School Building Design and Learning Performance
with a Focus on Schools in Developing Countries

Eberhard Knapp
Kaj Noschis
Çelen Pasalar, Editors
The Colloquium was organised by
Colloquia sàrl (Parc Scientifique à l’Ecole Polytechnique Fédérale de Lausanne,
PSE-C, 1015 Lausanne, Switzerland)
www.colloquia.ch, info@colloquia.ch

As the

12th Architecture & Behaviour Colloquium

with support from:

KfW Entwicklungsbank - KfW Development Bank
Swiss Agency for Development and Cooperation (SDC)
Cantone Ticino

The Colloquium was organised at the joint initiative of
Eberhard Knapp (consultant with KfW) and Kaj Noschis (EPFL).
Eberhard Knapp, Celen Pasalar and Kaj Noschis worked on the Proceedings.
Grateful acknowledgement to Joshua Peery who has edited most of the papers.
Cover picture: Photo credit: Bernhard Kogel

Comportements and authors, Lausanne, 2007

Imprimé par /printed by:
Imprimerie Chabloz S.A.
Lausanne

Imprimé en Suisse

ISBN 2-940075-11-5
# Table of Contents

**General introduction** ................................................................................................................. 5

**Part 1: Dilemmas : Quantity versus Quality Issues**
- Introduction ................................................................................................................. 5
- School Building in Developing Countries: Is Quantity the Only Relevant Dimension of the Problem ?
  *Eberhard Knapp* ........................................................................................................ 9
- The Fast Track Initiative and School Facilities: achieving the Second Millenium Development Goals
  *Michael Wilson* ....................................................................................................... 19
- Architectural Quality in School Building Design: A view from India
  *Kirtee Shah* ............................................................................................................. 25

**Part 2: Research Findings**
- Introduction
- What the OECD PISA study reveals about the physical learning environment
  *Hannah von Ahlefeld* ............................................................................................ 35
- Building Quality, Academic Achievement and Self-Competency in New York City Public Schools
  *Nicole S. Simon, Gary W. Evans, and Lorraine E. Maxwell* .............................. 41
- Spaces for Learning Through Better Social Interaction
  *Celen Pasalar* ........................................................................................................ 51

**Part 3: Country Reports**
- Introduction .................................................. 61
- Status of Educational facilities in Yemen
  *Mohamed Hassan Alsharafi* ..................................................................................... 63
- Public School Buildings in Jordan: Reality and Aspirations
  *Osama Maghayday* .................................................................................................. 67
- The School Planning Process and Maintenance of School Infrastructure in Egypt
  *Hatem Zaghloul Shalaby* ......................................................................................... 75
- Education in Palestine
  *Fawaz Mujahed & Ziyad Kullab* ............................................................................ 85

**Part 4: Project experiences**
- Introduction ........................................................................................................ 95
- From “Standard-Design” to “Standard-Procedures”
  Bernhard Kogel ................................................................. 97
- The Schoolyard as an Instrument to improve Learning Performance
  Beatriz Fedrizzi and Ivelise Flach ........................................... 105
- Community Participation in an Elementary School Classroom Addition
  Henry Sanoff ........................................................................ 111
- Relating Educational Objectives to Learning Spaces: A Design Games Workshop
  Henry Sanoff ........................................................................ 117
- New Didactic Approaches in Traditional School Buildings
  Yolanda Steijns ..................................................................... 121
- Learnscape: School Architecture as the Connecting Link Between Child and Context
  Mitra Hedman ..................................................................... 127
- Urban clusters as strategy for the university Campus in Lugano
  Enrico Sassi ......................................................................... 135
- Conclusions to the Colloquium ........................................... 141
- List of participants ................................................................. 144
Introduction

The XII Architecture & Behaviour Colloquium took place in Monte Verita (Ascona, Switzerland) from March 29 to April 1, 2006 and was a very productive meeting. Its theme was *Architectural Quality in School Buildings: School Building Design and its Relevance to Students’ Learning Performance – With a Specific Focus on the Planning and Design of Schools in Developing Countries.*

The Colloquium was the twelfth in a series of meetings of which several have been devoted to architectural issues related to cultural contexts outside Europe. This Colloquium brought together academic researchers and architects from Europe and America, furthermore representatives from the Ministries of Education and School construction from Middle East countries (in this case Yemen, Jordan, Egypt and the Palestine territories) as well as experts from organisations subsidising the construction of schools in developing countries (World Bank, Kreditanstalt für Wiederaufbau (KfW), European Investment Bank, Swiss Development and Cooperation). The group of about 30 persons discussed intensively and passionately during three days in the magnificent surroundings of the Ticino Canton overlooking Lake Maggiore.

The specific theme of the Colloquium can be rephrased in questions. Should we be concerned about how buildings look, how they work and are used by pupils and teachers in contexts where usually the priority is simply to be able to offer basic school training for youngsters? Is building quality a luxury in situations where the first challenge is just to find spaces where youngsters can be taught?

The issue of the interrelationship between school buildings and the level of students’ scholarly performances has been the topic of studies in the social sciences for a number of years. Research is being done at universities and institutes across Europe and North America and the debate is of considerable interest to both scientists and practitioners. Yet the impact of such research is uncertain. Some pedagogical approaches, such as those followed by Rudolf Steiner schools, do explicitly acknowledge and integrate the influence of the characteristics of buildings (e.g. colours and shapes) in their teaching programmes. But “ordinary” schools?

All will agree that architects, education administrators and funding agencies can only profit by getting updated information about the relationship between school architecture and pupils’ achievements so that informed decisions are made and good choices done when allocating funds and implementing projects. It is certainly worth not only to have in mind general standards and minimum technical requirements in designing schools but also to have a view on the influence of the built environment on the human psyche and about its impact on social behaviour. The question is also of relevance to developing countries, where scarce resources need to be carefully spent.

The 12th Architecture & Behaviour Colloquium originated at the suggestion of Eberhard Knapp, consultant for KfW and involved in assessing school construction programmes in developing countries around the world. He thought it would be useful to bring together researchers and representatives of instances implicated in decision making about and building of new schools. Kaj Noschis, responsible for the Architecture & Behaviour Colloquiums, was eager to follow up on
this theme. It became teamwork. When the Call for contributions was launched the organisers, Noschis and Knapp, got some responses from researchers directly involved in assessing the impact of the built school environment on learning. But they also got responses from several researchers and architects involved in experiments on school building with the tenet that “quality matters”.

Thus the group of participants became fourfold. Not only were there (1) representatives from funding agencies, (2) administrators from countries involved in such school construction programmes as well as (3) academic researchers with results on pupils’ performances’ evaluation in different physical school environments but now also (4) architects showing through their experiences in the field how “quality” had become part of their projects.

Thus the Colloquium had a programme where these four voices would be heard and have the opportunity to be confronted. The Colloquium itself saw short formal presentations from most participants and these were regularly followed by intensive debates.

Country teaching programme administrators would offer statistical data and general basic pedagogical aims. Survey results, pedagogical experiences as well as concrete obstacles and challenges met in the field by the concerned actors would then be presented, often pointing to exciting changes when “quality” had been taken into account. In addition the scientific research results presented brought evidence that the built environment is an important factor in enhancing learning. Yet, considerations on the social realities of the different country contexts would question the sense of giving priority to such matters in school construction. The pressure for just offering a basic school education to the largest possible number of children is most dominant. Funding agencies expressed their dilemmas by referring to their own contrasting experiences.

In the last Colloquium session it was decided to publish a volume of Proceedings of the Colloquium that would reflect the structure and content of the presentations and discussions.

All participants were invited to submit a short paper relating their presentation but with also the possibility of taking into account comments and discussions that had taken place during the meeting. The editorial team, Eberhard Knapp, Kaj Noschis and Celen Pasalar, got the task of finding an appropriate balance for the different voices heard during the Colloquium and of defining the format for the publication.

The result is in your hands. As strongly contrasting views were expressed during the Colloquium, all backed by data and coherent arguments, the editorial team decided to maintain this variety of convictions and has regrouped the papers under four headings that hopefully make it easier to situate and understand convictions, questions and challenges of the respective parties. The four parts are all introduced by a short comment that explains the respective headings and highlights the arguments of the authors grouped in that particular chapter. The headings are:

- Dilemmas of Funding Agencies: Quantity versus Quality Issues.
- Research Findings
- Country Reports
- Project experiences

In the general conclusion of the volume, as is to be expected given the content of the papers, more questions are raised than answered. However, and this is a reason for some optimism, the experiences related in the volume make it clear that experiments in planning and construction of schools and schoolyards where the first hand actors (teachers, parents, pupils) have been involved do improve school and learning programmes.
Part 1:
Dilemmas:
Quantity versus Quality Issues

Architects, education administrators and funding agencies / economists need to understand more about the relationship between buildings, their architecture and academic achievement so that they can make informed decisions and correct choices when allocating chronically scarce funds. It is necessary to make available not only general standards and minimum technical requirements for school designs, but also an understanding of the complexities of the interaction between the built environment and the human psyche and its possible impact on the formation of social attitudes and behaviour.

The question as to whether there is an interrelationship between the architectural / spatial quality of the educational environment and students’ learning performance is not only of importance to the improvement of educational facilities in Europe and North America but is also of great relevance to developing countries, where scarce resources need to be carefully spent – which, of course, also applies to the construction of new school infrastructure.

Often, “school building programmes” are co-financed by international development support. Indeed, one of the focal fields of support given by richer nations to developing countries has for many years been in the field of education, with a strong bias towards basic education.

Although the “soft components” of such programmes (e.g. curricula development, teacher training, improvement of teaching materials, etc.) are unquestionably an essential ingredient of any approach to improve the quality of education, it is equally true that the bulk of available funds are put into the improvement of the physical infrastructure, i.e. school buildings.

Amongst donor agencies there appears to be today a tacit consensus that quantity of classrooms created is the single most important criterion to measure the success of such projects. In this context, the World Bank, as part of the “FTI Indicative Framework”, defined as “benchmark” a unit cost of US$ 10.000, i.e. classrooms should, on average, cost not more than US$ 10.000 per unit, irrespective of location, climate or other site-specific parameters. Design and construction of school buildings is thus reduced to a single-goal approach only, i.e. that of providing in the short-term a maximum number of classrooms at the lowest possible unit-cost.

In addition, the design and planning of schools is often centrally controlled and coordinated and is based on rather rigid “standard designs”, which have mostly been established on the basis of (outdated?) only engineering requirements. There is therefore little debate or community involvement in the appearance or quality of school building “given” by the government.

The three contributions grouped in this section address these themes critically from quite different angles, but all result from extensive experience in the field and reflect the involvement of their authors in an extensive number of projects and settings. This first part offers an overview of the situation “in the field” today.
School Building in Developing Countries: 
Is Quantity the only Relevant Dimension of the Problem?

Eberhard Knapp
architect, 
consultant with KfW Bankengruppe, 
Frankfurt

It is necessary to focus more closely on the relevance of the topic under discussion for developing countries and for the respective decision-makers. This would, obviously, also include the multitude of donors who annually invest huge sums of money in the educational sector worldwide. It is not least in this context that an understanding of the full role of educational architecture can impact strongly on the way in which donor-funds are spent and on the efficiency achieved in aid-programmes funded by international donors.

1. Dimensions of the Problem

Undoubtedly, the shortfall of physical infrastructure (i.e. classrooms) is one of the most serious problems in the educational sector of many developing countries. In a strategy paper adopted by the German government it “is estimated that 113 million children worldwide still have no access to primary education” (BMZ, 2004). Available schools are often characterised by overcrowded classrooms and/or double-shift education, both of which arguably have a serious negative effect on the academic achievement of learners.

In other, mostly more remote areas, children go without schooling - or attend schools in very makeshift classrooms: in caves, under trees or in converted rooms - such as store-rooms, garages, residential buildings, etc, which are usually wholly unsuitable for learning purposes.

The international community has taken cognisance of this immense problem by proclaiming as the second of 8 Millennium Development Goals (see also: http://www.un.org/millenniumgoals/): «To achieve universal primary education». Consequently, financial support for primary education has continuously increased in recent years (see Tab. 1).
### Table 1: Basic Education in Bilateral Aid 1993 – 2003

<table>
<thead>
<tr>
<th>Year</th>
<th>Bilateral Aid Commitments to Basic Education (1993 – 2003) *</th>
<th>Share of Basic Education in total bilateral ODA (%-ages)</th>
<th>German Bilateral Aid (FC committed) – Primary Education (EUR mill)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>40</td>
<td>0.1</td>
<td>25.5</td>
</tr>
<tr>
<td>1994</td>
<td>27</td>
<td>0.6</td>
<td>77.5</td>
</tr>
<tr>
<td>1995</td>
<td>54</td>
<td>1.2</td>
<td>142.7</td>
</tr>
<tr>
<td>1996</td>
<td>56</td>
<td>1.3</td>
<td>153.0</td>
</tr>
<tr>
<td>1997</td>
<td>47</td>
<td>1.2</td>
<td>57.0</td>
</tr>
<tr>
<td>1998</td>
<td>42</td>
<td>1.0</td>
<td>81.9</td>
</tr>
<tr>
<td>1999</td>
<td>58</td>
<td>1.3</td>
<td>31.2</td>
</tr>
<tr>
<td>2000</td>
<td>78</td>
<td>1.8</td>
<td>30.8</td>
</tr>
<tr>
<td>2001</td>
<td>89</td>
<td>2.0</td>
<td>21.0</td>
</tr>
<tr>
<td>2002</td>
<td>109</td>
<td>2.2</td>
<td>47.4</td>
</tr>
<tr>
<td>2003</td>
<td>116</td>
<td>1.8</td>
<td>32.7</td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td></td>
<td>33.9</td>
</tr>
</tbody>
</table>

* Amounts in constant 2002 US$ millions

KfW Development Bank, through which Germany channels most of its bilateral financial cooperation, acknowledges that the provision of adequate educational infrastructure is beyond the capacity of most developing countries and constitutes a serious bottle-neck in educational systems (KfW-Entwicklungsbank, 2005, p. 7).

2. Solving the Problem - Quantity or Quality?

Faced with the enormous challenge posed by the desire to attain the defined MDG by 2015, the most common solution proposed is to build as many as possible classrooms at the lowest possible unit cost. As part of the “Indicative Framework”, the benchmark cost of US$ 10,000 per classroom was defined at the launch of the «Education for All - Fast Track Initiative» in June 2002 and re-confirmed by the Development Committee of the World Bank (World Bank, 2004).

It is worth noting here that initial investment cost was defined as the only criterion for school infrastructure.

Already on purely technical and economic levels, this one-sided cost-focussed approach appears to be inadequate, as at least two further cost factors are also part of the equation - albeit often conveniently ignored:

a) Operating and maintenance costs, i.e. while a certain solution may have a higher initial investment cost, the cost of operating and maintaining a school building may be lower due to the utilisation of more robust construction materials, stronger sanitary fittings or ironmongery but and

b) Life Cycle Cost: the building’s intended lifespan will ultimately determine its real cost. It would therefore be necessary to define as a benchmark not the initial investment cost, but total «life cycle costs» over a defined period of - say - 40 years. The picture then changes

---

1 Life cycle cost is defined as the total discounted dollar cost of owning, operating, maintaining, and disposing of a building or a building system over a period of time.

2 While 40 years could be considered a «normal» lifespan of a school building in a developed environment, I have seen many donor-funded projects in developing countries which have a real life-span of certainly not more than 10 - 15 years!
dramatically - where a higher initial investment cost may be offset by a much lower operating and maintenance cost. In many States of the USA such analysis is mandatory (State of Alaska, 1999). If this analysis was systematically applied, it would ensure that well-intentioned donors do not fund infrastructure which - in the medium term - poses additional financial burdens for already overstressed national budgets of developing countries.

Thus, by building «cheap» we are unfairly offloading on the beneficiaries a cost-burden which they simply cannot shoulder - apart from the simple fact that they very often have neither the funds nor the mindset for maintenance!

The importance of the two cost factors mentioned can be observed in the above example from West Africa. The two school buildings are adjacent to one another and both were built in 2002. While the left school is still in excellent condition, with a well-ventilated and adequately lighted interior, the right building is in urgent need of repairs – with a defunct sanitary block (picture), a heavily leaking roof and a general state of disrepair. The interior is dark and stuffy.

Maintenance is not only a technical necessity but also impacts academic achievement. Studies have shown a clearly positive correlation between a well-maintained, clean and neat school environment and the performance of learners. «These differences in achievement scores indicate that students in poor buildings are falling behind students in those buildings with the necessary elements to adequately support the educational program and permit students to learn effectively. ... In those instances where students are in poor buildings it means that these students are being placed in situations that will disadvantage them in their school work.» (Earthman, 2004: p. 18f.). Recent research pointing
to similar findings on this important aspect is presented elsewhere in this publication (in this volume Simon et al., 2006; Hedman, 2006).

‘Poor buildings’, of course, refer not only to the architecture and design of a building but more so to its physical status and the manner in which it has been maintained or not. Therefore, apart from being very necessary in order to reduce the life-cycle cost of a building, regular maintenance has a visible and objectively already recorded impact on the academic achievement of students.

However, it is my understanding that school infrastructure should also respond to a few other essential criteria.

(a) School building needs to be designed in response to their immediate climatic, topographic and cultural surroundings:

- Buildings should be so oriented as to have - in hot and arid regions – a minimal exposure to the sun\(^3\), especially in the mornings, when most classes are conducted. Where this basic tenet is ignored - classrooms heat up unnecessarily, becoming very uncomfortable during much of the year. At the same time, wrong orientation will lead to glare at student-desk levels (if no effective shading mechanisms are provided for).
- The design needs to take into account site-specific aspects such as existing (and future) vegetation, slope, soil conditions, surface-water runoff, etc.
- Every culture has its own specific requirements concerning the layout of buildings and, especially, sanitary facilities (which are generally considered essential to improve enrolment of girls). It is imperative that such requirements be taken into consideration in the design of a school, as otherwise utilisation will be less than optimal.
- Similarly, building technologies will often be very regional and it is advisable to follow local traditions and techniques and also take into account some underlying attitudes and skills of a given population. This will be prerequisite for local ownership and sustainability, as the possible scope of necessary maintenance and upkeep will be determined by such local characteristics.

---

\(^3\) Ideally, this is achieved by ensuring that the narrow sides (gables) of buildings face East and West, the eaves South and North.
(b) When planning a school building, care needs to be taken to design a technically and physiologically appropriate building, where aspects such as lighting, ventilation, heating, maintenance-friendliness - to name but a few - are carefully considered at an early stage.

- Natural light is preferable over artificial lighting (and cheaper), needs to come from front-left, and needs to be maximised without creating glare. The possibility of visual contact of a learner with the outside (green areas!) is psychologically important in enhancing his/her performance.
- Proper ventilation (cross ventilation) is absolutely essential, and needs to be carefully planned.
- In many regions, winter-time temperatures drop to near-zero levels (the effects of such cold on the health of learners may be exacerbated by the custom of sitting directly on the floor, e.g. the utilisation of floor-mats in parts of Pakistan or India). Designs should strive to maximise the utilisation of natural heating (sun), provide for appropriate floors (insulation, material), etc.
- Schools, fittings, equipment and school furniture are subject to extreme ‘operational demands’: in any environment, children are very rough with the equipment they handle and this has to be adequately considered in the design. This becomes extremely important with sanitary facilities, which have to be provided in a very robust quality.

In summary, when evaluating an educational infrastructure strategy or a specific school design, the criterion should not be limited to initial investment cost only. Rather, it will be necessary to look at a building in terms of the following four prime criteria:

1. Life cycle cost over a period of - say - 30 years. This must include cost of maintenance and necessary repairs.
2. Suitability to the local climate, topography and culture.
3. Physiological appropriateness (ventilation, lighting, acoustics, low-maintenance requirements).
4. Initial Investment Cost - in order to assess immediate opportunity costs.

Neglecting any one of these aspects will lead to a higher long-term unit cost and / or a built environment which is not optimal in that it does not provide the best possible learning environment for the children concerned.

3. School Buildings in Developing Countries: a Task for Qualified Professionals only!

In order to achieve school buildings which satisfy the four prime criteria identified above it is necessary to involve well-qualified architectural professionals with experience in school design and to allow them sufficient time for the all-important design-phase.

Both of these requirements are frequently ignored in donor-funded projects, where, as result of a mainly politically motivated desire to obtain as many as possible new classrooms in as short as possible a time, planning and design input is frequently reduced to the minimum possible. To make matters worse, professional fees are often reduced to the lowest possible level – with the obvious consequence that this type of “government work” is mostly left to the less experienced or less qualified professionals in a practice. At the end of the day: you get what you pay for!

At the same time, civil engineers are often employed instead of architects. Whilst the former are certainly well-qualified to plan and execute major civil works, the intricacies of purpose-built educational facilities require the expertise of a qualified professional with state-of-the-art experience
in educational architecture.

It can be assumed that - given adherence to these two preconditions - the quality of school buildings built by donor agencies in developing countries will increase significantly without a concomitant increase in the cost of such school infrastructure, especially not if life cycle costs are taken into consideration.

The application of site-specific design criteria in the planning process will result in a more efficient and sustainable utilisation of scarce resources, will improve the educational environment - and thus ultimately positively impact the academic achievement of learners.

An example in case has been the experience of a recent KfW-funded school construction project in Westbank, Palestine. Whereas in all previous projects implemented since 1996, school construction has been based on proven and well-established “standard designs”, the design brief for the architect of EGP VII called for “site-specific, innovative and state-of-the-art educational designs”

All schools are currently (June 2006) under construction, estimates of final construction costs are therefore quite accurate.

<table>
<thead>
<tr>
<th></th>
<th>Average Cost (EUR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>“Standard Design”</td>
</tr>
<tr>
<td>Cost per Student</td>
<td>1,417</td>
</tr>
<tr>
<td>Cost per sqm</td>
<td>302</td>
</tr>
<tr>
<td>Cost per Classroom *)</td>
<td>48,312</td>
</tr>
</tbody>
</table>

*) incl. proportional costs of special classrooms, offices, multi-purpose hall, covered areas

Table 2: “Standard Design” vs. “Innovative Design”: Comparison of Average Unit Cost

As is shown in Table 2, the better schools are less costly - both in absolute and in relative terms. Although the costs have as yet not been analysed in detail, it may be assumed that considerable savings were achieved by:

- Adapting the foundation dimensions to individual site and building requirements
- Developing designs which make optimal use of given site conditions, especially as concerns

KfW-Entwicklungsbank, Frankfurt: “EGP VII”
sloped sites, where “standard design” would often call for massive (and costly) site remodelling works.

• Reducing the share of traffic areas, e.g. by avoiding single-banded corridors.

4. Architect, Educational Architecture, and Academic Performance of Learners

The final question to be addressed concerns the actual interrelationship between architecture and academic achievement: does the architectural quality of a school building impact the learning performance of the students?

It appears as though very little scientific empirical research has been done in this field but every one of us has most likely individually experienced the effect of different types of buildings on our personal sense of well-being: while one building may be imposing or even oppressive, another gives the sense of human scale, respect of and space for the individual.

• “Authoritarian Buildings” vs. “Democratic Buildings”

Indeed, I would go so far as to say that there are «authoritarian buildings» and «democratic buildings». For example, many of the buildings designed by Hitler’s favourite architect, Albert Speer, would fall under the former category. As would be the case for other imposing and dominant buildings - built the world over and throughout the centuries, especially in authoritarian, undemocratic societies, where “control” is essential and the value of an individual’s freedoms is low. These are buildings that dominate (sometimes oppress), buildings that do not encourage individuality or allow for self-actualisation.

When I look at school buildings in some developing countries today - they are definitely ‘authoritarian’ structures and certainly not suited to encourage the emergence and development of young individuals, of democrats who will respect others and actively engage in civil society. In some instances they would actually remind me of prisons, places of incarceration...

Fig. 7.: «Authoritarian» School

Fig. 8.: «Democratic» School

«Democratic buildings», on the other hand, are people-oriented. They will be of a human scale, will be open and tolerant, and stimulate participation and initiative. They will encourage the development of the individual - and an «open society».

When I look at school buildings in some developing countries today - they are definitely ‘authoritarian’ structures and certainly not suited to encourage the emergence and development of young individuals, of democrats who will respect others and actively engage in civil society. In some instances they would actually remind me of prisons, places of incarceration...

