PAPER REF # 8018
Proceedings: Eighth International Space Syntax Symposium
Edited by M. Greene, J. Reyes and A. Castro. Santiago de Chile: PUC, 2012.

THINKING CRITICALLY TOWARDS EXCELLENCE IN SCHOOL BUILDINGS USING SPACE SYNTAX AS A CATALYST FOR CHANGE

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KEYWORDS: *Architectural Design Problem Solving; Design Brief; Conceptual Matrix; Physical-Analogue Representations; Functional-Topology Scheme*

THEME: Building Morphology and Usage

Abstract

School building rehabilitation has been subject of considerable attention by the end of the 20th century. The purpose of this paper is to explore the input offered by a Space Syntax approach to manage the design brief in the scope of school building rehabilitation. The research question is focused on Space Syntax contribution to thinking critically on the fundamentals that are imbedded into the design brief in order to facilitate communication between designers and non-designers involved in a collaborative design process.

The Secondary School Modernization Program (SMP) being carried out in Portugal since 2007 is used as a case study. A collaborative design process was put into action, with direct communication between different parties: designers, school users group and programme managers. The lack of experience on architectural design problem solving and skills on design cognition among almost all of the school users group and the inexperience of designers and other construction professionals to work in close collaboration with non-designers, has posed further problems. Additional efforts towards the implementation of an effective communication tool during the briefing process were tested. The proposed system combines conceptual-verbal and physical-analogue representations, derived from Space Syntax framework, although the key-players were non-familiar with Space Syntax or even trained to use the methodology. The aim was to arrive at an understanding of principles and constraints that govern school spatial design and a critical evaluation of its functional implications.

The paper is organized in three parts. The first one reviews the key themes involving school building rehabilitation. It aims to increase understanding of the design process, the strategies that might contribute to accommodate the 21st century educational agenda and its organisational implications. The second part refers to the case study. It introduces the SMP rational, describes the strategies applied in the design briefing process, and discusses its main issues and the type of interaction and collaboration established among the principal actors during the decision-making process. Finally the potential of applying Space Syntax framework to communicate complex messages related to school design and support communication between designers and non-designers is assessed.

1. SCHOOL BUILDING REHABILITATION: A PARADIGM SHIFT

Developments in educational research place stress upon conventional school buildings and their design, suggesting that school environment in the 21st century will be radically different from that of the 20th century, requiring a paradigm shift (Gaffney *et al* 2008), thus creating pressure upon existing facilities built for a 'one size fits all' model. They advocate that learning spaces must be reconfigured to support changes in the societal context of education and to respond to different teaching and learning practices as well as to a more decentralized learning process, which is no more exclusively confined to the classroom space and time,

The programmatic complexity of the contemporary curriculum is reflected in the spatial organization of school premises. Expanded curriculum and programs that go beyond traditional school offerings (such as multi-aged interaction, team teaching, project areas, vocational training and community use) result in a growing need for flexible learning spaces, informal learning precincts and social areas. The diversity of collaborative, exploratory and experimental learning activities provided in contemporary curricula requires the presence of spaces and facilities to enable their implementation within and outside class time.

Accordingly, to comply with the formal *curriculum* is necessary to provide a set of learning spaces and equipment fit for purpose. Besides, the way in which the remaining school spaces are organised and managed can have a significant impact on learning opportunities, encouraging students and teachers to remain longer at school, actively participating in educational activities and contributing to foster a learning culture.

In particular, the increased use of digital technologies and the portability of technological devices have a clear impact on school daily life and student learning habits. Students are now permanently connected to a world-wide-web and able to choose where and when they study. Catering areas, such as cafeterias and dining halls, lobbies and circulation spaces, common rooms, stairwells and other outdoor areas are examples of spaces where learning can occur, with students and teachers working together, sharing ideas and experiences. Having the opportunity to work and access information anywhere, students' choice of locations is now increasingly guided by criteria linked to the attractiveness of spaces and not to a functional "label" that has been assigned to them.

Improving school buildings called for a rethinking of the existing spatial conditions and their adaptation so as to provide a better response centred on learning and the ways in which people learn. In many existing school facilities, the design approach adopted follows a "stationary" model type. Each space and group of spaces is designed to cope with its own specific functional requirements and technical features. No extra investments were made to facilitate functional or technical adaptability in the future, limiting the building life expectancy. The school layout is organized according to a formal teacher-centred learning model, where the classroom is the core unit of its spatial programming. Complementary learning spaces allowing other pedagogical practices and learning modes are absent and support spaces are almost reduced to the minimum indispensible. Such school buildings are highly resistant to fit today's educational needs, in particular to be reconfigured to meet larger size requirements for learning areas, such as science laboratories, computer and arts rooms, vocational workshops and libraries. On the contrary, when the design approach follows a more neutral non-specific layout type, school buildings can be easily adapted to changing requirements over time.

1.1. School building rehabilitation: towards a collaborative design process

School building rehabilitation is always the final result of an extended and complex decision-making process, which involves the conversion of educational goals and its organisational implications into the existent school building and managing constraints imposed by design guidance and master specifications: a complex and receptive design process that asks for non-conventional responses.

Design guidance and master specifications are usually prepared by government bodies responsible for funding the rehabilitation project and are often based on lessons learned from previous developments. By providing rules and communication procedures to be followed along the design process, they aim to guarantee the coherence of operation and facilitate the design process, ensuring the quality of schools' facilities, while controlling construction and operating costs, taking into account codes compliance and time criteria.

School design guidelines and rules-of-thumb are well researched and documented in the literature, such as the schedule of spaces and fittings, required relationships of spaces, the quality of space and construction as well as operating and life cycle cost considerations. On the contrary, the design process and in particular the design briefing stage in the scope of school building rehabilitation is still considered problematic. It is almost embedded in traditional paradigms which are not always sympathetic with a collaborative strategy that combines the school vision, technical documentation and ultimately the school's physical improvement.

The critical goal of the *design brief* is about setting out the needs for the project rather than fixing the form of the design or establishing specific built solutions. Hence, it should set a clear framework for the work of the design team, acting as a *matrix* to help the project delivery reach its destination by meeting client needs and aspirations. Apart from developing the client vision statement the *design brief* can be used later as the basis for Post-Occupancy Evaluation, allowing understanding of how well the project works once it is occupied and providing resources for future projects (CABE 2007).

Recent literature on design briefing suggests that developing an uptake of the social context of a project is an essential part of the design process (Blyth and Worthington 2010, Leaman, 2002, Kumlin, 1995). In the specific case of school rehabilitation this implies, what Hillier (1996) has defined as the (re)interpretation of the form-function relationship, in which 'function' relates to educational vision and attitudes as well as practical needs allied to school organizational issues. Consequently the school design brief must be regarded as a flexible group of decisions and actions towards the school's future, projected in a limited time deadline – medium to long term.

