

Programming for Behaviour in Educational Environments

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Abstract: To attain a quality built environment the design process needs structure, rigor and rich, varied data on the relation of human behaviour and architectural design elements. To this end, the architectural program, or brief, is an important instrument, considering the complexities with which an architect is faced when designing a building or urban space. During the 1950's architects and engineers, aware of scientific theoretical developments, endeavoured to apply new methods to the building design process and the programming phase gained specific methods such as "Problem Seeking" by Peña and Parshall, today in its 5th edition (2012). This paper discusses the architectural program as a part of the building design process. In most programs (brief) emphasis is given to primary functions of architectural spaces and their interrelations. There is a need, however to introduce discussions on issues that support positive human behaviour in the built environment and prevent or avoid behaviour considered anti-social and non-productive. Various aspects of schools have been analysed over a long period, especially in Europe and in North America, from learning styles to vandalism and transformed into design criteria. However, this data is rarely structured to produce documents to be effectively used in the pre-design phases of the design process. Thus, a study is presented where behavioural issues, relating to specific settings, with emphasis on educational environments are structured according to the "Problem Seeking" programming method. This paper is based on a continuing study on the public school environment as found in the State of São Paulo, Brazil. The local school building design process was characterized and shown to lack a participatory briefing phase, and the "Problem Seeking" material should enable participatory briefing to be introduced in the local public school building design process.

Key words: school architecture; architectural design process; architectural program; behaviour and built environment

Introduction

Public education has always been an essential instrument to promote social progress and in developing countries, like Brazil, the importance of education cannot be underestimated. This paper presents further developments of a continuing study on the public school environment as found in the State of São Paulo, Brazil. Emphasis is given on the school building design process. The primary issues to be considered in such a design process are related to functional aspects of the building to embrace the educational activities indicated by the pedagogy and educational system adopted. These issues change over time and are place specific. Also, school buildings should be environmentally responsible and comfortable. Comfort includes, not only the typical environmental aspects of acoustic, thermal and visual comfort, but also functional and psychological comfort. Spaces and their relation to each other must accommodate adequately the necessities of learning and social activities, as well as the feelings of users. These feelings are related to environmental psychology and include a sense of belonging, security and spatial orientation. Positive behaviour should be stimulated in a quality-learning environment. For this to happen the school building design process needs to address a variety of issues. Particularly the briefing phase of this process needs a rich debate, supported by research data of technical and quantitative as well as subjective and qualitative elements related to school architecture. An extensive study on the Brazilian, and in particular the State of São Paulo, school building design process showed that this process lacks a participatory briefing phase thus stunting the necessary debates. But, an enriched design process is seen as capable of producing improved educational spaces, which can then be evaluated according to benchmarks set in the architectural program or brief (Deliberador, 2010).

The architectural design process with emphasis on the briefing phase

The architectural design process, shown in figure 1, can be divided into five important

phases: Programming (briefing), designing, constructing, occupying and evaluating (Post-Occupancy Evaluation–POE) and adjusting or refitting. Between the construction and occupation phases commissioning is added to prepare the building for occupation of users, adjust the infrastructure to optimum operational levels, train staff for best potential use and maintenance, and introduce minor retrofits of perceived problems.