5 In this context, “architecture” is seen not only as the ‘science of building construction’ but rather as the holistic approach towards the organisation and creation of spaces, their qualities, and their interrelationship. It deals as much with an enclosed classroom as it does with the schoolyard or the school playgrounds. Above all, architecture will define the relationship between indoors and outdoors, between the building and the user.
• **School as “Child-Environment”**

In designing schools, the planner needs to be aware that his “clients” are children or juveniles, he needs to take care to create structures, spaces and areas which cater to the specific (and varied) needs of precisely this target group. Spatial dimensions need to be child-based, allowing not only for learning but – equally important – for play and recreation. These elements or properties should by no means be seen as esoteric luxuries or as ‘icing on the cake’ only. Rather, they must be part of any school design – just as a motor car requires four wheels, not three!

If the architectural quality and specific design of a built environment leads to a sense of increased «wellness» in the learner, his/her academic performance will be higher than where a school structure is merely a «shelter» without comfort-zone, without positive «emotional» qualities. Thus, a school environment needs to provide not only spaces for frontal or active learning (classrooms) but also for social learning, peer-group interaction. This happens outside the classroom – on playgrounds and in corridors or halls of the school, in corners or under trees, where children can establish their own comfort zones.

Apart from these main areas and playgrounds, there have to be areas of retreat, places with a child-appropriate scale. Indeed, open areas and playgrounds are really learning spaces of equal importance to formal learning areas, i.e. classrooms (Fedrizzi, 2006).

5. **The Way Forward**

In developing countries, responsibility for inadequate educational structures very often lies with international consultants, economists, who are stifled by mono-dimensional “Terms of Reference”, instructing them to help improving a country's educational system by designing ever-cheaper schools! And, very often, by the sheer lack of interest (or even competence) in designing “good” schools.

What is needed is a paradigm shift in the manner in which we, the professionals, those who *should* know, plan and design schools, especially in developing countries. It should no longer be acceptable to focus on construction cost or “cost at entry” only. Instead; we need to explain to governments, donors or other agencies involved in the construction of schools that a school building is more than just a "box with a few openings and some basic furniture". Rather, schools are those places which contribute greatly to the education, development and socialisation of any country's youth. They constitute the single most important learning environment - next to a child's home - for the formation and shaping of a child's personality and character. Where children spend most of their waking time, where children live, play – and learn. We need to ensure that only qualified professionals are entrusted with these tasks.

In summary, we need to adopt a holistic approach to school design, where cost is understood as life-cycle cost and where we understand a school building as *part of a complex environment*, composed of spaces, buildings, green areas; and where such school buildings are physiologically appropriate and suited to the specific environment. They need to be places where children feel “comfortable”, where they like to be. They need to be places where children can learn, develop. So that they may become valuable, yet independent adults in their adult society.

Putting children in archaic structures and under the control of a rigid educational system characterised by the piece of hose-pipe in the hands of the playground supervisor and prison-like bars fitted to classroom windows is counterproductive in terms of educating and shaping modern, intellectually open and democratically minded young adults.

This cannot be achieved by adopting “standard designs” or replicating “economic solutions” throu-
School Building and Learning Performance

ghout a country, irrespective of specific site requirements. No where. Never. We need solutions which treat the children with the dignity and respect they deserve.

Bibliography
The Fast Track Initiative (FTI) has 20 member countries and will have an estimated 60 countries by 2009. FTI seeks to accelerate Education For All (EFA) in countries which are already making strong efforts by helping mobilize additional resources and by promoting policies which will accelerate achievement of the education Millenium Development Goals or MDGs. School fees abolition is one of the most important policies in this regard and FTI strongly supports it.

The criteria for FTI membership are: an established country poverty reduction strategy and program (PRSP) and a robust education sector development plan (ESDP) which reflects the educational norms and standards recommended by the FTI partnership. These include budgetary indicators such as education’s share of the national budget (20 percent or more) and the share allocated to primary education. These are important measures of a government’s commitment. Other indicators reflect targeted levels of costs (such as average teacher remuneration – 3.5 times GDP per capita – and the average cost of an equipped classroom – US$8000) and ratios such as average class size and pupils per teacher which are deemed important for maintaining the quality of education. These indicators are not rigid. Indeed, they are revised regularly and adapted to country circumstances. For example, a country might already have an average level of teacher remuneration less than the indicator above.

The FTI process

The local education development partners of governments are at its heart. They review the country ESDP and participate in its improvement. The local donor group may then endorse the ESDP officially with letters of support to the FTI steering committee (comprised of high level donor representatives). The local donor group commits to mobilizing additional resources while FTI seeks to widen the circle of financial and technical support.

Some countries – “donor orphans” – have had their ESDPs fully endorsed but the local donor group is small in size and can mobilize only limited resources. These countries can be eligible for transitional financial support (three years typically) from the FTI’s “Catalytic Fund” (CF). The Fund is so designated because its financing is designed to stimulate and deepen donor financial support for these FTI countries by helping them implement their ESDPs, demonstrating a sound “track record”. So far, nine countries have received support, with a total transfer of US$89 million. The funds were provided by nine FTI donor countries upon the recommendation of the FTI steering committee.

Since the establishment of the CF, it has been recognized that many very poor countries – in particular, countries in a post conflict environment – lack the capacity to develop robust ESDPs.
A new “window” of financial support – the “Education Program Development Facility” (EPDF) - has been created with funding by Ireland, Luxembourg, Norway, Sweden and the UK, designed to finance the technical assistance and operating costs required for developing an ESDP. A guiding principle in the provision of technical assistance is that it prioritizes national capacity building in terms of education planning and financing. At present, 54 countries have benefited from this financing.

The FTI Countries and Infrastructure Planning

Since the FTI countries are “good examples” of EFA strategy and planning within the context of Poverty Reduction Programs, examining the “treatment” of infrastructure planning in their ESDPs is a useful way of identifying strengths and weaknesses.

But first a more general observation. The Bank’s Independent Evaluation Group recently looked at the results of Bank investment in Education for All. It found that quality had been undermined by the push to increase access. Specifically, the “surge” in enrolments following school fee abolition (SFA) – sometimes by a million or more additional students at the start of the school year (Malawi notably) – led to seriously overcrowded classrooms and high pupil:teacher ratios – with inordinate pressure on sanitary facilities and water supply. These consequences impacted negatively on learning for all children and worked against girls’ access. In addition, community support for education was diminished – ministries of education were considered to have failed to meet the challenge.

Since there is a general move toward free basic education through SFA, there will likely be more cases of “surge effect”. Politicians tended to find SFA a popular vote getting tactic. Indeed, political decisions influenced by the timing of election, without time for planning, have characterized implementation of SFA in most of the early country decisions - Malawi, Mozambique, Tanzania and, more recently, Burundi and the Democratic Republic of the Congo. In Burundi (2005), the decision was taken just two weeks before the beginning of the school year. An additional 500,000 students enrolled – an increase of 30 percent. These countries have made fair progress in addressing the need for additional teachers, books and materials but the issue of infrastructure has been largely ignored.

A workshop sponsored by UNICEF, USAID and the World Bank will be held in 2006 to develop operational guidelines for countries planning to implement free basic education.

Review of the FTI Country ESDPs

The review reveals some recognition of infrastructure issues and their negative effect but few solutions are proposed and there is little attempt to estimate financing needs on the basis of a time-bound action plan. The key findings are:

- An assumption that communities will continue to shoulder maintenance (13 countries out of the 21) and even construction (3 countries)
- No clear recognition of the “downward curve of degradation” which over time leads from lack of maintenance to renovation needs – and eventually to replacement of the school
- Despite the recognition that SFA will create major pressure on existing infrastructure, no recognition of the time (for procurement and for construction and equipment) and investment required

To put this in perspective, the Ethiopia ESDP is the only one to consider the lifetime and costs per year of different combinations of materials. It concludes, unsurprisingly, that concrete block outlasts “mud and wattles”. This is only a slight simplification.
On the ground, the evidence of the curve of degradation is clear….

As Eberhard Knapp of KfW notes (in this volume), many schools are like archaeological sites. There are the remains of older buildings – the product of earlier donor investment, perhaps as little as 15 years ago. The lack of adequate standards of construction have combined negatively with the absence of maintenance, contributing to the early dilapidation of the investment. Alongside these “layers” of construction, temporary makeshift structures created to meet earlier, urgent demand remain in use since demand continues to outstrip investment. What are the reasons for the lack of a “pipeline” of new and replacement schools and a continuing backlog of renovation and maintenance?

The most important reason appears to be that government capital budgets are under-funded and give priority to economic investment – roads, bridges, etc – rather than to schools. Consequently, countries rely heavily on donors to finance schools – after all, they have continued to re-build the same schools in the past!  

But donor “preferences” are changing …..

Donors are less willing to finance construction. It's time consuming and slow disbursing, thus unattractive to officials and to parliaments – the latter are often loath to vote additional funds when there are large amounts of un-disbursed funds for school construction.

Donors prefer to finance books and materials which have a direct impact on learning. Financing these inputs also compensates for the high proportion of the recurrent budget spent on salaries (often as high as 95 percent) which effectively “crowd out” spending for these key inputs.

I note in passing that the WB education investment portfolio in 2003 had almost US$ 1 billion in un-disbursed infrastructure funds. Implementation capacity and procurement failures were the main causes for this backlog of un-disbursed funds. This lack of disbursement led to requests to extend the official credit period life well beyond the 3.6 years average time to reach full disbursement for WB credits in all sectors. The Bank’s investment in Kenya reflects the new trend, development credits in 2002 and 2004 – in support of SFA - were devoted to books, materials and operating costs. Each was fully disbursed within two years.

Another important reason is that entrusting construction or even maintenance to poor communities simply doesn’t work – so the inevitable downward spiral of degradation continues. A quote from a recent WB investment proposal for Niger makes the point clearly: “under the ongoing project, classroom construction projects required communities to contribute 10 per cent to the cost of construction. This led to significant delays in implementation due to the inability of many communities to mobilize their contribution and difficulties in financial management among those who did. In poor communities where basic health and nutritional needs cannot be met cost sharing is not realistic”.

Nevertheless, in 13 of the 20 FTI countries, contributions in cash, kind or labor are still sought. All FTI countries have significant backlogs of schools to be replaced and renovated – as do the countries present at this seminar. Lack of maintenance is the underlying factor.

Lack of maintenance impinges negatively on learning conditions in the lower middle income FTI countries. They possess complete networks of primary schools and low population growth means that access is not a problem. However, because of a lack of preventive maintenance, spare parts

---

2 The ODA data base reveals a pattern for Japan’s support for basic education which is clearly linked to school construction. Investment occurs every four to five years. An interesting case study would be to examine over time how much of the investment is for new construction and how much is for renovation; also, how the issue of maintenance is treated. The findings could be compared with those of a similar study of EU-financed schools. The EU has had one of the largest school construction programs in SSA.
and equipment replacement, inadequate heating systems lead to high costs (Moldova spends 20 percent of its operating budget on fuel in 2004-2005) and many “student days” of schooling are missed due to breakdowns during periods of extreme cold. The 2005-2006 winter was one of the coldest on record in Central Asia. In another CA country, failure of the government to provide an adequate budget for renovation of school buildings led school authorities to impose unofficial levies on parents. These levies amount to extortion – if parents don’t pay, their children’s grades may suffer.

Even when governments provide some funds for maintenance, they are often included in general categories such as “Operations and maintenance”. The result is they are consumed entirely by current operating costs.

When communities are asked to contribute, their contributions are rarely accounted for in public accounts or highlighted by public expenditure reviews. These contributions were introduced as part of the 1980s cost recovery approach, with a view to making the public purse stretch further so, in theory, it would have been rational – let alone “fair” – to publicly recognize them. This has not been the case. Governments treat these contributions as a “given”, ignoring this fiscal effort on the part of the poorest of citizens.

There are other factors which argue against such contributions. In some countries with a Marxist past, community “contributions” were often a matter of obligation, backed by sanctions. A community health care project in Guinea which depended on community contributions for maintenance failed because the community remembered only too well that they had been forced to build the centers! Thus, the “cultural memory” is often opposed to contributions, even if they are economically feasible. Given this unpopularity, some political parties have made the elimination of unpaid public works a matter of principle. Such was the position of the government of Malawi when out of power. Later, confronting the consequences of a failure to plan for the surge of enrolment, it reversed its policy – but to no avail.

There is another risk implicit in depending on families and communities for such contributions. Any slight “down swing” in the economy affecting family income jeopardizes contributions because issues such as food security and health care push education onto the “back burner”.

What can FTI do to help mitigate these problems?

The Endorsement Process

FTI can advise future candidate countries that both local donor groups and the FTI secretariat will expect ESDPs to include a ten year horizon infrastructure plan, costed out on the basis of specific norms, standards and unit costs, with a time-bound procurement plan for the development of the “pipeline” of school construction and for renovation and maintenance. FTI will no doubt also be asking countries to spell out the implementation measures for school fee abolition so such an endorsement condition is quite appropriate.

Country Assessments and Data Collection

FTI and other agencies can throw more light on current problems by financing field assessments of existing infrastructure and future needs, as part of the EDPF. These assessments will contribute to the improvement of existing data bases such as the OECD ODA data base. This data base could be modified to include donor financing by country for infrastructure, including unit costs for an equipped classroom. The FTI norm of US$8000 is certainly out of date for many countries but
School Building and Learning Performance

the data to make country comparisons is lacking.

School Design

FTI donor countries can work to pilot new designs with low maintenance specifications. Given changing demographics, one option which might be more thoroughly examined is the use of pre-fabricated, “moveable” classrooms for small rural locations. A change in climate can lead to entire villages “decamping” – the 1978 drought in Mauritania quintupled the size of Nouakchott’ population – and most newcomers never went back to their villages. In the US and G8 countries, such temporary facilities (practical but not pretty) have become a standard response to growing and changing urban populations. Modern prefabrication techniques are dramatically different to those of the past. They are durable, storm proof and learner friendly with flexible interior space, easily wired for IT. Existing technologies are adaptable to both desert and high rainfall climates. It would be worth taking a new look at the technology. Some countries have explored this option recently – Madagascar, for example. The results were not promising but the problems lay more in organization and logistics and could have been worked out.

Assessing Country Construction Capacity

If school infrastructure were better and more regularly financed, it could contribute to economic growth by providing a stable market for small and medium size enterprises, proving jobs over the medium to long term – unlike irregular, project financing driven community efforts in which the lack of skills, supervision and the transitory nature of the work contribute little to permanent capacity. The FTI might contact the International Finance Corporation (World Bank Group) to get their assistance in terms of identifying strategies for development of this potentially important segment of the private sector. With systems expansion, twenty years from now most of the value of government infrastructure will be locked up in education and training infrastructure - a durable market opportunity for the local construction industry.

It’s interesting to note that in Europe during the early development of primary education – law of 172 in the UK - many small builders in rural areas were able to find steady business in school maintenance and “grow” their enterprises, creating durable jobs in their communities as they expanded, with long term benefits. They also built durable schools. (I recently saw a Victorian era stone-built primary school in the North of England profitably sold for conversion to “condominiums” – compensating the county authorities many times over for their initial investment.)

This approach will require a change of attitudes. In many countries, school construction is seen as an in-house function, rather then a function which can be readily out-sourced. Education ministries have no comparative advantage in school construction except in planning capacity (perhaps) and in setting educational standards.

Exchanging Know-how

FTI can promote the exchange of country experiences and improved collaboration between governments and donors through workshops but also through data bases (OECD was already mentioned) and through on-line access to designs, specifications, unit costs and architectural expertise. Some

3 When donors invested heavily in construction – in the 70s and 80s – the data base was more complete. The ILO, the World Bank and UNESCO all had specialized units to collect cost data and design standards, facilitating the appraisal of investments. Given the WWW, it should be relatively easy for the donors to re-constitute this kind of operational data base.

4 While not pre-fabrication, standardization on the basis of easily available and field tested components can help reduce costs. A good example is the “cahier de charges” developed for the WB-supported Global Distance Learning Centers (available from the WB Information Systems Department).
of the donors at this workshop have expressed an interest in working with countries to develop
country level strategies for maintenance. This will be an important step forward. The World Bank’s
Africa Region is working on a school facility strategy for Africa in which maintenance will be an
integral part.

FTI donor countries could also help identify faculties of architecture, architectural associations and
schools of social science which could bring to bear their research and technology to the problem. I
note in passing an interesting initiative financed by the UK’s DiFD and executed by Manchester
University which enlists school children in the visual recording and analysis of school conditions,
with a view to improving them 5.

Highlighting the Investment Implications

One important step will be to make both government and donors more aware of the downstream
costs of the “curve of degradation”.

A simple simulation model, based on indicative budget norms for maintenance and renovation,
could inform finance ministers of required budget outlays and the downstream costs of failing
to budget for them. The norms could be expressed as simple percentages of the US$ value of dif-
ferent “age segments” of the existing school inventory, for example, schools older than 20 years
between 15 and 20 years, between 10 to 15 years, etc. The older the plant, the higher the norm,
and the required budget allocation (the US$ norm x the number of schools in the segment). Such
a simulation could project the increased costs for renovation and, eventually, for replacement - in
the event that annual allocations for each age segment were not respected.

At present, few governments and donors focus on the significant downstream costs of failing to
budget for maintenance and renovation. They are not surprisingly locked into grappling with
immediate problems.

The Interaction between Design and Learning

As we have heard, the OECD PISA study suggests the relationship may be tenuous… (von
Ahlefeld, in this volume)

What we do know, I would suggest, is that in secondary education where course offerings are
linked to student needs, design can do much to facilitate small group learning, individual learn-
ing and access throughout the building to information technology - and within the larger school,
design can promote the free flow of students, reducing “traffic time”, making more time available
for learning.

In primary education, overcrowding due to lack of classrooms, the lack of clean water and adequate
sanitation can cut down on-site learning, reduce learning time through water-related illness and
reduce access for girls. These are major concerns of FTI – if we can reduce these “negatives” we
will surely enhance learning – and clearly design has a role to play in making low cost, low main-
tenance, “friendly” learning spaces available.

---

5 Ian Kaplan of “The Enabling Education Network” (EENET) at Manchester University uses image-based research
and participatory action research with children and young people, to explore and share their experiences of educa-
tion. Health, safety, disability and access to comfortable teaching and learning environments are among the key
concerns raised by the young people (EENET projects are underway in Indonesia and Zambia).
1. Three Scenarios

My response to the debate concerning ‘architectural quality in school building design and its relevance to the students’ learning performance’ has three distinct perspectives and time lines:

- My own school days in a small village several decades ago
- My long association with NGOs in grassroots development work in villages and poverty pockets of urban slums
- My professional practice as an architect, with a good slice of assignments on the institutional - educational – buildings.

These distinct phases and perspectives, in life and career graph, naturally coincide with one’s growing up as an individual and maturing as a professional. Though the experience is personal, exposure is local, time span is stretched and the canvas is essentially micro, here is a presentation in that framework: as a student, as a development worker and as a practicing architect.

2. Representative Character

Let me first point out why and how this personal exposure and experience has a representative dimension to it in the context of school buildings in India.

- It encompasses schools in rural, tribal and urban areas; cases are related to both the primary schools and high schools.
- The schools under reference are government financed and department managed, as also privately financed and community managed.
- They are for the children of the poor and the middle class, as also the upwardly mobile.
- School buildings referred here are low cost and high cost, either simple shacks or built by village ‘Mistry’ (master mason) or designed by trained architects.
- The buildings are modern and traditional, crude and sophisticated.
- They are social service institutions as well as for profit business ventures, and
- In some cases they are special response buildings—for instance, built as part of a disaster reconstruction program, funded by international donors; as also multi use structures – a cyclone shelter during the emergency and a school building in normal times.
3. The Village Primary School

At the primary school in a small village in North Gujarat, where I had my early education, no one ever mentioned the word ‘design’, nor any one ever thought about its effect on and relevance to the students’ learning performance or personality development. Comment on the quality of the teachers and education were more likely. I remember parents talking, even complaining, about, ‘bad’ or ‘irregular’ teachers. Though, no one seemed to bother about the design of the building. It was a shelter, a given, taken for granted: good, bad or indifferent. Neither teachers, nor headmaster, or parents, or school inspector ever said anything about the building, beyond some minor repair. That its design quality could influence students’ learning performance was not even a distant thought.

I don’t think the situation is very different even now in the Indian villages, except for some special donor funded projects. Primary school buildings, often in poor condition, vary vastly in size, quality and ‘design’. However, what is almost constant is absence of this concern and awareness that a school building could do more than sheltering and that the quality of design could influence children’s learning performance. The ‘designer’ is absent. And even if he/she is there, mostly in form of a departmental engineer (never an architect) repeating standard designs, probably from the British Raj portfolio, his/her preoccupation is cost, not quality; codified template design, with no regard for the setting; and the ‘shelter’ function of the school, not its design quality. It is also a fact that many schools have no buildings, not even blackboards.

If the hypothesis, that an architecturally well designed school building improves learning performance of the students, has some validity - impressionistic or scientifically established - then it is a matter of concern that a large number of students in rural primary schools in India are at a disadvantage on this count. Seen in the context of other deprivations and disadvantages - poor water and sanitation, lack of most basic facilities like a blackboard and teachers, for instance – issues of priority, how to find financial and human resources for the correctives and where and in what form to deploy them, become important. It is unlikely that the vote would be in favour of higher financial investment in school buildings if that is what is needed to ensure good architectural design quality.
4. School Design and the Bare-Foot –Architect

Some of the NGOs I know, working with the rural poor and in urban slums, have a different take on this matter of architectural quality, generally speaking. They refuse to accept absence of good quality design in the school buildings as a resource or even a priority issue. They suggest that the school buildings where the children of the poor study should have good design; that it is possible within the given resources and available design and construction skills and blame the current situation of poor quality school designs on the denial mindset—denial of the local building traditions and the native, non-formal design skills—of the education and the design establishment.

While accepting that a well designed school building would have a positive influence on even a poor students’ learning performance1 the development workers’ perspective would differ on the definition of architectural quality (why should it be confined to formal brick-concrete buildings alone?) and a good, sensitive designer (why only an university trained formal professional?). Architecture—good architecture—is not absent in village settlements and the formal architects do not design or build villages. Good architecture and sensitive design is not only a function of money and more money. Making good and sensitive school buildings in villages, therefore is not only a matter of finding more resources or getting formal architects to design them, it is a matter of inventing, reinventing and engaging those artisans who build villages and giving them the support and assistance they need. The formal education system and the formal design establishment denying them the space to engage and perform is the crux of the problem. It is not so much the monetary poverty. It is the poverty of not being able to recognize and use the talent and resources available within. A mud wall and a thatch roof are not necessarily devoid of architectural quality.

---

1 An NGO colleague often argues that the Soviets claim that playing music in their cattle sheds improves milk yield. If the animals are sensitive to the “environment”, there is no reason why the human beings would not respond favorably to positive space and environmental quality.
With sensitive handling and proper amendments they can create a positive learning environment we talk about. That we have rejected them - their designs, materials and solutions - without appropriate substitutes is a problem. Giving the rural primary school child good learning environment demands, among other things, activating and engaging the ‘bare-foot’ architect.

5. The Design of the High School Building mattered

In my village school days, the high school picture was different. Unlike with the primary school, the design of the high school building seemed to matter. Without doubt, the high school building, a reasonably good looking two storey structure with plastered brick walls, r.c.c. slab roof, cement paint, a garden, playground in the yard and design motif on the parapet represented and symbolized to us the ‘urban’, ‘modern’, and ‘progress’. It was not called the ‘English’ school for just any reason. What was written on its formal decorative entrance gate (“Education is one that liberates”) and the manner of its financing\(^2\) motivated me and my schoolmates in our early formative years. Without the fear of exaggeration it could be said that for many of us the school building – yes, the building – laid the foundation for ‘dreaming’.

The building also taught us early lessons in cleanliness. Each student had to tend the garden. Maintaining the playground was student responsibility. We took pride in the number of trees planted, watered and nurtured. While reflecting on what the high school building did to us, the students, one could say, without overstating the point, that it gave us an attitude and made us think big. Not that the teaching or the teachers did not matter. It did. But my recollection is that the look, the image and the aura of the building was dominant on our young and impressionable minds. And it was not so much the ‘design’ as an architect would see it (form, function, space, aesthetics, proportions, texture, colour, inside-outside) but just the structure. It not only improved our learning performance, it gave us attitude and perhaps dreams for life.

\[^2\] Money for the school building was donated by a village Brahmin, by no means a rich or resourceful person, who worked as an ordinary accountant in a cloth shop in Bombay. We learnt to see it is a great sacrifice, a virtue to be imbibed. Even today, while recounting the village days, I describe it with considerable emotion as “giving till it hurt”, in Mother Teresa’s words.
6. Community Contribution

I have often wondered as to why did I and some of my contemporaries at the village high school carried such a positive influence of the school building and have even tried to analyze it in the modern ‘development’ context. Why did the school building mean so much to us, the students, and to our learning, to our preparation for life? Though it might sound harsh and unjustified to some, I believe the most decisive factor was - and is – absence of the government and presence of the community. Secondary education (high school education) in Gujarat State, a province of India, is jointly financed. Buildings are donated, built and managed by the communities. The running expenses – including teacher salaries - are met by the government. This encouraged and promoted diversity in the design and quality of buildings. In the government built and managed primary school, the village community has little or no role to play. Though, in the construction of high school buildings, community contribution plays a key role. And that brings in not only money, also pride. Also a healthy competition (building an even better building). It induces an urge to be different and better and offers opportunity to use collective community wisdom and resources. There is a lot to be said in favour of community contribution, participation and engagement in creating public assets.

