School building rehabilitation: thinking strategically towards excellence

Teresa V. Heitor

By the end of the 20th century, school building rehabilitation was attracting considerable attention: in some countries, an increased focus on improving student outcomes, coupled with a significant increase in capital funding for school buildings, led to the comprehensive modernisation of school facilities. This has resulted in a wide range of publications, from academic papers to practical guidelines for construction professionals.

The purpose in this paper is to review the key themes relating to school building rehabilitation and the challenges facing educational authorities and schools to effectively raise the competitiveness of schools. It aims to increase understanding of both the design process and strategies that might contribute to accommodating the 21st century educational agenda and its organisational implications, while making the most of available resources.

Introduction

The global "democratisation" of education in the 20th century led to a dramatic increase in access to education, putting pressure on school provision. It is recognised that a successful education policy depends on the quality of the school assets and the capacity of these assets to support specific geographic and demographic needs, as well as to meet curriculum requirements.

However, the way in which learning occurs in many classrooms has put pressure on existing facilities built for a "one size fits all" model of teaching and learning. Developments in educational research suggest that a paradigm shift is required to ensure that the school environment in the 21st century will be radically different from that of the 20th century (Fisher, 2005; Gaffney *et al.,* 2008; Oblinger, 2006; Scott-Webber, 2004). Research indicates that learning spaces must be reconfigured to better support different teaching and learning practices, as well as to facilitate a more decentralised learning process, which is no longer confined to classroom space and time.

Studies consistently show that high quality school facilities have a measurable positive impact on student outcomes and attendance rates: they are crucial to improve the quality and effectiveness of education, know-how, lifelong learning, social participation and well being. Similarly, teachers cite the physical condition of their schools as a critical factor for effective teaching (Schneider, 2004).

Having taken into account variables such as socioeconomic status, research also reveals that schools with poor environmental and functional conditions, such as inadequate acoustics, heat, light and air quality, critically affect student achievement and behaviour and can inhibit the effectiveness of learning strategies. Furthermore, school buildings with damaged and aging systems can be a threat to students' and school staff's health and safety (Higgins *et al.*, 2005; Rudd *et al*., 2008; Schneider, 2002).

School rehabilitation also offers both direct and indirect benefits to the overall community. Schools can shape the appearance and atmosphere of the urban environment, providing an anchor for social revitalisation and economic development. Besides sending the message that education is valued, a commitment to improving school infrastructure will help to make a more efficient allocation of resources in the educational sector, combat social exclusion of more vulnerable groups, and promote equal opportunities in the widest sense.

Moreover, the reuse of school buildings – as opposed to the decision to demolish and build new ones – will contribute to supporting healthy living, environmental awareness and social responsibility, as part of a comprehensive and lifelong approach. The demolition and

replacement of existing school buildings has a higher carbon impact, not to mention the material impact of the new construction.

The challenges facing school rehabilitation

In some countries, despite the inherent advantages of school building rehabilitation, there are several barriers to adaptive reuse. These barriers are associated with a changing educational paradigm that may call into question conventional architectural design approaches and normative construction guidance.

The programmatic complexity of the contemporary curriculum is reflected in the spatial organisation of the school premises. The introduction of expanded curriculum and educational programmes, which go beyond what a traditional school offers – such as multi-age groupings, team teaching, project areas, vocational training and community use – are resulting in a growing need for flexible learning spaces and updated technology as well as informal learning and social areas. In particular, the increased use of digital technologies and the portability of technological devices have a clear impact on learning habits. Students are now permanently connected to the world wide web and are able to choose where and when to 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, and where students and teachers are working together, sharing ideas and experiences.

In many existing school facilities, the design approach follows a "stationary" model, meaning that each space and group of spaces was designed with its own specific functional requirements and technical features. No extra investment was made to facilitate *future* functional or technical adaptability, thus limiting the building's life expectancy. The school layout was organised according to a formal teacher-centred learning model, where the classroom was the core unit of the school's spatial programming. Complementary learning spaces allowing other pedagogical practices and learning models were absent, and support spaces were reduced to the minimum. Such school buildings are ill equipped to meet today's educational needs. For example, their reconfiguration is less likely to respond to larger size requirements for learning areas such as science laboratories, computer rooms and arts rooms, vocational workshops and libraries.

However, when the design approach follows a more neutral non-specific layout type, school buildings can be easily adapted to changing requirements over time. Further investments in flexibility, both in design and construction, namely in the provision of extra spaces and ease of dismantlement, can extend the overall life expectancy of buildings and enable better compliance with new curriculum demands.

In addition, due to the age and condition of many school buildings, ensuring compliance with new or revised building codes and legislation, as well as with environmental and structural concerns, can add significant costs to a project and become a real impediment to reuse. Age may also have led to the obsolescence or deterioration of existing building systems and materials, which need to be replaced or repaired. Urban zoning permissions have often changed since most school buildings were constructed, in addition to comfort and indoor air quality standards, structural and mechanical systems, and accessibility and fire safety requirements. Code compliance usually implies the need to reorganise the school's internal spaces, reinforce the structural system and install new services ducts and lifts, especially where wheelchair ramps are impractical.

