An experiential analysis of educational interaction for the determination of space conditions of the classroom in Uruguay

Análisis vivencial de la interacción educativa para la determinación de condiciones espaciales de aula en Uruguay

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Abstract

Educational architecture is crucial to support quality education. However, its current design presents a formal uniformity based on constructive conditions 200 years old with few references to social changes and functional characteristics. This is evident in the classroom space where its shape and dimension are considered to be unquestioned by those responsible for its design and for those who use it. This paper presents a methodology of experiential analysis applied to the classroom environment to diagnose pupils -teacher relationship to determine architectural characteristics that can contribute to a better interaction. In Uruguayan classrooms photographic information obtained in situ, video-photographic records and interviews with teachers are analyzed. The findings suggest that this methodological corpus can quantify perceptual variations related to proportion and spatial distribution. The need to integrate perceptual records to architectural design to ensure the quality of relationships is also emphasized.

Keywords: schools, classroom; interaction pupil-teacher; experiential analysis; architectural design.

Resumen

La arquitectura educacional es un soporte crucial para lograr educación de calidad. Sin embargo, su diseño actual presenta una uniformidad formal basada en condiciones constructivas de hace un siglo con escasas referencias a cambios sociales y particularidades funcionales. Esto es notorio en el espacio de aula donde forma y dimensión son parámetros incuestionables por parte de los responsables de su diseño como por aquellos que lo usan. Este artículo presenta una metodología de análisis vivencial aplicada al aula escolar para diagnosticar la relación alumno - maestro que permita determinar características arquitectónicas que contribuyan a una mejor interacción. En aulas uruguayas se analizan: información fotográfica obtenida in situ, registros video-fotográficos, y entrevistas con maestras. Las conclusiones señalan que este corpus metodológico permite cuantificar variaciones perceptivas según relaciones de proporción y distribución espacial. Se enfatiza también la necesidad de integrar registros perceptivos al diseño arquitectónico para asegurar la calidad de las relaciones.

Palabras clave: Escuelas, aula escolar, interacción alumno - maestro, diseño arquitectónico, análisis vivencial.

Introduction

The educational infrastructure is considered crucial to achieving quality education (Horne Martin, 2004; Higgins et al., 2005; Woolner, 2010; Darmody and Smyth, 2012). However, the design of current facilities mostly present a formal uniformity based on constructive conditions dating back more than a century with few references to social changes, functional peculiarities and / or cultures of the place and the moment (Burgos, 2001; Gislason, 2007; Leiringer and Cardellino, 2011; Woolner, 2015). This is particularly notable in the classroom (Scott-Webber et al., 2014; Barrett et al., 2015). While there are studies on the transformation of classroom spaces in general (Dussel and Carusso, 1999; Cabanellas and Eslava, 2005), from a pedagogical (Brailovsky, 2013) and an architectural point of view (Grementieri and Shmidt, 2010), as well as in Uruguay in particular (Barran, 2008), the classroom traditionally conceived has remained practically unaltered in its proportion and spatial distribution. The classroom is usually taken as unquestionable by those responsible of the design of educational facilities and unchangeable by those who use it (Cardellino et al., 2017).

Rectangular shaped classrooms, with desks and chairs arranged in straight rows and with wide windows, was legitimate and necessary to the beginnings of the 20th century as it satisfied the basic needs of the moment. Narrow and long classrooms, for example, arise from the need to provide lighting to the entire space, prior to the appearance of electric lighting. The front of the class remained, then, determined by the location of the windows, since the students sat in such a way that the light coming from the window would enter over their left shoulder (Sommer, 2007). Despite changes and developments in lighting, acoustic and structural aspects, school architecture continues to be composed of 'boxes' containing classrooms, characterized by their rectangular shape and by the traditional arrangement of furniture where students sit in rows with the teacher at the front of the class as the main source of information next to the blackboard (Lim et al., 2012). While there are examples trying to break with rigid patterns and structures (for example: Burgos, 2001; Barran, 2008; Hertzberger, 2008) and although the first researchers in education invariably promoted learning based on an immersion in the world or society and not just in the classroom (for example: Rousseau, Pestalozzi, Fröebel and Steiner), the schools considered "experimental" turn out to be the exception rather than the norm.