7. Designing Schools: Issues to be considered

Our architectural practice offers opportunity to design school buildings (primary and secondary) for a diverse set of clients (public, private, non-profit and international donors) in different settings (cities, towns, villages and tribal pockets, in India and outside) for students with different socio-economic background. Having developed a work style that uses simple feedback studies in the design process, over the years, we have put together a general list of problems faced in design of school buildings. The 22 point ‘Concerns List’ includes the following:

1. Negative controls and restrictive building bye-laws by the planning and development control authorities, especially in big cities
2. Small sites
3. Non–participatory design culture
4. Overall resource constraints
5. Neglect, apathy and ignorance, on part of the designer, the climatic factors as reflected in the orientation of buildings, placement of openings, selection and use of materials, design of protection features (against sun or rain), etc.
6. Inadequate data base, analysis and rigor in design of internal lighting and ventilation
7. Inadequate movement analysis
8. Unimaginative site use
9. Neglect of the school yard and landscaping elements for space and environmental quality enhancement
10. Sketchy design brief
11. Lack of cost consciousness
12. Poor design, installation and maintenance of services: water, plumbing, drainage, electricity, rain water harvesting, etc.
13. Little attention to the end users’ psychological factors
14. Inappropriate scale perception for a building to be used by the children: window sill, toilet fixtures, water jets, etc.
15. Insensitivity to special needs of the disabled
16. Weak maintenance: Neglect in design, detailing, construction, financing and organization development
17. Furniture: unsuitable and faulty for comfort
18. Poorly planned, managed and maintained playgrounds and open yard
19. Poor sanitation facilities
20. Negligence on safety norms and standards
21. Poor detailing
22. Lack of multi-usability, even where essential

We try to use this – not always successfully - as a checklist: what to do and not to do while designing school buildings. It does not necessarily make the design ‘correct’ or ‘better’. However, the awareness tends to reduce arbitrariness to an extent and also helps making design parameters tighter and ground reality based.

This is no place or occasion to discuss the above listed concerns exhaustively. In the context of the theme of the colloquium – architectural quality in school building design and its relevance to students’ learning performance – a few, however, deserve discussion from a designer’s perspective. I am dwelling here on just two points from the list.

8. Participation in Design

The non-participatory design ‘culture’ relates to:
- the training and resultant attitude of the architects (not many believe in its virtue);
- the customs of architectural practice (intolerant and non-conducive to inclusive consultations);
- the level of preparedness on part of the clients (not always clear on what they want and not always ready to ascertain themselves);
- the definition of the client (owner? management? or all stakeholders, service providers and end-users?);
- the lack of knowledge and familiarity with the tools and rules of participatory design practice (little known and followed) and attitude to the design task itself.

Participatory design, especially for the community use buildings, is easier said than done, as it is perceived to:
- infringe on the architect’s creativity and decision making freedom (for arbitrariness as well);
- it requires a difficult art of consensus building (not always a strong point in the professionals’ training and make up);
- it is seen to demand compromises on creative freedom (real and perceived);
- it makes design a more analytical and contributory process (as against an intuitive and creative process)
- it demands a higher level of transparency, preparedness, openness and accountability.

It is now generally recognized, however, that in making a public building that hopes to go beyond ‘serving the purpose’ by value added features—often non-tangible—working in a participatory
manner, even if difficult, is essential. The process brings in inclusiveness, diversity and ‘richness’ in shaping the product. As a by-product, it also prepares and equips the stake-holders, the community, to relate, own and give. Design of a building, as we know it, is a team game. A conventional architect does not quarrel with that too much so long as the ‘team’ is what he/she thinks it to be and is comfortable with. The ‘stakeholder’ group represents a wider team concept. Participatory design demands a wider and inclusive partnership. That is not how a conventional architect works. Though, experience shows it to be a richer and better result yielding process.

It needs to be appreciated, however, that ‘participation’, ‘consultation’, and ‘inclusiveness’ is not an answer to all problems. Also that insensitively and un-imaginatively conducted participatory process can lead to confusion, lack of transparency and poor outcomes. Both a balance and special skills are needed.

9. Psychological Factors

Lack of attention to the psychological factors in school design is the second point from the ‘list of concerns’ I would like to address. The school designer is not always aware (even if available in form of imperical research or historical wisdom) of what factors and features in a building or the built environment improve the learning performance of a student. It is clear that an impressionable child, at a delicate stage in its development, needs more than comfort conditions to share and receive, that which constitutes real learning. No simple answer or formula exists. What is recognized, however, is that the designer should know more about it and make a great effort to understand it. The designer’s business is not only to make a building but to give it a quality that is suitable for the purpose for which it is meant. What environment is conductive to improving learning performance of students and how does one make it? We all know about the comfort conditions and how to play with space, colour, light, form, texture and nature in imparting architectural quality to buildings. That needs to be overlapped and harmonized with what teachers, parents and the educationists have learnt over the years about the micro environment, psychological factors and the non-tangible ‘space’ quality of the class room and the school building. The designer should understand, interpret and give that extra which makes the environment special for learning and growing.

10. Donor funded Schools : Value added Features

It is desirable that the public service buildings such as schools, hospitals, even disaster reconstruction housing, constructed for special circumstances and funded by the international donors, have value added features – be that sensitive design, cost reduction methods, appropriate technology, resource conserving features, environmental sensitivity, behavioral understanding of the users, sustainability concepts, etc. The buildings should be more than walls, windows and roof, with appropriate integration of interior and exterior and space modulation enhanced by landscape, trees, water and other elements of nature. They should function well, should be structurally strong and should be easy on maintenance. That is the minimum. They should also be designed imaginatively with good aesthetics and sensitive to the user’s psychological and cultural make up. Site sensitivity is crucial to any good design and even in bulk programs, where a large number of buildings are to be repeated on different sites, it is essential that the design offers site and context specific adjustments. The special circumstances projects, such as disaster reconstruction, that involve international funds and international professional skills, exposure and experience, have an opportunity-and an obligation, one would say-- to go beyond normal and conventional buildings.
11. Role Models: Raising the Bar

One of the many reasons why the donor funded building projects should have value added features – aesthetics is just one – is that because of numbers and geographical spread they could serve to raise the bar, be that design or quality of workmanship or detailing, for other buildings coming up in the area. They could serve as a role–model, so to speak, for others to follow. Buildings last a long time, mostly generations. They also stand tall in the landscape. It is important that they have quality - not only functioning well but also to touch the users’ and the viewers’ inner chord. In making public buildings, it is essential to get the users involved and excited, as the much needed ‘ownership’ would stem from it.

12. Sharing to Learn

And that is do-able. It is not so much the scale or the monumentality or more money, it is appropriateness and sensitivity. Also the process of making the design and constructing the building, as also understanding the client’s and the users’ needs, not only those which they define and articulate but also those which remain undefined and unspoken. Opportunities, such as Monte Verita, bring these aspects on table through example and sharing. And if the group consists of all stakeholders – architects, engineers, clients, funders and managers – the subject gets rounded treatment. It enriches all in the process and the quality of the end product improves.
In most nations, including developing countries, we are experiencing accelerating and intensifying educational reforms. Economic competitiveness, international comparisons in educational quality, and parents’ concerns for their children’s future stimulate political senses of urgency about researching how to raise educational standards and how to design and construct quality educational facilities, while minimizing costs.

Specifically in developing countries, building schools is a significant area of construction activity. Most of the time the process of school building is organized as government or donor-supported programs, or by NGOs and communities, and sometimes by the parent groups themselves. The scale of new school buildings to be constructed and the age range of the school facilities to be renovated are among the significant factors to consider in the design and construction of particular school buildings in developing countries. There are also numerous other important factors to consider including climatic conditions, disaster risk, cultural issues, available local building materials and skills, terrain, and health and safety issues. Due to the fact that some of these factors would vary from place to place it is not possible to define an ideal or optimum school building design and construction process suitable for everywhere and every community. However, there is need for a general understanding of how school building and its design can enhance the learning experience of students as well as of various communities.

A school building and its design can have a significant positive or negative effect towards fostering a creative and fruitful learning environment. Classrooms that are dark, uncomfortable, crowded, or noisy can be a discouragement for students to learn or even to wish to continue with their studies. School buildings with inefficient spatial layouts that impede the flow of activities, movement, interactions, and visibility of teachers and students from each other can cause alienation and ultimately decrease the sense of community. The design of schools from the viewpoint of the students and teachers is also important to ensure that all or most of their needs are met. Therefore, research studies looking at these issues in school buildings, analyzing design principles, and assessing the school building quality through case studies or examples would help provide guidance for the future school buildings to be designed and constructed for a particular location. Thus, it was the intention of the Colloquium to facilitate further discussions on a research based larger database, which will help many decision makers develop comprehensive guidance for planning, designing, and maintaining better performing, healthy, safe, and sustainable school facilities, also in developing countries.

The authors grouped in this section discuss issues related to research findings on school facilities and the effects on students’ academic and social performance. Interestingly, the first study in this
part questions such effects. The two others prove that there is an integral relationship between the quality of educational facilities and the level of student achievement, well-being, and the motivation for learning.

Hannah von Ahlefeld’s presentation examines the relationships between the built environment and student performance using PISA, short questionnaires, completed by school principals and students. The data presented also identifies the differences between countries looking at the achievement levels of student and the quality of school’s physical infrastructure.

Nicole Simon’s study explores the complex implications of school building quality (SBQ) - structural quality, maintenance, noise, crowding, privacy, hazards, and safety – and its relationship to students’ academic success and socio-emotional development using a standardized rating instrument by trained evaluators. The study also assesses children’s reactions to SBQ and, in turn, how their perceptions mediate academic outcomes of objective SBQ.

Celen Pasalar’s study investigates the impact of the physical layout of school buildings on students’ learning behavior and interactions. This study initially analyzes the properties of spatial layout of school buildings through space syntax methods defining the patterns of space use, circulation, and the degree of privacy and openness of learning spaces. Second, the study observes students’ behavior and movement patterns in spaces and measures students’ perceptions of physical attributes of school buildings and their impact on levels of co-presence, interaction, and patterns of learning activities.
What the OECD PISA study reveals about the physical learning environment

Hannah von Ahlefeld, 
Programme on Educational Building (PEB), 
OECD, Paris

Introduction

The Organisation for Economic Co-operation and Development (OECD) Programme for International Student Assessment (PISA) has been described as the “finest example of effective international governance by the simple dissemination of information”. The strength of PISA is its capacity to relate internationally comparable data on student outcomes to contextual factors using sophisticated statistical analyses. In PISA, student outcomes are measured using student assessment scores. In PISA 2003, students completed a two-hour paper-and-pencil assessment containing both multiple-choice items and questions requiring students to construct their own responses, which covered reading, mathematical and scientific literacy, and problem solving, with a primary focus on mathematical literacy. Items were organised in units based on a stimulus presenting a real-life situation. Data on contextual factors derive from short questionnaires completed by school principals and students on, for example, students’ family background, students’ learning of mathematics, school characteristics and pedagogical practices.

Examining relationships between contextual variables and student performance using PISA data permit the identification of differences between countries in the relationship of achievement and student- and school-level factors; the examination of the proportion of variation in achievement between and within schools; the analysis of the impact of schools in moderating or increasing the effects of individual-level variables on achievement; and addressing and monitoring these relationships over time.

This paper describes the PISA instrument and the results from PISA 2003 relating to educational facilities. Although this paper will demonstrate that existing data shed little light on the relationship between the built environment and student performance, the PISA tool has great potential for investigating this relationship in greater depth.

The PISA instrument

PISA is a collaborative effort among OECD member countries to measure how well 15-year-olds approaching the end of compulsory schooling are prepared to meet the challenges of today’s knowledge societies, reflecting a shifting paradigm in education that focuses on what students can do with what they learn at school, rather than mastering a specific curriculum.

The first PISA survey was conducted in 2000 in 32 countries, including 28 OECD member countries, using written tasks answered in schools under independently supervised test conditions. Another 11 countries completed the same assessment in 2001. PISA 2000 surveyed reading, mathematical and scientific literacy, with a primary focus on reading. The second PISA survey,
which focused on mathematical literacy, was conducted in 2003 in 41 countries.

In addition to these assessments, three types of context questionnaires were developed, which yielded data relating to social, cultural, economic and educational factors:

- **A student questionnaire**, which took students about 35 minutes to complete, covered student characteristics, family background, educational background of students, student reports related to school, students’ learning of mathematics and students’ lessons in mathematics. All countries participated in this questionnaire.

- **A school questionnaire**, which took school principals 20 minutes to complete, covered school characteristics, the schools’ resources, the student body, teachers, pedagogical practices and administrative structures in the school. All countries participated in this questionnaire.

- **Optional questionnaires** are additional surveys in which countries can choose to participate. In PISA 2003, for example, 32 countries elected to participate in the ICT Familiarity Questionnaire, and 21 countries chose to complete the Educational Career Questionnaire. Students were the primary respondents.

### Measuring the quality of the schools’ physical infrastructure using PISA data

In the PISA 2003 school questionnaire, school principals were asked about the extent to which they perceived that the school’s capacity to provide instruction was hindered by a shortage or inadequacy of 20 variables related to the schools’ educational resources and physical infrastructure, such as qualified teachers, instructional materials and school buildings and grounds. A four-point scale with the response categories “not at all”, “very little”, “to some extent” and “a lot” was used.

Results for infrastructure-related variables (Chart 1) indicate that in Macao-China, Norway, Turkey, the United Kingdom and Uruguay, more than 65% of school principals reported that instruction is hindered by a lack of school buildings and grounds. On average across OECD countries, less than one third of school principals reported that instruction is hindered by a lack of heating/cooling and lighting systems. Amongst OECD countries, more than half of school principals in Denmark, Finland, Greece, Hungary, Ireland, Norway, Slovak Republic, Turkey and the United Kingdom reported that learning is hindered by a lack of instructional space. In Korea, less than 12% of school principals reported that instruction is hindered by a lack of school buildings and grounds or lack of instructional space.
An index of the quality of the schools' physical infrastructure was constructed using the three variables school buildings and grounds, heating/cooling and lighting systems and instructional space (e.g. classrooms). This index has an average of 0 and a standard deviation of 1 across all OECD countries. A negative value indicates a lower quality of physical infrastructure compared to the OECD average. Charts 2a and 2b show the index values for all countries by quarters of the index (Chart 2a) and the average index value (Chart 2b). In Chart 2b, countries in dark shading are above the OECD average on the index, while countries marked in light shading are below the OECD average on the index.

Quality of the schools’ physical infrastructure and student performance in PISA

According to PISA 2003 results, do differences in the schools’ physical infrastructure — as perceived by school principals — influence student performance? Data indicate that schools’ physical infrastructure has a negligible net effect on performance. On average across OECD countries, the PISA index of quality of the school’s physical infrastructure explains 1 per cent of the variation in mathematics performance. Although there are some differences in students’ scale scores in mathematical literacy between the top and bottom quarters of the index, most of the differences in OECD countries are small and not statistically significant. Chart 3a shows that ten countries demonstrate statistically significant differences in student performance between the top and bottom quarters of the index.

By contrast, with regard to educational resources, there is a

1. Response rate too low to ensure comparability.

Countries are ranked in descending order of the second quarter of the index of the quality of the school’s physical infrastructure.

### Chart 3a. Performance on the mathematics scale, by national quarters of the index of the quality of the schools' physical infrastructure (2003)

<table>
<thead>
<tr>
<th>Country</th>
<th>Bottom quarter of the index</th>
<th>Top quarter of the index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>517</td>
<td>541</td>
</tr>
<tr>
<td>Austria</td>
<td>500</td>
<td>493</td>
</tr>
<tr>
<td>Belgium</td>
<td>526</td>
<td>534</td>
</tr>
<tr>
<td>Canada</td>
<td>537</td>
<td>533</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>521</td>
<td>518</td>
</tr>
<tr>
<td>Denmark</td>
<td>516</td>
<td>511</td>
</tr>
<tr>
<td>Finland</td>
<td>542</td>
<td>543</td>
</tr>
<tr>
<td>Germany</td>
<td>506</td>
<td>514</td>
</tr>
<tr>
<td>Greece</td>
<td>431</td>
<td>452</td>
</tr>
<tr>
<td>Hungary</td>
<td>490</td>
<td>509</td>
</tr>
<tr>
<td>Iceland</td>
<td>510</td>
<td>522</td>
</tr>
<tr>
<td>Ireland</td>
<td>513</td>
<td>498</td>
</tr>
<tr>
<td>Italy</td>
<td>443</td>
<td>471</td>
</tr>
<tr>
<td>Japan</td>
<td>533</td>
<td>532</td>
</tr>
<tr>
<td>Korea</td>
<td>523</td>
<td>571</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>467</td>
<td>532</td>
</tr>
<tr>
<td>Mexico</td>
<td>375</td>
<td>419</td>
</tr>
<tr>
<td>Netherlands</td>
<td>534</td>
<td>536</td>
</tr>
<tr>
<td>New Zealand</td>
<td>518</td>
<td>532</td>
</tr>
<tr>
<td>Norway</td>
<td>489</td>
<td>495</td>
</tr>
<tr>
<td>Poland</td>
<td>494</td>
<td>493</td>
</tr>
<tr>
<td>Portugal</td>
<td>463</td>
<td>464</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>515</td>
<td>487</td>
</tr>
<tr>
<td>Spain</td>
<td>483</td>
<td>502</td>
</tr>
<tr>
<td>Sweden</td>
<td>503</td>
<td>516</td>
</tr>
<tr>
<td>Switzerland</td>
<td>530</td>
<td>531</td>
</tr>
<tr>
<td>Turkey</td>
<td>424</td>
<td>441</td>
</tr>
<tr>
<td>United States</td>
<td>482</td>
<td>501</td>
</tr>
<tr>
<td>United Kingdom¹</td>
<td>511</td>
<td>513</td>
</tr>
<tr>
<td>Brazil</td>
<td>352</td>
<td>389</td>
</tr>
<tr>
<td>Hong Kong-China</td>
<td>564</td>
<td>541</td>
</tr>
<tr>
<td>Indonesia</td>
<td>370</td>
<td>346</td>
</tr>
<tr>
<td>Latvia</td>
<td>489</td>
<td>483</td>
</tr>
<tr>
<td>Liechtenstein</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Macao-China</td>
<td>538</td>
<td>520</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>460</td>
<td>478</td>
</tr>
<tr>
<td>Serbia</td>
<td>437</td>
<td>436</td>
</tr>
<tr>
<td>Thailand</td>
<td>412</td>
<td>423</td>
</tr>
<tr>
<td>Tunisia</td>
<td>344</td>
<td>351</td>
</tr>
<tr>
<td>Uruguay</td>
<td>408</td>
<td>457</td>
</tr>
</tbody>
</table>

1. Response rate too low to ensure comparability.

Values that are statistically significant are marked in bold and highlighted.


### Chart 3b. Performance on the mathematics scale, by national quarters of the index of the quality of the schools' educational resources (2003)

<table>
<thead>
<tr>
<th>Country</th>
<th>Bottom quarter of the index</th>
<th>Top quarter of the index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>517</td>
<td>545</td>
</tr>
<tr>
<td>Austria</td>
<td>503</td>
<td>497</td>
</tr>
<tr>
<td>Belgium</td>
<td>523</td>
<td>544</td>
</tr>
<tr>
<td>Canada</td>
<td>530</td>
<td>540</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>512</td>
<td>509</td>
</tr>
<tr>
<td>Denmark</td>
<td>501</td>
<td>518</td>
</tr>
<tr>
<td>Finland</td>
<td>546</td>
<td>543</td>
</tr>
<tr>
<td>Germany</td>
<td>479</td>
<td>513</td>
</tr>
<tr>
<td>Greece</td>
<td>430</td>
<td>467</td>
</tr>
<tr>
<td>Hungary</td>
<td>481</td>
<td>519</td>
</tr>
<tr>
<td>Iceland</td>
<td>512</td>
<td>518</td>
</tr>
<tr>
<td>Ireland</td>
<td>503</td>
<td>501</td>
</tr>
<tr>
<td>Italy</td>
<td>440</td>
<td>477</td>
</tr>
<tr>
<td>Japan</td>
<td>521</td>
<td>527</td>
</tr>
<tr>
<td>Korea</td>
<td>522</td>
<td>552</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>518</td>
<td>481</td>
</tr>
<tr>
<td>Mexico</td>
<td>369</td>
<td>406</td>
</tr>
<tr>
<td>Netherlands</td>
<td>509</td>
<td>554</td>
</tr>
<tr>
<td>New Zealand</td>
<td>502</td>
<td>536</td>
</tr>
<tr>
<td>Norway</td>
<td>493</td>
<td>495</td>
</tr>
<tr>
<td>Poland</td>
<td>481</td>
<td>498</td>
</tr>
<tr>
<td>Portugal</td>
<td>470</td>
<td>466</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>480</td>
<td>509</td>
</tr>
<tr>
<td>Spain</td>
<td>467</td>
<td>494</td>
</tr>
<tr>
<td>Sweden</td>
<td>511</td>
<td>520</td>
</tr>
<tr>
<td>Switzerland</td>
<td>525</td>
<td>539</td>
</tr>
<tr>
<td>Turkey</td>
<td>403</td>
<td>434</td>
</tr>
<tr>
<td>United States</td>
<td>471</td>
<td>507</td>
</tr>
<tr>
<td>United Kingdom¹</td>
<td>497</td>
<td>532</td>
</tr>
<tr>
<td>Brazil</td>
<td>321</td>
<td>405</td>
</tr>
<tr>
<td>Hong Kong-China</td>
<td>561</td>
<td>564</td>
</tr>
<tr>
<td>Indonesia</td>
<td>367</td>
<td>345</td>
</tr>
<tr>
<td>Latvia</td>
<td>484</td>
<td>490</td>
</tr>
<tr>
<td>Liechtenstein</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Macao-China</td>
<td>529</td>
<td>529</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>448</td>
<td>484</td>
</tr>
<tr>
<td>Serbia</td>
<td>445</td>
<td>435</td>
</tr>
<tr>
<td>Thailand</td>
<td>395</td>
<td>443</td>
</tr>
<tr>
<td>Tunisia</td>
<td>336</td>
<td>367</td>
</tr>
<tr>
<td>Uruguay</td>
<td>423</td>
<td>450</td>
</tr>
</tbody>
</table>

1. Response rate too low to ensure comparability.

Values that are statistically significant are marked in bold and highlighted.

significant performance difference between the top and bottom quarters of the index of the quality of schools’ educational resources in 23 countries (see Chart 3b). The index of quality of school’s educational resources is derived from seven items measuring the school principal’s perceptions of potential factors hindering instruction at school: instructional materials (e.g. textbooks), computers, computer software and calculators for instruction, library materials, audio-visual resources and science laboratory equipment and materials. Like the index of quality of the school’s physical infrastructure, items were inverted for scaling so that positive values indicate a high quality of educational resources compared to the OECD average, and negative values, lower quality compared to the OECD average. On average across OECD countries, the PISA index of the quality of the school’s educational resources explains 2.5 per cent of the variation in mathematics performance.

Interpreting PISA data
A number of caveats must be taken into consideration when analysing PISA results.

In general:

• It is difficult to make causal associations between variables. It may be, for example, that good performance and attitudes towards learning are mutually reinforcing. Other factors, such as home background or differences in the schooling environment, also play a part.

• Results may be influenced by cross-cultural differences in the perception of standards. In international contexts, the impact of multiculturalism and multiple languages should be considered from survey development to analysis of results.

• Results may be influenced by the social desirability of certain responses. For example, when students were asked how many hours they read per week, rather than responding “none”, some students may have responded at the highest category, e.g. “two or more hours”, as they believe that this is the expected or most correct response.