Understood as a mode of inquiry that includes problem finding and problem shaping, the design briefing process requires specific skills, knowledge and intuition to translate multidimensional problems into architectural design strategies. Blyth and Worthington (2010) show the importance for open and continuous externalization of ideas and information during the initial stage of the design brief as well as the integration of contributions from different players. Design briefing involves conceiving and envisaging the architectural design problem, defining and formulating the real problem and assessing the quality of the continuous formulation of the problem and its resolution. All of these actions require a comprehensive knowledge of different domains, experience in problem finding and also the ability to communicate functional ideas that can be later translated into guiding design principles and integrated into the architectural design solution.

School boards, staff, student and parents involvement in the briefing process as part of the design team is critical in determining the future use of school buildings. In addition to demonstrating how school users

regard their educational environment, it can also be useful to help understand how buildings and their use can be improved and made more effective. Nevertheless, these users are often not consciously aware of the distinctive ways in which they use space: their usual patterns of space use may only be brought into the realm of conscious thought when they are disrupted.

The lack of experience on architectural design problem solving and skills on design cognition among almost all of the school users group and the inexperience of designers and other construction professionals to work in close collaboration with non-designers, poses additional communication difficulties. It is well recognized that designers enter into communication with their own vocabulary and language, perceptions, attitudes and values, and their ability to communicate is restricted and often quite inaccessible to those not trained in design domains such as architecture or engineering. In general, non-designers do not have the appropriate training for grasping designers' terminology and semantics, understanding technical issues and translating it appropriately to support problem solving.

One of the problems faced by project managers is how to engage with the diversity of perspectives, experiences, knowledge and skills and utilize the relevant specialist knowledge that exists within the users group in order to make the best decisions. Research by Emmit and Gorse (2003) indicates that although good open debate, which allows opinions, proposals, challenges and disagreements and help ensure that all suggestions are properly considered, complexity and uncertainty could often result in a confusing message, leading to misrepresentation, distortion and hence conflict.

The challenge is on how to develop effective communication strategies during the design briefing stage to narrow the gap between designers and non-designers and achieve mutual understanding. The aim is to help them to process and interpret different types of information related to the architectural design problem and transform it into functional ideas, without taking into account the physical response.

In the literature on design cognition and problem solving, physical-analogue representations like bubble-diagrams can be defined as nonfigurative representations that entrenched the core of a problem solution conceptualization. It corresponds to "a scheme or system of ideas (…) to explain or account for a group of facts or phenomena" (Exchenique, 1972).

In the architecture domain physical-analogue representations are recognized as effective tools to communicate complex messages in a simple and informative manner and a powerful tool in problem solving since "they embed the core of a design solution encapsulating its generic characteristics and constraints and conveying the form of a possible solution" (Dogan, F. and Nersessian, N., 2002). At the same time they are not ambiguous in the way 'unformed drawing', like notes and sketches are, i.e. a free illustration of something spontaneously imagined or a suggestion for something to be researched further. On the contrary, the power of physical-analogue representations is based on the "directness of their correspondence to reality, the accuracy with which they simulate objects and the evaluation of important design performance issues they enable" (Akin, 2001). By defining a set of spatial concepts and relationships to support function and experience in buildings, physical-analogue representations give an idea about the complexity of space. As Akin (2007) argues they are not an inventive, but a critical tool for architectural design enquiry, since they help in the process of exploring ill-structured problems.

2. A CONTEXT TO NARROW THE GAP BETWEEN DESIGNERS AND NON-DESIGNERS

The implementation of a communication tool combining conceptual-verbal with physical-analogue representations was tested under the scope of a school building modernization programme (SMP) launched by the Portuguese government in 2007 (Heitor, 2008).

The communication tool was conceived to ensure the programme rationale was effectively understood by designers and non-designers, and applied in the school spatial reorganization process.

Although the key-players were non-familiar with Space Syntax or even trained to use the methodology, this tool incorporates Space Syntax model based theory. The intention was to arrive at an understanding of principles and constraints that should govern the reorganization of the school spatial layout and a critical evaluation of its functional implications by simulating part-whole relationships and exploring patterns of space use (movement and encounters). Sharing Peponis (2006) perspective "Space Syntax studies the principles we use when designing space. It can be introduced as an attempt to make explicit the spatial relationships that underlie our everyday experience of the designed environment and the way it functions culturally and socially".

As it is well recognized in the Space Syntax literature, the spatial layout embodies the social nature of the building and by placing its users according to their roles, status and the activities they perform, modulates their interaction as well as their experience of the space. In the specific case of school buildings, educational values are expressed in the way space is tailored to perform the educational - socio-informational - function. The spatial configuration has the potential to position students and teachers and regulate the ways in which knowledge is shared and learning takes place. The type of rules imposed on school users by space constitutes the key condition in how the socio-informational function may arise.

2.1 The school building modernization programme

Over the last years, it has been recognized by Portuguese educational authorities that a successful education policy depends not only on the existence of extensive school network coverage, but also on the quality of the school assets. The SMP aims to modernise public-secondary schools in order to improve and modernise the quality and usefulness of teaching and learning facilities to accommodate the 21st century educational agenda, as well as to restore the schools as centres of the community.

The school building stock under intervention is a quite heterogeneous group in terms of building types, architectural features and quality and, as such, they mirror the changes in education in Portugal over the 20th century (Heitor, T., 2010). They also express the developments in construction technology and the technical and financial resources available to meet the requirements of the respective moment. Some date from the end of the 19th century but the majority were built after 1970, reflecting the period of expansion in the school network and the extension of compulsory schooling. In terms of spatial configuration, they evolve from a centralized building type with a compact configuration and a closed courtyard, to linear buildings, following a U, H, L or E shape, based on central corridor building type. At the end of the 1960's, a standardisation strategy, based on a pavilion type was adopted and continuously applied up to end of the 1990's.

These schools can be grouped into three periods or phases on the basis of when they were built: (1) from late 19th century up to 1935; (2) from 1935 to 1968; (3) from 1968 onwards. The above classification makes

it possible to link the respective functional programmes, architectural features and building processes to a particular construction period and to support a typified characterisation of the current condition (diagnosis) and the interventions required. In general terms school facilities presented a picture of construction anomalies, physical deterioration and functional obsolescence affecting environmental comfort and conditions of use.