Existing school buildings and grounds often have environmental concerns. Structures built between the mid-1920s and the mid-1970s may contain asbestos or lead paint that must be replaced as part of rehabilitation. Moreover, these buildings often do not address concerns of reducing energy efficiency and maintenance costs. To operate as a low energy building, energy performance would need to be optimised and new systems installed, which would extend beyond the footprint of the existing buildings.

But the chronological age of a school is not necessarily an indicator of its construction quality. Most schools built in the first half of the 20th century, for example, are masonry-bearing

structures that rely on massive walls to provide structural stability. Many were overdesigned in load-bearing capacity by today's structural standards. Most older schools are easier and less costly to rehabilitate than schools built in the second half of the 20Th century, when low-cost materials and less durable construction techniques were common. Several durability problems are often due to low-quality job execution; not to the age of the building.

School building rehabilitation also introduces additional difficulties in terms of construction management. In almost all cases, it takes longer to rehabilitate an occupied building than to vacate it. And once works start on a site, unforeseen problems can affect the programme completion date and lead to increased costs.

The impact of rehabilitation on an occupied school building depends on the extent and scale of the work, as well as on school precinct capacity and building typologies. Usually works are carried out in parallel with school activities, according to a multi-phasing programming. Apart from requiring temporary relocation of classes and other school activities, restricted access areas and provisional circulation routes, it calls for careful planning and professional execution to prevent noise, vibration, dust and other momentary disruption of services. Care also has to be taken to avoid increased risks to health and safety from construction.

Guiding principles for school building rehabilitation programmes

School building rehabilitation is always the final result of an extended and complex decision-making process, which involves translating the educational goals and the organisational implications of these goals to the existing school building, taking into consideration constraints imposed by design guidance and master specifications. This is a complex and responsive design process that calls for non-conventional responses.

Design guidance and master specifications are usually prepared by government bodies responsible for funding rehabilitation projects and are often based on lessons learned from previous developments. Providing rules and communication procedures to be followed over the course of the design process helps to guarantee the coherence of operations and facilitate the design process. This also ensures the quality of facilities, while controlling construction and operating costs and taking into account code compliance and time constraints.

Issues such as comparative construction costs and schedules are critical components of the school building rehabilitation process. Guidelines and rules-of-thumb for these issues are well researched and documented in the literature. On the other hand, the design process is still considered problematic.

Often, the conventional design process does not address issues in relation to the school's vision, technical documentation and, ultimately, the school's physical improvement. Traditionally, programming is seen as the first step of an essentially linear process of six sequential phases – programme development, preliminary design, design production, tenders and bid management, construction and evaluation – despite the internal feedback loops at each stage (Sanoff, 1977). Once completed, the programme is only revisited during the evaluation phase, typically in the form of post-occupancy evaluations (POEs). Accordingly, the design process follows a "solution-focused strategy", which means that the problem is approached by attempting to create solutions rather than by analysing the problem itself.

An interactive briefing process

It is therefore important to recognise the limitations of a linear approach to school building rehabilitation when developing a complete and accurate design solution that meets specified targets. A better approach would be to integrate programming with design, and include evaluation processes, in a holistic and inclusive way as a cycle of interrelated stages, with direct communication between designers and the user-clients. This way, it would become an interactive briefing process allowing regular feedback throughout the project, contributing to progressive decision-making with "milestones" acting as gateways (CIB, 1997).

The advantage of an interactive briefing process is that more players are involved early and

more options are considered. As a result, it clarifies in a timely manner which design decisions should be referred back to the client to be tested against their anticipated needs and which can be tested internally as part of the design process (Blyth and Worthington, 2010). At the centre of this process, from the programming through design stages, is the search for synergies, *i.e.* strategies with resultant benefits greater than the sum of individual design decisions. It is recognised that such a process is the most cost-effective way to achieve a high-performing building. It addresses issues early on, avoiding missed opportunities related to performance and economy. In times of tightly controlled budgets, it optimises investment in keeping with the school community's goals.

Recent work on briefing also suggests that developing an understanding of the social context of a project is an essential part of the design process (Blyth and Worthington, 2010; Kumlin, 1995; Leaman, 2002). In the specific case of school rehabilitation, this implies the (re)interpretation of the form-function relationship, in which "function" relates to educational vision and attitudes as well as practical needs related to school organisational issues.

The educational brief should be clearly defined and prioritised independently of considerations regarding the physical facilities. Rather than setting out specific built solutions, it sets a clear framework for the design team's work by identifying the general principles to be adhered to in the reorganisation of the school spatial layout, with a view to accommodating the educational agenda and its organisational implications. For that reason, the educational brief works as a conceptual matrix, which can be supported by diagrams that explain how this is translated into the building itself.