Regarding data relating to the quality of the school’s physical infrastructure:

• Indices rely on the judgment of school principals rather than on external observations or the views of students and teachers. When interpreting these figures, it should be borne in mind that school principals did not provide objective measures of the condition of physical infrastructure. Although such measures are for this reason difficult to compare across schools and countries, such perceptions can have an important influence on the work of school principals and therefore warrant attention.

• Indices based on responses by principals rely on a comparatively small number of observations (on average, in PISA 2003, 250 schools per country)7.

Further work
The OECD Programme on Educational Building (PEB) is currently exploring how PISA could be used to shed more light on the relationship between the quality of educational facilities and student performance, through for example the development of a new optional context questionnaire or development of additional items in existing context questionnaires.

Notes

1. The OECD Programme for Educational Building (PEB) is committed to informing those responsible for educational facilities on how to obtain maximum educational benefit from investment in educational facilities and emerging technologies, and on how to efficiently plan and manage educational facilities (www.oecd.org/edu/facilities). With PISA, PEB works within the OECD Directorate for Education (www.oecd.org/edu) to develop policies that deliver quality learning programmes and quality learning environments in today’s rapidly-evolving knowledge society.

2. Comparable data collection, analysis and dissemination are the strengths of the Organisation for Economic Co-operation and Development (OECD), a forum in which governments in its 30 member and 70 partner countries work together to address the economic, social and environmental challenges of interdependence and globalisation (www.oecd.org).


5. Australia, Austria, Belgium, Brazil*, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hong Kong-China*, Hungary, Iceland, Indonesia, Ireland, Italy, Japan, Korea, Latvia*, Liechtenstein*, Luxembourg, Macao-China*, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Russian Federation*, Serbia and Montenegro*, Slovak Republic, Spain, Sweden, Switzerland, Thailand*, Tunisia*, Turkey, United Kingdom, United States and Uruguay* participated in PISA 2003. Asterisks (*) indicate countries that are not members of the OECD.

6. For further information on the PISA methodology, see PISA 2003 Technical Report (2005), Paris, OECD.

Building Quality, Academic Achievement and Self-Competency in New York City Public Schools

Nicole S. Simon, MS, Gary W. Evans, Ph.D. and Lorraine E. Maxwell, Ph.D.  
Cornell University  
Ithaca, NY, USA

American school buildings are falling apart. Nearly a third of US public schools are in disrepair (GAO, 1995) with close to 15% rated as “non-operational” (NCES, 1999; Ortiz, 2004). Large urban schools, where the majority of students are low-income (NCES, 1999) are most likely to be inadequate (Evans, 2004; Ortiz, 2004). For example, four-fifths of New York City’s schools are in need of repair (Buresh & Hayden, 1996). The situation for the vast majority of schools attended by children throughout the world is much worse (Satterthwaite et al., 1996).

Unfortunately much of the research on school building quality (SBQ) and child development suffers from conceptual and methodological problems. Most studies rely on school personnel to rate building quality and thus are subject to potential bias. Another common approach is to compare child data in old versus new school buildings without measurement of SBQ. SBQ data are typically assessed at the school level. This ignores within school variability in quality and precludes investigation of individual children’s reactions to SBQ. Children perceptions of SBQ, however, are different than adults. Moreover their SBQ perceptions may be a critical factor mediating the link between objective SBQ and child outcomes (Maxwell, 1999). Herein we present a preliminary exploration of SBQ using a standardized rating instrument by trained evaluators. We also assess children’s reactions to SBQ and, in turn, how these perceptions mediate academic outcomes of objective SBQ.

Earthman and colleagues in a series of studies have found positive correlations between SBQ and standardized test scores, controlling for school income (Al-Enezi, 2002; Cash et al., 1997; Earthman et al., 1995; Hines, 1996; Lanham, 1999). School wide SBQ was based on self reports of school personnel and no child SBQ perceptions or individual academic achievement data were collected. Building conditions more readily discernable by children and teachers (e.g., maintenance, cleanliness) were more strongly related to academic achievement than indicators of structural quality (e.g., roofing) and infrastructure (e.g. heating). A few studies using expert ratings of SBQ have uncovered similar trends and stronger research designs using before-after comparisons in school improvement also reveal improvements in test scores (Evans, 2006).

The magnitude of SBQ impacts on child development are difficult to assess at present given the paucity of data available coupled with some of the conceptual and methodological limitations outlined above. Nonetheless some interesting trends are noteworthy. SBQ accounted for more than 10% of the variance in standardized test scores among 11th graders in comparing new and old schools in Georgia (Garrett, 1980). In a study of Milwaukee public schools, academic achievement among children in grades 4, 8, and 10 was predicted better by SBQ in comparison to
income levels or absenteeism in schools (Lewis, 2001).

The current study analyzes a broader array of potentially salient characteristics of SBQ based on expert evaluations that employ a standardized rating instrument. In addition to structural quality and maintenance, we also examine noise, crowding, privacy, hazards, and safety – environmental dimensions with well known developmental implications (Evans, 2001; 2006; Wachs, 2000). We also disaggregate overall SBQ into classrooms, hallways, bathrooms, and the cafeteria and incorporate children's perceptions of SBQ into our analyses. Finally, our analyses are at the level of the individual child rather than aggregated into school level achievement test data.

Method

Participants. We developed and pilot tested two new instruments to assess school building quality and children's perceptions thereof in three, low-income NYC public schools. Data were collected from 70 fourth graders ($M = 9.6$ years, 60% female) who had attended the school for at least two years. The three schools were chosen to vary in building quality but comparable in income levels. Variation in building quality was based on date of construction and latest renovation.

Building quality. Building quality was assessed by a trained rater in conjunction with a facility tour accompanied by the custodian. Teachers were also interviewed for information best assessed by a user. The overall building quality instrument was reliable ($\alpha = .7$) and consisted of subscales that covered noise, crowding, ventilation and odor, thermal comfort, access to nature, functional windows, safety, maintenance, structural quality, and equipment/technology support.

Child perceptions of building quality. Both open ended, qualitative data on least and most favorable spaces and reasons therefore, and rating scale information for major subspaces in the school (i.e., classroom, bathroom, hallway, cafeteria) were collected from each fourth grader. For each space as well as the overall building, preferences were measured by asking children to jump different distances conforming to Not at All, A Little, or A Lot. A two week, test-retest exceeded .90 for these measures (see Bandura & Schunk, 1981; Evans et al., 1995 for information on this technique). For classroom, bathroom, hallway, and cafeteria, children rated noise, privacy, safety, dirtiness, and crowding, respectively, by placing a game piece on a thermometer graphic arrayed vertically from A Lot, A Little, to Not At All. Multiple items were used for the latter assessments with $\alpha$'s ranging from .50 to .67. Copies of both instruments are available from the second author.

Academic, cognitive, and socioemotional outcomes. NYC standardized math and English test scores (3rd grade) and first term 4th grade marks were used. We derived a personal growth score from teacher ratings of effort and homework completion, cooperative work, and respect for class/school rules. Each child was also administered two subscales of the Harter (1985) competency scales, Perceived Scholastic Competency ($\alpha = .61$) and Global Self Worth ($\alpha = .70$).

Results

As Table 1 and 2 demonstrate, the most favorite space mentioned in the qualitative probes was overwhelmingly the gymnasium/playground, followed by the child's own classroom. There was also strong convergence on the least favorite spaces: cafeteria and bathrooms.
Table 1: Favorite Spaces by School

<table>
<thead>
<tr>
<th>Favorite Space</th>
<th>School</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Gym</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>Art Room</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Current Classroom</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Library</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Entrance</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Music Room</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Cafeteria</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>3rd Grade Classroom</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Computer Room</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Playground</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Science Lab</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Guidance Office</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Auditorium</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2: Least Favorite Spaces

<table>
<thead>
<tr>
<th>Least Favorite Space</th>
<th>School</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Not Reported</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Gym</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Art Room</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Current Classroom</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Library</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cafeteria</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Computer Room</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Science Room</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Bathroom</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Principal's Office</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Auditorium</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Staircase</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Writing Room</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Hallway</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Rug in Science Room</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The rating scales matched up well with the more open-ended probes providing some validation for the former. We also used random probing for the child's perceived quality scales, asking the child why s/he answered the question as they had. Independent ratings of the degree of correspondence between the rating and the open ended responses also converged \(\text{Kappa} = .86\). After controlling for household income, building quality as assessed by the walkthrough evaluation was significantly related to children's perceived building quality \(r = .42\), teacher ratings of personal growth \(r = .34\), school tardiness records \(r = .27\), child self-ratings of scholastic competency \(r = .12\) and standardized math scores \(r = .24\). In addition to examining overall building quality, we also explored specific spaces. Bathrooms and classrooms contributed the most to both cognitive and socioemotional outcomes, but overall building quality was consistently a stronger predictor of cognitive and socioemotional outcomes. We checked for gender and ethnic interactions with building quality, but given our small sample size, were not surprised to find none.
Discussion

School building quality (SBQ) is significant for children’s academic and socioemotional development. Both objective and perceived measures indicate that the physical learning environment is related to academic success and socio-emotional development, even when income is statistically controlled.

The positive correlation between objective SBQ and math test scores is congruent with previous research (Al-Enezi, 2002; Cash et al., 1997; Earthman et al., 1995; Garrett, 1980; Hines, 1996; Lanham, 1999; Lewis, 2001). However, insignificant correlations between objective or perceived building quality and reading test scores are inconsistent with these previous studies. This finding is especially interesting because although poorer buildings were objectively noisier and were perceived to be noisier, reading scores were not correlated with objective or perceived noise levels. This is inconsistent with research on noise and reading, which suggests that quieter learning environments yield better reading test scores (Evans, 2006). Though reading scores for students with Limited English Proficiency were not included in the study, the reading results may be confounded by the number of children who come from non-English speaking families.

Such discrepancies may also be rooted in methodological differences. While previous research generally relies on a singular building rating completed by school personnel, this study incorporates multiple building ratings, including objective evaluations of researchers, teachers and custodians, and subjective ratings including children’s perceptions. Furthermore, previous research compares building quality with overall school or district-wide test score means, a method which ignores within-school variance, and suffers from the ecological fallacy.

Lateness results are important because they may reflect an apathetic or negative attitude towards school, resulting from interpretations of poor building quality as a reflection of the importance of school. In interviews, children studying at the two lowest quality buildings expressed their negative attitudes towards their building, explaining that the “old building with no air conditioning” and “everybody squished together… and screamin’” frustrates them, and that the “stinky” smells in the cafeteria, gym and bathroom make them “nauseous.” Children in poor school buildings also expressed annoyance with the empty, trash-ridden, ill-equipped playgrounds: “we have no toys or nothing” except broken [basketball] hoops” with no nets, which don’t get used because “the playground’s too dirty.” So, instead of playing, the children “sit on pipes, because there’s nowhere else to sit.” Teachers commented that the “lack of outdoor playground space… greatly limits the activities the children can participate in during recess time” and undoubtedly affects their ability to restore motivation and excitement towards school.

Contrastingly, in the best facility among the three buildings, multiple children commented that they “feel comfortable in this school” and are excited about learning because there are no “cockroaches or waterbugs, like at my old school… you don’t see papers on the floor [in the hall] or people throwing stuff and the bathroom’s not dirty.” Some children discussed the school’s décor as an element contributing to their comfort: “the carpet is a good, fun space… and I feel comfortable in the science room cuz there’s, like, stuff on the walls and displays and stuff.” Other children explained how school resources, particularly in specialty spaces, like the science room, peak their interest in school work. One student explained that she is “into science [because the science lab has] “animals and he has things all over and he has experiments… I never had a science lab in my other school.” Another student described the art room as her favorite space because “we get to do things that are fun and it’s not too hot and not too cold.” A third child mentioned that “the comfy chairs that are adjustable and on wheels in the computer room” equipped with state-of-the-art Macintosh computers stimulate her interest in computers. As mentioned earlier, a well-equipped
school is inviting to children and increases excitement towards learning.

The relationship between perceived bathroom quality and overall building quality is congruent with previous research involving interviews with children (Maxwell, 2000), which found that children often discuss the bathroom when asked about their school building because it is a particularly unlikable place. Since elementary school bathrooms are usually unsupervised spaces not used by adults, they tend to be places where multiple negative dimensions of building quality converge; school bathrooms are often dirty, noisy, undefensible, crowded spaces where children seek refuge from adults and other children, but have trouble obtaining it.

**Limitations.** The results of this study are ungeneralizable due to three methodological problems. Firstly, sample size is small. Secondly, in some schools, teachers admitted to selecting their best students to participate. Therefore, the sample is not random. Thirdly, the objective SBQ assessment was performed only once. Ideally, it would have been performed multiple times to ensure reliability.

In addition to methodological flaws, one of the most complicated problems was ensuring that children limited their responses to ratings of the physical environment, despite interviewers’ repeated attempts to explain to children that they were only interested in the physical environment.

**Future Research.** As stated earlier, a primary goal of this study is to expose the importance of the physical learning environment, and to begin a series of studies exploring the effects of the environment on learning. While the results delineated here exhibit the importance of studying this topic, the study needs to be replicated in larger samples, with students of varying demographic backgrounds. This study focused on fourth grade in order to determine whether building quality begins to influence children in elementary school. Future research should expand the age range. A longitudinal study, researching the effects of school building quality on learning over time, would be a valuable contribution.

Low-income children are most likely to attend schools in dire condition (Noguera, 2004; Ortiz, 2004; Schneider, 2004; Talbert-Johnson, 2004). Future research should explore the implications of SBQ for the well documented income gap in achievement. Perhaps one important contributor to low-income children’s relatively poor performance in school is suboptimal, building quality. Income and achievement studies that incorporate measures of SBQ would enable researchers to determine the potential mediating role of school building quality in the relationship between income and achievement.

As Bronfenbrenner’s (1979) theory of ecological development suggests, school is only one component of the complex system in which children develop. Research on school building quality should be incorporated into studies of related contexts in which children grow up. For example, in order to gain a full understanding of how children’s environments affect development, children’s school buildings should be compared with children’s home environments. Maxwell (1996), for example, found that adverse impacts of daycare facility crowding on preschool children were exacerbated if they child also lived in a more crowded home.

**Conclusion.** The single most important implication of this study is that building quality matters. It is imperative that future research continues to explore the complex implications of building quality and its relationship to academic success and socio-emotional development. This study reveals that both objective and perceived building quality are potentially intricately linked to motivation and thus may affect achievement in important ways. Results regarding the links between objective building quality and math standardized achievement test scores suggest that building quality may contribute to standardized test performance. Without a concrete understanding of
external factors influencing teaching and learning, inundating our teachers and students with standardized tests is futile; it is unreasonable to measure teacher talent and student intelligence when important variables such as SBQ are not also taken into account.

The current study also implies that building quality is perceived by children and, in turn, helps shape socio-emotional development. It is likely that perceived self-competency mediates the link between building quality and academic achievement, because children with poor perceptions of their ability to succeed are likely to quit trying. If children lose motivation to exert effort in their school work and consistently arrive late in fourth grade, it is highly likely that negative attitudes and destructive behaviors will increase as children experience poor building quality for extended periods of time.

Winston Churchill eloquently stated “we build buildings and then they build us” (Guadagni, 2000). Future research on school buildings is needed to ensure that our children not only receive the sound, basic education they are entitled to as universal right, but that they develop into motivated, high performing, adults who perceive themselves as important citizens with potential – and then reach the high standards they set for themselves.

Bibliography


Al-Enezi, M. M. (2002). A study of the relationship between school building conditions and academic achievement of 12th grade students in Kuwait public high schools. Virginia Polytechnic Institute and State University, Blacksburg, VA.


Hines, E. (1996). *Building condition and student achievement and behavior*: Virginia Polytechnic Institute and State University, Blacksburg, VA.


Lowe, J. M. (1990). *The interface between educational facilities and learning climate*. Texas A&M University, College Station, TX.


Spaces for Learning Through Better Social Interaction

Çelen Pasalar,
North Carolina State University
Raleigh, NC, USA

Introduction

Today’s schools in the US are facing new challenges as a result of the rapidly changing social and cultural values of communities. Increasing student enrollments in schools across the US and spatial needs to accommodate changing educational practices have been facilitating the required changes in the design of school buildings. A growing number of researchers agree that building better designed school buildings generate more stimulating environments, for learning and social interaction. Students in stimulating school environments, who are socially engaged with their school community, tend to achieve better in class activities and gain skills. The need for more new school buildings to be constructed as well as the existing ones to be renovated increases the urgency of understanding how different school building designs function and respond to the needs of both students and teachers.

Schools as the primary social settings aim to teach and provide the opportunities for students to interact with their peers and teachers by means of academic and social practices. Therefore, both the quality of student socializing and the quality of education given in schools need to be paid more attention, while designing today’s innovative school environments (Gump, 1987). Although there have been explorations into prototypes as simple answers for designing school buildings, there have been new attempts and continuing research efforts to look for the benefits of developing small schools where more personalized and intimate learning environments are offered for students (Genevro, 1990). In that respect, a variety of school types, such as focus schools, charter schools, schools-within-schools have emerged across the US sharing common principles – schools that are smaller, safer, cohesive, intimate, and more responsive environments. Creating smaller schools is assumed to reduce the isolation that often causes the alienation and violence among students, but in reverse, to increase social interaction and learning abilities of students (Wasley et al., 2000).

An understanding of how small school environments are spatially organized and how spatial relationships support students’ behavior and interactions is important to improving school environments. It is important to recognize that much of students’ time spent in school is devoted to socializing as well as learning (Sanoff, 1994). There is need for diverse sets of activity areas in concert with classrooms offering different opportunities for students to learn, explore, and socialize in non-classroom environments. The availability and the spatial planning of these areas are equally important to generate that healthy social interaction among individuals.

This study examines whether the built environment (i.e. the way that we design and build current school buildings) affects the degree to which students are involved in their school communities and interact with each other. The fundamental premise is that some school building designs (spatial layouts) enable or encourage social ties or interactions, whereas others do not. Theoretically, the
school building designs (or types) most likely to promote social activities and interactions among students are those that have legible spatial layouts providing visual and physical access to different activity areas and are responsive learning environments, which foster students’ development of competence for the new tasks and challenges through physical attributes of individual areas (e.g. open versus enclosed spaces).

Research has shown that spatial layouts can be designed to facilitate social contacts when desired, while preserving the possibility of privacy as well (Lang, 1987; Archea, 1999). The spatial layout of the school building can facilitate and contribute to the development of students’ competence toward both social and physical environment, if spatial cues are clear and easy to understand to the individuals. Spatial cues, such as boundaries and enclosures between spaces, make it possible for goal-directed or informal activities and encounters to happen (Goldbeck, 1985). Cues, such as shape, openings providing the visual and physical linkages between spaces, or other arrangements, all convey messages from which people read, make judgments, and act accordingly (Sanoff, 1994; Archea, 1999).

From the rural one-room schoolhouse to today’s specialized facilities, a school program is shaped according to political, economical, and practiced pedagogic parameters that characterize a social formation. Educational space is mainly a result of the combination of two historic elements that merged – the evolution of curricular, social, and educational activities based on the needs of the society and the traditions; and practices coming from the architecture: new spatial layouts, new shapes, new forms, and new technologies.

There are three approaches that this study considers about school environments. This study basically analyzes schools: (1) as a design pattern (spatial planning); (2) as a social setting (social organization); and (3) as a set of interactive interfaces for social and educational activities. In terms of school design most of the schools are based on the geometrical grouping of different areas. For example, egg-crate school design of the 1950s, the pod and the open-plan classroom arrangements of 1960s-70s, all relied on grouping rectangular classrooms in a linear or cluster arrangement. However, just as every other building type, it is a challenge to think how to assemble many similar instructional spaces such as classrooms together with other diverse set of spaces such as halls, corridors, larger common areas etc. into a coherent whole in order to support regularly occurring sequential activities and interactions (Hanson, working notes on the schools, 2001). The school is always thought of as a classic set of relations between teachers and students, where their interactions occur mostly within classrooms. Central to the original thinking of the early educators, John Dewey (1967) and Vygotsky (1978), the notion of learning and the community in school environments suggests that students learn as much from each other and from their environment outside the classrooms as they do in their classes (Dudek, 2000). Thus, schools can be considered as settings where students socialize and learn from each other both inside and outside of their classrooms.

Schools can also be considered as a set of interfaces in terms of a spatial system accommodating both students and teachers, who are continuously interacting and conducting educational activities. Therefore, it is necessary to understand the characteristics of spatial layout in school buildings that will supplement the needs for availability, access, and use of multidimensional activity settings and its related impact on students’ interactions and activities.

From the social point of view a school is the first small community for students outside of home. Schools have generally been thought of as communities based solely on curricular organization. However, besides curricular organization schools accommodate a self-contained society of different groups, which is organized (brought together or isolated) physically according to the crosscutting
relations and roles of its individuals. Student groups in schools are generally age related. It is the aim that these different age groups will, to a degree, interact with each other, while at the same time they will be kept in separate grade units. Each grade unit aims to provide integration among students within the same age group. Schools aim to provide diverse types of social spaces with different activity settings in relation to classrooms where privacy as well as continuous communication and interaction among students can be achieved within and outside classrooms.

Students' behavior and movement patterns in schools and their interactions in relation to spatial planning of school buildings are among the important issues of architectural programming and the performance of educational settings. The need to enhance social interaction has been frequently mentioned as a basic human drive, while the need to limit social interaction in different settings has also been recognized (Lang, 1987). Hence, the school environment can, in general, increase or decrease the socialization among students and can have a major impact on how well the school facilities function through its spatial planning. Research has shown that spatial layouts can be designed to facilitate social contacts when desired, while preserving the possibility of privacy as well (Lang, 1987; Archea, 1999).

This study examines the relationship between school building layout design and social interaction among students. Firstly, this study makes the assumptions that circulation paths/hallways in school buildings, which connect the well-defined activity settings, encourage students’ use of spaces in task-related activities as well as activities enhancing their socialization. This study further explores the following general hypothesis: “The potential for students to interact outside classrooms is controlled by the spatial layout of the school building (spatial connectivity and integration between classrooms and other shared facilities). Physical and visual access to activity settings and movement from one place to another reveal patterns of co-awareness of others and potentials for interactions (encounters) among students increasing their sense of belonging to the rest of the school community”.

Methods

To examine the relationship between school building design (layout) and social interaction level among students, this study uses a “cross case analysis” approach (Stake, 1995; Creswell, 1998), which examines and compares four different school building layouts, through syntactic and user-based qualitative information. The study uses three sets of methods for analyzing each selected school setting: the spatial analysis through space syntax, behavioral analysis through activity log and observation, and social analysis through questions revealing students’ perceptions of the spatial qualities of the school buildings.

Spatial Analysis: Axial Map Analysis. This study uses the space syntax methodology, the axial map. This analysis helps to compute and predict the space use and occupancy rates of different areas characterized by integration and connectivity values of the visibility lines or movement paths in school building layouts. Simple regression is used to explore the relationship between spatial attributes of spaces (integration and connectivity) and the activities (rates and types). These spatial attributes used in this study also help to describe overall accessibility and visibility features to and from spaces based on the spatial organization of the school building layouts under investigation.

The empirical findings coming from the space syntax techniques identify social patterns that are intimately linked to spatial parameters. Therefore, by analyzing spatial patterns it is possible to answer questions of how social and cultural content are embedded in spatial patterns, as well as how built spaces can shape social relations. The way spaces organize social interaction, among individuals, can be interpreted in many ways from an abstract to a systematic approach (Hillier and Hanson 1984). The analysis of spatial configuration/layout is a systematic approach in order
to understand the relation between space and community. In that sense this study uses data based on the syntactic measures of spatial layout of school buildings, which were used for measuring the relationship of space with the distribution of students’ activities and interactions in each school setting.

Observing Activity Pattern: Behavioral Mapping and Activity Log. Data based on the observational measures were used to better understand the students’ behavior in each school building. The activity log was used as a means to discover how the students use spaces over a period of time (at regular, predetermined time intervals) in each school building. The activity log is essentially an observation tool where the students observe themselves rather than being observed by the researcher. The items of the log were recorded by each student “before, during, and after classes” throughout a three-day period. It is generally recognized that students are usually engaged in similar activities. However, the places in which activities are carried out often vary. Therefore, the collected data is used to set up correlations between two general items: activity (type) and locations.