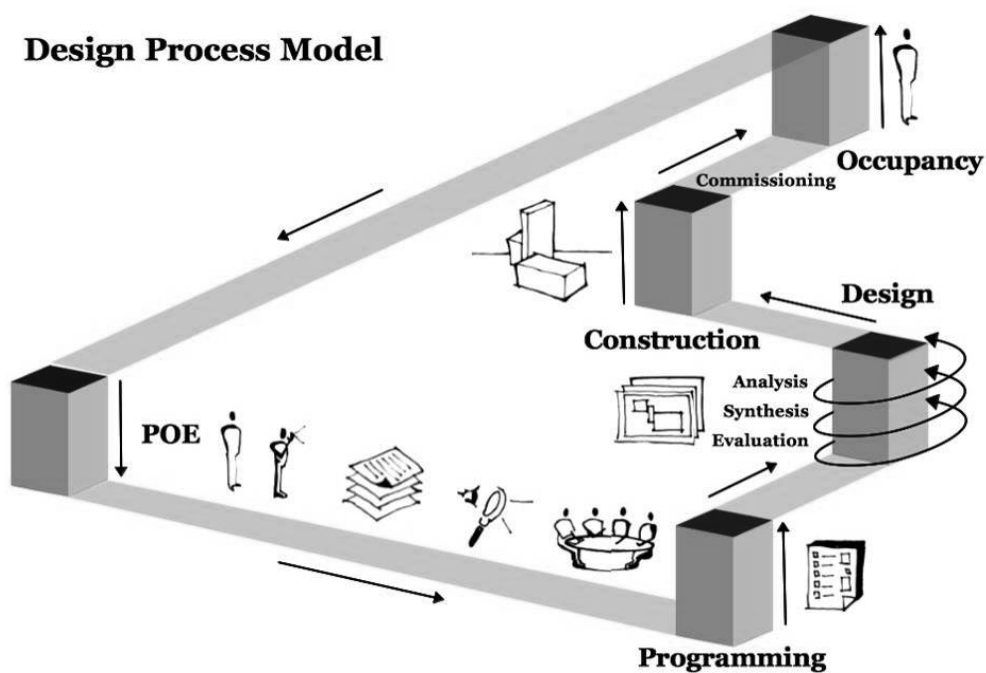


Figure 1. A model of the typical architectural design process

To attain a quality built environment the design process needs structure, rigor and rich, varied data on various technical and functional aspects of design and the relation of human behaviour to the physical environment and its architectural design elements. To this end, the architectural program is an important instrument. During the 1950's architects and engineers, aware of scientific theoretical developments, endeavoured to apply new methods to the building design process and the programming phase gained specific methods such as "Problem Seeking" by Peña and Parshall, today in its 5th edition (2012).

A design process that supports the development of a quality school environment is first and foremost based on educational goals and values. The physical environment is considered an essential partner, or the third teacher, to achieve productive learning experiences. A multidisciplinary team conducts this process. Appropriate tools are introduced to simulate comfort levels and other important functions of a building are evaluated along a loop of such processes. Knowledge is accumulated and passed on to new projects, through feedback. Users, or potential users are involved in the decision-making process, since participation can enrich design discussions. Ideas are generated, conflicts removed and design intentions better understood. However, care must be taken to avoid misunderstandings and over-promises in such a process (Woolner, 2009). A specific analytical data collection phase is important to support the briefing activities that follow.

According to Peña and Parshall (2012), five steps are essential in the briefing phase. These are: setting goals, collect and analyse facts, uncover and test concepts, determine needs and finally state the design problem adequately in the document, the architectural program. To structure these steps a detailed list of issues is organized in the “Problem Seeking” method according to four frameworks of: function (people, activities, relationships); form (site, environment, quality); economy (budget, operating costs, life cycle costs) and time (past, present, future). Visual representation of the concepts are further recommended for productive programming activities and the final document (brief), should give priority to graphic representation of data, diagrams, tables, sketches, etc...

The Public Education Scenario in Brazil

In Brazil, the quality of public education has been under debate, especially in light of recent unsatisfactory performance levels obtained by students. To evaluate education as a whole governments and independent agencies use several metrics. In Brazil the Basic Index of Educational Development (IDEP), measure through average scores the performance students in local schools. The latest statistics give a negative picture. As an example of recent surveys,

average scores at the high school level are 3.7 for public schools and 5.7 for private institutions, on a scale of 0-10 (IDEP, 2013).

The need for change can be corroborated by results of Post-Occupancy Evaluations (POE) of school buildings in Brazil. Such studies show that problems related to environmental comfort are frequent and schools lack a variety of spaces to support a rich array of recommended educational activities. This data indicates that current design parameters require revision. The design process must be enriched with up-to-date information, as well as access to tools to support the design of high performance school buildings (ORNSTEIN, 2005; KOWALTOWSKI et al., 2001).

A discussion on the design process of public schools in Brazil is presented here, with emphasis on the State of São Paulo, where school buildings are managed by a government agency called FDE (*Fundação para o Desenvolvimento da Educação*) (Deliberador, 2010). An example of a typical school building in the State of São Paulo, is shown in Figure 1. Opportunities to improve this process and therefore the product are identified.





Figure 1 Example of a recent school building, administrated by FDE in the State of São Paulo, Brazil (E.E. JOSE ROBERTO MAGALHAES TEIXEIRA PREFEITO, Campinas, SP. Brazil)

In the local Brazilian public school context this process is as yet not fully adopted, as shown in Figure 4. Many efforts have been made to improve the design of school buildings, especially in the State of São Paulo, through the implementations of FDE, including the periodic engagement of well-known professionals (DELIBERADOR, 2010; ORNSTEIN, 1997 & 2005).

