

Pedarchitecture: Which Learning Environments for the Personalisation of Teaching and Learning? An Educational Architecture for the Schools of the Future



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Abstract This project investigates how to overcome traditional learning environment's rigidity; those established practices that may hinder full use of what we might call new learning environments. It addresses how teachers adapt their teaching to changing learning environments, what impact new educational spaces have on teachers and students, how to organise students with different criteria, and how learning environments can be redesigned in old schools with limited investments. The research studies four schools: in Denmark, the Hellerup Folkeskole in Gentofte and the Ørestad Gymnasium in Copenhagen; in Italy, the Enrico Fermi High School in Mantua and IC3 Piersanti Mattarella secondary first grade in Modena. New learning environments are intended to enhance teacher collaboration and stimulate the exchange of new teaching methods, enabling learning personalisation. This is often facilitated by team teaching, which in this chapter is seen as a "bridge-culture" concept, offering a wider vision including structural and organisational details. The chapter discusses how this strategy lead to students improved learning skills, them taking on greater personal responsibility and displaying aptitude to study in different ways. In this sample of "architecture feeds pedagogy" schools, some key concepts are explored that might guide future learning environments design: readability, "semantic-topical", flexibility, invisible pedagogy and affordances.

Introduction

The cultural background that characterises societies is undergoing a steady transformation, and schools are involved in this change. Teachers are increasingly being asked to evolve their disciplinary knowledge and teaching methodology according to the integral growth of the student and her/his understanding of new social and employment needs. This is only possible if there is an anthropological vision of education that adopts a global and comprehensive approach, so that the individual's development is central and integral to the schooling structure. This can be done in

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many ways, but surely the organisation of the spaces and new school architecture, where the school is a “third teacher”, are elements that need to be taken in account?

Although at first sight architecture and pedagogy fields of study seem distant from each other, the collaboration between the two disciplines is being more widely studied and analysed. This chapter will tackle the fundamental question of whether it is possible to overcome the traditional spatial rigidity which views “schools as a factory, the child as its product, the teacher as a worker and curriculum as its management system” (Imms, 2016a, pp. 151–52) and propose “new ways of doing school” with new learning environments helping to drive new teaching methodologies (OECD, 2009).

Why is the relationship between person, education and space so important? Education is a global process involving all the supportive structures for human life (Ruini, 2009). In this scenario, the school’s role is to support personal development in a process where “the person shapes himself in order to become a person” (Maritain, 1943, p. 12). Teachers must be able to apply disciplinary knowledge and teaching methodologies according to the integral growth of the student (Bertagna, 2006) so that beyond just learning, dignity creativity and the basic right to schooling and education are recognised for everyone (Mounier, 1935).

The relationships between education and schooling are complex because one cannot educate without teaching, while it is easy to teach without educating (Arendt, 1961); the relationship that exists between the teacher and the learner is critical, and this chapter argues that the spaces within which this relationship is enacted is an element of this complexity (Byers, Imms, & Hartnell-Young, 2014). In the eighteenth century Jean Jacques Rousseau identified the importance of physical spaces as the “third teacher” (Rousseau, 1762, p. 10), and wrote that “each of us is therefore made up of three kinds of masters” and that “education comes from nature or from people or things” (Rousseau, 1762, p. 10). Later the educational philosophies of Maria Montessori, Loris Malaguzzi and Trung Le reinforced this by emphasising the importance of space working in partnership with the instructor in effective learning. For example, in terms of furniture, the location of student and teacher desks can influence students and regulate their behaviour (Foucault, 1975; Hall, 1959). The teacher can be conceived as a theatre director who, by changing the teaching environment, can produce a different scenario and therefore introduce a new teaching model (Gamelli, 2001).

Flexible school spaces are argued to allow adaptation to the different needs and “multiple intelligences” (Gardner, 1993) of students; teachers can be modified over time through an educational relationship involving all those participating in the educational process. The analysis of data presented in this chapter starts with the relationships between people, education and learning environments, through the lens of its potential to stimulate personalised learning. The student must be considered as a human being (Bertagna, 2012) in a position to make choices, be independent, responsible, self-sufficient (Hoz, 1988) and conscious of his or her learning (Collins, 1991; Dent-Read & Zukow-Goldring, 1997; Lippman, 2010; Santoianni, 2010). Personalised learning is the most useful strategy (Hopkins, 2008), so that each student reaches the best possible results (Miliband, 2006).

In order to understand how new learning environments can facilitate this type of teaching methods and learning, it is important to study the complex interaction of people, actions, education and school spaces. The school building can be seen as a site for this; they represent a “pedagogical problem” because “the school environments assume a fundamental importance for the educational process ... and environment in this sense means equipment, furnishings, teaching supports” (Coèn, 1965, p. 5) as well as the relationships between the teachers and students. Any interpretation of pedagogy must recognise an encompassing overall view of the total educational phenomena, and within the chosen methodological orientation to accept that people are the subject-object of research, and they are involved in all educational actions related to them in concrete situations.