The behavioral mapping technique was also used to observe and map students’ locations, activity distribution, and movement patterns through spaces in school environments over a period of time. Behavioral mapping describes patterns of activities and the use of physical space (Rivlin and Rothenberg, 1976). This study is interested in finding whether behavioral patterns in school buildings with different spatial layouts differ from each other. Together with the activity logs, the plans of each school building were provided to the students where they marked their activity locations and movement patterns on the maps. Students marked their locations and movement patterns on the maps using the numerical coding system provided to them on the activity log table specific for each time interval. That way activities and locations marked on the maps were later easily tracked in relation to the data provided on the activity log.

Student Perceptions of School Building Layouts. Students’ perceptions of the physical attributes of the school building layouts were collected from students’ assessment by using sets of questions (strongly agree, agree, somewhat agree, somewhat disagree, disagree, or strongly disagree). Students assessed their school building layouts in terms of number of public/common areas existing in each school; connection of common/public areas to each other; accessibility to each common/public area; general circulation system in the building; and visibility through spaces (specifically from classroom areas to other parts of the building).

School Building Layout Categories

The school building layouts were subjectively categorized into four types by the researcher before conducting the study. The schools were all selected from North Carolina, US and are considered as examples for small schools, each accommodating approximately 200 to 350 students. The school buildings studied through this study include the following four types:

Case I: Multi-story Compact School Building with Clustered Classrooms. This four-story school building was built based on the idea of clustered classrooms surrounding a core area lined along a main hallway leading into main six activity zones on different floor levels (1) administration area; (2) resource areas, such as library (3) instruction areas (classroom clusters); (4) eating area; (5) sport and art facilities, such as the gym, music room, and dance room; and (6) informal social areas (outdoor courtyards/open spaces).

The school building benefits from level differences for locating different classroom/instruction areas in relation to each other. Each classroom house or cluster is repeated on each level with its core resource areas at the center. Each storey in the building houses one grade level. Administration units are placed towards the main entry of the building. The di-
This two-story school building was built based on the academic house concept where a smaller learning environment is created for each grade level. This particular school building is comprised of diverse sets of spaces, such as educational spaces (classrooms), specialized instruction areas (art studios, drama, music rooms, science labs), administrative office spaces, specialized common areas (gym, cafeteria, library), and informal social areas (different size of hallways, gathering areas, courtyards, outdoor playing fields, etc.).

**Case I: Multi-story School Building with Clustered Classrooms.** This four-story school building was built based on the idea of clustered classrooms surrounding a core circulation area lined along a main hallway leading into main six activity zones on different floor levels (1) administration area; (2) resource areas, such as library (3) instruction areas (classroom clusters); (4) eating area; (5) sport and recreation; and (6) informal social areas (outdoor courtyards, study areas).

**Case II: Two-story Academic House School Building.** This two-story school building was built based on the academic house concept where smaller learning environments are created for each grade level. The basement area accommodates the gym and the music/dance rooms. The library is also located on the first floor. Staircases and atriums with differing sizes are distributed within the building providing connections between different activity zones and floor levels.

**Case I Floor Plan**

**Case II Floor Plan**
areas (different size of hallways, gathering areas, courtyards, outdoor playing fields, etc.).
The spatial layout of the building includes a linear scheme where “houses” for each grade are lined up along the main circulation area (corridor). The school has one main entry for both students and visitors where the administration offices are located. The school building is composed of five main clusters/houses mainly comprised of classrooms.

Houses for each grade include regular classrooms and other specialized areas, such as science, language, and math. Each house has its own common gathering area unobstructed at the center of the house, which acts as an extension area for classroom activities or occasional team/group gatherings/lectures. The exploratory house includes computer labs, performance, drama, music, and arts facilities. Specialized public areas (gymnasium, dining area) in the building are located on the first floor opposite to the academic houses. The second floor also includes classroom clusters, together with the library. The major staircase is centrally located, with two auxiliary stairways located at opposite ends of the building. The major hallway is the main artery providing access to each house unit.

Case III: Spread - Finger Plan Schools. This single-story building is an example for finger plan type school building design where classrooms for each grade are gathered on separate wings attached perpendicularly to the main atrium area. The main atrium acts as a hub area in the building from where the circulation pattern reaches to the rest of the building. Regular instruction areas for each grade, such as science, social science, and math classes are all located in the classrooms wings. On the other side of the atrium/foyer area, the media center and other specialized classrooms for language and other elective courses (art, music, dance and performance) are located. The gymnasium and cafeteria form a different activity zone in the building, which are also used for major social gatherings. Hallways at certain locations become wider, forming transition activity nodes or gathering areas for students before entering into any specific areas. Overall this school building provides diversity in activity nodes and gathering areas.

Case IV: Radiant - Finger Plan Schools with Central Courtyard. This single-story school building is comprised of five major activity zones: regular instruction areas (classrooms); specialized instruction areas (art, drama, music); resource areas (media center); social areas (cafeteria, courtyard, hallways,
entry halls, and gym); and the administration offices. The building is designed incorporating five arms (wings) branching from the core inner courtyard (green space) of the building. The courtyard is enclosed by hallways on all sides. Each wing is attached to the central circulating hallway system around the courtyard. Different from other schools used in this study, the hallways in this case have the same width everywhere in the building. Three of the arms accommodate individual grade units. Each of those three wings is comprised of individual units of classrooms (social sciences, math, science, and computer lab) lining along the hallways. The rest of the arms together form the social zone of the school where students eat or participate in sports facilities. Opposite the gym, exploratory facilities such as art, drama, and music rooms are located. Overall, the layout of the building groups related functions in separate arms/wings where the hallways provide the physical connection between each unit. Different from other cases, this school does not provide diverse informal gathering spaces.

Results

All school buildings used in this study differ in their spatial layout: linear, compact, spread, or radial. The locations and the diversity of the common areas in each school also differ. The spatial analysis reveals that the overall accessibility level of spaces in Case III is higher compared to other school building layouts. Using the symbol “<” to compare the school building layouts, it is possible to indicate the variance of the integration values among each school as: Case I<Case II<Case IV<Case III. The comparison of the connection and integration of informal gathering spaces of each school building also indicates similar results.

The correlation between the connectivity and the integration values of all spaces in the building measures the intelligibility level (based on R-square value). When the correlation is high, the local importance of a space, which is directly observable by looking at the number of neighboring spaces, gives a good idea of the space location and its importance in relation to the entire spatial layout of the building. Different values for intelligibility indicate the differing environmental opportunities provided for students, which enable them to move and have access to different areas in the building easily. At the same time, clear and easily understood circulation routes in school buildings help to create opportunities for students to see and be seen by the others through which possibilities for encounters and interactions are created. In this respect, school buildings with multiple-floor levels (Case I with R2=0.19 and Case II with R2=0.17) indicate less intelligibility values com-
pared to the single-story school buildings (Case III with $R^2=0.52$ and Case IV with $R^2=0.57$). Both student responses and spatial analysis of each school building indicate that the vertical connections in the building were observed to weaken the students’ ability to have a sense of what is happening with the rest of the school community. This means that movement through enclosed vertical connections provides less awareness of the surroundings, where students have rather poor visual and physical access to the rest of the community. Conversely, single-story school buildings indicate better integration and connectivity values in contrast to the multi-story school buildings suggesting more easily accessible spaces, which will help generate opportunities for encounters and interactions among students, especially when moving through those areas.

In each school building layout the relative position of the public/gathering spaces in relation to the classrooms differs, which further leads to differences in the usage frequency of these areas. The behavioral analysis provided information about the overall occupancy rate of the areas together with activity and movement patterns in each school building. Activity type and distribution within the spatial layouts were analyzed to indicate the relations between syntactical attributes and the development of students’ behavior. Overall results from the behavioral analysis of each school building indicate that:

- Students’ activities in school buildings are highly programmed during class periods but highly incidental before and after classes.
- Highly integrated hallways are designated as areas where more student interactions and movement occur.
- Public gathering areas located along these major hallways indicate higher occupancy rates. Any gathering area requiring longer walking distance and change of direction in the movement indicate less use rate.
- Students have the tendency to use shorter and directly accessible routes in order to arrive their destinations in the building. Preferred short-cut routes were also among the most integrated areas in the building.
- The space occupancy level is highly correlated with students’ movement in the building ($0.39 < r < 0.75$)
- Students’ interactions are also highly correlated with the space occupancy level of the areas in the building ($r=0.89$).
- Besides classrooms, hallways in classroom wings are where students conduct static (sitting, reading, standing, watching around), practical (packing/unpacking at lockers, working in labs), interactive (talking, joining in conversations), and minor movement related activities.

Behavioral analysis indicates how the students’ behavior is modulated through the spatial attributes of the school buildings. Overall, all the school buildings, under investigation, indicate that school buildings provide different levels of segregated and integrated areas, which can manipulate students’ behavior by the spatial arrangements of these differing areas. Areas with different spatial properties, in terms of visual and physical access, constrain the manner in which they can be used.

Students’ evaluation of their school building layouts also revealed that a majority of the students in each school (83% in Case II, 70% in Case III, 68% in Case IV, and 61% in Case I) believed that the number of the common areas available in their school buildings was sufficient for the use of the entire student population. At the same time, 88% in Case I, 81% of the students in Case II, 78% in Case IV, and 64% in Case III agreed that common areas in their school buildings were very well connected to the rest of the building. A majority of the students in each school agreed
that the access to the common areas in their school building was easy. 84% of the students in Case II, 82% in Case I, 72% in Case III, and 46% in Case IV all agreed that the circulation system was easy to understand. In contrast to other spatial features of each school building, a majority of the students (72% in Case IV, 76% in Case III, 57% in Case II, and 58% in Case I) indicated that it was not easy for them to see and follow anything happening in the building from where their classrooms are located. Overall students in Case IV indicated poorer satisfaction about the spatial properties of the school building than the students in other three schools.

Overall results indicate that there are highly significant differences in students’ responses about the spatial properties of their school buildings in academic house type school buildings (Case I and Case II) versus finger plan type of schools (Case III and Case IV). In general, students’ responses indicated that academic house type school buildings indicated more satisfactory spatial properties than the finger plan type schools.

Discussion

Although there are fine scale differences in the distribution and densities of the movement through spaces in each school building across the day relating to particular activities, overall spatial use, occupancy, and movement patterns visually respond to the spatial integration pattern (accessibility) of each school building. This indicates that although there is a predetermined schedule directing the use of the areas throughout a day, students’ informal activities in non-classroom areas are generated according to the spatial pattern of the school buildings.

Spatial analysis of each school building layout and the observational data show that students’ patterns of movement are directed by the spatial patterns. Specifically, the degree to which a space is “deep” or “shallow” from all other spaces in the school building determines the level of movement through that space. Shallower or more integrated spaces convey greater levels of movement than deeper segregated spaces. The movement pattern also results in a pattern of spatial location of interaction. Interaction among students either takes place in the presence of movement and to a degree related to the amount of movement, indicating that it results as a by-product of movement and space use level, or it takes place in the absence of movement. The former includes the “unprogrammed” or incidental interaction within, or just off, the main hallways. The latter are the programmed meetings within classrooms.

The level of space use was highly correlated with students’ movement, which was also correlated with the students’ interaction level. It indicates clearly that students’ perception of one and another increases with occupancy levels of the spaces. This may be associated with the use of particular facilities locally, rather than affecting significantly a more global sense of intervisibility. Spatial configuration, visibility, walking distance, perceived environmental quality, and space-use level are shown to be significantly related to unprogrammed interactions among students. The results suggest that space planning is a potential precursor of social interaction in school settings, which needs to be considered for facilitating better learning and social experience through space planning in schools. In other words, the way that we design and build our school buildings affect the social interactions.

Unfortunately, the way many schools in US have been designed is likely to have a negative effect on the development of students’ social skills. Most school building designs actually discourage social interaction. The common belief has been that social interaction can be a distraction for students and may threaten the discipline and rules in each specific school culture. We now begin to accept that social discourse and collaborative learning are critical component of students’ development to well-rounded citizens. These skills for sure are accepted as top qualifications for
success in almost most professions.

Changing this negative trend in school building design will require changes in approaches to create spaces for social interactions and a shift in spatial planning, which will intelligibly replace dull, narrow corridors with other types of spaces that will permit circulation but also serve the goals of social and emotional development of students.

Of course, before we get to that point, we need to know more about how the school building layouts affect social interactions. The results of this study cannot be generalized since every case has been investigated in itself. More data must be gathered regarding how different spatial planning strategies in school buildings affect social interaction in general. What are the other typical school designs that can be analyzed? What are the other factors that might influence the use of spaces, such as rules applied by school administrations to limit the use of spaces?

Bibliography:


Part 3:
Country Reports

We have grouped in this chapter four country reports. They give an overview of current educational challenges facing Yemen, Jordania, Egypt and Palestine. It was one of the privileges of the Colloquium to have as participants representatives from these countries who are direct actors and decision makers in the respective educational ministries or sectors.

Thus, in these published reports are to be found not only figures describing the evolution of schooling but also more personal views on achievements and priorities as defined by the authors - Mohamed Hassan Alsharafi, Osama Maghayday, Hatem Zaghloul Shalaby and Fawaz Mujahed with Ziyad Kullab. This provides all readers of this volume with an insight on how complex the articulation of help from international funding agencies is with local country policies and regulations.

Every country has its specific history and political context that sets priorities and limits to what can be done and at what pace. It was a very positive experience for all parties to be exposed to widely differing perspectives yet with the common concern of improving general access to education.
1. Introduction

The education system in Yemen requires that a child or a student should pass through non-compulsory (early childhood and kindergarten) and obligatory phases (9-year basic education), followed by a 3-year secondary education. In addition, there is technical training and vocational education.

For this purpose, the State has implemented several plans and established the Basic Education Development Strategy (BEDS) and a secondary education development strategy is currently being developed. These plans and strategies, along with their programs, are also highly focused on school building, given its effective role in education development.

2. Impact of School Design on Students’ Learning Achievements

The place of learning, undoubtedly, has an impact on both the student and teacher: the less suitable or healthy conditions are, the poorer will be their performance.

Generally, when designing a building, architects will consider all requirements of users and beneficiaries. In the case of a school such considerations at designing stage are of even greater importance.

In Yemen, we adopted the Educational Facility Improvement Project in order to reach the best architectural designs for school building in terms of:

1. appropriateness to climatic conditions;
2. appropriateness to environmental conditions;
3. meeting of educational requirements;
4. expandability and improvability;
5. most cost-effectiveness;
6. sustainability of materials used, with an aim to reduce maintenance costs.

Due to the diversity in conditions of Yemeni regions – coastal areas, mountains, desert etc. – many designs and schemes have been produced. The number of such patterns totals 43 so far, and the Ministry of Education is still developing more standard designs to achieve the best and most sustainable and cost effective ones.

In order to demonstrate the impact of a school building on students’ achievements, in addition to the school administration and teaching staff, Table 1 shows the results achieved by students of well-designed schools and those of educationally and health-wise less or inappropriate buildings:
As shown by the above table, design and location have a significant impact on success rates. We therefore requested the Ministry of Education as well as other organizations concerned to consider the most appropriate calm location for schools within the general layout of cities.

By examining the number of students actually enrolled in basic education (2000-2001), one can find that the percentage of enrolment was 62.3%: the number of students in the age-group 6 – 14 years (basic education) was 5,457,000, while the total number of enrolments was only 3,401,500 students. Of these, a total of 1,216,200 (or 36%) were girls.

In recent years, the percentage of girl enrolment has increased to 49.3%. This is the direct result of the construction of new, improved schools, in particular for girls, with a total of 93,950 classrooms constructed so far.

This means that the ready access to a school helps encourage beneficiaries to enroll, especially in rural areas, when the school has an attractive design differing from the other surrounding buildings and in terms of service and recreational facilities available at the school.

The difficulty the Ministry of Education is facing and seeking to cope with is not technical or administrative; it pertains to the resources available, the absence of an applicable and constant rule and the limited funds that are inadequate for existing requirements and do not meet liabilities, leading to considerable hindrances for many projects. During the last two years the Ministry has coped with many of these difficulties and several delayed projects have been implemented; others will be implemented during this year.

Although budgetary allocations for the educational sector are comparatively high, these funds are inadequate when taking into consideration the so-called population explosion with the consequent increase in demand from school-age groups and it is obvious that the government alone cannot meet all requirements. While several strategies, plans and programs were developed and partnership agreements have been entered into, there is still an urgent need to double efforts and to seek more funding in order to implement the plans and program in pursuance of achieving the Dakar Declaration. This is, however, not an easy task, since the basic-education-aged population in 2005 numbered about 6,810,000 - while the schools had a capacity of only 3,817,000 students (56% of needs). In addition, it is expected that the basic-education-aged population would reach 7,170,000 by 2010, not to mention the scattering of population which would further increase the need for school buildings.

Based on the above, and according to the educational survey, it is clear that by 2010 there will be a real need for at least an additional 170,000 classrooms in order to fully cater for the target groups.

Currently (2005) we have only 76,820 classrooms available for basic education, i.e. we need to construct 93,980 classrooms over the next five years. Furthermore, we have to rehabilitate (renovation) a number of facilities and we have a need for ancillary facilities to improve education, such as

<table>
<thead>
<tr>
<th>No</th>
<th>School</th>
<th>Enrolments</th>
<th>Passes</th>
<th>% of</th>
<th>Building &amp; location</th>
<th>Mgmt.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Olofi</td>
<td>1,813</td>
<td>1,458</td>
<td>80.4</td>
<td>inappropriate design +</td>
<td>Weak</td>
<td>constant noise</td>
</tr>
<tr>
<td>2</td>
<td>Khaled</td>
<td>2,509</td>
<td>2,010</td>
<td>80.1</td>
<td>good design +</td>
<td>Weak</td>
<td>classrooms inappro-</td>
</tr>
<tr>
<td>3</td>
<td>Khaola</td>
<td>1,143</td>
<td>1,092</td>
<td>95.5</td>
<td>good design +</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Nashwan</td>
<td>3,235</td>
<td>2,550</td>
<td>78.8</td>
<td>good design +</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Rabiea</td>
<td>1,554</td>
<td>1,495</td>
<td>96.2</td>
<td>good design +</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Asma’a</td>
<td>1,467</td>
<td>1,317</td>
<td>89.9</td>
<td>good design +</td>
<td>Weak</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Tariq</td>
<td>2,268</td>
<td>1,848</td>
<td>81.5</td>
<td>good design +</td>
<td>Weak</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Impact of design, location and administration on success percentage in some schools of Sana’a City
residences for female students and teachers in rural regions, as well as for male students and teachers. Furthermore, it is necessary to also consider basic education outputs into the secondary education system, an inevitable cost. Female education, being a strategic goal, will certainly necessitate more investment, such as laboratories for sewing, needlework, weaving, housekeeping, etc. This cannot be achieved by the State alone; efforts must be consolidated both locally and internationally.

3. Government Designs vs. Designs from Implementing Agencies

It is no exaggeration to say that the designs provided by the Ministry of Education are the most suitable ones. Most of the implementing agencies' designs are usually implemented in accordance with the MoE's designs and where MoE standards or designs are not implemented, comments are increasingly made on schools in terms of defects of components or unstudied actions, e.g. designing of mini-dimensioned classrooms under the title of sub-classrooms or planning of large schools without adequate provision of additional facilities, such as activity rooms, libraries or spaces for educational services supplementary to curricula.

There are, of course, some good and clear designs that can be used and developed, e.g. those presented and implemented by KFW, the Japanese assistance for I and II phases, and the design principles followed in the Al-Saeed Complex School, which was grant-funded by the Hael Saeed Ana'am Group.

4. Cost of School Buildings and the State's Efforts to reduce Cost

While seeking to improve outputs at all levels of education, the Ministry of Education is exerting great efforts to establish cost-effective schools without prejudice to quality and efficiency of the school building. The designs that were produced and have commenced to be implemented for BEDP, showed a decrease in cost for initial bids and are all evidence of the fruitful advantages obtained as result of the efforts exerted by the Government through MoE.

Designs by the Facility Improvement Project that are based on studying and learning from others’ experiences, will undoubtedly give an effective push towards further decreasing the costs. The Ministry of Education will, in coordination with organizations concerned, reduce disbursement procedures and provide sufficient funds for governmental projects for both local and central governments. This will save some expenditure on school buildings.

In the near future it is intended to appoint an international consultant to study, with support from a technical team from all agencies, the cost of school building in Yemen. This will be based on field visits to the different regions to know and understand implementation conditions. A unified mechanism or guide for supervision of implementation will be established by appointing a local consultant (who has commenced work) to conduct an appropriate study.

School Building Maintenance

The Ministry of Education is taking this aspect in consideration, either in choosing materials during the design process or in developing a strategy for the constant maintenance and upkeep of school-buildings. This is to be done through community participation, the establishment of a special renovation fund, development of manuals and training of staff to undertake constant and regular maintenance.

Good results have also been reached through the Basic Education Extension Project (BEEP), as well as the projects executed with KFW and Japanese assistance, where manuals were developed and the Renovation Fund Act was promulgated. These components need to be further developed,
particularly in the light of the newly introduced Local Authority System. Staff (engineers and educationalists) have also been trained on approaches of constant and regular maintenance and renovation in all Yemeni governorates through BEDP.

<table>
<thead>
<tr>
<th>No</th>
<th>Implementing Agency</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MoE (central, local, BEEP, FTI, Japan, German)</td>
<td>781</td>
<td>2,431</td>
<td>1,052</td>
<td>4,224</td>
</tr>
<tr>
<td>2</td>
<td>PWP</td>
<td>264</td>
<td>1,492</td>
<td>83</td>
<td>516</td>
</tr>
<tr>
<td>3</td>
<td>SFD</td>
<td>301</td>
<td>1,993</td>
<td>227</td>
<td>1,428</td>
</tr>
<tr>
<td>4</td>
<td>UNICEF</td>
<td>17</td>
<td>38</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td>1,363</td>
<td>5,954</td>
<td>1,362</td>
<td>6,168</td>
</tr>
</tbody>
</table>

Table 2: Summary of Educational Projects - implemented in 2003, 2004 and 2005
Public School Buildings In Jordan: Reality and Aspirations

Osama Maghaday,  

Education in Jordan

In Jordan, the Ministry Of Education (MoE) is responsible for all aspects of the educational process in the country, which include all school buildings, teachers, students, etc. in government-owned schools. The Ministry also plays an active part in supervising and monitoring the schools owned and operated by other authorities and the private sector. The total number of students in the country is 1.55 million (which is almost one third of all Jordanian citizens) and the total number of schools is currently 5,348.

Education in Jordan is divided into two levels:
- Basic education (grades 1 to 10), which is compulsory for all students in this age interval, (6 – 15 years)
- Secondary study (grades 11 + 12), which is optional and sub-divided into many streams of which:
  - Academic
  - Vocational
  - Information technology
  - Agricultural
  - Industrial
  - Nursery

Schools in Jordan

Schools in Jordan can be divided into three main categories according to their respective ownership:
- 3,200 Public Schools, owned and operated by the national government
- 2,076 Private sector schools
- 174 United Nations Relief and Works Agency (UNRWA) Basic Schools, serving the Palestinian Refugees only

Because of the increasing demand for education in Jordan, changes in the country's educational needs, and taking into consideration the current status of existing school buildings, the Ministry of Education recently carried out a survey to evaluate schools according to international standards. As a result it was found that many of the schools face one or more of the following problems:
- They are rented schools
- They operate as double-shifted schools
- Overcrowded schools
- Unsuitable environment for educational process
- Lack of budget allocated for school's renovation / maintenance
In recent years, construction of new schools in Jordan was undertaken mainly with funds from international donors, e.g. World Bank, EIB, KfW, etc. as the money allocated to the Ministry’s annual budget for school construction activities (which is only about 2 - 2.7% of the total MoE-budget or 45 -50% of the Ministry’s capital budget) is used mainly for schools extensions (addition of classrooms, scientific labs, …etc) and maintenance.

1.2 Schools Construction History

School buildings in Jordan faced many improvements and modifications during the last three decades which can be divided into four main categories:

- Up to the seventies of the last century, schools, especially in rural areas, were built in a random manner to satisfy the increasing need for new schools. In view of the availability of land, they were conceived mainly in a spread I-shaped design, without any scientific labs or computer rooms.

- In the seventies a modified I-shape of schools was adapted by the Ministry of Education. This was referred to as the Hay Nazal Prototype and was built mainly in urban areas. It consisted of multi story school buildings with up to 3 stories.

![Standard-Design School of the Seventies](image)

- At the end of 1980 the Ministry of Education embarked upon a school construction program called “Educational Projects”, financed by the World Bank. This program included the construction of new schools and the renovation of existing schools. Science labs were added to existing schools.

- In 2003 the Ministry of Education launched a new multi-donor-funded Five Year project known as the “Education Reform for Knowledge Economy Project”.