The public school design process of the State of São Paulo, managed by FDE, is initiated by contracting local accredited architectural firms. The chosen professionals receive a predefined brief, or architectural program, elaborated by the State Secretary of Education and construction detailing instructions, based on modular design and prefabricated components, made of concrete. The brief consists of a list of spaces and their dimensions, with some recommendation on environmental comfort aspects, such as minimum light levels in LUX. The more subjective expressions of goals, values, desires or dreams of a school community are excluded from the local process. The site conditions are provided through specific documentation (topography and soil as well as foundation conditions). In addition, a list of design regulations, that should be consulted, is indicated. A preliminary design is produced with these requirements, documentation and information. This is then evaluated by FDE and design proceeds, culminating in construction documentation and complementary designs (structural and installations) (FDE, 2000). A special manual, developed by FDE, should support the treatment of open areas. However, since contracts are poorly remunerated, most

designs only indicate very basic landscaping elements. This process provides few opportunities to introduce new design concepts. Some change is under way with FDE's recent adoption of the AQUA Process (FCAV, 2007). This new demand on projects is seen here as an opportunity for the introduction of further improvements.

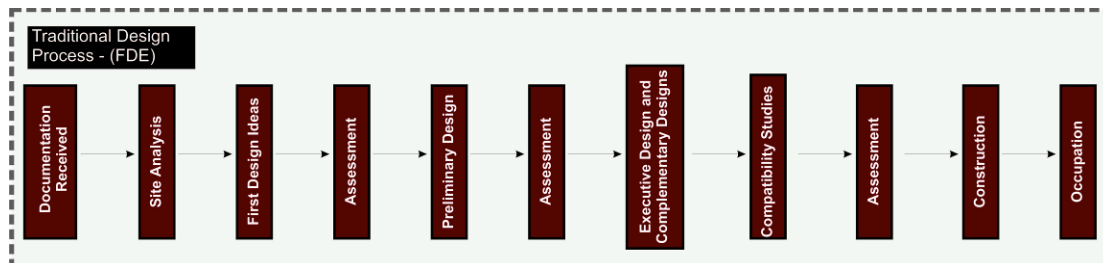


Figure 4 A model of the local school design process based on the process administered by FDE

Minimum standards of care are only required in the present situation and the process is essentially linear, lacking a feedback loop of positive or negative design solutions. Thus, a learning mechanism is excluded. Architectural decision-making deals with often-conflicting parameters, which implies that design methods should display interferences and provide adequate information for the proper conduct in finding the best solution for specific problems. Also, according to research on local Brazilian professional practice, designers use little reference material while designing, limiting them to codes and eventually some checklists (GRAÇA, 2008). Evaluations in the form of simulations and optimizations are rarely applied to designs and the design process does not include the participation of users. POE studies are not a regular activity of school design teams, not being part of remunerations and contracts. Due to these factors building performance assessment data is not readily available for application to new designs.

In Brazil, as well, the traditional classroom dominates the school building, although, teaching methods and social demands have over the years put pressure on the architectural programme in favour of a more flexible brief, allowing new activities to be engage in. The traditional configuration can stunt efforts to improve education, but it, to some extend, reflects the authoritarian public school administration found in most states and municipalities in Brazil. Dynamics of education require constant updating of architectural programmes, based on reflections of users and agents involved in planning and design of new schools or remodelling of old buildings. The wide diversity of users: students (of very different ages, with different backgrounds and at different stages of development), parents, staff, teachers and the

community in general of surrounding urban areas need to be heard, to embrace the complexity of educational issues in their context (KOWALTOWSKI et al., 2012).

In Brazil, most cities still present a large deficit of schools, demanding the construction of new schools. The new buildings must deal with new demands, coming from recommendations and the creation of new programs, launched by the Ministry of Education and the State Secretaries. For instance, the full day school program (*Programa Mais Educação*), proposed in 2007 and adopted by many schools through the specific implementation in the State of São Paulo (*Programa Ensino Integral*), is put in action without, in most cases, proper adaptation of school facilities and training of staff, although recent investments show that schools in the State of São Paulo are being adapted for new demands of this program (FDE, 2013). Cafeterias are enlarged and science laboratories are added to existing facilities, offering a full day program. These schools therefore cater for double the amount of students at the same time, since public schools operate in morning and afternoon shifts and in some areas additional night classes exist.

Many efforts have been made which are positive. FDE has abandoned stock plans and invites recognized firms of architects to design public schools for the State of São Paulo. To envision improvements in school design however the specific design process of these professionals needs investigation, to identify bottlenecks and opportunities to introduce changes in the process itself and the design solutions, products of this enriched process.

Developing a briefing support system for school building design

To improve the local school design process the first recommendation is to expand certain phases of the present process. Thus the programming phase must be given more importance. This should be a moment of questioning important issues and traditional ways of doing things. In relation to the local public school design, a democratic view of providing similar standards for all, today excludes the local school community from the decision-making process, to avoid demands unable to be met, inflating expectations and envy. This process however perpetuates old models, without a learning process from previous

experiences and evaluations. Since in Brazil the quality of public education has been under debate, especially in light of the unsatisfactory performance levels obtained by students in general tests, new ways to improve the total school environment should be introduced.