In the relationship between education and school “the building sets the method” (Romanini, 1962, p. 21). “The question of the epistemological pre-requisite on the person’s centrality” is fundamental (Pavan, 2003) according to those philosophical assumptions (Mertens, 2014) that recognise a strong orientative value (Mortari, 2012).

The analysis of educational actions is very complex and for this reason this chapter argues it is a perspective that requires one “to base one’s intentionality on clear and explicit paradigms, capable of nourishing the reading and interpretation of experiences” (Sandrone, 2010, p. 6). This is because the reality in which pedagogy takes place is multifaceted, ephemeral and complex. So too must research be flexible; “Every research takes place within the framework of a paradigm” that “guides action” (Mortari, 2012) or may, explains Mertens, be “the way of looking at the world” (2014) with a perspective that orients it. For this chapter an ecological paradigm has been chosen using the lens of the European Personalist Movement (Emmanuel Mounier, 1935; Jacques Maritain, 1943; Paul Ricoeur, 1983) drawing on epistemological and anthropological structures of the individual and the influence that learning environments have, along with proxemics dimension and strong symbolic value of furniture present in the classrooms.

The research informing this chapter is aimed at understanding if learning spaces, built according to an innovative pedagogical vision or modified at the organisational and structural level, might (1) bring a change in teaching methodologies, (2) allow greater collaboration and sharing of work among teachers and (3) improve the well-being, motivation and attitude of students at school. In order to get an understanding, even if partial, of how learning environments can be structured in an innovative flexible, beautiful and pleasant way, four schools, two in Denmark (Gentofte and Copenhagen) and two in Italy (Mantua and Modena), have been analysed. As the cultural context is different, we do not intend to make a comparison but rather analyse how the educational spaces have been designed and/or reorganised with new technologies and new teaching that allows each person’s abilities development in personal skills.

Methodology

This research has an explorative character using qualitative survey techniques and case study methodology. It is also focused on specific analysis by “mixing” the Phenomenological-Eidetic and Grounded Theory methods, with a “hermeneutical approach” (Mortari, 2012, p. 193). This has allowed a thorough understanding of the situation in its uniqueness and specificity (Trincherò, 2002) and to simultaneously safeguard the features of real-life events (Yin, 2003). The research considered numerous existing factors as well as some factors that were not fixed beforehand (Trincherò, 2002). Four schools were chosen as examples which represented unique situations (Merriam, 1998). The choice of multiple techniques was made to grasp the multifaceted and varied reality of the analysed situations, but with the awareness that the analysis is certainly partial and focuses only on some aspects rather than the complete picture (Silverman, 2000).

An initial exploratory survey was made to choose the epistemic instruments and better identify the research aspects and the interview questions. This included papers and documents supplied by the schools (Staff of Hellerup Skole, 2012) or found on-line, videos and photographs, direct observation of the school premises as well as the observation of the interactions on the field. In this research, single and group interviews were used, allowing the interviewer to give explanations in case of interpretative difficulties and, thanks to the group dynamics stimulating the interviewees, allowing the researcher to obtain more detailed information. Trincherò (2002) makes a distinction between “between group” interviews, in which the interviewer asks questions to more than one person and more than one person responds, and “in a group” interviews in which the interviewer asks questions to a person at a time, in the presence of the whole group and only that person responds.

The questions were formulated quite homogeneously, with variations for some questions depending on the different study years of students, thus the professional focus of the teachers. The questions included in the survey concerned the possibility of overcoming the traditional spatial rigidity to propose “new ways of doing school”, and potential educational actions based on the concept of personalization of teaching and learning.

The aim was to answer the following questions:

- How have teachers adapted their teaching to changing learning environments?
- How can the educational setting be changed for teaching and learning personalisation?
- What impact might new learning environments have on teachers and students’ perception?
- How can learning environments be redesigned in old schools with limited investments?

Case Study Sites

In essence, the schools presented in this research are very far from a functional determinism that typifies the majority of schools built in the past. They are, each in differing ways, experimental or progressive schools; this has allowed the stakeholders to appropriate the spaces and to change their role from “users” to “inhabitants” (Faiferri, 2012). They also allow teachers to propose new teaching methods to students, and above all to develop a sense of belonging, feel well-being and feel good at school as at home. This purposive sampling allows the research to properly explore the stated research questions.