2. Education Reform for Knowledge Economy Project (ERfKE 1)

In response to the revolutionary developments in the computer industry worldwide and in view of the fact that Jordan has no natural resources except its population (as is the case of many countries, e.g. Singapore, which mainly depends on its qualified citizens as her sole resource) the Ministry of
Education initiated an ambitious project known as “Education Reform for Knowledge Economy”. The purpose was to capacitate students and encourage them to specialize in the “knowledge economy” which was expected to result in a young, independent and self motivated generation. As a prerequisite, many reforms were to be adopted by the Ministry concerning school building, teacher training, students, and the curriculum.

The Education Reform for Knowledge Economy project consists of four components, which can briefly described as:

1. Reorientation of education policy, objectives and strategy through governance and administrative reform
2. Transform education programs and practices for the knowledge economy
3. Support provision of quality physical learning environments
4. Promotion of learning readiness through early childhood education

The Total Budget of the project is EUR 300 million (US$ 380 m).

ERfKE 1 is a multi-donor funded Project, with the following contributing donors:

- World Bank
- German Development Bank (KfW)
- Arab Fund for Economic & Social Development
- Islamic Development Bank (IDB)
- European Investment Bank (EIB)
- U.S. Agency for International Development (USAID)
- Japan International Cooperation Agency (JAICA)
- The Arab Gulf Programme for United Nations Development Organizations (AGFUND)
- Department for International Development (DFID)
- Canadian International Development Agency (CIDA)


The Third Component of the ERfKE – project, with a total budget of EUR 200 million (US$ 245 m), will focus on supporting learning through construction of new schools and upgrading of existing facilities to face the large demand and need for extra schools. It is thereby intended to:

- Minimize the percentage of rented schools
- Minimize the number of double-shifted schools
- To minimize the overcrowdings in schools
- Provide a quality learning environment in existing schools.

Consequently, component three consists of two sub-components:

- Construction of 160 new modern schools and 25 new schools by the German-funded Project “Basic Schools Construction Program I & II.I”
- Upgrading of existing schools by addition of:
  - 650 computer labs
  - 800 classrooms
  - 350 scientific labs
  - 140 Kindergartens

In total, 340 schools are to be rehabilitated.
The contributing donors for this Third Component are:

- World Bank
- KfW (Germany)
- Arab Fund for Economic & Social Development
- Islamic Development Bank \ Jeddah (IDB)
- European Investment Bank (EIB)

Through implementation of this Third Component, the Ministry Of Education has achieved the following:

- Preparation of architectural guidelines
- Modification and improvements to school designs.

The improved school designs have resulted in unique school shapes for the ERKKE project, which individually depend on:

- Geographical location of schools
- Surrounding environment
- Prevailing weather
- Usage of natural resources
- Compatibility with the surrounding structures.

2.2 Experience with Funding Agencies

Working with international funding agencies over the three last decades offers the ministry's staff:

- Good opportunity to exchange experience
- To get acquainted with up to date modification in school building standards and requirements
- Provide the ministry with the required school construction funds
- Enhance the chance for staff training on new and modern engineering and construction technology.

2.3 School Construction Cost

On the basis of recent (2003 – 2005) awards of school construction tenders, high prices submitted by bidders specially after year 2004 have been observed. They are mainly due to:

- Significant increase in the price of raw materials (cement, construction steel, fuel, etc)
- Enforcement of new taxes
- Boom in the construction industry in Jordan
- Fear of the contractors of unseen and unexpected rise of prices in the future
- Scarcity of engineers and increasing appearance of inadequately qualified labour because of incentives offered by the private sector and the booming economies of neighboring countries
- Special circumstances in neighboring counties (war in Iraq).

<table>
<thead>
<tr>
<th>Tender Number</th>
<th>Award Date</th>
<th>No. of Schools</th>
<th>Total Area</th>
<th>Award Value</th>
<th>Cost (JD) per sqm</th>
</tr>
</thead>
<tbody>
<tr>
<td>81/2003</td>
<td>21/10/03</td>
<td>2</td>
<td>8,030</td>
<td>1,504,786</td>
<td>187</td>
</tr>
<tr>
<td>134/2003</td>
<td>02/11/03</td>
<td>3</td>
<td>10,030</td>
<td>1,594,977</td>
<td>159</td>
</tr>
<tr>
<td>152/2003</td>
<td>10/11/03</td>
<td>1</td>
<td>4,328</td>
<td>687,053</td>
<td>159</td>
</tr>
<tr>
<td>153/2005</td>
<td>13/11/03</td>
<td>1</td>
<td>2,807</td>
<td>472,640</td>
<td>168</td>
</tr>
<tr>
<td>160/2003</td>
<td>04/12/03</td>
<td>1</td>
<td>4,020</td>
<td>735,060</td>
<td>183</td>
</tr>
<tr>
<td>161/2003</td>
<td>07/12/03</td>
<td>1</td>
<td>4,004</td>
<td>721,494</td>
<td>180</td>
</tr>
</tbody>
</table>

#### Average: 173

### Donor: European Investment Bank (2005)

<table>
<thead>
<tr>
<th>Tender Number</th>
<th>Award Date</th>
<th>No. of Schools</th>
<th>Total Area</th>
<th>Award Value</th>
<th>Cost (JD) per sqm</th>
</tr>
</thead>
<tbody>
<tr>
<td>45/2005</td>
<td>03/07/05</td>
<td>2</td>
<td>8,609</td>
<td>2,375,679</td>
<td>276</td>
</tr>
<tr>
<td>127/2005</td>
<td>23/10/05</td>
<td>2</td>
<td>8,900</td>
<td>2,107,312</td>
<td>237</td>
</tr>
<tr>
<td>128/2005</td>
<td>23/10/05</td>
<td>1</td>
<td>3,660</td>
<td>835,379</td>
<td>228</td>
</tr>
<tr>
<td>22/2005</td>
<td>08/05/05</td>
<td>2</td>
<td>8,676</td>
<td>2,000,392</td>
<td>231</td>
</tr>
<tr>
<td>23/2005</td>
<td>28/04/05</td>
<td>2</td>
<td>3,603</td>
<td>815,196</td>
<td>226</td>
</tr>
<tr>
<td>49/2005</td>
<td>08/10/05</td>
<td>1</td>
<td>2,692</td>
<td>745,047</td>
<td>277</td>
</tr>
</tbody>
</table>

#### Average: 246

### Donor: KfW (2005)

<table>
<thead>
<tr>
<th>Tender Number</th>
<th>Award Date</th>
<th>No. of Schools</th>
<th>Total Area</th>
<th>Award Value</th>
<th>Cost (JD) per sqm</th>
</tr>
</thead>
<tbody>
<tr>
<td>127/2004</td>
<td>28/04/05</td>
<td>1</td>
<td>3,010</td>
<td>857,012</td>
<td>285</td>
</tr>
<tr>
<td>126/2004</td>
<td>28/04/05</td>
<td>1</td>
<td>4,130</td>
<td>1,050,144</td>
<td>254</td>
</tr>
<tr>
<td>125/2004</td>
<td>28/04/05</td>
<td>1</td>
<td>2,212</td>
<td>676,422</td>
<td>306</td>
</tr>
<tr>
<td>129/2004</td>
<td>28/04/05</td>
<td>1</td>
<td>1,780</td>
<td>636,326</td>
<td>358</td>
</tr>
<tr>
<td>11/2005</td>
<td>28/04/05</td>
<td>1</td>
<td>4,930</td>
<td>1,288,382</td>
<td>261</td>
</tr>
<tr>
<td>10/2005</td>
<td>28/04/05</td>
<td>1</td>
<td>3,840</td>
<td>1,052,384</td>
<td>274</td>
</tr>
<tr>
<td>12/2005</td>
<td>28/04/05</td>
<td>1</td>
<td>4,180</td>
<td>1,145,956</td>
<td>274</td>
</tr>
<tr>
<td>19/2005</td>
<td>12/07/05</td>
<td>1</td>
<td>2,154</td>
<td>693,351</td>
<td>322</td>
</tr>
</tbody>
</table>

#### Average: 292

---

### 3 Funds Allocation for School Renovation in the Government Budget: School Buildings’ Maintenance

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Ministry current budget*</th>
<th>Ministry capital budget*</th>
<th>Amount allocated for extensions*</th>
<th>Percentage of total and capital budget</th>
<th>Amount allocated for maintenance*</th>
<th>Percentage of total and capital budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>273.4</td>
<td>12.15</td>
<td>6.00</td>
<td>2.1%; 49.4%</td>
<td>1.42</td>
<td>0.5%; 11.7%</td>
</tr>
<tr>
<td>2004</td>
<td>290.12</td>
<td>14.00</td>
<td>5.00</td>
<td>1.6%; 35.7%</td>
<td>1.41</td>
<td>0.5%; 10.1%</td>
</tr>
<tr>
<td>2005</td>
<td>307.00</td>
<td>12.84</td>
<td>5.00</td>
<td>1.6%; 38.9%</td>
<td>1.20</td>
<td>0.4%; 9.3%</td>
</tr>
<tr>
<td>2006</td>
<td>327.25</td>
<td>19.38</td>
<td>4.25</td>
<td>1.2%; 21.9%</td>
<td>5.23**</td>
<td>1.5%; 27.0%</td>
</tr>
</tbody>
</table>

* All amounts in JD millions
** Money allocated increased only this year

---

Tab. 1: School Construction (2003 – 2005) and School Construction Cost

Tab. 2: Funds Allocation for Schools’ Renovation in Government Budget

School building maintenance can be divided into two levels according to the nature of work required:

- Routine maintenance: which includes school painting, replacing broken glass, etc.
- Preventive maintenance: which is carried out in school buildings and all related buildings,
may be divided according to the scope of work and its specific nature:

- Minor maintenance: which concerns the replacement and maintenance of floor tiles, plastering, sanitary units fixtures, school yards
- Major maintenance (Rehabilitation): specially to old schools in Jordan in need for structural maintenance of buildings, e.g. ceilings, columns, foundations, use of unique supporting techniques to extend the life cycle of a structure, etc.

Tab. 2: Funds Allocation for Schools’ Renovation in Government Budget

3.1 Maintenance Implementation

Maintenance is divided according to the implementing authority into three levels:

- Daily maintenance – undertaken at school level: deals with daily maintenance of school, e.g. replacing of glass, door locks, etc.
- Light maintenance work – undertaken at the level of Educational Directorates: for light maintenance work where the total cost does not exceed 10,000 JD (EUR 11,000).
- Rehabilitation and heavy maintenance works - undertaken at the level of the Ministry of Education where the total cost exceeds 10,000 JD (EUR 11,000).

3.2 Challenges to School Maintenance

- Scarcity of funds allocated for maintenance in the Government budget.
- Lack of a well-designed and updated school maintenance database to reflect school condition and maintenance history. Although though MoE used a simple database in the nineties, there will be always a strong need to adapt and improve the maintenance system. It is assumed that this will be achieved through the German-funded BSCP I & III.
- Maintenance works are usually executed by minor grade contractors only.

4. Architectural Guidelines for Governmental Schools

Over the past decade the Ministry of Education in Jordan has made remarkable progress in providing for an improved education coverage by building new schools wherever needed or providing for extensions to existing schools. Not only was the absolute number of schools increased, the Ministry also improved the quality of the educational system in order to meet the requirements of new Knowledge Economy.

In the Directorate of Buildings and International Projects our role is to design and/or direct others to design the educational spaces to serve the learning needs of students according to the Ministry’s policy, and to control the design stage of the governmental schools through providing the plans and requirements for typical teaching spaces. In order to facilitate this, the Ministry has developed “Architectural Guidelines for the Design of Schools”.

4.1 Objectives of the Guidelines

The Guidelines are intended to serve as a reference for designers of schools and/or school facilities. They define and describe the educational spaces needed by type, size and specifications and according to international standards as well as the requirements established by MoE for academic and vocational schools in urban and rural areas of Jordan.

The Guidelines include the required specifications and sample drawings for all types of school spaces such as general classrooms, administrative areas, play-grounds, special activity rooms (laboratories, libraries, art rooms, etc.). They can be used at a number of different levels, including:
• Design of new schools
• Design of extensions to existing schools
• Evaluation of existing schools
• Study and provision of school furniture and equipment

The Guidelines present the minimum and maximum allowable recommended spaces for schools where flexibility, cost-effectiveness and efficiency are essential in good school design. They will be periodically updated to reflect new or revised policies and requirements established by MoE and are intended to serve as a reference and guide for all those who are involved in the process of planning, designing and building new school structures or renovating existing school facilities (administrators, teachers, contractors and architects, engineers and other design professionals as they plan and design the educational spaces).

4.2 Modification and Improvement to Schools Design (Under ERFKE1 Project)
For schools designed since implementation of ERFKE 1 commenced several modifications of design requirements have been required:
• Modification of school shape according to geological, climatic and meteorological requirements and in consideration of the surrounding environment
• Computer network infrastructure needs to be implemented, including the classrooms to benefit from the e-learning
• Two computer labs in each school, equipped with the adequate number of computers, and air conditioned
• Addition of facilities for disabled students to proceed with their education, including ramps, special toilets, etc.
• Usage of new color combinations in indoor and outdoor school painting
• Addition of a kindergarten to all female schools to encourage pre-school education
• Installation of central heating to all schools built under project

Fig. 2: “New Design” – with landscaping, smaller yards and playgrounds

5. Project with German Development Bank “KfW”
Since 2000, there has been a much appreciated and continuous support given by the German Government through “KfW – Development Bank” to the Ministry of Education, particularly in the field of new school construction. Currently there are three programs concerning the construction of new schools:
5.1 Basic School Construction Program I

BSCP I consists of the construction of up to 13 new schools with a total cost of EUR 11.2 million. These schools are under implementation and it’s expected that 8 schools would be completed and handed over by the end of the current year with the remaining schools to be completed in 2007.

These schools have been designed with the following criteria:

- High standards & specifications in the school designs
- New and specific designs for each site
- The addition of new requirements as result of ERfiKE (e.g. computer labs, electrical wiring, central heating, external insulation)
- The use of new materials in construction, e.g. double glazed windows, thermal insulation for both the walls and the roof.
- Planting of trees and shrubs on the school site
- Re-use of the grey water from drinking fountains for irrigation of the green areas

The above improvements are reason for the recently experienced increase in the unit-construction cost for these schools.

<table>
<thead>
<tr>
<th>Square meter cost (EUR)</th>
<th>Total Schools Area m2</th>
<th>Total Award Value EUR-</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>210</td>
<td>125,360</td>
<td>26,280,000</td>
</tr>
<tr>
<td>240</td>
<td>122,000</td>
<td>29,280,000</td>
</tr>
<tr>
<td>255</td>
<td>164,370</td>
<td>41,840,000</td>
</tr>
<tr>
<td>266</td>
<td>80,212</td>
<td>21,320,000</td>
</tr>
<tr>
<td>316</td>
<td>34,279</td>
<td>10,824,000</td>
</tr>
</tbody>
</table>

Fig. 2: Unit Cost According to Donor

5.2 Basic School Construction Program II (Grant)

This program is embedded in the ERfiKE1 programme and consists of the construction of up to 12 new schools with a total cost of EUR 11.2 million. As beneficiaries were to be strictly limited to “poor communities”, a “Poverty Distribution Study in Jordan” was elaborated. On this basis, a final shortlist of 18 schools in poor areas was drawn up.

The selection of the consultant is in the final stages, and it’s expected that the designs, drawings, bills of quantities and tender documents will have been completed in the second quarter of 2007.

The implementation of the schools is expected to be completed by end of 2008.

5.3 Basic School Construction Program III

BSCP III consists of the construction of up to 12 new schools with a total cost of EUR 11.2 million. As all the designs, drawings, and bills of quantities are ready, the tenders for these schools will be announced shortly. In the selection of contractors, ICB will be used.

The implementation of the schools is expected to be completed by the end of 2008.

5.4 Debt Swap

The German Government has initiated a debt swap program with the Government of Jordan to compensate for the government contribution in the ERfiKE 1 project budget since this contribution is invested in a public benefit program.
The School Planning Process and Maintenance of School Infrastructure in Egypt

Hatem Zaghloul Shalaby
*Architect, Under Secretary, General Authority for Educational Buildings (GAEB), Cairo, Egypt*

1. General Authority for Educational Buildings (GAEB)

In Egypt, the General Authority for Educational Buildings (GAEB) is responsible for the planning, construction, furnishing and maintenance of all school infrastructure throughout the country – as identified by the targets set out in Egypt’s plan for general economical development.

GAEB was installed in 1990 in order to assist the Ministry of Education in providing the physical infrastructure required for the educational system in the country.

It is responsible for:
- Defining a general scientific plan for a school mapping system.
- Preparing studies necessary for developing criteria and specifications necessary for the design of educational buildings.
- Designing various typical prototypes of schools for different educational stages and different educational specialisations.
- Construction of all educational buildings – according to the identified needs.
- Repair, maintenance and rehabilitation of all existing school buildings.

Currently GAEB manages some 24,900 schools with some 384,000 classrooms in all of Egypt. Annually, GAEB is responsible for the construction of about 10,000 new classrooms.

2. School Mapping System

GAEB follows a scientific approach to planning and distributes the required educational buildings all over Egypt by using a *Geographical information System* for all administrative sections, based on survey equipments (gps).
The school mapping is important in determining served and underserved areas (the most appropriate regions that are in need for schools). Important outputs of the school mapping are:

1. List of land parcels owned by GAEB according to the geographical distribution.
2. A map showing recommended locations required for new schools and how many classes according to the population density.
3. List of existing schools that could be extended; the list includes number of classrooms and kind of required extensions.

These outputs are a result of having a database used for documenting all educational buildings on the national level. This provides complete and accurate information that helps decision makers in developing the educational process, also connecting different departments and facilitating data flow and the exchange of information.

Through these outputs:
- The educational departments in the governorates review and prepare their educational studies;
- The role of the popular participation begins by the donation of lands or appropriating lands that are a part of the state properties in the governorates via the Governor;
- An automated workflow among the branches in the governorates and the headquarters for preparing the school tender documents is initiated.

3. Testing a new Planning Approach:

GAEB is now testing a new planning approach through a pilot project supported by the German Government through KfW – Development Bank. Such an approach does not require an entirely “new” planning system in GAEB. The local structure (branch offices) as well as most planning tools and databases already exist. Together with some new tools they can be combined in a new planning framework. The Integrated Village Plan methodology is such a new planning framework. The approach is characterized by:

- Entire spatial units (villages) are planned, the use of existing school infrastructure is optimised
- The planning tendency is strengthened in favour of decentralisation.
- The planning methodology includes spatial criteria such as location of schools and distances students have to walk to settlements
- All relevant stakeholders participate effectively in the planning process (GAEB, MoE, Local Units, local population, Board of trustees, NGOs, etc.)
- An interactive working methodology (workshops) is applied.
- Effective and efficient information products visualise the planning process, enable effective participation, document the decisions and communicate the results.

Fig. 2: The Future Compound School in Cairo
We believe that using typical integrated model designs and unifying planning steps and components can reduce cost, increase the speed at which we can build a lot of schools in a short time, will enable us to achieve a better quality, and will allow for ease of supervision and follow up of construction work.

**Examples of such improvements are:**

1. Unify external and internal finishing.
2. Unify standards for different spaces, heights, doors & window.
3. Unify architectural and structural details for all models.
4. Unify specifications and bills of quantities.
5. Pre-priced B.O.Qs list and permit contractors to put a percentage (plus or minus) through his proposal for every region (the price list is updated every 2 years according to price changes)
7. Oblige contractors to perform quality control tests for all structural elements during all stages of execution.

![Fig. 3: Information Technology School in Ismailyia](image)

**4. GAEB Maintenance Strategy**

The total value of educational buildings has, on a national scale, relevance to the national economy and it is thus of considerable importance to maintain such value as far as possible, thereby extending to the maximum possible their life-span and allowing for an optimum use of such facilities. This is particularly so in view of the recent considerable developments in the building industry’s methods of construction and building which have influenced the quality and value of school buildings and have thereby enhanced overall national wealth.

**School maintenance and the participation of both the schools and the communities in simple maintenance are a must:**

1) GAEB provides every district with training for their staff and the required tools to perform the necessary school maintenance.

2) A yearly competition to choose the best, most beautiful, and cleanest school is held at every administrative section (village – district – governorate). The competition aims to:
   - Encourage community participation.
   - Strengthen and encourage support of the board of trustees.
   - Encourage the pupils and teachers to take care of their school.

**4.1 Maintenance Systems:**

The maintenance systems for the educational buildings are divided into:
a) Continuous and Simple Maintenance:
Continuous and simple maintenance is conducted by the educational departments and the schools’ principals via the school activity groups, the maintenance team of the local educational directorates and the trained laborers by daily inspecting the building condition and executing necessary maintenance works, e.g. simple sanitary works, carpentry-work, painting, minor electrical repairs, all of which do not require high technical qualifications or expertise.

Committees are formed of the educational departments and GAEB branch office engineers for periodically and monthly to review the simple maintenance works technically, administratively and financially according to an approved plan and recording the results in simple maintenance form prepared for that purpose.

b) Urgent Maintenance:
Through the daily inspections it will be possible to discover major faults or defects that require an expertise higher than that provided by the school activity group. The branch office will then assign one of the contractors registered in the branch office to carry out the work. This type of maintenance includes the following works:

1) Ordinary works (simple structural and architectural repairs, e.g. renewing the isolation works for WC floors, renewing painting works, replacing of defective tiles, minor carpentry works, etc.).
2) Sanitary works (for example: replacing of a damaged pipe line, replacing of old sanitary installations, installing or repairing water tanks, setting a fire extinguisher, etc.)
3) Electrical works (e.g. replacing some damaged electrical lines, replacing lost or damaged electrical flashlights, replacing of breakers in distribution boards, etc.).

c) Major Maintenance
Within the framework of GAEB’s integrated plan for maintenance, GAEB Branch Offices should set an annual plan in full coordination with the local educational departments according to the priorities established by checking all schools and drawing up BoQs for necessary maintenance works. These are to be approved by the respective Branch Office consultants. The required works are then to be carried out by contractors and companies that are specialized in such type of maintenance and have previously achieved privileged pre-qualification.

The annual maintenance plan is carried out according to the available funds and a guide directory referring as to how to prepare an integrated technical report, that is required for ultimately establishing which major maintenance works have been executed.

An amount of EUR 20 million (L.E. 150 m.) is allocated annually to be spent on the main maintenance works over the school year. This sum is, however, not enough to implement all the required major maintenance works for schools. Thus it is necessary to establish implementation priorities for these works and arrange them according to their importance:

1 Conserving the safety of buildings by performing the necessary maintenance for the school buildings’ structural elements such as repairing, restoring or reinforcing of foundations, columns, beams, ceilings, walls, stairs, roof parapets, etc.
2 Insulating roofs and WCs in order to preserve roofs and to protect them from the water leakage – so that reinforcement steels do not oxidize (start rusting).
3 Maintaining the sanitary installations including repairing and replacing any damaged feeder or draining pipes, values or gulley traps.
4. Maintaining the electrical installations and replacing any damaged distributing boards, switches, sockets, cables, branched and public circuits.

5. Maintaining the fire extinguishment system in the buildings and its inclusions (valves, lines, and pumps)

6. Maintaining the floors and walls of buildings by repairing plasterwork and paintwork of buildings.

7. Maintaining all carpentry installations such as windows, doors, i.e. wherever wood has been used.

8. Maintaining the schoolyard and playground areas, including sidewalks and gardens.

5. Remarks

1. School facilities impact on student performance by helping to improve the quality of education by means of more suitable school premises in terms of:
   - the outer shape / the proper area fit for educational spaces
   - a good ventilation and lighting of classrooms and other educational spaces
   - the easiness of movement and the availability of open areas (playgrounds)
   - locating educational buildings for away from negative effects, noise, pollution. The educational environment becomes more appropriate as it increases the ability and willingness of students to learn, to improve their educational achievements and helps in developing their skills and experiences.

2. The relationship between the classroom environment and student performance (or teacher Performance) is continuous and impacts the lives of students.

The classroom is considered as a second home, therefore it should be an attractive place and adequately deal with the following issues:
   - Climatically appropriate orientation of buildings.
   - Good ventilation and lighting.
   - Appropriate share for the student in the classroom area to facilitate movement.
   - Flexible furniture to meet student and teacher needs.
   - Cheering colours in finishing the classroom.
   - Providing necessary educational aids.