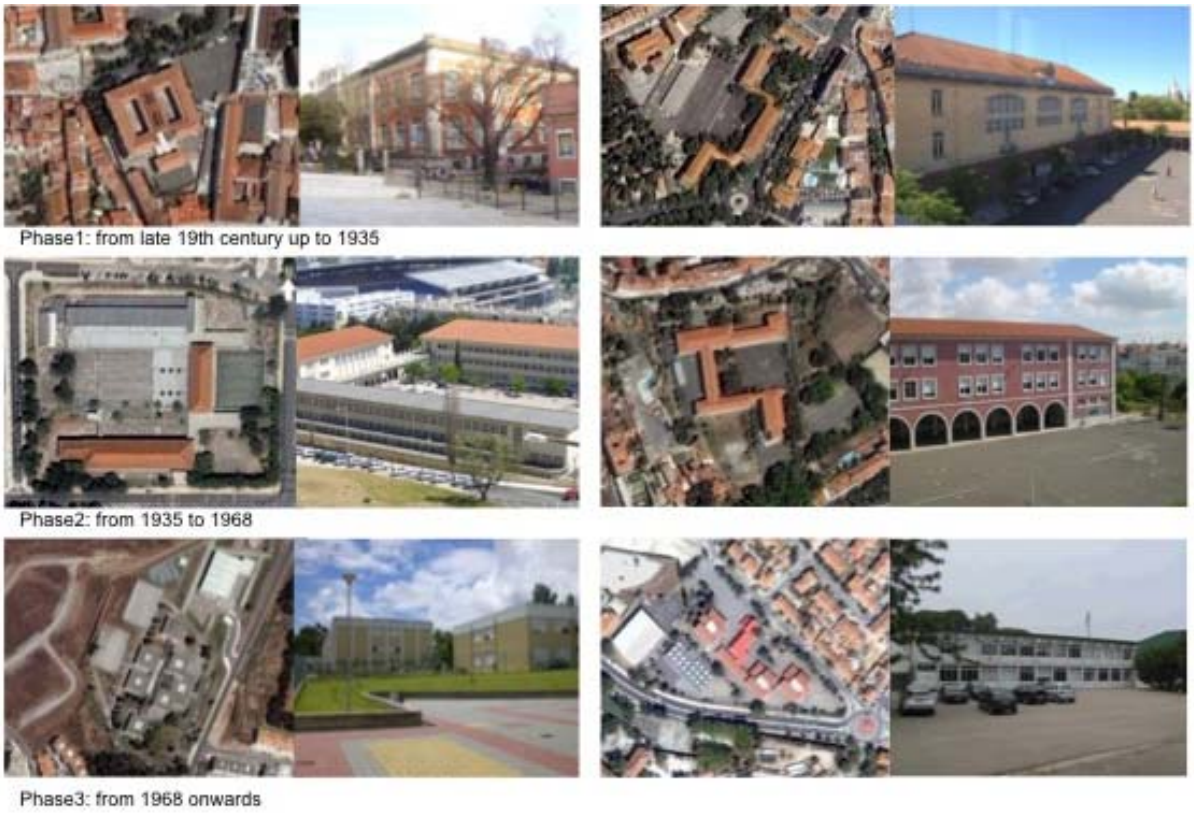


Fig.1: School building types

Given the SMP objectives, and the need for convergence of interests and solutions, the intervention methodology focused on the development of a continual collaborative process of interpretation and negotiation involving different key players – designers, school users and other stakeholders (e.g. local authorities, education authorities and local community) – with a variety of skills and expertise.

2.2. The design briefing process

The interaction between the school users and the design team begins as early as the programme development phase, thus providing exceptional conditions for involvement of schools in defining the solutions to be put in place. From there, the schools collaborate directly with the teams of designers until the Final Design is produced and approved by the school community.

The design brief was defined according to a two-stage process. The initial one was previously defined by the program rational and sets out the general principles that should be attended in the reorganization of all schools buildings. It works as a conceptual-verbal model, called SMP model, to be later *customized* by each design team, according to the school vision, needs and features. This stage begins with a general meeting with the school boards aiming at presenting the SMP rationale and the school reorganization model.

The second stage implies the use of physical-analogue representations to convey design information.

2.2.1. The conceptual-verbal representation

The key concept behind the SMP model reflects three basic principles: integration between the various functional sectors (learning and non-learning areas); guaranteed conditions for their integrated operation; and possibility of opening up some sectors for use by the wider community during and after school periods (Heitor, T., 2011).

The intention is therefore to connect the various functional areas of the school via a path - learning street - comprising a succession of indoor and outdoor spaces with different purposes, related to different formal and informal learning conditions.

The SMP model considers informal contacts between the different members of the educational community established outside classroom space and time, and the message received when walking around the school - the spatial experience - play a key role in the learning process. It is then the role of architecture to provide new spaces appropriate for and adaptable to different situations, capable of offering users a variety of possibilities for appropriation and exploration.

According to the SMP model the library occupies the "core" of the school, assuming a topological and a symbolic centrality. The message is that of a workspace providing a diversity of information sources which is open and comfortable and where everyone is welcome, allowing a number of uses: personal reading, multimedia access, group work. Its visibility fosters use by the community and disseminates a learning message by deconstructing images that might still exist due to associations between the old fashion school library and a cathedral of knowledge. Similar logic is applied in science laboratories, art studios, ICT rooms and workshops for vocational training, which share a high level of visual and physical accessibility. Transparency, works here as an integrator so that not only is the school community aware of its existence, but it may also take advantage of its presence, "see and participate in what goes on in there”, thus stimulating the students' attention and interest. Visibility also becomes important internally to control students within the different school functional areas and externally to encourage use by the community and spread the practice of learning.

2.2.2.The physical-analogue representation

The SMP model is translated into a physical-analogue representation, the so-called *conceptual matrix*, designed as a *functional-topology* scheme by applying the basic principles, which underlie the justified graph explanatory model.

The resulting representation displays a visual type of bubble-diagram, which illustrates the "depth" of the school layout and the relational patterns between functional sectors. Given the problem of clustering the school building functional sectors into logical groups, the "bubbles" can be useful in creating an understandable representation of these functions and their relationships. In complement, "depth" levels representation specifies the spatial distance between functional sectors, thus adding the nature of topological relations that should be present in the school layout. In short the matrix reflects the proper relationships and interconnections between the various elements of the program.

The *conceptual matrix* is based on two interrelated structural rings, with five levels of depth. The first level comprises the entrance and reception areas. The second includes all the school management areas. Further up the segregation level is the third which encompasses the sports areas, social educational support areas and the adult training centre. The fourth level acts as the "core" of the school, aggregating the informal learning spaces such as the library, bar/refectory, students lounge, multipurpose hall/auditorium and the staff spaces. Lastly, in the fifth and most segregated level are the formal learning spaces as well as the teacher areas,

As for the structural rings, a shallow one connects all the school spaces available to the community after school hours. A deeper one intertwines the teaching core with teachers' workspaces. These two rings intersect in the informal core space.