Recently, new means of recording and strategies of experiential perceptual analysis are available showing contributions in anthropology and urban studies that, applied to small-scale architecture, are useful to diagnose the current performance of school spaces and identify design conditions that contribute to its better use in the future. In this sense, the application of these media offers provide opportunities to obtain a new perspective on the space / user relationship and space.

This article presents a methodology of experiential analysis of educational interaction to determine architectural conditions of the classroom. The starting point is the conceptualization of the classroom as a formal container where educational interaction occurs between teacher and students and where the teaching and learning phenomenon is defined as the process of direct, face-to-face communication between teacher and students. According to communication theories, for an optimal reception of a message it must reach the receiver with no noise to distort it along the way (Davis, 1978). This interaction takes place in a given space, the classroom, during periods defined by their own cultural traditions and in mass institutional organizations. The study is based on a study of cases of traditional classrooms in Uruguay where special attention is paid to the relationship between educational interactions teacher – student and the spatial conditions of the classrooms. It is concluded that there are spatial aspects of classroom proportion and spatial arrangement of the furniture affecting perceptual registers of the students.

This way of researching derives from the scientific / philosophical phenomenology movement officially arising with the German philosopher Edmund Husserl (1859 - 1938) who advocated for studies without previous assumptions (prejudices or hypothesis) of the phenomena appealing to the pure experience or perception, that well practiced brings us closer to the essence of observed objects. Yet it is Goethe who points out that phenomenology does not imply the separation of the observer from the phenomenon, but rather seeks an intimate encounter with the phenomenon through the educable senses of human perception (Seamon and Zajonc, 1998). Hence, Goethe's emphasis is on the permanence or fidelity of the observer with the experience of the phenomenon during the course of the study. This is a crucial point of contrast to Husserl's phenomenological style where, although the researcher begins with the experience of the phenomenon, it then goes back and brain examines through reflection and other tools of the intellect (Varela et al., 2009).

For Goethean phenomenology, the theory arises from the experience itself, from the contemplative state of the object where the key to understanding the world depends on the co-presence and co-dependency between object and subject (del Solar, 1993). In this sense, several authors argue that Goethe's phenomenology has not yet been surpassed (Steiner, 1989, 2000, 2008; Seamon and Zajonc, 1998; Zajonc, 1994; Amrine et al., 1987; Amrine, 1995).

The central focus of phenomenology in architectural work has to do with the way in which people exist in relation to their world. Heidegger (1962) argues that the relationship between people and their world is indivisible since the person cannot exist apart from their world, but both are closely related. Stewart and Mickunas (1990) consider them as an indissoluble unit and Heidegger (1962) as being-in-the-world. In this way, it is not possible to dissociate the person from the world, and vice versa, since both always exist together and, therefore, can only be interpreted in terms of a holistic relationship (Seamon, 1990; 2000). So, one of the phenomenological challenges is the description of this intimate person-world relationship in a way that legitimately escapes any subject-object dichotomy (Seamon, 2000).

This said, the line of research focused on the study of human behaviour has remained, in a certain way, in a state of methodological underdevelopment. Its instrumentalization to date has been sparse and scattered. One of the reasons why it has been left behind is that, in general, authors have referred to the theory without suggesting, or testing, a possible methodology for its analysis. This methodological underdevelopment has repercussions when designing architectural complexes since the consideration of experiential aspects are not acknowledged (Helio Piñon, 2006; Muñoz Cosme, 2008; Corona Martínez, 2009). Architectural designs tend to be based on pre-established architectural programs and experiential "assumptions" - that is, personal memory of activities.

From Hall's seminal studies (1969) concerning the impact that space has on human behaviour, it is known that man-made space directly influences their behaviour as well as the human relationships that develop within it (Hall, 1969). This, in turn, has an impact on the way the surrounding space is organized. Naturally, the best way to test a space is to personally experience the spatial relationship and scale of the place. Once personal observations begin to be measured, collected, and systematized, concepts such as human scale, senses, and needs take on a more concrete meaning. These concepts are no longer incorporated as an idea after the end of the project but are incorporated naturally from the beginning of the design for the 'people' (Lawson, 2001; Gehl and Svarre, 2013).