3. A well-designed school and the general atmosphere, along with the design of external and internal spaces, have a direct impact on student behaviour and reaction inside a school. A good school design needs to include playgrounds, lawns, cheerful and coloured furnishing, aesthetically and architectural facades, etc. All these factors attract student attention and help them develop their own skills.

The relationship between space and the interactive processes taking place among students is of great importance. It appears as though a sense of comfort in such spaces stimulates such processes. For a designer this implies positively considering spatial dimensions (length - width), high ceilings, sight scope or visual perspective, appropriate ventilation and lighting, appropriate furnishings and colours, etc.

4. The educational environment quality depends basically on an integrated school building design which will consider all cultural, social, sportive, and recreational aspects, thereby providing the appropriate environment for learning dialogue language and encouraging students to adopt a participatory behavior. This will also improve democracy inside the classroom itself.
5. Providing complementary spaces for the educational process result in developing the student socially and culturally. This will include specialized facilities such as labs, libraries, playgrounds, activities, and appropriate furnishings.

6. Several factors should be considered when applying spatial design to achieve spatial quality:
   - Student share of space.
   - Student vision angles.
   - The direction of natural lighting should be from a student’s left side (except for left-handers).
   - Natural ventilation, coming from a northerly direction.
   - Finishing materials for space components.

Achieving spatial quality will reflect on students’ and teachers’ comfort and will, ultimately, lead to an improved student performance.

7. Given climatic factors should be taken into consideration when designing an educational building, e.g. orientation of educational spaces, windows sizes, sun breakers, external finishing, selection of building materials, etc.

8. Colours play a role in defining lighting quality and can lead to varying physiological and psychological effects on students. Designers should select the best colours for different spaces, such as:
   - Light colours for ceiling – they reflect incoming light much better.
   - Warm colours provide the student with warmth and ease.
   - Gloomy colours should be set aside as they are emotionally stressful (“bring feelings down”).

9. Enforcing various laws concerning hygiene and safety conditions of school buildings resulted in a good building-performance, e.g. concerning:
   - horizontal and vertical traffic factors
   - width of corridors
   - maximum walking distance from a classroom door to staircase (escapeway)
   - width of staircases.

---

Fig. 4: Elements of the Educational Environment and their Impact on Students
All these factors help in achieving safety and security for students.

10. Classroom floors should be made of anti-slip or a rough substance

Meanwhile it should not attract student attention or cause him / her to lose his/her concentration. Harmonious colours should be applied with the rest of classroom space.

6. Reflections on the Work of Funding Agencies

The triangle figure represents the elements of the educational environment that impact on a student. Taking into consideration only one side of the triangle and disregarding the others will impact negatively on the educational process and not contribute towards achieving the target. Thus, the donor countries must always take care of all three “sides” of the educational environment via determined projects adhering to this strategy formulated for upgrading of school facilities on the basis of such three – sided relations.


Applying the sustainable framework on “Students”

According to the radial diagram shown below, a student is affected by the following factors:

- Human factors: Teachers and students’ skills, knowledge & info., ability to work, health
- Natural factors: environment, biodiversity,
- Financial factors: Family income, allocated budget for education (budget for buildings, books, equipments, furniture, teachers salaries…)
- Physical factors: schools buildings, technology, shelter, transportation.
- Social factors: Parental and community participation, access to institutions

Fig. 5: Factors affecting a Student

Fig. 6: Student’s Share of each Factor

Fig. 7: The Aim would be to “push out”, extend the area of these factors
Improving the above mentioned factors is done through the enhancement of the educational process with all its components.

8. **Egypt : Context**

- Population: 73.7 million; Urban Population: 8.3 million
- 4600 Villages; 917 Cities and Towns
- GDP Growth Rate 4.9 %
- GDP Per Capita: $ 3.9
- GDP composition: Agriculture: 15 %; Industries: 35.7 %; Services: 49.3 %

8. **Population Below Poverty Line**: about 14 million

9. **Population in the 0 - 14 Age Group**: 23.4 million

- Population Before Kindergarten 0 - 4 6.693.000 million
- Population Kindergarten 5 - 4 3.121.835 million
- Population Primary 6 - 11 9.370.739 million
- Population Preparatory 12 - 14 4.286.675 million
- Population Secondary 15 - 17 4.396.767 million

10. **Population before university education** 4 - 17 21.176.016 million

9. **Infrastructure Status and Requirements of the Educational System in the Republic of Egypt (2006)**

Egypt has a total of 39,926 schools (private and public), they are subdivided as follows:

- 4,983 private schools with 1,296,332 students
- 34,943 public schools with 14,147,176 students

Of these, the distribution is as follows:

<table>
<thead>
<tr>
<th>Education Type</th>
<th>Total Schools</th>
<th>Total Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Education</td>
<td>33,537</td>
<td>13,243,072</td>
</tr>
<tr>
<td>Technical Education</td>
<td>1,445</td>
<td>1,835,647</td>
</tr>
<tr>
<td>Private Education</td>
<td>804</td>
<td>36,808</td>
</tr>
<tr>
<td>One-class Education</td>
<td>3,444</td>
<td>76,602</td>
</tr>
<tr>
<td>Training Education</td>
<td>637</td>
<td>244,953</td>
</tr>
<tr>
<td>Sport education</td>
<td>59</td>
<td>6,426</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>39,926</strong></td>
<td><strong>15,443,508</strong></td>
</tr>
</tbody>
</table>

Private schools have a total of 42,331 classrooms, public schools have 341,532 classrooms.

Currently, the total demand for *additional classrooms* is as follows - as result of various aspects:

- Inclusion of 6th Grade in the Primary School Cycle: 1,833 classrooms
- Elimination of double-shift teaching: 48,313 classrooms
- Reduction of classroom densities: 39,254 classrooms
- Additional requirements for deprived areas: 36,916 classrooms
Provision of classrooms for Kindergarten 35,507 classrooms
Provision of “Special Needs’ classrooms 8,633 classrooms
Alternative accommodation for rented classroom facilities 36,153 classrooms
Natural population growth 15,575 classrooms
Replacement of derelict infrastructure 21,701 classrooms
Total requirement 243,885 classrooms

Annex

Improving the Quality of Education: Typical School Design

School designs for various levels should contain minimum spaces required for meeting special educational needs, e.g.:

- Activities
- Computer education
- Laboratories for biology, chemistry or physics
- Library facilities.

A typical 19 classrooms secondary school would thus have on a groundfloor area of 1,140 sqm (3,430 sqm total area):

19 classrooms
3 laboratories
1 arts room
1 computer classroom
1 music room
1 multipurpose hall
1 library
3 teachers’ rooms (“Fields”)
1 cafeteria
Sanitary facilities for students (boys and girls)
Administrative offices
Store-rooms

Fig. 8: Typical school elevation
Fig. 9: Layout ground Floor

Fig. 10: Layout First Floor

Fig. 11: Layout Second Floor
Education in Palestine

Fawaz Mujahed Ziyad Kullab
General Directorate for Buildings and Projects,
MEHE, Ramallah / Gaza

1. Brief Historic Overview

The Palestine problem became an international issue towards the end of the First World War with the disintegration of the Turkish Ottoman Empire. Palestine was among the several former Ottoman Arab territories which were placed under the administration of Great Britain under the Mandates System adopted by the League of Nations pursuant to the League’s Covenant.

All but one of these Mandated Territories became fully independent States, as anticipated. The exception was Palestine where, instead of being limited to “the rendering of administrative assistance and advice”, the Mandate had as a primary objective the implementation of the “Balfour Declaration” issued by the British Government in 1917, expressing support for “the establishment in Palestine of a national home for the Jewish people”.

During the years of the Palestine Mandate, from 1922 to 1947, large-scale Jewish immigration from abroad, mainly from Eastern Europe, took place, the numbers swelling in the 1930s with the notorious Nazi persecution of Jewish populations. Palestinian demands for independence and resistance to Jewish immigration led to a rebellion in 1937, followed by continuing resistance from the Palestinian side and terrorism and violence from the Jewish side during and immediately after World War II. Great Britain tried to implement various formulas to bring independence to a land ravaged by violence. In 1947, Great Britain in frustration turned the problem over to the United Nations.

After looking at various alternatives, the UN proposed the partitioning of Palestine into two independent States, one Palestinian Arab and the other Jewish, with Jerusalem internationalized. One of the two States envisaged in the partition plan

---

1 See also: http://www.un.org/Depts/dpa/ngo/history.html
proclaimed its independence as Israel and in the 1948 war expanded to occupy 77 per cent of the territory of Palestine. Israel also occupied the larger part of Jerusalem. Over half the indigenous Palestinian population fled or were expelled. Jordan and Egypt controlled the other parts of the territory assigned by the partition resolution to the Palestinian Arab State - which did not come into being. (The map shows the partitioning of Palestine).

In the 1967 war, Israel occupied the remaining territory of Palestine, until then under Jordanian and Egyptian control (the Westbank and Gaza Strip). This included the remaining part of Jerusalem, which was subsequently annexed by Israel. The war brought about a second exodus of Palestinians, estimated at half a million. Security Council Resolution 242 of 22 November 1967 called on Israel to withdraw from territories it had occupied in the 1967 conflict.

In December 1987, a mass uprising against the Israeli occupation began in the occupied Palestinian territory (the intifadah).

A Peace Conference on the Middle East was convened in Madrid on 30 October 1991, with the aim of achieving a just, lasting and comprehensive peace settlement through direct negotiations along 2 tracks: between Israel and the Arab States, and between Israel and the Palestinians, based on Security Council resolutions 242 of (1967) and 338 of (1973) (the “land for peace” formula). A series of subsequent negotiations culminated in the mutual recognition between Israel and the Palestine Liberation Organization, the representative of the Palestinian People, and the signing of an agreement by the two parties in Washington, D.C., on 13 September 1993.

Subsequent implementation agreements led to several other positive developments, such as the partial withdrawal of Israeli forces, the elections to the Palestinian Council and the presidency of the Palestinian Authority, the partial release of prisoners and the establishment of a functioning administration in the areas under Palestinian self-rule. Among these other agreements was the so-called “Oslo Agreement” with the following implications:

a. Until a final status accord would be established, Westbank and Gaza would be divided into three zones:
   • Area A - full control by the Palestinian Authority (civilian and security)
   • Area B - Palestinian civil control, Israeli security control.
   • Area C - full Israeli control, except over Palestinian civilians. (The map shows the areas of A, B and C)

b. The aim of Israeli-Palestinian negotiations is to establish a Palestinian Interim Self-Government Authority, an elected Council, for the Palestinian people in the Westbank and the Gaza Strip, for a transitional period not exceeding five years, leading to a permanent settlement based on Resolution 242 and Resolution 338, an integral part of the whole peace process.
c. A five-year transitional period would begin with the Israeli withdrawal from the Gaza Strip and the Jericho area. Permanent status negotiations would commence as soon as possible between Israel and the Palestinians. The negotiations should cover remaining issues, including: Jerusalem, refugees, settlements, security arrangements, borders, relations and cooperation with other neighbors, and other issues of common interest.

The total area of the historical Palestine is estimated at 27,000 km$^2$ while the area of Westbank is approximately 5,000 km$^2$ and that of Gaza Strip some 360 km$^2$.

In 2000, after a lengthy process in which Israel had dragged out the implementation of the different agreements reached and during which it did not honor some of the commitments made, especially to end the interim period in 1999, the Palestinians launched their second Intifada. Its objectives were once more to end the occupation and to achieve independence.

During the period up to 2000, which was supposed to lead to ending the occupation, the Palestinians witnessed, on the contrary, more land confiscations, a rapid expansion of existing settlements and the construction of new settlements, and the continuation of the closures system – in summary: the consolidation of occupation.

In the meantime, the Israelis started building the separation discrimination wall, with a planned total length of 730 kms. It starts from the northern parts of Westbank and reaches all the way to the southern parts of Westbank. The largest part of the land required for this wall (approx. 1,100 hectares) was confiscated from Palestinian owners by the Israelis. These lands are amongst the most fertile in the area with a fourth of the Palestinian population depending on it for a livelihood. The annual return of the land was some US$ 900-thousand per sq.km, double that of other fields in Westbank or Gaza. Furthermore, 3% of Palestinian-owned wells will be on the western side of the wall and thus inaccessible to the owners. Israel has confiscated 36 wells as they lie in the deliberately defined isolation area.

The map shows the final location of the separation wall. Only the white area will belong to the Palestinians.

The Wall will separate about 380,000 Palestinians living in the traditionally Arab East Jerusalem from villages in Westbank. About 680,000 Palestinians (30% of the total population) will be passively affected by this separation wall. More than 274,000 Palestinians will be living in 122 rural areas enclosed between the wall and the green line or areas completely surrounded by the wall. These pockets amount to about 850 sq. kms of newly occupied Westbank lands. 14.5 % of the total area of Palestine will be squeezed between the wall and green line.

2. The Palestinian Authority (PA)

As a result of the Oslo Agreements there had been a transfer of authority from the Israeli Government to the newly created Palestinian Authority of all responsibilities related to education and culture, health, social welfare, direct taxation, and tourism.

While the total area of the historical Palestine was about 27,000 km$^2$ the area placed under the jurisdiction of the Palestinian Authority (PA) was about 5,360 sqkms (Westbank: 5,000
According to the Oslo Agreement and subsequent agreements, the PA would have a partial and limited control over the Westbank and Gaza Strip (see above). Our further focus will only concern these areas.

3. **The Ministry of Education & Higher Education (MEHE)**

A Ministry of Education and Higher Education was created in August 1994 with a relatively small staff in accordance with the Gaza - Jericho agreement. On 28 August 1994, with the signing of the Transfer Agreement, responsibility for the education system in Westbank was transferred to the PNA. The Ministry of Education and Higher Education (MEHGE) consequently assumed responsibility for the entire education sector, including governmental, private and UNRWA schools. It is responsible for all levels of education from kindergarten to higher education and all streams - general, vocational and technical.

The basic education cycle is compulsory and it consists of grades 1 to 10. The secondary cycle consists of grades 11 and 12 and is divided into two programs: academic and vocational. The academic program consists of two streams: one scientific and one literary. The vocational secondary program is composed of commercial, agricultural or industrial studies and nursing.

At the end of the secondary cycle, students sit for the general secondary school examination (Tawjihi). In the Gaza Strip the Tawjihi was organized by the Egyptian education authorities until 1994. In Westbank the Tawjihi was administered by an examination committee which sent the results to secondary cycle. Private schools are subject to supervision, licensing and control by the PNA education authorities.

Upon its creation, MEHE faced many challenges among which were:

- **a.** In terms of infrastructure, MEHE faced a situation in which classrooms and schools were totally overcrowded. Many school buildings were ramshackle and some were even in dangerous structures. Many rural areas had inadequate school buildings and not enough classrooms for girls.
- **b.** Many schools operate on a double-shift basis and some even have three shifts per day.
- **c.** Poor teaching and learning in terms of lack of equipment and teaching and learning materials.
- **d.** In terms of vocational secondary schools, all teaching is done in the classroom and is theoretical in nature – due to the lack of appropriate workshops.
- **e.** In terms of curricula and textbooks, there were two types of curriculum offered in Palestine: the Jordanian curriculum and textbooks in Westbank and the Egyptian curriculum and textbooks in the Gaza Strip.

One way of achieving unity in Palestine is through achieving unity of learning and teaching in its classrooms. Therefore an urgent task facing the PNA and MEHE was the development of a purely Palestinian curriculum. The curriculum taught in Palestinian schools was that of either Egypt or Jordan and foreign to the Palestinian cultural needs, national aspiration and personal development.

- **f.** No in-service training for teachers took place during the 27 years of Israeli occupation.
g. Extra-curricula activities for students is a very important area of education which had been totally ignored.

4. Structure of the Educational System

The educational system in Palestine is divided into three stages:

- Basic Education Grades 1-10 which is compulsory
- Secondary Education Grades 11 and 12
- Higher Education (tertiary level)

Three authorities are providing basic and secondary education to the Palestinian children

- Government – through MEHE
- Private Sector
- UNRWA (United Nations for Relief and Works Agency)

The total number of students enrolled in all schools in 2006 is 953,621 students; of which about 700’000 are enrolled in the government schools, about 200’000 are enrolled in UNRWA schools, and the rest are enrolled in private schools.

5. Developments

Since 1994, many developments have taken place in the government education sector. The following table shows some of these developments:

<table>
<thead>
<tr>
<th>Year</th>
<th># of Schools</th>
<th># of Students</th>
<th># of Teachers</th>
<th># of Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994-1995</td>
<td>1,084</td>
<td>418,807</td>
<td>14,938</td>
<td>11,817</td>
</tr>
<tr>
<td>1995-1996</td>
<td>1,070</td>
<td>447,822</td>
<td>16,810</td>
<td>12,524</td>
</tr>
<tr>
<td>1996-1997</td>
<td>1,113</td>
<td>481,678</td>
<td>18,858</td>
<td>13,623</td>
</tr>
<tr>
<td>1997-1998</td>
<td>1,175</td>
<td>516,160</td>
<td>21,186</td>
<td>14,729</td>
</tr>
<tr>
<td>1998-1999</td>
<td>1,230</td>
<td>549,404</td>
<td>22,695</td>
<td>15,633</td>
</tr>
<tr>
<td>1999-2000</td>
<td>1,289</td>
<td>586,777</td>
<td>24,318</td>
<td>16,541</td>
</tr>
<tr>
<td>2000-2001</td>
<td>1,343</td>
<td>621,285</td>
<td>26,173</td>
<td>17,338</td>
</tr>
<tr>
<td>2001-2002</td>
<td>1,406</td>
<td>653,650</td>
<td>28,015</td>
<td>18,279</td>
</tr>
<tr>
<td>2002-2003</td>
<td>1,490</td>
<td>686,507</td>
<td>29,930</td>
<td>19,381</td>
</tr>
<tr>
<td>2003-2004</td>
<td>1,577</td>
<td>711,541</td>
<td>31,858</td>
<td>20,382</td>
</tr>
<tr>
<td>2004-2005</td>
<td>1,659</td>
<td>733,735</td>
<td>33,398</td>
<td>21,292</td>
</tr>
<tr>
<td>2005-2006</td>
<td>1,725</td>
<td>757,615</td>
<td>35,013</td>
<td>22,082</td>
</tr>
</tbody>
</table>

Other areas where progress was achieved concern curriculum development, educational technologies and school infrastructure.

a. Curriculum

It has been a national necessity for Palestinians to produce a curriculum of their own, which meets the demands and aspirations of the Palestinian people for the first time in the history of education in Palestine: a curriculum that emphasizes the Palestinian identity and independence.

By the end of year 2004 the Palestinian curricula for grades (1-9) have been prepared and imple-
mented in all schools. It is anticipated that by the end of 2007 the secondary curricula will be completely prepared under the supervision of the curriculum center.

b. **Educational Technologies**

As a result of accelerated scientific progress in today’s world, core changes in the educational system have to be implemented so as to better put up with accelerated technological developments and to train young adults who would be able to satisfy the requirements of the modern economic world and who could benefit from the accomplishments of modern technology.

Accordingly, MEHE has, since its establishment in 1994, taken care of educational technologies by providing these technologies and employing them effectively so as to improve the quality of education and satisfy the requirements of the modern age.

Since 1994, MEHE has equipped about 47% of schools with science laboratories and 50% with computer laboratories. Approximately 53% of the Palestinian schools have libraries.

c. **School Infrastructure**

The main challenges that faced the MEHE upon its establishment in the school infrastructure sector can be summarized as follows:

a. Overcrowding in the existing schools
b. Double shifting which was estimated at 45% of classrooms in Gaza and 25% of classrooms in Westbank.
c. Lack of schools in many rural areas.
d. Ignorance of maintenance and rehabilitation for the existing schools.
e. Absorbing the natural increase in school population.
f. Lack of special rooms in the existing schools.

Palestine has a high natural growth rate - with an annual increase of about 4.5%. To absorb only this natural increase, MEHE has to build about new 900 classrooms annually.

Despite this relatively big number of classrooms annually needed, MEHE has made a remarkable accomplishment in the development and rehabilitation of the school facilities which can be summarized in the followings:

a. Most of the schools in Gaza Strip have been comprehensively maintained and many schools in Westbank have been rehabilitated.
b. New schools have been built in many deprived and previously underserved areas.
c. Double shifting has been alleviated, overcrowding has been considerably reduced (albeit not eliminated).
d. The natural increase in school population can, to a large extent, be absorbed.

During the last twelve years, MEHE succeeded in building more than 10,000 new classrooms throughout Westbank and the Gaza Strip. However, this achievement was only possible with the generous financial and technical assistance from donor countries and local Palestinian communities.

The main donors to MEHE are the Palestinian community, Germany, Norway, France, Japan, Spain, the Islamic Development Bank, the World Bank, the European Union, and others.

Generally, new schools are designed according to the standards of MEHE, which have been
published in a standard manual developed in cooperation with UNESCO: “Future Schools in Palestine”.

In following up on the above mentioned accomplishments, MEHE developed a ten-year plan for the further development of school infrastructure. The following table shows the cost of this plan (all figures in US $) over the next ten years:

<table>
<thead>
<tr>
<th>Description</th>
<th>Total</th>
<th>Sites Cost</th>
<th>Engineering Services</th>
<th>Furniture &amp; Equipment</th>
<th>Construction Cost</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Increase</td>
<td>392,060,000</td>
<td>81,200,000</td>
<td>13,190,000</td>
<td>13,550,000</td>
<td>284,120,000</td>
<td>619,880,000</td>
</tr>
<tr>
<td>Double Shift</td>
<td>136,356,000</td>
<td>47,240,000</td>
<td>4,040,000</td>
<td>4,316,000</td>
<td>80,760,000</td>
<td>262,420,000</td>
</tr>
<tr>
<td>Rented</td>
<td>35,728,000</td>
<td>2,240,000</td>
<td>1,518,000</td>
<td>1,610,000</td>
<td>30,360,000</td>
<td>108,418,000</td>
</tr>
<tr>
<td>Overcrowding</td>
<td>36,831,000</td>
<td>640,000</td>
<td>1,668,000</td>
<td>1,163,000</td>
<td>33,360,000</td>
<td>102,243,000</td>
</tr>
<tr>
<td>Unsuitable</td>
<td>40,086,000</td>
<td>0</td>
<td>1,836,000</td>
<td>1,530,000</td>
<td>36,720,000</td>
<td>108,568,000</td>
</tr>
<tr>
<td>Special Room</td>
<td>98,156,750</td>
<td>0</td>
<td>3,533,750</td>
<td>23,948,000</td>
<td>70,675,000</td>
<td>193,818,750</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>52,500,000</td>
<td>0</td>
<td>2,500,000</td>
<td>0</td>
<td>50,000,000</td>
<td>152,500,000</td>
</tr>
<tr>
<td>Total</td>
<td>791,717,750</td>
<td>131,320,000</td>
<td>28,285,750</td>
<td>46,117,000</td>
<td>585,995,000</td>
<td>1,056,454,000</td>
</tr>
</tbody>
</table>

6. **Effect of the Israeli Occupation on Education in Palestine**

At the start of the school year 2000 - 2001, two landmark events in the history of Palestinian education took place:

- the first ever Palestinian national curriculum went into effect; and
- MEHE launched its 'Five Year Educational Development Plan', committing itself to reforming and developing the education system at all levels.

At almost exactly the same time, at the end of September 2000, the second Intifada began and in the few years since, Palestinian education has faced a barrage of military attacks directed against schools, universities, students, teachers, and the Ministry of Education itself. Rather than tackling the long overdue issues of educational development, the Palestinian education system has once again been plunged into a state of emergency.

The Israeli military attacks and obstruction of schools, universities, students and teachers are a lens through which to see the impact of the Israeli occupation and illegal policies of collective punishment on Palestinian society as a whole.

The ongoing process of cantonization and ghettoization of Palestinians by the Apartheid Wall and hundreds of military checkpoints and roadblocks that divide and encircle Palestinian cities, towns

---

2 «Right to Education Monitor»; published July 2004
and villages, together with relentless closures and curfews, make all aspects of Palestinian daily life a struggle. 3.4 million Palestinians are living in a state of virtual confinement in the Westbank and Gaza Strip and access to schools and universities is affected in the same way that access to hospitals, the workplace or going to visit family and friends is systematically obstructed and prevented.