Denmark

In Denmark, the case study sites were the Hellerup Folkeskole in Gentofte, for students 6–15 years old, and the Ørestad Gymnasium in Copenhagen for teenagers aged 17–19. The choice of Denmark was made for three reasons. The first relates to investments that have been made in the school architecture after the poor results in the OECD-PISA 2000 survey. The second concerns the choice of two schools that interpreted the Danish Government’s directions on education to design new schools where it was possible to propose an innovative teaching method with the student as the centre of the education process, acknowledging and utilising various learning styles (McGrane, 2012). The third is historical: in Denmark since 1844 laws have been issued requiring adequate and clean classrooms, stressing the influence of the educational spaces on child development (Vindum, 2007). The “*2000 Debate Paper on Folkeskole Vision 2010*”—states that a “radical change” of building projects is needed so that there is an inevitable break with the traditional organisation of teaching methods (Undervisningsministeriet-UVM, 1999).

The ambition was to change the school culture by changing the physical environment, so that teachers were put in a position to rethink their teaching practices and forced to change the teaching methodology and their way of “doing school”. As a result of that document the design and building of new schools has included input from the various stakeholders, including children, because it is part of the school change process to listen to the voice of the pupils with the intent of understanding how the environment can be structured to make them feel calm, serene, peaceful and able to learn (Juelkjær, 2012).

Hellerup Skole

Hellerup has about 650 students and is entirely an open space, spread over three floors with the students distributed according to age. There are nine Home Areas where students’ daily life takes place. The large central staircase, the “heart” of the

school, connects the floors as a metaphor of life: one step a day to reach the goal (AA.VV., 2012). Hellerup was built through the SKUB (The School of the Future) programme developed in Gentofte and inaugurated in 2002. SKUB was a restricted programme, but very significant because it created a trend in Europe proposing a new vision of the school (Juelkjær, 2012).

The design of the building started with a pedagogical vision of an inclusive project that involved the whole community (Woolner, 2010, 2015). The environmental qualities of the space now creates a pleasant and familiar atmosphere with muffled and diffused sound, natural light from a ceiling skylight and no bell to demark lesson times. At the corners of these areas there are the Home Bases, two by two-metre hexagonal moveable structures where pupils sit to listen to teachers' explanations for about twenty minutes. They then choose where to sit and work where it suits them at the tables, lying on the floor, on the sofas in the relaxation areas or on the hexagonal-shaped steps.

Through observation one can see that thanks to careful planning and teachers' collaboration, each student is engaged in their small or large group activities or alone in complete freedom [1]. This enables the personalisation of student learning and empowerment [2] and the teachers promote learning by trying to identify the nearest zone (Vygotsky, 1980) of each student.

Ørestad Gymnasium

The Ørestad Gymnasium was built in 2007 in response to the Danish governments new vision for the organisation of spaces in school buildings. With about 1200 students, Ørestad was designed on the principle of "one room, one school" [3]. Visiting the school for this project, it now presents as a large cube-shaped building with several floors connected by a helix staircase, what feels to be the throbbing centre of the school. The pedagogical goals of the school provide an interdisciplinary synergy supported in part through the use of information technology to create a "paper free school" with all the educational material being digital, and students only using iPads.

The central core of the school is dominated by a large spiral staircase that dramatically links the floors. It is a space for relationships, a place for meeting and socialising. There are few classrooms compared to the number of students because "school takes place outside school" [4]. Through a network of companies, students have the opportunity to take some lessons outside the physical boundaries of the school. The school is an "exploration ground where teachers constantly develop new methodologies allowing each student to learn, be independent, develop their own opinions and to be able to work in a team" [5]. There are several possible space lay-outs/settings available to teachers and students: open spaces for individual work; a meeting room where students work in teams monitored by teachers; a classroom with glass walls; where students attend brief quite didactic lessons; open areas that can be transformed into large spaces where, for example, three teachers can work with about ninety students; and a large room that can hold a very large number of students.

Italy

Enrico Fermi Institute

In Italy, the Enrico Fermi High School in Mantua caters for teenagers aged 14–19. Known as a high school of applied sciences, it is now an example of what is possible in old schools with limited investment, but with concerted attention given to innovative pedagogies and teaching methodologies. Fermi was the first school in Italy to organise school spaces with “Readable Subject Classrooms” (Fig. 1) in the 2011/2012 school year.

The Fermi Institute has around 1800 students. It used to be a school with very traditional teaching methodologies centred on the teacher. In recent years, the headmaster’s vision has led to significant change, beginning with updating technological infrastructure to allow for modern computer technologies. Following that, subject classrooms were created and assigned to the teachers so that the students move at the change of lessons instead of the reverse. Subject teachers share the same classroom and have all the materials (personal computer, multimedia interactive whiteboard, books) available for their lessons. The headteacher created in teachers a “sense of urgency” (Kotter, 1996, p. 35) and an awareness of the need to change so that teachers can “collectively” create this change (Armenakis, Harris, & Mossholder, 1993).