Most improvement discussions centre on the system of public education, curriculum and pedagogy, but should also touch on the adequacy of the physical environment to support necessary educational changes to increase performance levels (Gomes da Silva et al., 2009). The need for change can be corroborated by results of POEs of school buildings in Brazil, which show that problems related to environmental comfort are frequent and schools lack a variety of spaces to support a rich array of recommended educational activities, indicating that current design parameters require revision (Kowaltowski et al., 2003; Ornstein, 2005;).

When a school design is started the technical and functional issues are usually given priority during a typical design process. During the analytical and briefing phase however, other types of data are important. Data from environmental psychology is important to understand underlying issues relating to an individual's identity with the schools, where different age groups will be present, and different social and cultural backgrounds can affect user and community characteristics. Privacy, security, segregation, the social/psychological environment and implications, individuality, wayfinding, behavioural patterns, groupings and densities are further issues with profound impacts on the decisions to be taken at the briefing stage. However, data on such issues are not usually readily available and often unrelated to physical elements of the built environment. For productive briefing, such data should be organized and referenced for analysis, reflection, questioning and application.

From recent studies on the brain, for example, we know that each brain is unique, but that it functions better when users work in groups, thus the social ingredient is important. Also, there are better cognitive connections with specific activities, such as music, for example. Stress affects learning negatively, but other emotions (passion for something) can

enhance learning (Rashid & Zimring, 2008). Lackney (1998) has translated this research data into design recommendations, based on at least twelve principles of brain-compatible learning that have emerged from research. Lackney (1998) also recommends a stimulating school environment and design should not be reduced to functional space allocations. Schools should have an appropriate colour scheme and provide places that invite social interactions, such as nooks and alcoves, to isolate a small group from the hustle and bustle of a typical school corridor. Both active and passive spaces are important. The brain should be given enough oxygenation through outdoor connections and body movement. Feeling secure is important, as is a variety of form, colour and light. Children and teachers must be able to change spaces spontaneously, personalizing rooms and walls, and transforming a staircase, for instance, into a small □theatre. The flexible use of space must be encouraged, which does not mean providing neutral spaces, but environments that demonstrate a variety of possible uses, thus carry affordances. Access to equipment and learning material should be easy, to make the most of available resources. The community around the school should play an active part in daily school activities, so that learning can be more practical and occur in the real world.

To improve the local school design process this type of information has been structured according to the “Problem Seeking” architectural programming method. The organization of such data should enrich briefing debates, direct a participatory process and stimulate research on the relation between human behaviour and the physical environment. Figure 3 shows how this information was structured according to the four considerations framework of “Problem Seeking”.

This information should be available to a briefing team with access to the original study (references) through hyperlinks, for instance. The literature on school buildings is vast and diverse, where behavioural data is dispersed. The information should be as direct as possible, to instigate a focus on design issues, such as for example, group sizes, where the discussion

should dwell on space configurations that give groups autonomy (territoriality and privacy) and at the same time interaction with other groups (social contact). The issue of feelings of crowding (positive and negative) and space requirements that define densities need clarification, experimentation and testing to reach educational productive area requirement data.

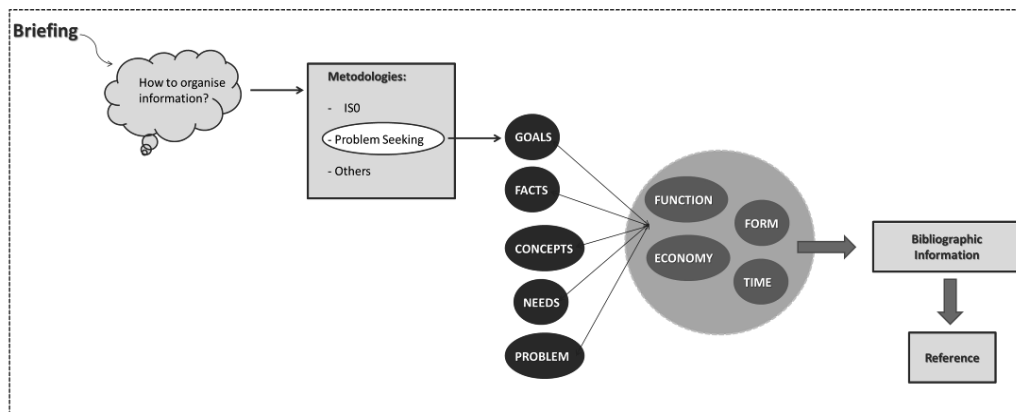


Figure 3. Organization of behavioural data related to school buildings structured according to the “Problem Seeking” programming method.