Teachers and students spend most of their day in the classroom where they maintain a formal educational relation. In this sense, the classroom is considered as a social space for participation and interaction within the school environment (Fragoso Franco, 1999). This provides the classroom with a unique status among spaces for human use, considered as one of the most important physical structures in society. The physical environment of the classroom can stimulate or inhibit the type of interaction desired, and therefore learning (García Ponce, 2000). For example, the spatial distribution of students determines their greater or lesser participation, which in turn depends on the size of the classroom and whether or not they are located in the teacher's visual field. The ability to "make eye contact" (look someone in the eye) is, at least in Western culture, the key to establishing communication in a group, and is particularly important to the teacher.

The study of the classroom as a physically structured setting for interaction has been limited. Indeed, Marx and colleagues (2000) state that among the physical aspects of the classroom that need consideration are those that dictate the relative position of students in relation to the teacher. Studies on the distribution of furniture in this space tend to agree that the distance between the teacher and the students' influences the quality of interaction and communication (Holliman and Anderson, 1986; Gump, 1987). Several studies argue that educational interaction is strongly related to the position of the student in a traditional row distribution (Marx et al., 2000). Research of the traditional classroom with students sitting in rows facing the teacher have tended to indicate that those students sitting at the front and centre of the class communicate more with the teacher. In this sense, MacPherson (1984) analyses the traditional classroom environment and points out that the perception that students have about the advantages and disadvantages of being located at the front of the classroom has to do with proximity to the teacher and the blackboard as educational agents. Likewise, the

students highlight the visibility of the blackboard, the audibility of the teacher and the opportunity for one-to-one interaction as notable aspects of being located in the front row. Sommer (2007) states that students located in the front rows and in the centre of the classroom have greater participation than those seated on the sides. Lim and colleagues (2012) point out to the existence of spaces in the classroom that acquire specific meaning depending on the position and distance of this area in relation to the student and the teacher. In their work they investigate the different types of spaces in the classroom and the affective meaning associated with them.

It is from these research studies that this study finds its starting point. It is argued, therefore, that the neglect of the student's perspective implies that parts of the logic that structures the spatial distribution of the classroom are ignored or neglected. In fact, despite numerous studies, few researchers put the architectural dimension of the classroom under the microscope to determine the interaction that exists between them and the sources of information.

Methodological approach

The methodological strategy that is proposed is of a phenomenological nature since the architectural problem does not cover only what is built but also the individuals it hosts. In fact, it is the individual-work relationship that allows to speak, in contemporary terms, of an architectural phenomenon. In this sense, the unilateral notion of 'making' architecture is questioned since individuals play a fundamental role in the space-user dialectic.

Accepting that any type of recording of an experience is a reduction of it, the proposed methodological strategy basically derives from (1) visual studies (2) the distances derived from proxemia and (3) video-photographic

information obtained in situ, which are obtained from the point of view of the student as a user of the classroom space.

Visual relation

The visual aspect derived from an experiential nature can be described as the effective visual field, photographically abstracted, that is obtained from a certain location in space. These visual aspect captures, in a tangible and effective way, what is seen of the space in an instant from a specific location. That is, you want to see what the student is seeing. For this study, the visual of the student is obtained through the photographic capture that he makes from his spatial location in the direction of the blackboard. This photographic image provides concrete data on the elements that make up the participant's visual field from which the percentages of teacher, blackboard and students are extracted (see figure 1).

Proxemic relation

Based on the theory of proxemia, the concept of interaction spheres arises from communication distances that Hall (1969) defines as: intimate, personal, social and public. Each of these distances, generated when two or more people interact, has characteristics referring to the type of communication that takes place. For the purposes of this study, these communicational spheres serve to estimate the type of interaction that each student maintains with the teacher within the classroom, always considering that the student's location in the classroom is constant.

To carry out the data collection, the spheres - intimate, personal, social and public - are superimposed on the architectural plan of the classroom according to the spatial