By dismantling the partition walls of some classrooms during the 2012/2013 school year, TEAL (Technology Enabled Active Learning) (Dori & Belcher, 2005) classrooms (Fig. 2) with origami desks and Debate classroom were created (Fig. 3). Redesign of some unused areas created informal spaces for relaxation and individual

Fig. 1 Languages classroom



Fig. 2 TEAL classroom



Fig. 3 Debate classroom**Fig. 4** Widespread library

study. Financial investment has been limited, but what has been forthcoming has assisted the development of revitalised pedagogical approaches, resulting in new teaching methodologies and higher motivation and student learning [6].

In the 2020 school year, the new headteacher wanted to further improve some areas of the school to meet emerging student needs, so new learning environments were created. Spaces that had remained largely unused have become a widespread library (Fig. 4), relaxing areas, and spaces for individual and small group study.

The headteacher, the teachers and the students were interviewed about the impact of modifications and general reorganisation of the school spaces to make them more innovative. In her interview the head teacher explained how she approached the transition from a traditional situation to an innovative situation by trying to involve some teachers. The important thing was that the headteacher had support from a group of teachers who helped her in the reorganisation, and this motivated even the most reluctant teachers. This is consistent with leadership's need to create a fundamental educational community (Sergiovanni, 1994).

IC3 Piersanti Mattarella

The IC3 Piersanti Mattarella in Modena, catering to students aged 11–14, is a comprehensive middle school. It was inaugurated in September 2016, and has become known as an aesthetically pleasing and innovative institution. It now maintains tradition with subject classrooms allocated to the teachers, with some spaces such as the library and

the computer lab open to general use, and with an architectural project that reflects the pedagogical project shared among teachers.

The IC3 Piersanti Mattarella in Modena has about 180 students and was inaugurated in September 2016, but its project dates back several years earlier. The building was intended to be a primary school, but the needs of the neighbourhood changed and consequently the project had to be revised.

A group of teachers proposed a review that included the creation of classrooms assigned to teachers. Some of these “breakout or quiet area” (Nair & Fielding, 2005; Sandri & Marcarini, 2019); named “L’isola che c’è—The island there is” (referring to a famous Italian song titled “L’isola che non c’è”), (Figs. 5, 6 and 7), with a soft corner enables the possibility of using them for individual study moments or very small or peer group activities or for student with disabilities, so they can stay inside the classroom with their classmates and not outside in a special room. Students’ personal lockers play an important role in the pedagogical project, as they stimulate student autonomy and decision-making capacity. According to Romanini (1962), the individual didactic locker must be comfortable and “inviting” similarly to the affordance concept by Gibson (1979). Students are obliged to plan the organisation of their teaching materials according to the lessons in the morning when they arrive at school, at the interval and at the end of the lessons.

Fig. 5 Classroom plan with “L’isola che c’è—The island there is”

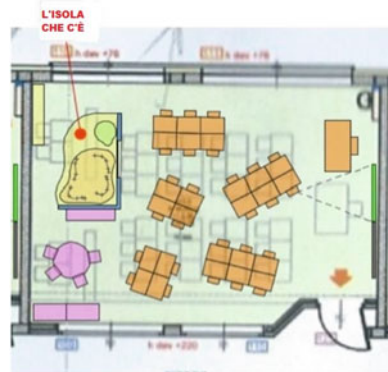


Fig. 6 “L’isola che c’è—The island there is” seen from the front



Fig. 7 “L’isola che c’è—The island there is” seen inside



Fig. 8 Spazio L.E.O.—L.E.O. space



In May 2019 the L.E.O. (Learning Expression On-the-job) space (Fig. 8) was created by the architect Francesco Bombardi. It is based on a design by Leonardo da Vinci. It is a large space adapted to a multifunctional laboratory organised on four “knowledge” rafts: Technological (Robotics/Virtual Reality/FabLab); Performance (Videomaking, Radio, Podcast); Agri-food (Hydroponic Greenhouses, Microscopes, Extractors, 3D Food Printing); Stage (Theater, Cinema, Debate).

The space is truly innovative and aesthetic, incorporating some specific technical solutions: an industrial style ventilation system that keeps the room warm in winter and cool in summer; the vertical sound-absorbing panels hanging from the ceiling that allows each group of students to not disturb the others and the Carnovsky RGB curtains (by Francesco Rugi and Silvia Quintanilla art designer) that favours a visual separation of the different rafts and areas of activity, creating surfaces that interact with different chromatic stimulus.

Method

The results are a selection of narrative material collected during the interviews from the perspective of the interviewer. Regarding the interviews in Denmark, English was used as the language during the interviews as it was a medium between the mother tongue of the respondents, Danish, and the mother tongue of the researcher, the Italian. Then there was a subsequent task of transcription and translation, with a further interpretative passage.