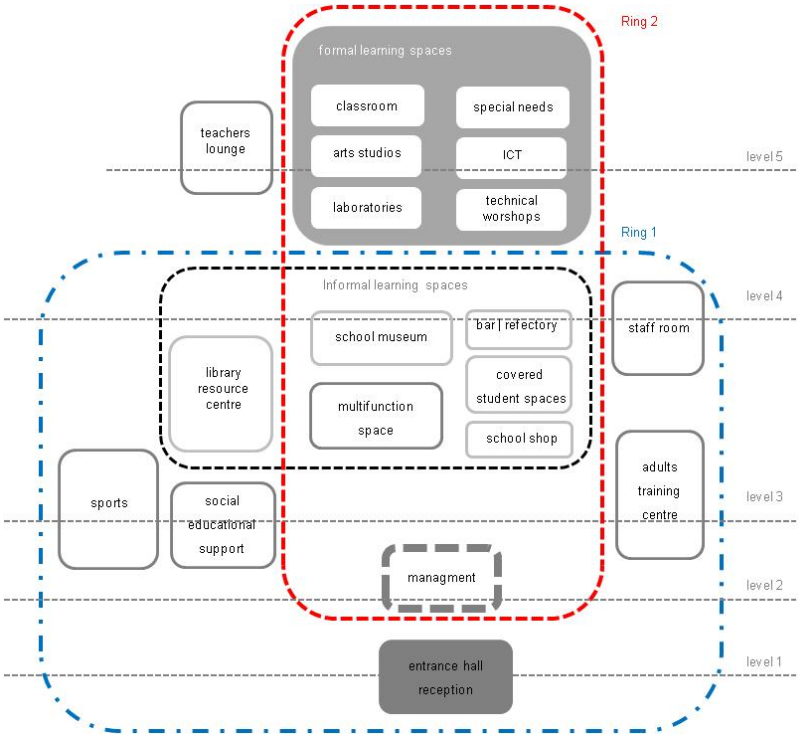


Figure 2 – SMP conceptual matrix

The functional hierarchy proposed by the *conceptual matrix* provides a new understanding of the distribution of key functional sectors within the school universe designated as *Anchor Spaces*. These spaces are informal and formal learning spaces as well as social areas such as the library, the refectory and bar, multipurpose / auditorium and the sports areas. They are organised in relation to the principal point of entry in the school, shifting into different levels of accessibility according to their needs for physical proximity to the exterior community.

Key spaces in the daily life of the school community such as formal learning spaces and teachers' areas assume a deeper level of segregation, protected from external contamination, whereas the social areas become more centrally accessible, preparing them for eventual external community use.

2.3 Customising the SMP model

The second stage of the briefing process incorporates each school educational vision. It corresponds to the *customisation* of the SPM model.

Firstly the school is asked to develop a strategic plan - the educational brief - prioritising the work needed to point out and tackle existing problems and to maximise the building's effectiveness over the coming years.

The "educational brief" is defined and prioritized independently of considerations for physical facilities. It sets out the school vision and educational orientation and the principles, values, goals and strategies that the school hopes to achieve. General ideas that should be attended in the reorganization of the school spatial layout to accommodate the school educational agenda and its organisational implications are also defined. Also provided are on-line forms to help schools make a comprehensible description of the existing facilities, identify their limitations, disadvantages and precedence in their needs. The structure of this on-line document is intended to help the school to be explicit and precise about the relationships between facilities, organizational conditions and requirements for the success of the rehabilitation project.

Evidence provided by school users through interviews and walkthroughs, together with technical surveys to assess the facilities' physical and environmental condition and suitability, complement this information.

The information from the "educational brief" is used to develop the concept design and the schedule of accommodation. The project manager with the school and the architects' team then holds meetings so that they can begin to develop an understanding of the needs of the school for which they will be developing the design brief. Design solutions are later presented and discussed with the school community.

The following example shows the intervention into a school located in the metropolitan area of Lisbon. This school was built in the 1980's according to a pavilion-based modular type, called 3x3 block, that posed as a stationary model building unresponsive to changes and which was reproduced throughout the country during the 1980's and 1990's. It had a capacity for about 1000 students, aged12 to 17, combining vocational training with regular education.

The school consisted of five *3x3* blocks, placed in a disjointed manner on account of the plot's rugged topography. Given this fact two blocks were cast at the ground floor forming segregated areas without visual control that were used by students to socialize during breaks. The design of each block was based on a two storey square plan of 21.60x21.60m, within a regular grid of 7.20x7.20m, and a repeated modular partition of 50m2 organized around a central staircase. These modular spaces were used as both learning

areas – classrooms, laboratories or workshops – and non-learning areas such as school library, administration and teachers spaces.

Formal learning spaces were mostly made up of classrooms. The school library was well equipped, but physically and visually segregated. Spaces and facilities designed to support teachers and students work outside the classroom space and time were reduced and revealed poor conditions of use. Paths of teachers and students were not coincident. Attendance to students and their guardians was carried out in inadequate conditions. Social areas - student common room, canteen, bar and kitchen – were placed altogether in a single storey block, also visually segregated within the school layout.

The existing pavilion-base layout was reorganized and reconverted into a compact layout by means of a new building connecting two of the existing blocks and a canopy connecting the remaining ones. The new building works as the school core. It defines the new school entrance that is shared by all users, focusing and organizing pathways, and accommodates the school library, the administrative sector, the assembly room and the food hall as well as all the school spaces available to the community after school hours, except the sports area. The canopy connects all the remaining pavilions, giving access to the learning spaces. It defines a multi purpose covered space, immediately accessible from the main entrance, sharing high levels of topological and symbolic centrality.