Figure 1. Photographic record of a student and the distinction of percentages of teacher, blackboard and students (own elaboration).
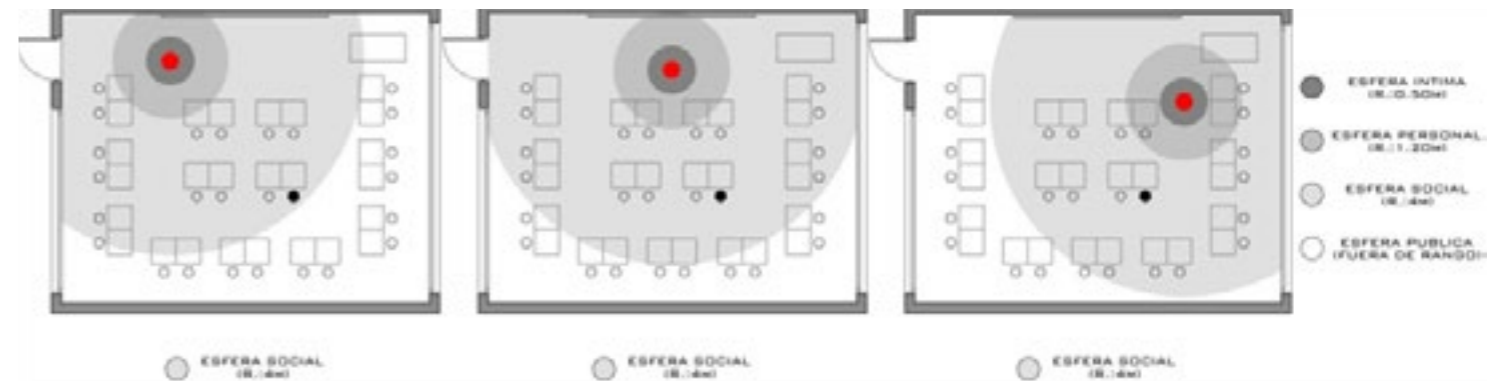

Figure 2. Classroom plan with proxemic distances corresponding to a student (own elaboration).

location of the teacher (figure 2). For the purposes of this research, three different records are considered that are linked with the most common spatial positions of the teacher. In this way, the spheres are drawn from the teacher like concentric arcs and graphically capturing the sphere in which the student is located. The following representative example shows the student as a black dot and the teacher with a red one. For each instance of the teacher's location, the student is located in a sphere that is determined by the distance that separates it from teacher.

Kinetic relation

Movement log provides data on the scrolling patterns of people. Tracing, then, involves drawing lines on a plan according to the movement of people during a specified period of time. For the kinetic record within the classroom, firstly, the class is filmed and the camera is placed in a specific place in the classroom from where it can capture the most activity. Filming is done in order to record the movements made by the students and the teacher inside the classroom for an hour of class. From the video the displacements of each of the students are recorded and drawn as lines on the architectural floor plan of the classroom (figure 3).

Finally, interviews were conducted with the teachers who reported on their perception of what happens in the classroom space. They were carried out with three teachers who used the traditional teaching method. The case studies are four traditional classrooms located in two schools in Uruguay. The classrooms are for 4th grade students and host, respectively, 28 students with 1 teacher in charge. Its shape is rectangular and with a traditional arrangement of students (figure 4).
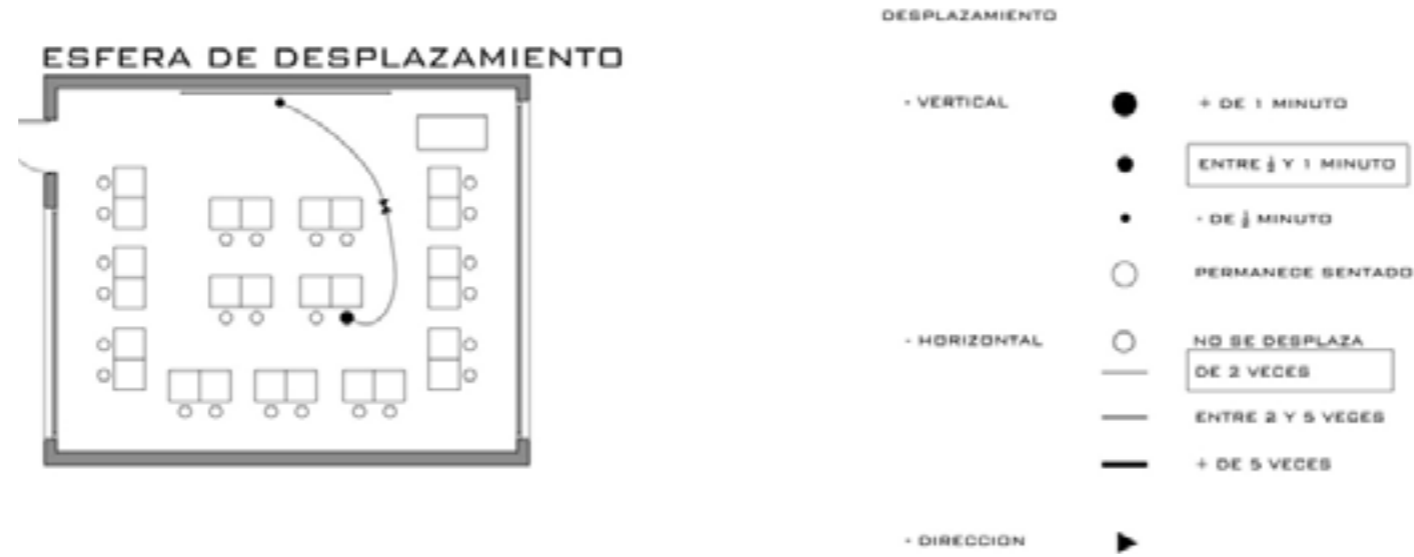