In Denmark, at the beginning of the interviews, photos of old schools or of very traditional teaching methods were shown as a lead-in. At Hellerup the interviews involved the headteacher, one teacher for 7–9 year old children (1st–3rd grade), one for 10–12 year olds (4th–6th grade), one for 13–15 year olds (7th–9th grade), the Coordinator of Students with Special Needs and a group of five students of different ages (7th–9th grade). We also participated as observers in two primary school lessons.

At Ørestad the interviews involved the rektor, two teachers and a group of six students of different ages, from first to third years. We also participated as observers one large group lessons involving two classrooms students.

At Istituto Enrico Fermi in Mantua, videos of Danish schools were shown before the interviews. The interviews focused on headteacher and on a group of six teachers of the first and second years, a group of six teachers from third to fifth years. Both groups consisted of high school and technical institute teachers. We participated as observers in some classrooms and TEAL space during the lessons.

At IC3 Mattarella, the interviews focused on the vice-headteacher, two different groups of five teachers and three groups of students; two groups of first and second year, and a mixed group of first and second year. We participated as observers in math and science classrooms during the lessons.

The survey questions were developed to address key issues' through a literature review and by reading and analysing the initial pedagogical projects of the two Danish schools (Hellerup and Orestad) and Mattarella Institute. For Fermi Institute, which had no written projects, but only educational practices related to activism, we interviewed the headteacher and read some documents written by her. Some indicators were identified to be able to detect during the observations, how teachers carried out their didactic activities.

For the first question, the indicators aimed at observing: the duration of frontal lessons; the use of new teaching methods (cooperative learning, individual activities, work in pairs, in large groups or between two groups-class), ICT and new furnishings; the use of alternative spaces depending on the activities to be offered to students (open space, classrooms, relaxation areas) and doing the schoolwork given by the teachers.

For the second question the indicators concerned: the flexibility of the furnishings, both in new schools where the furnishings had been chosen based on the activities to be carried out and in the old school where have the same old furniture; the ease reconfiguration of furnishings in new schools according to the activities proposed by teachers, the objectives and the needs of the students; the teachers' ability to "govern the spaces" in an expert manner and not "suffer them passively".

With the third question, through the observations and interviews, the reflections and perceptions of the teachers and the students were captured. The teachers were asked about the impact and effects of innovative learning environments in open space schools and about the space reorganisation with "readable subject classrooms" at Fermi Institute on: the students' learning and motivation; the teachers' work in terms of ease of use of the spaces according to the proposed activities; the collaboration among teachers for building the "bridge culture" and an educating community

The students in the open space school were asked if the innovative and very beautiful environments were: comfortable, motivating and useful to study better and socialise with schoolmates.

The students in the Italian schools with “readable subject classrooms” were asked if the new organisation, that expected their movement from one class to another, was positive and useful and allowed for a better use of school space and a better socialisation with schoolmates.

With regard to the last question for the Fermi Institute only, in addition to the headteacher interview questions were asked about the masonry work to build the TEAL classrooms, relaxation areas and spaces for individual study, and in the interviews to the teachers and students regarding the decoration of the subject classrooms to make them readable, the space changes were also detected with a survey using the school planimetry.

In terms of how the questions were addressed in the method, the first question “*How have teachers adapted their teaching to changing learning environments?*” was linked to observations conducted in each school. The teachers alternated short lectures with explanations or slides of school work given to the students, or programmed activities of cooperative learning. In the four schools the flexibility of the spaces allowed teachers to programme activities in an innovative way: in small groups, in large group with two or more classes, individually or even through new methodologies by the flipped classroom or other methodologies.

The second question “*What impact might new learning environments have on teachers and students?*”, asked teachers to explain what happened between them. The new learning environments had “forced” them to collaborate with each other and to use with the students a more empathic and less formal relationship. The same happened with the interviews with the students: moving from one class to another, allowing greater socialisation, and a factor of re-motivation and pleasure in the study, as reported by the students interviewed.

The question “*How can the educational setting be changed for the personalisation of teaching and learning?*” highlighted the change that occurs in the setting of learning environments, the teachers change the setting depending on the use of different teaching methods that consequently allow to customise learning.

The last question “*How can learning environments be redesigned in old schools with limited investments?*”, reflected the importance of highlighting that the fact that there are many old but functioning schools, and explored how to adapt them to new educational needs given that they cannot be knocked down.

Results

Hellerup Skole and Ørestad Gymnasium

The teachers of Ørestad pointed out that the innovative architecture of the school and the new technologies “nurtured pedagogy and allowed the flexible and structured use

of learning environments” [7]. At Hellerup and Ørestad there appeared to be on-going collaboration, facilitating new teaching strategies and collaborative lesson planning, resulting in the recognition of the students utilising different learning styles (Dunn & Dunn, 1978) [8]. Working closely together, the teachers of Hellerup shared their knowledge and skills available in a way that built a Peer Education modality among colleagues, as well as a mentality of sharing the materials produced, the teaching strategies used, and the potential to personalise both learning and teaching [9].