Figure 4 shows part of the “Problem Seeking” information created for the organization of behavioural data. The figure only shows data relating to the “form” giving aspects of a programming discussion with the initial code relating to the information index of the “Problem Seeking” method of Peña & Parshall (2012).

When the function of a school is debated, during the briefing phase of a school building design process, other issues must be addressed. The question to ask is: What does the client want to achieve and why? In relation to a school, the answer should touch on the people the school serves. The education of young people should be the primary goal. Facts, to be considered for example, are related to studies, which show that the maximum number of students per school is best kept within 500 (Moore & Lackney, 1993).

	Code	Summary	Description	Bibliographic Information
FORM	14	Bias on site elements	Identify any clients attitudes toward existing elements on the site (trees, water, open space, facilities and utilities)	Identification of reference points. Better orientation, wayfinding, feelings of belonging and security.
	15	Environmental response	Identify client attitudes toward the facility response to its environment	Sustainability behaviour, (recycling, efficient use of water and energy), care for the environment, community spirit. Promote environmental awareness to increase user participation. Teachers need environmental competence.
	16	Efficient land use	investigate the land use policy for efficiency and environmental character	Incorporate sustainable elements to give visual cues towards sustainable behaviour.
	17	Community relations	identify policies concerning coincident planning and relations with the neighboring community	Identify the role of school in its community, improve community relations, create sense of belonging, increase the sense of value given to educational activities. Create feelings of security. Pride of school which increases productivity and educational outcomes.
				Relation of the school with its surrounding. Avoid vandalism through community acceptance and use of school facilities by the community.
	18	Community improvements	identify policies concerning the investment in, or improvement of, the neighboring community	Acceptance of community of school design. In line with community image of what a school should express. Better acceptance of school policies, better relations, better possibility of community involvement with school activities.
	19	Physical Comfort	identify the level of physical comfort required	Importance of environmental comfort and learning productivity. Avoid aggressive behaviour and apathy
				Importance of verbal communication to avoid lack of understanding, feelings of confusion, lack of involvement.
				Acoustic conditions adjusted to activities to avoid interference between incompatible activities. Avoid failures in verbal communications.
				Give priority to natural lighting, to enhance the circadian cycle, avoid glare on tables and blackboard to avoid failure in visual communication. Correct lighting levels and mixture of light increases the feeling of comfort and security.
In many school there is a tendency for less space to play. Revise this. Children can no longer perceive the city as a place to live and play since so many limitations are imposed due to safety and security issues. Give opportunities to play in front of the school. Functional space requirements must be at ideal levels to perform desired activities with ease. Avoid disorder, crowding. Sense of order is an important feeling affecting positive behaviour towards learning. Reserve enough space for deposits of teaching equipment and material, cleaning products and tools. Scale and size of spaces affect density and crowding which can lead to aggression and less social interconnections. Teachers tend to overlook certain areas of a typical classroom. Teachers need training in environmental competence. The concept of affordance (what does the space show to be capable of supporting?). Legibility of space, presence of comprehensible patterns. Environmental awareness increases students autonomy and feeling of security. Importance of perception and experimentation. Awareness of introducing changes. Questioning the setting by new layouts.				
Optimize environmental comfort indicators to provide for a comfortable learning environment. Comfort affects productivity and aggressiveness.				
20	Life Safety	identify critical life safety considerations	Safe routes to school and playgrounds. Feeling secure affects learning attitudes and social behaviour.	

