classrooms and activities (Torres, Sanders & Corsi, 2002).

Noise is also known as an issue in most of the French schools, even if it is not considered a significant criterion in the Clever Classrooms study (Barrett et al, 2015). Indeed, it has been shown that too much noise can affect oral comprehension capacities (Shield, Greenland & Dockrell, 2012) and reading performances (Klatte et al, 2013). What was interesting in the experiment with the Lab Education was that although noise is an issue, it was also a way to help children regulate their own voice. For instance, in the secondary school of Avignon, after the walls were removed to create a 100sq-m classroom, the noise was quite an issue. However, after a while, pupils started to learn how to moderate their voice in order to not disturb others. The space became a way to comprehend one's behaviour amongst others. On the other hand, in the Saint-Brieuc high school, noise was too much an issue to keep teaching in the hall. The conclusion was to 1) recreate smaller spaces within the hall, in order to allow courses to take place, without them being

disturbed by students passing by, and 2) enhance the acoustics.

Through the Lab Education experiment, it has also been found that nature had a great part in calming and focusing children. Two schools – a preschool and a secondary school – were studied regarding their link with nature. The two experiments allowed children to connect with plants via newly built environment – outside furniture and small garden in a patio. According to teachers, children were found to be calmer and more respectful to their environment and the others. The literature has shown the impact of nature, or simply a view of nature, on performance and well-being (Mozaffar & Somayeh Mirmoradi, 2012).

Although light and colour are known to be significant criteria in school design (Wohlfarth, 1986; Grangaard, 1995; Goven et al, 2009), the Lab Education experiment did not allow to study its impact on the users. However, it will be part of the next experiment and included in the process of evaluation soon to be created.

From Post-Occupancy Evaluation (POE) to Complete Process Evaluation

Lab Education: what we learned

The experiment of the Lab Education helped studying the outcomes when involving users in the process of design. Although it was a positive outcome regarding the sense of ownership and respect, it was questionable in terms of anticipation and innovation. Indeed, because of the status of the experiment, and the refurbishment of the spaces, users tended to see it as a gift, choosing to look into colorful furniture and digital tools regardless of their fundamental needs. It was at the end of the experiment, when the users actually lived in the spaces that problems appeared: temperature, air quality, noise. This situation decreased the well-being in several spaces, despite the newness of the refurbishment. The Cité du Design of Saint-Etienne also launched a series of refurbishment of schools for 9 years, involving users in the design of their spaces, but it is not possible to say how the process affected users. What can be said however is that this process requires more time than the classic one. It has been noted that local authorities are not always inclined to support it, although there are good outcomes in terms of buildings' life cycle management and the sense of ownership by users (Paquot, 2015).

Archiscola: what we learned

In November 2016, the EMA laboratory of the University of Cergy-Pontoise hosted the first ideas' competition for architects about the design of tomorrow's schools. During a day, 20 finalists presented their work to over 100 jurors – students, future teachers, researchers, designers, architects. The projects looked into the role of nature in schools (70% of them had trees or plants embedded in the design) and the speeches took into account the impact of active learning and digital tools. Nevertheless, looking at the projects, most of the classic designs remained. Indeed, 53% of the projects presented rectangular buildings, and 58% of the learning spaces were also rectangular. Besides, 65% were closed outwards. One of the reasons can be situated in the training of the architects, who do not have specific courses on this subject. Therefore, they have to trigger their memories and intuition to create what they consider to be new learning spaces. If competition is an essential part of the design process, maybe it has to change, looking into collaboration and transdisciplinarity, to be able to find more adequate and innovative solutions.

What's next

With all these facts in mind, our laboratory is looking into reuniting all the actors of education, to work together and create a series of guidelines for designing schools. It is necessary to design schools involving users and considering new uses. Thinking about criteria in terms of pedagogical needs, users' needs and reflecting them on architecture and design is a beginning into changing the learning spaces. One meeting took place in November, with almost twenty people from different disciplines – builders, academics, programme managers, researchers, architects, local authorities – to discuss innovative school design, and the impact of the built environment on users. The next step will be to form working groups and come up with guidelines and tools to rethink the current situation and support local authorities, architects and constructors in the design of new schools and learning environments. This is part of a more global goal for the research chair in experimenting a way of enlightening the relationship between space – which impacts the practice – and the learning in didactic situations. By analysing the conditions of execution and evaluation of the school form (Vincent, 1994) regarding the configurations of spaces, it is possible to emphasise the quality of school environments and the performance of the act of teaching (Rouzel, 2010). Thus, the intrinsic characteristics of the didactic environment (Brousseau, 1998) – from indoor air quality, acoustics, light, colour, materials, to mobility and settings – were largely proved to be pertinent in taking into consideration the "better-being" to learn, although as independent variables. The question is therefore the following: what are the characteristics of lived and perceived spaces which allow the consideration of the multiple intelligences in an evolving configuration in time? We are considering an approach with four determining factors – which statistics significance is still to demonstrate. First, we

reflect on the space as an actor of the communication, mediatisation, mediation (Perraya, 1999) and transmission process. The second factor takes into account the interaction rituals (Goffman, 1974) and the silent speech of the teacher (Moulin, 2004). The third one is elaborated from rules of actions (Pastre, 1997) inherent in the activity and its regulation in place. The last one is linked to the necessary skills to apprehend the didactic space rationally, the latter being either formal or informal, material or e-material (Duroisin, 2015) and carrying sense through its codes and values.

This research project is built around three mid-term goals. First is the studying of a possible collaboration between the research chair and the research laboratory of the University of Melbourne – Learning Environments Applied Research Network (LEaRN) – whose themes of research are concomitant with ours. Second is the setting of an autonomous tool to measure the characteristics of learning environments. Finally, the last goal consists of testing the impact of the acoustic quality on the school climate, in collaboration with Ms Lavandier, from the ETIS laboratory, UCP.

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