In view of this approach, the programming stage represents the start of a critical phase in the school building rehabilitation process. Consequently it must be regarded as a flexible group of decisions and actions towards the school's future, projected in a limited timescale: medium- to long-term. It must involve an evaluation of the school's educational vision, organisation and functioning, together with a comprehensive assessment of current suitability and operational issues (both short and long-term), expansion needs and opportunities, historical and community significance, and the financial resources to be allocated to rehabilitation works.

Consultation with school boards, staff, students and parents is critical to determine the future use of school buildings. In addition to demonstrating how these groups regard their educational environment, it can also be useful to help understand how the buildings and their use can be improved and made more effective. However, these groups 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. Moreover, as advocated by Lichfield (1996), the impact of a building rehabilitation may also be perceived as negative. Although it can be an obvious advantage for school communities and education authorities in general due to the improvement of teaching and learning conditions, there may also be internal tensions within the school community. These tensions may occur, for instance, between teachers who frequently are disappointed or not convinced by the proposal of a new type of classroom or laboratory configuration with the new workspace conditions, or in general when old conventions and habits are challenged.

Other local actors may also feel disadvantaged, for instance, due to the perception of loss of community spaces or neighbourhood invasion resulting from more movement, car traffic or less parking in the vicinity of the school. These conflicts may affect the project, as approval is required on final decisions. Early negotiations with the school community as well as the relevant local authorities can reduce the cost of subsequent changes made in meeting their interests and requests. When all users' needs and project requirements are defined at the start, there are fewer changes at later stages of the project, thereby saving time and resources.

Engaging all parties involved in the school project in order to define and solve design problems is vital to creating positive and collaborative working relationships. Nevertheless it implies investing additional efforts in implementing an effective communication system. The participatory review is a useful tool as it provides an opportunity for the parties involved to review the design as it develops. For school users, the review is a good opportunity to check that

the design solutions meet users' needs and that the architect's assumptions about how they will use the building are correct. It also provides a useful opportunity to discuss how new problems might be resolved, after relevant information has been gathered, thus creating a simultaneous planning and learning cycle.

Commitment in the participatory review process and the programme managers' expertise and experience are important elements for ensuring the success of the school building intervention and the general quality of the final product. Programme managers, acting as agents for the educational authorities and answering the needs of the school community, should also combine collaborative multidisciplinary work and problem solving with fulfilling requirements and responding to complaints. As a mediator, their role is to resolve conflicts and recommend alternatives to as to keep within education specifications and budgets. As a facilitator, they should ensure that each of the parties involved understands the intended goals of the project and the steps in place to achieve them and should get the opportunity to address his or her part in the project on time.

With the increasing autonomy of the various disciplines involved in the rehabilitation process, technical drawings and specifications have become an essential means of communication, as well as a tool for solving problematic design issues. However the lack of skills and know-how among the school users' groups, especially their lack of experience in working closely with designers and other construction professionals, poses additional problems. Few of them have the appropriate training to grasp designers' terminology and semantics, understand technical drawings and specifications and translate these appropriately to support decision making.

As such, programme managers become privileged knowledge translators, who are able to interact with all parties and interpret different types of data in terms that can be understood by designers and integrated into the design process. Besides preparing the master planning and programme budgets, including design schedules, they oversee the design team and work closely with procurement staff to assist with contracts, as well as co-ordinate arrangements with the school throughout the construction work and the move-in stages. If the programme manager's team role is weak, decision-making may be slow and delays are to be expected.

Conclusion

Even in times of financial crisis and uncertainty, school building rehabilitation programmes around the world represent a significant investment in relation to governments' financial resources. Many schools and universities in this Compendium are part of highly successful school building rehabilitation experiences worldwide, which demonstrate an effective use of resources and cost control. Although very different in terms of urban and social context, building typologies, architectural features and building components, design approaches and adaptive strategies, these examples pose similar questions and contain certain common elements and responses concerning school building rehabilitation.

A decision to rehabilitate a school building is only justified when educational, technical and economic resources are jointly identified and the intended change can be carried out with the approval and support of the whole school community. In addition, it would be pointless to rehabilitate a school building if the intervention does not take into account progress in the field of education and the importance of providing high quality teaching and learning environments.

The challenge is showing the value of re-usage by making an adaptive project feasible and better value for money, thus encouraging creative responses from both designers and the building sector. Learning will continue to evolve and school buildings will need to reshape themselves in response to the paradigm shifts accompanying education in the 21st century.

As Louis Khan once said,

> *"I think of school as an environment of spaces where it is good to learn. Schools began with a man under a tree, who did not know he was a teacher, discussing his realisation with a few who did not know they were students . . . the existence-will of school was there*

even before the circumstances of a man under a tree. That is why it is good for the mind to go back to the beginning, because the beginning of any established activity is its most wonderful moment."

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