In both schools the open spaces meant teachers had to be very open minded and flexible because what one did was visible to everyone. It was an important aspect from a psychological point of view as it helped teachers support each other and share challenges. Teachers understood from the periodic tests and the results of the examinations that this organisation allowed students to learn more, better and with pleasure.

This developed a “bridge-culture” linking different levels (Sandrone, 2007), which was seen as a more sophisticated strategy than team teaching (where teachers meet in groups at predetermined times) (Bair & Woodward, 1964; Dean & Witherspoon, 1962). This bridge-culture also included structural and organisational components, and allowed teachers to overcome the fragmentation of disciplines and the lack of a unifying centre. According to students of both schools, the Cooperative Learning and Peer Education methods allowed rapid, personalised and informal learning, as theorised by Roger Cousinet (1952) [10].

To unpack this further, it should be noted the organisation of learning and teaching spaces can be found in pedagogical activisms theorised by John Dewey (1915), Maria Montessori (1921), Roger Cousinet (1952), Célestin Freinet (1946) and Loris Malaguzzi and Reggio Children (1998), and supported by new technologies [11]. Here, the students are closely monitored by teachers who stimulate their learning in different ways by trying to empower them in order to make them independent in their itinerary and aware of their own learning characteristics, leading to personal responsibility and a sense of meaning in their learning (Bonhoeffer, 1951). How this looks in practice is students being grouped by teachers, sometimes working in small groups, other times in large groups. This enhances socialising, learning to collaborate, recognising that young people learn quickly and efficiently when they work with a group of peers, and when they can take part in making decision on what goals they want to achieve and how (Görkiewicz, 2016). In terms of this translating to the physical environment, students are seen to be very good at interacting with the environment, adapting to spaces, using every corner, and making the school a place that feels like home (Volpicelli, 1964). In the school structures in this study, they appear to feel totally free to choose the place where to study and move and they think an open space “broadens the spaces of the mind” [12].

In both schools, students are not considered as a homogenous mass, but as unique and original individuals, which reflects the concept of the Danish pedagogue Nicolai F. S. Grundtvig (De Natale, 1980). In order to teach in these schools, it is imperative to believe in the pedagogical project and work closely with colleagues at multiple levels since this sparks a strong synergy among them. Consequently, design flexibility that is aligned to these pedagogic principles allows students to leave the traditional

“isolation and control school, governed by authoritarian transmitters of closed and undisclosed knowledge” (Iori, 1996, p. 120). There is a flow of informal exchange between teachers and students, creating a collaborative atmosphere and educational community.

Enrico Fermi Institute and IC3 Piersanti Mattarella

In Italy the new organisation of learning spaces by switching to “Readable Subject Classrooms” and TEAL classrooms obliged teachers to revise their teaching methods. Traditional frontal teaching was reduced, and new methodologies introduced such as Cooperative Learning, Debate and EAS (Episodi di Apprendimento Situato—Located Learning Episodes) (Rivoltella, 2016) [13]. The use of new technologies allowed teachers to bring the “school to children’s rooms” [14].

The teachers of both schools appreciated the opportunity to share the classroom with their colleagues because they had their material available without having to move continuously from one classroom to another [15]. Again, this modality created the bridge-culture referred to earlier in this chapter. The drawback was the lack of informal exchange with the colleagues of the same class. Teachers helped by students personalised their classrooms and it allowed them to better enhance the creativity of the students and to keep the rooms beautiful and tidy (Fianchini, 2017).

Teachers agreed, however, that new teaching methods increased the students’ attention and motivation, and enhanced positive learning, learning behaviours and discipline management [16].

In the interviews students appeared thrilled because they could move from one classroom to another at the change of a lesson, and allowed for a break of “decompression” and an increase in relational exchange and socialisation with students of other courses [17]. The classrooms became “readable” because the students could personalise them with their teachers. Students claimed they were enthusiastic to go to school because they found it to be a comfortable, familiar environments where they learned without anxiety. It was, they claimed, an environment that made them feel comfortable, being “the fuel of motivation” [18].

The same was found at IC3 Mattarella school. The possibility of using flexible spaces allowed changes to the physical classroom setting and the capacity to propose different organisational solutions and teaching methods [19]. Thus, space became “...a pure form of intuition that anticipates every representation of sensibly given objects” (Heidegger, 1996, p. 29). In this school at the time of the research every teacher had their own classroom, but in upcoming years, the intention was the teachers had to share their classrooms, due to increasing students number from 180 students to about 300 [20].