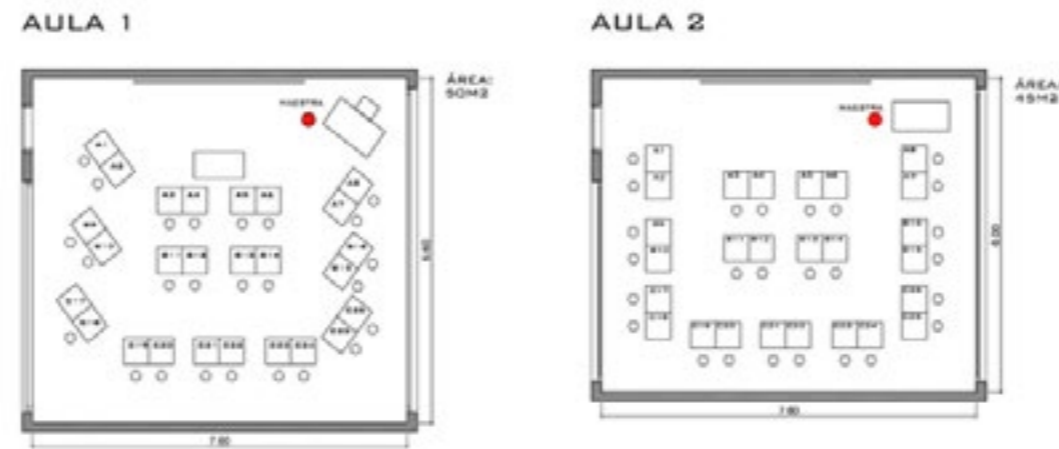**Figure 3.** Record of the kinetic relationship of a student (own elaboration).

Figure 4. Area, proportion and spatial arrangement of the classrooms of the case studies.

Case study analysis

From an experiential analysis of these case studies, perceptual variations of interaction between student and teacher were identified and quantified according to proportional relationships and spatial arrangement.

Classroom proportion

Variations in classroom proportion allow the increase, or decrease, of the number of students in optimal visual relation. It is considered as 'optimal' relation when the student can interact with the information source in a fluid way and without major interferences.

Classrooms 1 and 2 have a proportion tending to the square shape (with an approximate proportion of 0.9) where the maximum distance between the blackboard and the back wall is 6 meters. This makes the maximum of rows restricted and determined by the proportions of the space. It implies, in turn, that there is no possibility of a distance greater than 6 meters between the teacher and the student sitting in the back row. On the contrary, Classrooms 3 and 4 are rectangular in shape, where the classroom depth corresponds to the longest side (8 meters). This makes the distance between the teacher and the students seated at the back of the classroom higher and, therefore, the number of rows can be increased to five.

Classrooms 1 and 2, in this respect, are 25% shallower compared to classrooms 3 and 4. This implies that in the first two the spatial distribution is in 3 rows, that is, there are no students in these classes who have more than 2 students in front. For the cases of classroom 3 and 4, on the contrary, the distribution space is constituted by 5 rows, which are distributed in depth, an aspect that implies that

there are students who have up to 3 or 4 students seating in front of them.