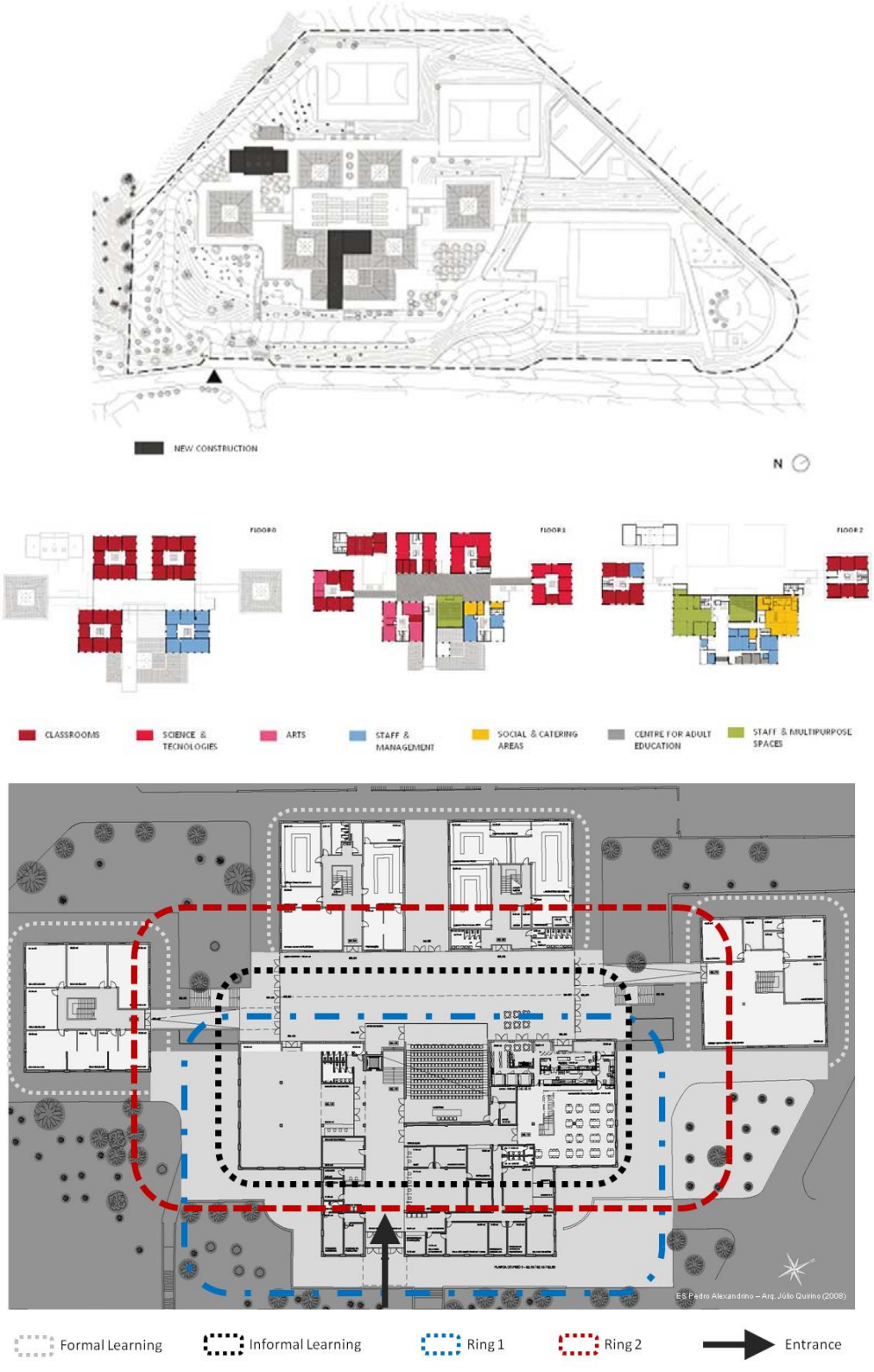


Figure 3 – Pedro Alexandrino School - Customised SMP model

3. ASSESSING THE DESIGN SOLUTIONS WITHIN THE SMP MODEL FRAMEWORK

To promote a critical perspective of the SMP model framework it was important to understand how it was interpreted by designer teams and embodied in the assortment of types of the existing schools prior to the SMP. Although being firstly conceived with explanatory purposes, the *conceptual matrix* was applied as an explorative model to look back on reality and assess whether the built solution matches the brief.

A sample of 14 schools, intervened and currently at the stage of operation, was chosen to be analysed. These schools, as shown in tables 1 to 4 of the annex, are representative of diversity within the school building stock, both geographically and in terms of the architectural type of buildings: two phase 1 schools; seven phase 2 schools; four phase 3 schools and 1 non-typified school building (former private school).

In order to access the *anchor spaces* relationship and connections, a methodology for the analysis was devised based on the study of the design plans and in direct local observation of the schools, where a questionnaire was filled followed by the respective data analysis. Although the core activities of this study were based on space analysis and observations, in-depth interviews of some participants – architects and school boards - were also conducted. The reason for holding the interviews was to clarify the collected data and to seek more in-depth data, in particular on how the SMP model was adapted to each particular school and faced the constraints imposed by building codes, legislation, environmental and structural conditionings, the so called *type1 laws* (Hillier, 1989).

Assuming that the architectural design is a configurational activity (Hillier, 1996), the questionnaire was devised to translate into a direct “yes and no” type of questions the description of key functional spaces spatial configuration. It resulted in an exercise to extract non-discursive characteristics to be used by a team of information gatherers not familiar with the Space Syntax methodology, making it utter important to create a simple way to explore spatial configuration queries.

The chosen sample of schools were analysed in a comparative map for each key functional sector. The results produced a percentage value in terms of the whole sample, producing spatial configuration information across and in spite the wide diversity of architectural designs.