Goals relating to Form

FORM	21	Social/ Psychological environment	identify clients attitudes toward the social/ psychological environment to be provided	High performance schools affect learning positively. Functions of space are: security, shelter, social interaction possibilities, expression of symbolic meaning, appropriate for tasks at hand, give pleasure, promote user involvement, gives cues towards appropriate behaviour. Strange reactions should be checked against layout Explore the relationship of spaces and buildings to cultural and social values of the community. Social interactions enhance learning. Think of educational spaces as being learning facilitators or the third teacher. This will improve psychological feelings of comfort. Things children like in playgrounds: trees, fountains, sports grounds, sand, water, benches, cycle lanes, tunnels, caves, playstructures, slide etc.. Give importance to the relation of teaching methods and the pedagogical concepts applied when making design decisions. Each type of pedagogy asks for specific spatial solutions.
	22	Individuality	identify goals concerned to the promotion of the personal individuality of the user	Give more importance to individual studies, through spaces where children can isolate themselves from the group. This will enhance selfesteem, autonomy and independence and increase learning. Personal space feeling. Need for quiet spaces to relax, concentrate and gain control over moods. Give opportunities for isolating aggressive behaviour. Children need their personal space to keep their belongings. Preserve selfesteem, increase feelings of security. Avoid bullying.
	23	Wayfinding	identify goals dealing with the flow of people and vehicles to provide wayfinding with a sense of orientation (knowing where you are) or a sense of entry (knowing where to enter)	Make school facilities fully accessible improve wayfinding to increase feelings of security and selfesteem. Improve the way children go to school. Better parking facilities, better bike routes, busstop near school.
	24	Projected image	identify the image that must be projected	Choose an architectural language that expresses the local image of what a school should be. Increase feeling of belonging and pride in education. Avoid vandalism. Impact perception of space and place. Going from sensation to perception to cognition (recording the place in memory). These concepts are related to size and distance (proxemics) scale and movement in space, as well as social order. Evaluate what is perceived in foreground, background, verticality, symmetry, colour, number of elements, their meaning their context. Is there a sense of territory. Think about space and time (Classroom activity intervals. Importance of space identity. Students have a lack of access to variety of art forms, schools need to address this issue.) Local signature is important to set the school apart from other schools to increase pride in the school, feeling of belonging and caring. Territorial expression increases user involvement in school activities and caretaking. School should be a point of reference. Less prison like design language.
	25	Client expectations	identify clients attitudes toward the quality of the physical environment and the balance of space and quality	Quality designs express that public money is well invested. Community feels gratified and will get more easily involved in school activities. Lack of play space is often related to cost per area issues. Reflect on this.

Goals relating to Form

	Cods.	Summary	Description	Bibliographic information
FORM	53	Site Analysis	Analyse the existing site conditions to include: contours, views, natural features, buildable areas, access and egress, utilities, size and capacity	Elements which impact levels of sustainability, influence user attitudes towards the environment and sustainability behaviour (recycling, energy and water use efficiency)
	54	Soil Analysis	Evaluate the soil test report and determine its implication on cost and design	Not applicable to behaviour relations
	55	FAR and GAC	Evaluate the floor area ratio, the ground area coverage, people per acre, and other comparative measures of density	Spatial densities affect feeling of belonging, crowding, aggressive and reclusive behaviour Provide a minimum of 1,5 sq m per student in academic areas, avoid crowding.
	56	Climate Analysis	analyse the climate to include climatological data on seasonal temperatures, precipitation, snow, sun angles and wind direction	Thermal comfort affects productivity, alertness and lack there of aggressive behaviour.
	57	Code Survey	evaluate the form giving significance of code and zoning requirements	School setting in relation to architectural values of the urban setting. Similar architectural language or contrast to impact the community. Feelings of creating a special place within the community.
	58	Surrondings	analyse local materials and the immediate surroundings of the site for possible influences	Environmental questions in relation to urban or rural context. Regard for and preservation of natural forms and elements. Humanization elements impact school maintenance and productivity through place attachment. Choose good materials which impact a feeling of quality and values towards educational goals. Avoids vandalism.
	59	Psychological implications	understand the psychological implications of form on territoriality and movement of people and vehicles	Possibilities of: territorial feelings and ownership, sensory stimulation, social interactions, feelings of security and safety.
	60	Point of reference / entry	define points of reference and entry	Create a sense of entry to impact a feeling of belonging and exploration of the school complex as a whole.
	61	Cost/SF	establish a mutual understanding of building quality on quantitative basis (cost per square foot)	
	62	Building or layout efficiency	understand the effect of building layout efficiency (commonly referred to as net to gross ratio) on quality	Functional questions should provide possibility to change layouts to include educationally important activities with ease. Smooth running of a classroom increases productivity, individualization of attention, avoids monotony, increases productivity. Include generosity of space, surface areas, infrastructure (equipment availability, plugs, wifi, etc.)
	63	Equipment costs	understand the effect of equipment cost on quality	
	64	area per unit	establish the functional adequacy (area/unit) of spaces as an indication of quality	Functional aspects go beyond mere space adequacy for each activity, They include dynamic possibilities, group involvement in space usage, rich and diverse activities, less monotony, more productivity. Impact on personal involvements. Feeling of belonging. Dependent on: space adequacy, spatial relations, flexibility, generosity of available space, equipment, surface areas, plugs etc..)