The student lockers were very important because they represented a place of meeting, exchange and socialisation [21], as well as a symbolic space; a kind of nest that was immediately associated with the image of the house (Bachelard, 1957). These

were seen as an intimate space and also a “vital space” (Lewin, 1936), where, behind the objective vision, there was the vision “of the imaginary” (Moles & Rohmer, 1982).

Discussion

Looking closely at how the organisation of learning spaces interacts with the didactics (pedagogy) of teaching, it is possible to identify the pedagogical activism of John Dewey, Maria Montessori, Roger Cousinet, Célestin Freinet and Reggio Children. The structure of an environment in a rigid and disciplined way can be considered an artificial device which, acting on the student, “forces him to operate and behave in a certain way” (Bertagna 2010, p. 301). Changing learning environments requires a change in methodology to personalise teaching and learning, so a very important factor is how teachers think about their teaching role in the new learning spaces. Hattie and Zierer (2018) have defined ten mental frames or behaviours that teachers should adopt to maximise student success. In essence, the quality of professional action depends on critical reflection on professional practices, so as to constantly, consciously and critically modify one’s actions, and innovative learning environments help the teacher to reflect on their teaching practices (Schön, 1983).

Data collected for this project in selected progressive schools where a symbiosis exists between special design and teaching practices, puts the teachers as proponents of a new vision of “doing schools”. Here, teaching and learning are increasingly placed within a dimension of collective practice that builds together shared social meanings (Zuccoli, 2017) to make the school a real third educator. Therefore, the professionalism of the teacher and his or her actions between theory and practice are in a constant dialectic relationship: the teachers’ reflection on her or his actions can help them become aware of their tacit professional practice so as to place them in a critical analysis of their actions and to intervene promptly when difficulties arise. The idea of reflective practice “leads to new conceptions of the relationship between teacher and pupil and would certainly lead to an improvement in professional practice” (Schön, 1983, p. 336).

Artificial, natural, biological, family or community devices can be considered as a set of practices able to capture, orient, determine, intercept, model, control and ensure not only gestures and behaviours, but also opinions, beliefs, discourses, and meanings expressed by “human beings”. Each device acts and plays a decisive role, albeit with different modes and forces depending on the situation, in subjecting the people who are born to the already existing and established natural, technical, artificial, family and community rules and balances of such institutions. However, it is possible the teacher’s role is emptied of emotional contents because it ends up becoming “teaching without saying anything about oneself, complaining of a too superficial and passive listening on the part of the students who retire at the margins of the formative process” (Gamelli, 2001, p. 110).

The school spaces are not only the places of “teaching practice”, but are “places of life” in which one establishes “educational relationship” and “existential relationship” (Gennari, 1988; Iori, 1996). For these reasons it is very important that the school spaces are beautiful, where students and teachers feel well, in serenity and well-being (Iavarone, 2008; Avalle, 2009). In fact, neuroscience research tells us that space and objects presented in an environment are mapped by our body that physiologically and emotionally empathises with the surrounding environment through mirror neurons and then coded through the sense-motor, emotional and hedonic circuits and only then we have the positive or negative awareness of our experience (Gallese, 2013; Gallese & Gattara, 2015; Mallgrave 2013).

All these experiences remain in our emotional memories through emotional short circuits. A mechanism of connection between cognitive and emotional aspects is regulated by the amygdala. If, while learning, we have positive emotions, we will easily and with pleasure remember what we have learned, but if learning is linked to painful memories, the suffering linked to that negative situation will emerge in the memory because, with this information negative emotions are also coded (Goleman, 1995).

The amygdala manages the basic emotions and it is the archive of emotional memory, in situations of anxiety and fear stimulates the escape, even from memory. An educational caress and a feeling of well-being command the production of neurotransmitters in the hypothalamus linked to the oxytocin hormone that regulates anxiety and produces feelings of well-being. For this reason, it is necessary to associate positive feelings when learning because only in this way the memory will be pleasant (Ledoux, 1996; Lucangeli, 2017).

In learning environments that are pedagogically focused but also designed to be beautiful and with flexible furnishings that meet and educational needs of students, everyone feels recognised, supported, appreciated and valued. Students feel good and this improves study and school performance (Barret et al., 2015; Horne-Martin, 2002, 2006). In a new organisation of learning environments with an idea of school as a third teacher, the classroom can be thought of as a backstage of theatre and the teacher as an educational director who can propose a new didactic model with a plurality of proposals that can stimulate learning personal itineraries (Gamelli, 2001; Rivoltella, 2012).

According to Rivoltella, “teaching is technology of performance” (2012, p. 159) and there are two instances that link the text to teaching. The first concerns the text intended as a lesson or laboratory activities that must be programmed according to a precise scheme, as a theatrical or cinematographic script; the second is related to the text intended as a “textbook” or other medium that serves the teacher in his own didactic action.