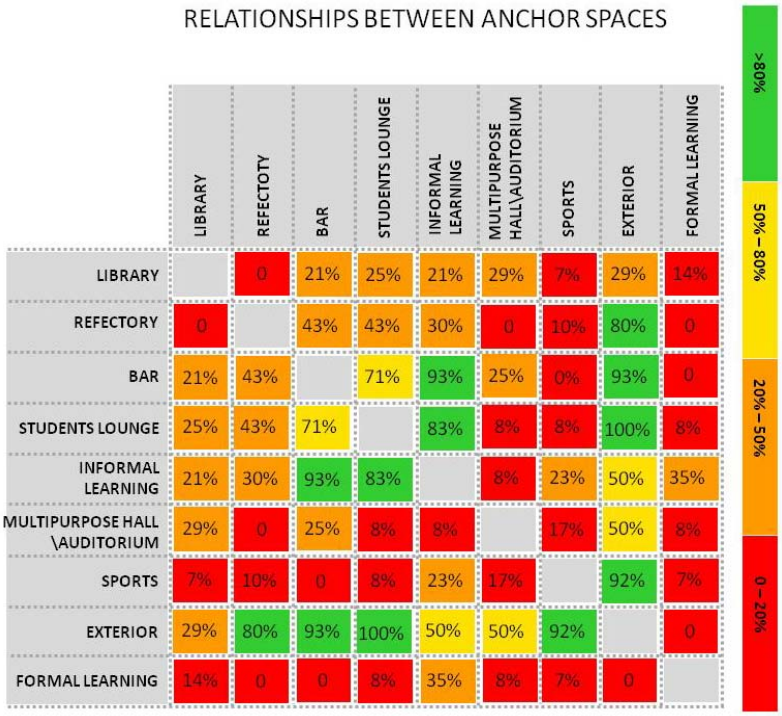
Library		ES D Pedro V		ES Aurélia de Sousa		ES Avelar Brotero		ES Josefa de Óbidos		ES Marquesa de Alorna		ES Gabriel Pereira		ES Carolina Michäelis		ES Rocha Peixoto		ES Rodrigues de Freitas		Conservatório Musica do Porto		ES Rainha D Amélia		ES Benavente		ES D. Manuel I		ES Mouzinho da Silveira		Polo D João de Castro	
		Design	Use	Design	Use	Design	Use	Design	Use	Design	Use	Design	Use	Design	Use	Design	Use	Design	Use	Design	Use	Design	Use	Design	Use	Design	Use	Design	Use	Design	Use
Centrallityy	Physical?	x	x	v	v	IND	IND	x	x	v	v	x	x	x	x	v	v	x	x	x	x	x	x	v	v	x	x	v	v	v	v
	Simbolic?	v	x	v	v	IND	IND	v	v	v	v	v	v	x	x	v	v	v	v	v	v	x	x	v	v	v	v	v	v	v	v
Easy visual and physical access?	Inside the school?	x	x	x	x	IND	IND	v	v	v	v	x	x	x	x	x	x	x	x	x	x	x	x	v	v	v	v	x	x	v	x
	Open to the communiy?	x	x	v	x	IND	IND	v	v	x	x	x	x	x	x	x	x	x	x	v	v	x	x	v	v	x	v	x	x	v	x
Extended community use with easy access from the exterior?		x	x	v	x	IND	IND	v	x	x	x	x	x	x	x	x	x	x	x	v	x	x	x	x	x	x	v	x	x	v	x
Is there enough room in the library for the various activities considered?	Reception?	v	v	v	v	IND	IND	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	x
	Informal reading?	v	v	v	v	IND	IND	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
	Consultation?	v	v	v	v	IND	IND	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
	Multimedia?	v	v	v	v	IND	IND	v	v	v	v	v	v	IND	IND	v	v	v	v	IND	IND	v	v	v	v	v	v	v	v	v	v
	Exhibition area?	v	v	v	v	IND	IND	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
	Library multifuntion	v	x	x	x	IND	IND	x	x	v	v	v	v	x	x	x	x	x	x	x	x	x	v	v	v	v	v	v	v	v	x
	Archive?	x	x	v	v	IND	IND	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
Visual control	Reception?	v	v	x	x	IND	IND	v	v	v	x	v	v	v	v	v	v	v	v	x	x	v	v	v	v	v	v	v	v	x	x
	Librarian office?	v	v	x	v	IND	IND	v	v	v	x	v	v	x	x	x	x	x	x	v	v	v	v	v	v	v	v	v	v	x	x
Does it connect to the *anchor space* s and other spaces within the school?	Bar	x	x	x	x	IND	IND	x	x	x	x	x	x	x	x	x	x	v	v	x	x	x	x	v	v	v	v	v	v	x	x
	Refectory	x	x					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	x	x	x	x
	Sudents lounge	x	x					x	x	v	v	x	x	x	x	x	x	x	x	x	x	x	x	v	v	v	v	v	v	x	x
	Multipurpose Hall / Auditorium	v	v					x	x	v	v	x	x	x	x	x	x	x	x	x	x	x	x	v	v	x	x	x	x	-	-
	Informal learning spaces	x	x					x	x	v	v	x	x	x	x	x	x	x	x	x	x	x	x	x	x	v	v	x	x	-	-
	Sports areas	x	x					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Exterior	v	v					v	v	x	x	x	x	v	v	x	x	x	x	v	v	v	x	x	x	x	x	x	x	x	x
			x	No						v	Yes					IND	Infomation not available						-	Not considered							

Figure 4 – Library - Example of comparative map analysis

The list of questions of the questionnaire reflects these concerns translating them into precise queries such as “Is there space visual control – from the reception or the librarian office?” allowing a very quick and unequivocal assessment of the “configurational activity”.

3.1 Key findings

The findings for each afore mentioned key functional space analysis were summarised in an *anchor spaces* relationship map where, unlike the colour system of Space Syntax axial maps or convex spaces, the set of colours used represent in green a higher connectivity or adjacency and in red smaller linkage.



- The Bar and Student Lounge are highly connected with the other Informal Learning spaces.
- The Refectory, Bar and Students Lounge have a strong relationship with the Exterior.
- The Students Lounge has high correspondence with the Bar.
- The Informal Learning spaces and the Multipurpose Hall/Auditorium have direct relationship with the Exterior.
- There is a moderate connection of the Formal Learning, the Refectory and the Sports areas with the Informal Learning spaces.
- The Bar has a moderate relationship with the Library, the Refectory, and the Multipurpose Hall/Auditorium.
- The Formal Learning spaces have a week connection with almost every anchor space (except the Informal Learning spaces).
- The sports areas have a weak relationship with most anchor spaces, with the exception of the Exterior spaces.

Figure 5 – Relationships between *Anchor Spaces*

By analyzing the relationship map, it is patent that there is a correlation between the functional nature of the spaces and their level of segregation. In fact the formal learning spaces are more distant from most of the other anchor spaces, confirming what is established in the functional hierarchy matrix - level 5. On the other hand, the sports areas are also segregated from the other anchor spaces, which becomes of the most importance as they need to be accessible to the community without interfering with the rest of the school areas.

There is also a high interconnection between social spaces (such as bar and refectory) and informal learning areas or the exterior, opening up of the interior space to patios or garden areas, namely the busy social areas (such as the library, bar or student lounge); privileged relationship with the exterior space of potential

public use (auditorium and sports areas); and spatial versatility in certain areas with strategic functional "zoning", namely the bar that can be used as a "support" space for the multipurpose hall/auditorium, library and refectory when they are being used for community events.

The Informal learning spaces have a moderate connection to Formal learning spaces, creating a functional permeability available for use in pedagogical activity of their users. This manifestation is the materialization of the design schemes given to designers along with the design brief. Informal learning spaces are placed in areas with visual control, allowing the permanence of students to develop informal learning activities.

4. FINAL REMARKS

This paper research question was focused on Space Syntax contribution to the design briefing process in order to facilitate the understanding of the architectural design problem in terms of problem finding and shaping and to help the communication between all parties involved.

The answer to this question required the development of a communication tool, which was developed in the scope of a school building modernization programme, by combining conceptual-verbal and physical-analogue representations, derived from Space Syntax framework. The aim was to provide designers and non-designers with a broad understanding of school space performance, recognize whether learning settings meet the needs of school users, identify well-designed spaces and major failures and help to spread good architectural design practice.

Space Syntax methodology was thus introduced at two stages. Primarily to dictate the design guidelines by applying a *functional-topology* scheme, underlining the justified graph explanatory model analysis to assist school layout reorganization, making it possible to represent the ways by which the range of academic activities should be spatially disposed. At a second stage, to test how these concepts were incorporated into the schools design.

Through the sample of schools analysis, there is clear evidence that the adopted model for conveying information resulted in the materialization of the SMP design principles. All the preparatory work of the design briefing process is reflected in the capacity for abstraction from the existing morphological features, breaking free from stationary model buildings and allowing a reorganization of schools in spite of their existing characteristics.