Facts relating to Form

	Code	Summary	Description	Bibliographic Information
FORM	90	Enhancements	evaluate the natural features of the site, and identify those to be preserved or enhanced	Identifiable objects that serve as reference points. In schools: special entrance elements, fountains, totems, amphitheater.
	91	Special foundations	evaluate the climate analysis and determine the implication on climate controls	Climate (hot and humid) may cause fatigue, apathetic behaviour, reduced productivity, reduced attention span, aggressive behaviour.
	92	Density	evaluate the for-giving implications of the code survey, and identify the salient safety precautions	Spatial densities
	93	Environmental controls	evaluate the soil analysis report and determine the possibility of special foundations and their costs	Not related to behaviour of users
	94	Safety	evaluate climate, demographic data, site conditions and land value to establish general density standards	Environmental values
	95	Neighbors	evaluate the policy concerning the neighboring community to uncover the concept of sharing or interdependence	Give importance to community expectancy in relation to the artistic value of the new school. Determine the total population size to enhance community use of the school. Maximum recommended = 500 students
	96	Home Base/ officing concepts	uncover the need for an individual's home base or territoriality	Campfire-spaces and individual study and relaxation nooks. Impact of distance learning on social behaviour of students. Personal space for keeping personal items, value of the individual. Importance of individual study palces distributed within the school compound. Increase concentration behaviour of students.
	97	Orientation	uncover the need for good orientation, maintaining a sense of direction through a building or campus	Importance of evaluating wayfinding issues in POE studies. Spatial orientation problems may cause apathy and learning disfunctions.
	98	Acessibility	uncover the need for the concept of accessibility, which promotes a sense of entrance and of arrival, providing directly access to public-oriented facilities	Promote the sense of entrance through architectural elements. Improve access and check accessibility in POE studies. Comparative floorplan evaluations are recommended.
	99	Character	uncover the general character of the architectural form that client intends to project as an image	Building should express the community spirit. And have a special signature to distinguish one from another school. Feeling of belonging - ownership, territoriality, interventions by group users, sense of caring. The image of the school affects a sense of attachment, impacts care and a feeling of belonging and ultimately productivity and a liking of school.
100	Quality control	understand that quality control is an operation concept used to provide the highest quality level feasible after the balance of quality/cost factors	Importance of commissioning phase Relation of construction cost, running and maintenance cost. Quality is measured through intrinsic attributes: accessibility, adaptability, crowding, spaciousness, legibility wayfinding, meaning, possibility to personalize, feeling of ownership, physical comfort, privacy, safety and security.	

Concepts relating to Form

	Code	Summary	Description	Bibliographic Information
FORM	118	Site Developments costs	identify the components of site development cost	
	119	environmental influences on costs	consider the factors of the physical and psychological environment, as well as site conditions as influences on the construction budget	Impact on vandalism
	120	building costs/ SF	establish mutual agreement with the client on the construction quality expressed for each activity by organization, location, space type and time	Positive impact of a quality environment on users: feelings of belonging, better care and use of buildings and grounds, impact on reduction of vandalism.
	121	building overall efficiency factor	evaluate the efficiency factor that was used to determine the useable, rentable or gross area requirements	Schools may rent out spaces to generate income for school installation, maintenance and upgrading

Needs relating to Form

	Code	Summary	Description	Bibliographic Information
FORM	135	major form considerations that will affect building design	identify and abstract the major form-giving influences of the site on the building design	It is important to evaluate the design at various stages of its design process. Include the school community in this.
	136		identify the salient environmental influences on the building design	Apply an integrated design process to evaluate the design from different perspectives, including environmental impacts.
	137		identify the quality of the project and its implication on the building design	Importance of including a commissioning phase into the design process for retrofits, training of staff and education of users on full usage of infrastructure.

Problems relating to Form

Figure 4. Part of the “Problem Seeking” (Form) method for the local school design process with organization of behavioural data

Different pedagogies have different goals, reflected in the educational activities, student grouping and their spatial arrangements. Prime activities are important. Progression and segregation as well as security feelings must be discussed for each age group. In architectural terms the flow of people (students) in learning spaces is important and behavioural patterns can affect the management of a

classroom. Giving students choices to develop uninterrupted blocks of work time, for instance, and having access to specialized educational materials, as in the case of Montessori schools, can be an important issue.

Briefing debates should not forget to question the standard or traditional “factory-learning model” of schools. The criticism of this type of school shows that architecture affects academic performance and that leaking roofs, broken windows, dark classrooms and other poor quality environments are related to lower achievement rates of students (Upitis, 2004). In Brazil, “Constructivism” based on the works of Jean Piaget, Lev Vygotsky and John Dewey have had an important impact on public education, through the teachings of Paulo Freire Darcy Ribeiro, who emphasise the importance of the learners’ background and culture (Campayre, 2003; Salvatori, 2003).

Other goals should be, to achieve established educational standards, through the teachings of reading, writing, arithmetic, art, music, crafts, motor and social coordination skills. It is interesting to note that few school briefing debates touch on some of the problems associated with such basic educational standards. For example life skills, such as social communications, cooking, gardening, small house or equipment repairs, hygiene and infant and childcare are often absent in these type of debates. Preparing the school environment for teaching these skills is not as difficult as it might seems.