Regarding the depth of the classroom, those students in the first row have the higher teacher and blackboard percentages compared to the students located in the back of the classroom. This percentage decreases considerably in those students located in the later rows, where for those students in row 2 its visual is reduced by 50% and in row 3 the reduction is 75%. This abrupt decrease in the percentages of the students in row 3 corresponds to a distance of 5 meters from the center of information. This suggests that classroom depth is a key factor since a classroom considered deep "invites" to have a greater number of rows and that, therefore, the proportions of the space exert a direct control in this sense.

Likewise, it follows from the proxemic analysis that the number of students at a recommendable distance (within the social sphere proxemics) are in classrooms 1 and 2. In classrooms 3 and 4 there are 18 students in each classroom who remain in the public sphere with respect to the teacher. The number of students within this sphere in Classrooms 1 and 2 drop to the half that correlates with the results of the visual relation and the interviews and indicates a direct link with depth of classroom space.

The results of the analysis allow to argue that the classroom width ratio, in turn, has an influence on the number of students in optimal visual relation. In this sense, it is found that those students located in the areas to the side of the classroom show low percentages of teacher and blackboard in their visual field even if they are located in the front areas. The students' capture from this location in the classroom shows that those located at the sides of the classroom have very lateral visuals of the teacher and the blackboard. This aspect indicates that they are out of the class focus regarding the teacher and suggest a relation between perception and perspective of the students.

The proportion of the classroom, in turn, has an impact in the number of students the classroom space can accommodate since having 28 students inside the classroom makes that some are in deteriorated conditions with respect to the interaction with the teacher. The results obtained suggest that the number of students should not exceed 24. Likewise, this aspect finds its correlation in the interviews with the teachers who indicate awareness on the problem of the high number of students in the classroom. Specifically, one of the teachers point out that:

´When they miss class you realize, the space is enlarged … it is many hours and many children, many people inside a class´ (Teacher, classroom C).

From the analysis of the data that arises from the records and from the interviews with the teachers, it can be intuited that to equalize the conditions of educational interaction, the proportions of the space must be limited not only in the depth ratio but also in the width of the classroom space.

Spatial arrangement of students

The number of lines in the classroom impacts the number of students in optimal visual relation with the teacher and the blackboard. With the provision space of classrooms 1 and 2 a greater amount students interact optimally with the teacher through the arrangement in three rows. Indeed, during the interviews the teachers say that three rows is the most recommended for this type of classroom since:

'Those behind were not far (with the new arrangement). It seems to me that even three rows were perfect. In other words, I saw their faces […] when you already have 4 or 5 rows of students with 3, 4 or 5 children ahead, you don't see them' (Teacher, classroom C).

In turn, and taking into account the panoptic ideology characteristic of traditional education (Focault, 2002),

teachers indicate the need to be in control of what happens to students in the classroom. They point out that ´... it is actually better to have them ´ closer, closer to hand´ and ´my eyes reach to see everyone equally´ (Teacher, classroom C). They also highlight that ´... actually it is better have them 'closer, closer to hand' and 'my eyes can see everyone the same '(Teacher, classroom C).

Conclusions

There are many physical-social conditions with various connotations that infer the student-teacher interaction within the classroom space. In this study, spatial aspects were extracted that are considered to have been relatively neglected and that allow for a better understanding of the physical space of the classroom, without forgetting the social aspect since both can generate an optimal environment for interaction.

The methodology applied in the case studies is based, mainly, on the analysis from the student's point of view the interaction –with centers of information (teacher and blackboard) in the space. This phenomenological analysis allows for the characterization and quantification of architectural features of the classroom that have not been previously analyzed from a experiential point of view and therefore will be useful for informing future designs.

The results show that from a distance of 5 meters from the teacher, the accumulated deterioration in the interaction of the students falls sharply and is higher than 50% compared to the rest; aspect that becomes more severe according to the longitudinal relation of the classroom. The interaction is then affected by the proportion of the classroom, from which it can be estimated that the recommended situation would tend to have a similar proportion of width and depth of space.

Beyond the analytical potential of experiential analysis, it is even more important to promote informed design based evidence for new configurations space. It is essential to highlight, then, that the possibility of transforming the concept of experiential analysis in a design tool implies a change in the act of designing. This suggested new method may help architects explore shapes, proportions and more complex spatial distributions providing security at the time to propose approximations to the problem in the different stages of the design project. Whatever the form, central to the aim of perceptual / experiential analysis is to optimize and balance the interaction between users during the use of the educational spaces, while opening new research lines, design and how to think about the architectural space.

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