One of the criticisms that are often directed to Space Syntax model refers to its simplification of the spatial reality. But, it seems that its efficacy, as a communication strategy relies precisely on the ability to simplify reality and clarify all its shaping relationships.

An idea central to the proposed communication tool is then that school activities are spatially organized into distinct functional sectors according to educational principles and socio-informational strategies. This concept of functional sectors performs as a "school topological program" rather than a "school functional program". In this sense it seems to have provided a fundamental diagram of patterns for the understanding of school spatial organization and the embedding of formal and informal learning spaces onto the spatial structure of the buildings.

Thus this paper bears witness to an intervention methodology that not only embodied specific concepts of space and functional flexibility in school buildings rehabilitation, but most strikingly devised tools for a collaborative design process.

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ACKNOWLEDGEMENT

This article derives from the authors work at Parque Escolar EPE, an independent state-owned company created in 2007, which is responsible for planning, managing, developing and carrying out the Secondary School Building Modernization Program.

ANNEX

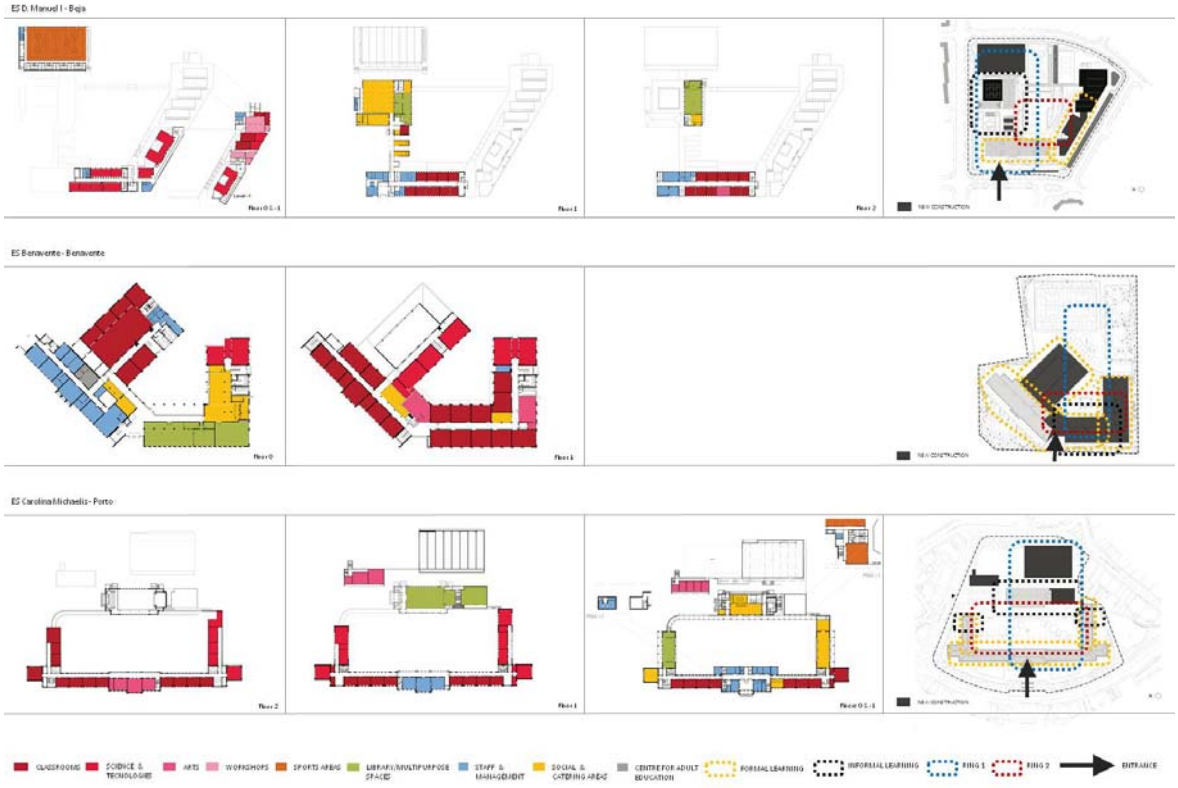

Table 1

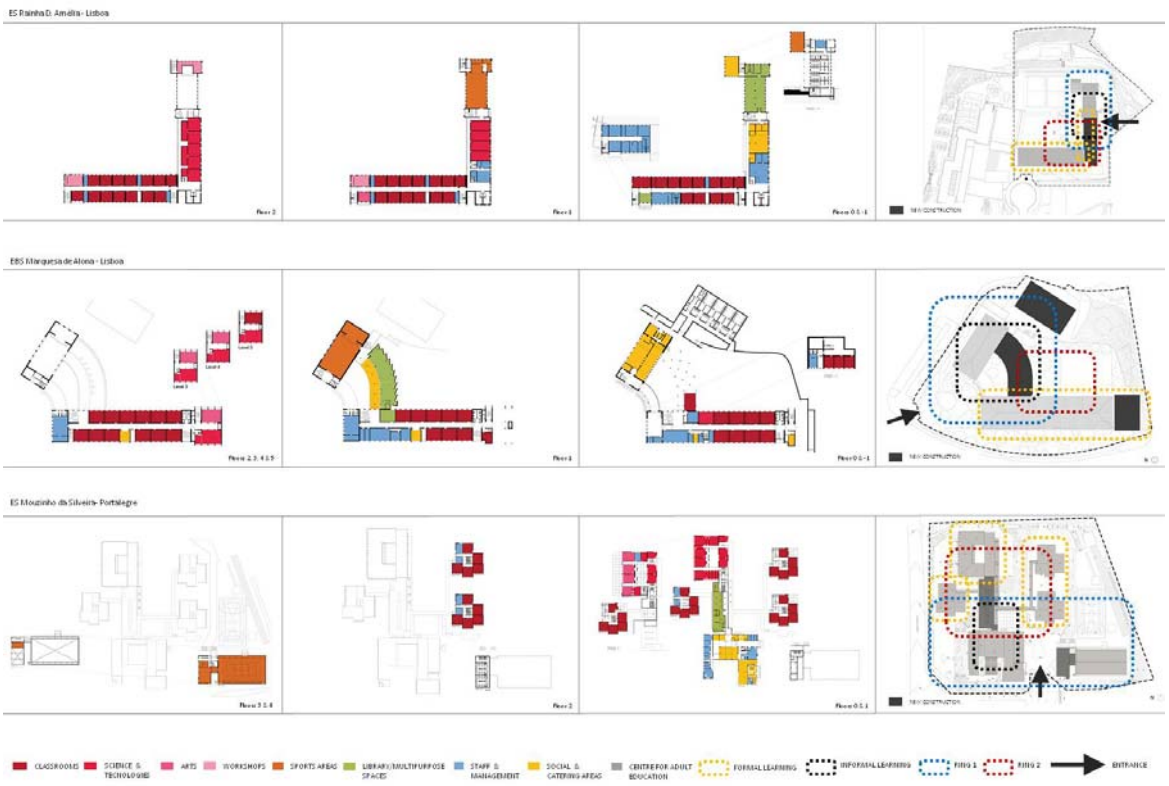

Table 2

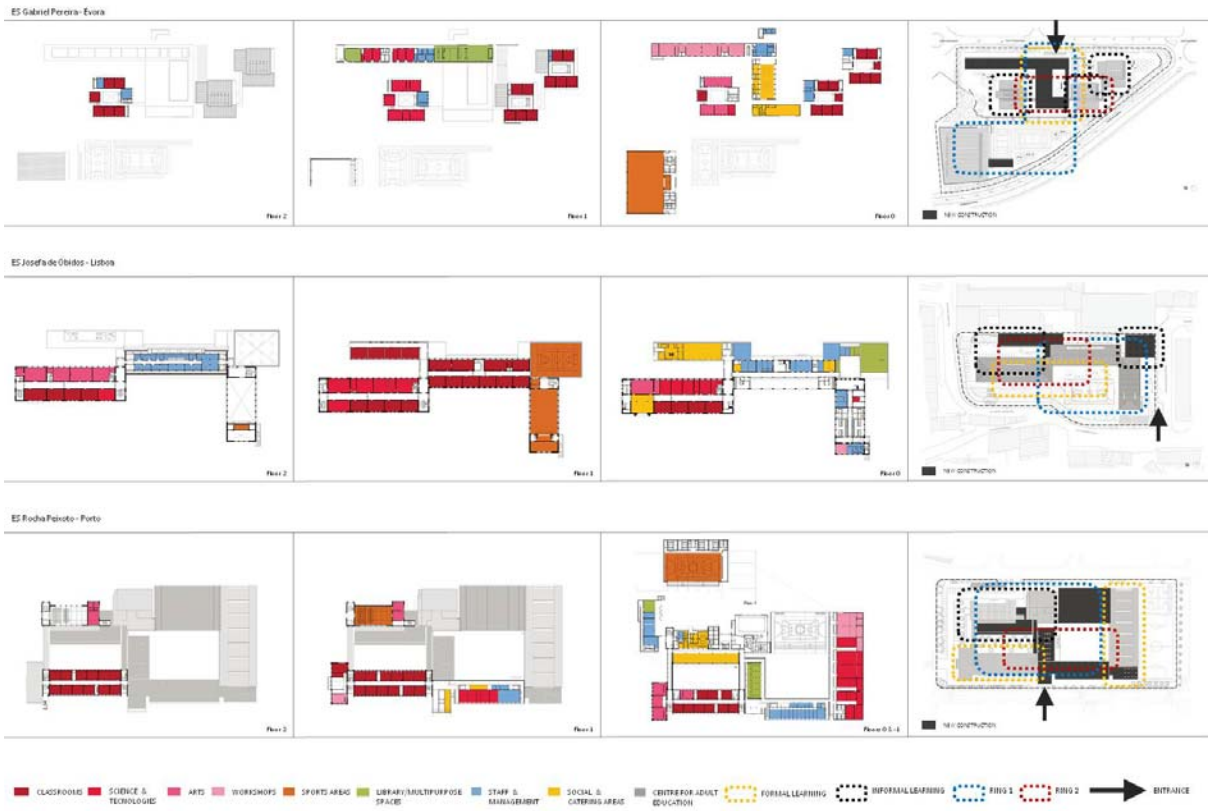

Table 3

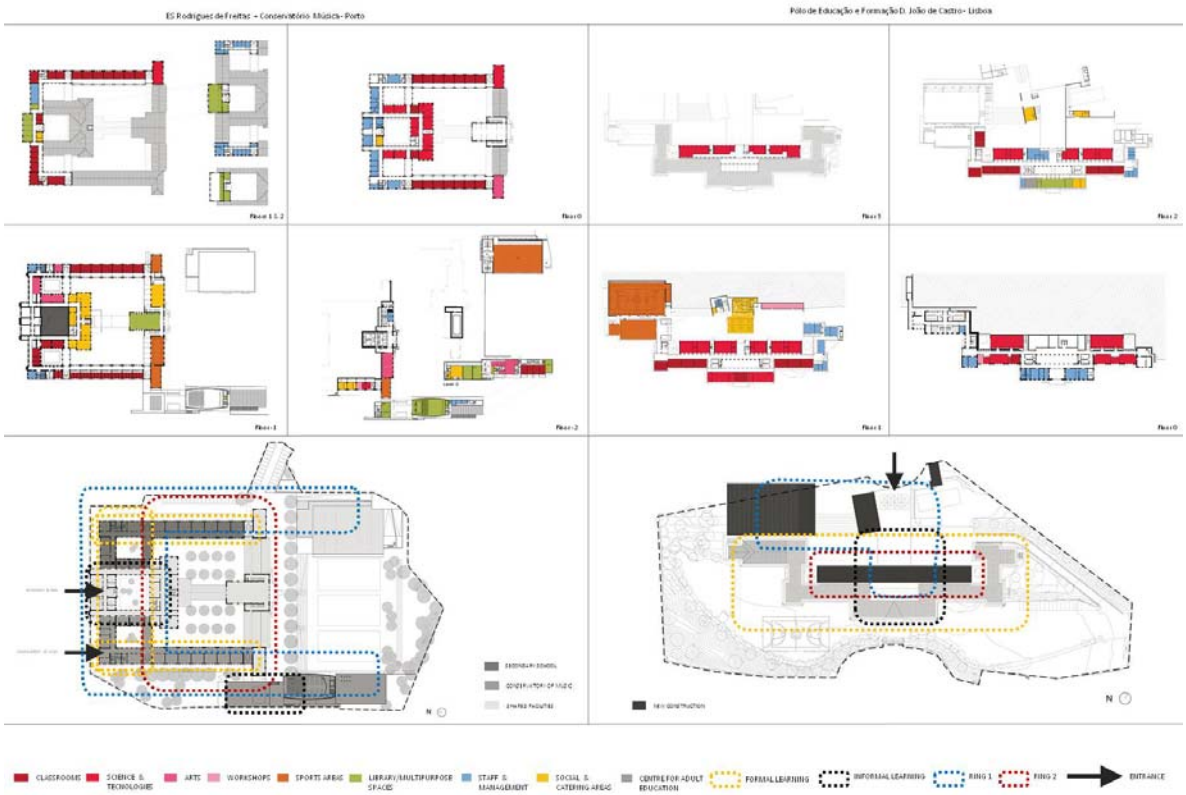

Table 4