In these schools the perspective has been inverted compared to the past in which the teacher was at the centre of the teaching-learning process; it is now necessary to focus on the student and on her or his educational dimension, through appropriate educational choices that are in relation to his or her real educational needs.

The design of an educational environment represents the process of attributing meaning to environments, defined as “semantotopic” (Franceschini & Piaggese, 2000,

p. 55). In order to design a physical space, that is, a “topical text”, the designers and the beneficiaries of the space must share the same meaning as well as refer to semantics. The environments offer “affordances” (Gibson, 1979, p. 205), which is a kind of “invitation” through the existing objects that guide actions. The environmental organisation acts in an invisible way through the “invisible” (Bernstein, 1979, pp. 192–224) or “latent pedagogy” (Bondioli, 2008, p. 14) which is passively accepted and experienced by teachers.

This chapter uses data from four exquisite schools to emphasise fundamental concepts that guided the design and/or reorganisation of the spaces: readability, flexibility, semantotopics, affordance and invisible or latent pedagogy. The readability of the spaces refers to the possibility of categorising and recognising them immediately through certain elements that allow their orientation (Kaplan, 1987; Lynch, 1960). There must be an “intrinsic flexibility or actual variety” that is what architects call “built-in-flexibility” (De Bartolomeis, 1983, pp. 188–94). And these qualities must be measurable (Imms, Cleveland, & Fisher, 2016).

Conclusion

Célestine Freinet claims that, if modernisation is made possible in the classrooms and learning spaces, it is also possible to modernise teaching (Freinet, 1946). In the schools presented in this chapter, learning environments and new technologies are seen to help teachers to modify teaching. But not all teachers take advantage of their potential. The temporal quality of change may be the key—time may allow some teachers to use these new environments in positive ways and move away from the certainty of established practices (Imms, 2016b). This step is complex because it does not represent an adjustment of methodologies, but a total transformation that challenges every aspect of the system: from identifying the roles that are played within the school (Osborne, 2016), to the duration of the lessons that would be less fractionated. Time and space go hand in many circumstances and they are assimilated by expressions such as “measure”, “distance”, “interval” that are applied to both (Minkowski, 1968); for this reason, changing the spaces means it also becomes almost necessary to modify and merge the way we address timetabling in schools.

The innovative structure of learning environments with the high-tech classroom and “variable geometry” settings (Ferri, 2011) has allowed the introduction of new teaching methodologies and learning personalisation. In the four schools presented in this chapter, the students agreed that teachers were not always expert in technologies, nor in arbitrating types of learning.

It becomes important to start from the space, its organisation and new technologies in order to propose a new teaching model where at the centre there is no longer the teacher but the learner, as the conscious protagonist of his own learning. Teacher adaptation to new learning environments requires changing teaching practices because the knowledge must be constructed by the learner (Jonassen & Land, 2012). Success will be more likely if headteachers build change processes, adopt a leadership style

appropriate to the context and engage in participatory planning, problem solving and promoting the creation in the teachers a sense of utility (Osborne, 2016).

In this study some categories have been identified in a way that they describe pedagogical facts, opinions and behaviours representing the meaning they expressed. Although the results of this study cannot be generalised, they represent a useful point of specific analysis of pedagogical architecture and heuristic value for any subsequent investigation. “Pedarchitecture” seems to be the right word to highlight the link between pedagogy and the architecture of learning spaces.

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Endnotes

- [1] Hellerup—observation protocol.
- [2] Hellerup—pedagogical project: <https://hellerupskole.aula.dk/> last visit 10.04.20.
- [3] Ørestad—rector’s protocol interview and information on: <https://www.oerestadgym.dk/in-english/about-oerestad-gymnasium/> and <https://www.youtube.com/watch?v=dEla4ClzmI> last visit 10.04.20.
- [4, 5] Ørestad—rector’s protocol interview and pedagogical project: <https://www.oerestadgym.dk/in-english/about-oerestad-gymnasium/> last visit 10.04.20.
- [6] Fermi—headteacher’s protocol interview.
- [7] Ørestad—teachers’ and rector’s protocol interviews and information on: <https://www.oerestadgym.dk/in-english/out-teaching/> last visit 10.04.20.
- [8] Hellerup and Ørestad—teachers’ protocol interviews.
- [9] Hellerup—observation protocol.
- [10] Hellerup and Ørestad—students’ protocol interviews.
- [11] Hellerup and Ørestad—observation protocols.
- [12] Ørestad—students’ protocol interview.
- [13] Fermi—observation protocol.
- [14] Fermi—headteacher’s protocol interview.
- [15, 16] Fermi and Mattarella—teachers’ protocol interviews.
- [17, 18] Fermi students’ answers to protocol interview.
- [19] Mattarella—observation protocol.
- [20] Mattarella—teachers’ protocol interview.
- [21] Mattarella students’ protocol interview.

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