Importance must be given to the student population characteristics. First, according to age groups, Piaget has given us many indications on how children perceive their environment and adjust their behaviour (Bencostta, 2005). There are other factors that influence a child’s development, such as socio-economic conditions of the family and risk situations that should be mitigated by the school

environment (Argilaga et al., 2003). The preparation of future generations for the challenges that lie ahead is a further issue to be included in a quality school program. Sustainability can be incorporated into the building design, thus teaching through physical examples of energy and water use efficiency. Good nutrition and cooking can touch on food shortages in the world and be exemplified in specific workshops and exhibits in a school to increase awareness to complex issues. Visual reminders throughout the school building are important.

Teachers often are not aware of the potentials of the educational spaces available. Staff, therefore need training during the commissioning phase of a school building design process (Horne, 1998, 1999; Martin, 2002). To provide maximum opportunities for positive educational activities in the classroom, and elsewhere in a school building, spaces have to have flexibility but should avoid neutrality. The environment needs to give signals as to appropriate uses (Voord & Wegen, 2005). In the classroom confusing circulation patterns should be avoided, since they may cause disorientation. Increased student densities in classrooms create more movement and consequently distraction, which might affect learning (Martin, 2006).

Lippman (2010) gives us an indication as to the most important activities that must be able to be performed in school environments. 18 experiences are listed in Nair & Fielding (2009), each demanding a specific space configuration and furniture layout for effective teaching and learning to take place. The spatial arrangements for these modalities are illustrated with drawings and images of example schools in Nair and Fielding (2009):

Other issues, not directly related to the prime goal of an educational institution must also be included in programming debates. These should touch on antisocial behaviour in schools: drugs, bullying, gangs, vandalism, and extreme behaviours,

from timid to aggressive students (National Crime Prevention Council, 2003). Vandalism demands more robust design elements to prevent damage as a result of boisterous young playfulness. Good quality materials must be specified and the building should have a pleasant, non prison-like feel to it. Vandalism is also more common in public areas of schools, mainly in the more hidden parts of buildings. Thus designs should avoid dead-end corridors without views to the exterior and sanitary facilities and locker-room must be placed where supervision is natural through user movement. Freedman (2011) gives us more clues on how to avoid antisocial behaviour. Making children feel safe, will help in learning productivity (UNICEF, 2010). Children need autonomy both in the classroom and on their way to school. This has been drastically curtailed in the modern large city, giving few opportunities to children to walk or bike to and from school, affecting as well obesity at an early age, through a lack of daily physical activities (Balzani & Borgogni, 2003; Gorman et al., 2007; Rissotto, 2003).

To support a participatory and enriched programming phase for the local public school building design process other additional tools should be applied. Evaluation tools such as DQI and CFA (Gann et al., 2003; Voordt et al., 1997) for instance, must be made available (translated for local conditions), since they are directly applicable to the preliminary design stages. They provide the design team visual returns on the design development, appropriateness of building shape, size and organization in relation to vital issues of pedagogy, function and environmental comfort.

To structure and stimulate the briefing debates Sanoff (2001a; 2001b) has developed several design process activities, some of which can be applied directly to local needs. Others must be adapted to specific situations encountered in the public

school realm in Brazil. Pattern languages, such as those of Alexander et al. (1977) and Nair and Fielding (2009), can be developed for the local public school design process. Design parameters, organised and presented as patterns, thus based on “if...then” statements, are efficient in conveying scientific data in a direct way to typical design activities. Some local Brazilian school architecture issues exist which must be specifically addressed. These are, for example: the question of security and control over schools sites; the importance of cross ventilation for the mostly tropical climates, found in the country and the connections between isolated buildings when the school complex is the result of an evolutionary building process.

Conclusions

Argument in favour of a more structured and participatory design process for public schools. This paper is part of a continuing study on the public school environment as found in the State of São Paulo, Brazil. The local school building design process was previously characterized and shown to lack a participatory briefing phase (Deliberador, 2010). A discussion on the importance of this phase and specific methods, to be employed during the design process, to improve the local school environment were included. The rich literature on human behaviour in relation to architectural elements was organized according to issues of the “Problem Seeking” architectural programming method.

Various aspects of schools have been analysed over a long period especially in Europe and in North America, from learning styles to vandalism and transformed into design criteria. This organised material should enable participatory briefing to be introduced in the local public school building design process with a goal to support increased learning and productivity in schools. Improved educational spaces can then be evaluated according to benchmarks set in the architectural program itself.

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