At the same time, it is also clear that Palestinian education is being directly targeted. Israel has a deliberate policy to militarily attack and obstruct Palestinian schools and universities, effectively undermining the entire Palestinian education system. Universities, kindergartens, elementary and secondary schools all over the Westbank and Gaza have been invaded and attacked by the Israeli Army. Birzeit University reports an average of 1-2 incidents every week, with Israeli soldiers either blocking access to the University by road, harassing students and staff at the University’s entrance gates, or firing tear gas and rubber bullets on to the campus. The targeting of Palestinian education is further evident in the propaganda of ‘terror’ and ‘incitement’ against the educational curriculum and the forced closures of Palestinian schools and universities by military order. In particular, the military closures of Hebron University and the Palestine Polytechnic University in 2003 represent the continuation of a long history of Israeli closures of Palestinian educational institutions. The above photo shows students prevented by the Israeli soldiers from reaching their school.

The Israeli occupation has hurt the infrastructure of the educational process in many different ways and means, and the followings are facts about what is happening:

1. 498 schools have been disrupted and closed because of curfews, sieges and districts closures since the beginning of the new scholastic year 2002 - 2003.

2. Moreover, 1,289 schools have been closed since the beginning of the Intifada.

3. 282 school buildings have been damaged as a result of rockets and tank shellings, since the breakout of the Intifada.

4. 9 schools have been totally closed, 3 of these schools were changed to military bases in Hebron;

5. US $ 5.2 mill is the estimated value of the Israeli damage to Palestinian schools.

6. US $ 4.85 mill is the estimated value of the Israeli damage to Palestinian Universities.

7. 38 schools in Jenin, Tulkarem, Qalqilia, Jerusalem, and Bethlehem, which had nearly 11 thousand students, have been affected as a result of the Israeli policy of annexation and expansion.
The Wall’s Impact on Education

The recent ruling by the International Court of Justice (ICJ) found that the 687km Wall currently being constructed by Israel through and around Palestinian areas in Westbank and Jerusalem is illegal. Israel’s misleading term ‘security fence’, obscures the reality that the Wall is being built on Palestinian land, dividing, isolating and encircling Palestinians areas. The Wall is more than twice the length of the Green Line, indeed only 11% of it actually runs along the Green Line, and according to the Palestinian Environmental NGOs Network (PENGON), “nearly 50% of the Westbank population will be affected by the Wall through loss of their land, imprisonment into ghettos and isolation into de facto annexed areas by Israel.”

Areas in the northern Westbank and around Jerusalem, where construction of the Wall has been completed, are already showing signs of stress in the education system and frequent interruptions to the daily routines of both students and teachers. So far, 22 communities have been separated from their schools by the Wall.

In Qalqilya, Tulkarem and Jenin areas, many students and teachers are forced to pass through the Wall’s ‘gates’, which are often either closed or where they need several hours to pass through, in order to reach their schools on the other side of the Wall. In coordination with a local bus company and monitored by UNICEF, the Israeli Army now runs a bus service for school children in Qalqilya, Tulkarem and Jenin areas to pass from one side of the Wall to the other in order to reach their schools. Far from providing a solution, the arrangement merely serves to demonstrate the total absurdity of the situation. UN bodies observe that the buses are frequently held up at the Wall for hours, making children late for school and late getting home.

“In early September 2003, the Israeli District Coordination Office informed the inhabitants of Jebra [near Tulkarem] that the gate providing access to and from the village would only be open for the 88 village school children between 6-8am when they go to school and between 12:30-2pm when they return home. But two weeks after its initial implementation, the schedule was unexpectedly changed. The gate, it was announced, would only be open for 10 minutes each morning and afternoon. The precise time was not given. Consequently, the school children gather every morning, whatever the weather, waiting for the soldiers to open the gate. When the children return from school, the problems are even greater. Children in the first preparatory class finish school at 11am. However, these five-year old pupils have to wait for the gate to open at around 2pm, when all classes have finished, before they can return home.”

---

3 Defence for Children International / Palestine Section, Fragile Childhood, p.65
Part 4: Project experiences

The authors grouped in this section have as their common tenet that “quality matters”. When the Call for papers was originally launched we had not anticipated that architects directly involved in academic or field projects where a deeper design reflection on school buildings in relation to their use was at the forefront would directly respond to our call. This pleasant surprise gave a specific twist to the Colloquium itself as it became possible to refer to and discuss concrete examples of school architecture where the design element was a crucial aspect of the project itself. Examples are from highly sophisticated contexts but also concrete experimentation and building in developing countries. Some relate explicitly pedagogical theories to characteristics of the built environment.

The first paper by Kogel presents school projects and buildings from Palestine where attention to site and context factors have had concrete positive effects in terms of use and costs.

Fedrizzi has been involved in several school court-yard planning projects in Brazil. She relates how involving students and teachers in these operations has changed their attitude towards the school buildings, towards teaching and learning.

Sanoff, guest-speaker at the Colloquium, presented a case where involving the all community in the planning process of a new school had a strong positive impact on the built outcome. The project became everyone’s (teachers’, pupils’, parents’) “own”.

During the Colloquium Sanoff also ran a workshop where participants were asked to take part in a participatory process, thus being concretely confronted and involved with the elaboration of a “joint” result.

Hedman in her paper, outgrowth of her dissertation, discusses spatial characteristics of the Diana School inspired by Malaguzzi’s pedagogical approach in Reggio Emilia. The “public square” of the school, alluding to the democratic city’s spatial heart is here an essential element, yet how to generalise from a geographically specific example?

Steijns relates the re-affectation of school-buildings in Holland following pedagogical innovations. This is a case where spatial characteristics of school buildings are redefined following a new pedagogical paradigm for public-school teaching programmes.

Sassi, the only participant from the region close to Monte Verita, contributed with a presentation about a forthcoming architectural competition on the new local University Campus. The aim is to group on a single campus, in the inner city of Lugano, school buildings currently dispersed in diverse areas. The competition rules offer a view on how planning guidelines on schools can be innovatively framed.

We believe that the papers grouped in this chapter offer exciting food for further thought.
Bernhard Kogel,
Professor of architecture,
University of Würzburg, Germany

1. Quality despite Quantity

As enlightened development experts, school planners and pedagogues, we all widely agree that a school is supposed to be a place of free and comprehensive education:

- A place which helps to discover and enhance the physical and intellectual abilities of the children.
- A place that allows for creativity and sensitivity
- A place where social life and thinking are being taught and practiced
- A place where the human being is seen and understood as part of a complex environmental system, which has to be protected.
- A place where pupils learn how the interactions between humans are working and why certain rules facilitate collaboration.

These educational objectives for modern school buildings are based on the enlightened perceptions and experiences of liberal school building experiments performed in the 20s and 70s of the 20th Century. In most cases it was a liberal political climate that led to free educational and cultural institutions. But in developing countries like the Gaza Strip and Afghanistan, we are working in hierarchic, partly military or even feudal social structures. The logic of these systems designates the social “rules of the game” and is evidently affecting the educational sector.

So let’s have a look at the basic qualities of everyday life in school and how we can contribute to them with our architectural work. School authorities, parents, teachers and students, administrative personnel as well as donors and planners all bare a very different image of “quality”. Such images are formed by the experiences of each group. It is therefore necessary to create opportunities for the exchange of experiences in order to become capable to discuss and reach a consensus.

It is unquestionable that the school building itself is intrinsically tied to teacher training, the didactic concepts and the choice of teaching materials. In this short presentation the focus, however, will be on buildings. In the past the requirement to make available very fast as many classrooms as possible with a very limited budget lead to minimalist thinking. This not only happened in the school building sector; similar experiences have been made in different countries also in the sectors of housing, universities and hospitals.

The postulation of standardized buildings appears as soon as there is a great number of schools to be built. The main arguments for such “standard designs” are about the presumed saving on expenses for design and administration. Also, the belief, that standardization of schools reduces construction costs in same manner as it does in industrial production remains intractable. It is
fact, that even if a contractor has to build several “standard schools”, there will be no effect from rationalisation, due to the low level of prefabrication. Unfortunately, in many countries uniform school blocks in the middle of desolate walled sites have become the corporate identity of school buildings.

Therefore it is essential to develop and realise economical but effective strategies, which use the committed financial funds of the donors in the sense of high-quality schools despite difficult general political conditions.

This affects the two main fields of management and design:
1. Coordination of solution-finding procedures in partnership with all parties involved.

2. Gathering ideas targeting the enhancement of the building, the interior and the outdoor facilities.

2. Coordination of the solution process

Trying to understand the tenacity with which, donors, authorities and consultants are defending and excusing the destitute school types, always leads to the same arguments:

- A lack of traveling possibilities and the absence of technical literature greatly restrict the local expert’s acquaintance and experience with innovative examples and complicates the evolution of visions.

- Traditional typologies, that make allowances for the local climate and regional materials, are considered antiquated and “out of fashion”.

- Often, the education and training of the local partners involved in the construction programmes focus on solving the task only from the engineering point of view rather than solving a complex, particular, urban and architectural problem acknowledging its social and psychological interrelationships.

Therefore the assistance of international experts and consultants may not be restricted to the pure management of a quantitatively maximised number of built classrooms. It has to be an active and energetic assistance in the evolution of individual ideas and rising quality standards.

- Good experiences have been made at projects in the Gaza Strip and in the West Bank, where initialized by KfW - workshops took place in partnership with the representatives of the responsible authorities and local consultants.

- Collective events within and beyond the regular education by the concerned schools, should involve teachers, pupils and parents in the design process.

- It is possible to decisively enhance the identification with one’s own school and reduce vandalism with the help of collective events such as building-, painting- and planting-actions, during the construction- and the later utilisation- phase.

Fig. 3a Workshop 2004, Palestinian experts in discussion with german headmasters, teachers, consultants and KfW-exerts, Germany

Fig. 3b Workshop 2006, Five palestinian consulting companies are preparing presentations at ElArish, Egypt.
3. Enhancing the quality of buildings, interior design and outdoor facilities.

3.1 Responding to the urban context and surrounding conditions

- The design has to match the topography and not the other way around. The consideration of the existing topography is cost-cutting in terms of excavation, retaining walls and transportation.

![Fig. 4: In this instance, the topography was adapted to fit the standard design for the houses, a costly procedure](image)

- Schools are not just solitary buildings. The typology of the buildings has to be interconnected with the surrounding urban structures and take into account existing spatial borders, lines of sight and greenery.

- The shape of the site, the topography, the orientation and the space allocation plan should define the adequate architectural shape of the school. With the use of standard-layouts, it is likely that the urban context and the essential setbacks to ensure illumination and ventilation are left unconsidered. Often, trees - no matter how old and beneficial– are cut down because it is deemed "unavoidable".

![Fig. 5a School, usable as community center in rural areas, Afghanistan](image)

![Fig. 5b School with two courtyards, in- and outdoor classrooms, schoolgarden, volleyball-field, Afghanistan](image)
3.2 Responding to Fundamental Climatic Conditions

- It is easier to concentrate on studying in a light but well shaded classroom, rather than in a gloomy or overheated one. This is why, with the help of the orientation of the building, the size and shape of the windows, and the type and design of the shading elements, the basic framework for a high-quality school environment is created. Adequately thick walls and thick ceilings support the heat storage during the day and provide well-tempered rooms through the nightly cooling. This effect can be intensified by an inner insulation in combination with separated shells. In wintertime, the same measures, in combination with individual heating units, can help to improve insulation in cold areas.

- In a well ventilated classroom children are not as likely to get tired as easily as in muggy surroundings. Upper window-openings and chimneys guarantee a well functioning cross-ventilation, which positively affects the students.

3.3 Responding to existing resources

- Local materials are usually low priced, increase the job-creation-effect and "anchor" the building to the place.
- Rainwater should be collected or at least applied directly to the plants on the sites.
- Simple solar panels should be used, wherever possible, to generate electricity.

3.4 Multi-functionality of the school

- Like a small village, the school should have clear spatial divisions and should be organized
in a differentiated way. The buildings and outdoor facilities should form an interesting and stimulating studying environment, worth to be discovered. Therefore the different areas have to be flexible in use and should not be explicitly defined. Niches, corridors and, in particular, multi-purpose spaces should serve flexible and creative uses. Enclosed and strictly defined multi-purpose halls do not achieve this goal. The multi-purpose hall should be the heart of the school.

- The school should also act as a community centre for assemblies, celebrations, exhibitions, concerts or other events. This supports the appreciation by the community and can be a contribution to the economical self-sufficiency of the school.

- Despite their minimized area, the classrooms should be proportioned in a way which also allows several forms of teaching and not only ex-cathedra.

### 3.5 Sensuality and poetry in the school

- The school ambiance should stimulate all the senses in a positive way and enhance creativity. As a rule, colored surfaces are not more expensive than monochrome ones. Individual colors in the school and in the classrooms enhance the identification of the children with their schools and classrooms. Nameplates and logos have similar benefits.

- Changes in the materials are a symbol for a change in significance. An ornament in the flooring of the corridor could for example signal the entrance to the classroom. Rough or structured wall surfaces stand for distance, smooth surfaces are “fondle-friendly”.

- “Art in the building”, best made by the children themselves, provides encouragement and makes the children feel proud. Therefore free space has to exist (e.g. “coloring walls” etc.)

- Creating interesting lines of sight. The continual sight of a grey boundary wall is not really beneficial to creativity. The view on plants and colors is desirable.

### 3.6 Stimulating outdoor areas

- The outside space is an important part of a school’s educational concept;
• Shaded spaces for breaks, groups of trees, climbers and pergolas provide for a better short-time rest than 15 minutes in the blazing sun;
• Well-oriented sports fields and simple but interesting playground areas—e.g., made out of recycled materials—do not cost a lot of money and help to save energy;
• School gardens and small animals can be helpful in biology lessons and also increase the perception of responsibility;
• Outdoor areas should provide well-shaded areas, which can be used as open classrooms.

3.7 Low-maintenance planning

• Materials and details have to be, based on the intensity of their use, sturdy and have to require low-maintenance.
• With the help of a protection strip, edges and wall surfaces have to be protected against damaging. Doors should be equipped with doorstops.
• Exposed plastic pipes have to be avoided.
• Toilets preferably have to be simple, easy to clean and well ventilated. Pipes above the roof should be shaped in a way which provides permanent exhausting of the toilets.
• The responsibilities for maintenance have to be precisely clarified between administration, pupils, teachers and parents. The canteen-licensee could possibly overtake janitor-duties.
4. Summary

In order to accommodate the differentiated demands for "good" schools on very different sites, individual and specific designs are required. The aspects to be studied and considered are mostly the same, but it is impossible to standardize solutions.

This design approach does not inevitably lead to higher costs, as proved by projects in the Gaza Strip and the Westbank.
The Schoolyard as an Instrument to Improve Learning Performance – A Case Study in Brazil

Beatriz Fedrizzi & Ivelise Flach,
University of Rio Grande,
Porto Alegre, Brazil

In this study, details are provided about interdisciplinary research performed at the Schools of Architecture, Engineering and Agronomy at the Federal University of Rio Grande do Sul (UFRGS) – Brazil. We have been working on the subject of ‘schoolyards’ since 1989, doing research and coordinating a group that includes Landscape Architects, Architects, Agronomists, Schoolteachers and university students. Our group has a purpose of changing Brazilian public schoolyards in order to provide a better quality of life for the school community, including improving student learning, sustainable aspects, and well-being. One of the aims of this work is to develop and design projects to improve public schoolyards according to the school community needs. These are identified using a workshop called Landscaping in the Schoolyard.

The schoolyard is considered a new resource for the school community, and it reflects the demands of that part of Brazilian society that attends public schools. Brazil is a heavily segregated country, with great differences among social classes. The main income of a family is the basis for health, nourishment, housing, clothing, sanitation, security, and educational conditions (Monteiro, 1988). Low income in Brazilian society, besides poor living standards, can lead to lack of self-confidence and self-respect, leaving these people behind. It’s not hard to find public school students lacking many basic needs such as food, clothes, love, respect, medical care, references, etc. Some children only attend school because of the school lunch (Kafuri, 1985).

Open spaces can offer a stimulating environment for learning. Children see that the schoolyard can become a place to learn more, and they also say that learning can be fun. They consider the schoolyard a place for practical learning and it will complement what they learn in the classroom. They associate learning with play and this can be an active way to learn (Fedrizzi, 2000). Learning can occur more democratically and naturally through play. Schoolyard design plays a major role in learning possibilities, because one of the means that can be used to transform the idea of education into reality, is for the physical environment to be designed according to the role assigned to it by the principles of education.

Learning and teaching can take place in the schoolyard, complementing what is taught in the classroom, and vice versa.

The school of the future is a school where the children enjoy studying. A good school is where pupils feel confident about their future. It is a place where students are successful at what they do, otherwise they may lose interest. Therefore, it is essential to help kids believe that they are able to do things, and that what they do can make a difference. It is also important to find ways to stimulate their curiosity and help them to become responsible and independent in their learning. The schoolyard can be used as an educational resource to achieve these goals.
The Case Study:
The case study, reported here, was carried out in a school located in southern Brazil, in the state of Rio Grande do Sul. The school is in a rural area, 11 km from the town of Sertão Santana, and there are 150 students in the morning and 110 in the afternoon.

On the south side of the school building there was a small native wood, behind it an unused vegetable garden, and on the north side a slope with serious erosion problems. The front of the school was used for school bus parking, and the children played dangerously around them.

The school community was interviewed before and after the workshop. They were asked about their impressions concerning the schoolyard, how they wished it to be, and how changes could and have brought change their lives. They were asked how and where they play.

The Workshop Method

We did not succeed the first time we tried to help a school to change a schoolyard, at least not to a satisfactory result. We had the opportunity of meeting a teacher from New Zealand, Robina McCurdy, who has an intervention method called the S.E.E.D. Program. We adapted her methodology to the Brazilian reality, and finally our results were greatly improved. This intervention was organized as a workshop with five full days of meetings, in which the school community participated full time.

1. Introductory day for parents and teachers: for establishing credibility. Vision and setting goals (broad scale). Establish a School Development Committee.
2. Working with sub-groups of parents, teachers and students on: holistic goal-setting exercise; resource inventories; followed by a summary of the results of each sub-group. Environmental inventory; soil conditioning; nursery.
3. Design with each class, plus parent-teacher subgroups. Using model and base map (fig.1). Placing elements from holistic goal-setting onto base map with all groups. Summary by school. Presentation to school community.
4. Creating lesson plans based on outcomes identified by the school community, with reference to the state curricula and skills development requirements for each grade. Gathering of cultural knowledge – local and traditional songs, dances, stories, poems, etc.
5. Practical implementation of Stage One of design, using local resources (fig.2 and 3).

There were two other visits, two and six months later, to support the school community in these changes and to collect research data.

Results and Discussion

The intervention process shows that the community became very much involved in the changes to the schoolyard. The school Principal and Vice-Principal both said that they found the workshop effective because the whole community got involved. They were surprised that some students considered as “problem kids” became very involved in the process.

We had a very large number of parents, the biggest so far compared with experiences in other schools. We believe that because they are farmers, they found the activity interesting since it involved planting. They brought plants, tractors, soil, etc, and made a very knowledgeable contribution. Erosion control was done in different parts of schoolyard, by using logs to stop the rainwater runoff, planting grass (fig.4) and covering the slope by a thin textile. *Lonicera caprifolium* was planted as ground cover (fig.5 and 6).
Comfort was improved by planting a deciduous tree outside a classroom which received the sun all afternoon, making it very warm. The playground equipment was mostly in the woods where it was cold and damp in winter (but pleasant on hot days). New playground equipment donated by a paper company was placed in a sunny spot.

The schoolyard became much greener because of the trees (mostly deciduous), fruit trees, shrubs, ground cover, vegetables and herbs. Richer habitats were also provided for wildlife, and produced good quality fresh food (free of pesticides).

A new parking place was designed for school buses, which before had been unsafely parking where children played. An open classroom (fig.7) was designed by the school community. The logs were donated by a near-by paper factory, one parent lent his chain saw, and they were given leftover paint by the Department of School Administration. Much use was made of the classroom on hot days. The children behaved better with each other, and also got along better with the staff, as Grahn also found in his research (Grahn 1994).

During the interviews performed after the workshop, the Principal told us that drop-out rates diminished by 50% and “problem kids” were now much more involved in the school activities than before. Children remarked that lectures became more fun and interesting.

There are better opportunities for social interaction among parents and children, which creates ongoing interest in learning outside the classroom. It also ensures respect for nature for the future.
School Building and Learning Performance

It is therefore important to consider an environment that stimulates the children and provokes their curiosity. Having someone who can answer the children’s questions is then very important to facilitate their learning..

The results have also shown that the students’ learning capacity increases when the schoolyard fulfills their needs.

It has been noted that the combination of indoor preparation and outdoor studies is an effective learning strategy, and that learning in school grounds can be as effective as field trips (Harvey, 1989). Sheat (1989) had recommended guidelines for student involvement in the various stages of school grounds design.

Considering the poor conditions of Brazilian public schools, we have been using sustainable principles while developing projects to change the schoolyards. This is especially evident in teaching the students how to grow fruits and vegetables in the school grounds for providing food. Sustainability promotes development and improves the quality of life for people now and in the future. Lucas (1997) argues that schoolyard development needs to be holistic, sustainable and participative, and that when this occurs, a range of benefits accrues including “more effective learning and teaching”.

Furthermore, the presence of vegetation is an important reference point in this research. According
to the school community, vegetation can turn the schoolyard into a more pleasant place and have a calming effect on the student, improving their learning.

Vegetation and nature in a schoolyard can have a beneficial influence on the educational system. Children can easily visualize the subjects that have been theoretically taught in the classroom.

Results show that the workshop methodology seems to be very effective by involving the whole school community. After intervention, the schoolyard was greatly changed. Erosion was controlled, comfort was improved, play areas increased, the schoolyard became much greener, a parking place was designed for school buses, an open classroom was created, richer habitats were provided for wildlife. The schoolyard produces fresh food - vegetables, fruits and herbs - in harmony with nature, for children to experience, use and learn to grow at home. As to behavioral aspects, there is less disagreement among the children, and they get along better with the staff; dropping-out has decreased and the children say that classes are more fun and more interesting.

There are better opportunities for social interaction among parents and children, creating ongoing interest in learning outside the classroom. It ensures respect for nature, for the future and the well-being of the school and the community.

Conclusions

The planning of schoolyards is often given serious attention only after the ‘more important’ design of the school itself is completed. This approach reflects a lack of understanding of the complex and important relationships environmental areas have to the overall educational program, the safety and security of students, and opportunities for school use by the community. Beyond this, when we think about what schoolyards mean to people, when most adults are asked to recall the good times they had in school - they usually remember the schoolyard, and go on to describe it in great detail.

Considering our experience of changing schoolyards in Brazil, we confirm that the cost of making changes in the schoolyard according to community needs can usually be considered low as compared to the resulting benefits.

References

Community Participation in an Elementary School Classroom Addition

Henry Sanoff,
Professor Emeritus of Architecture,
North Carolina University

Introduction

Education has always been an important subject but today the condition of our educational infrastructure and its ability to meet current learning demands has become an international concern. School classrooms are often unable to support specific courses or teaching methods (Lackney, 1994). Schools with inadequate ventilation can make students drowsy and lower their performance. Classrooms with poor acoustics and visual distractions can divert attention from the best-prepared lesson plans. Congested hallways can fuel student tensions. Drab interiors, poor lighting, and the lack of pleasant social gathering spots make school less than inviting as a place to work and learn.

One hundred and fifty years ago, classrooms represented a common teaching method. Today teaching methods have changed, but, often, the design of the classroom has remained static. An examination of current learning styles and teaching methods suggests a new form of learning environment characterized by different activity settings and small group activities.

In order to experience healthy development, students require certain needs to be met. Schoolagers require diversity, which entails different opportunities for learning and different relationships with a variety of people (Levin & Nolan, 2000). In a school that responds to its students’ need for diversity, one would not find students all doing the same thing, at the same time, in similar rooms. One would not expect to see students sitting in neat rows of desks, all facing teachers who are lecturing or reading from textbooks. Instead, in responsive schools, students and teachers would be engaged in different learning activities in and out of the classroom. A variety of teaching methods including small group work, lectures, learning by doing, individualized assignments, and learning centers, would be used (Jacob, 1999).

Intuitively, we know that the furniture layout and configuration of the classroom has an impact on the behavior of both teachers and students. The difficulty is to understand how this impact occurs, and how much is deliberately planned by the teacher.

Teachers are much more influenced by the physical environment than they realize. Malcolm Seabourne, a historian of school building in England suggests that the building made the teaching method. The separate classroom was a sign that teachers were trusted to be independent and had greater privacy. The classroom was designed and built to represent and shape a particular form of teaching behavior. The way a school is designed to work reflects social ideas about institutions
School Building and Learning Performance

and the education these institutions are created to further (Grosvenor et. al., 1999). The shape
of spaces, furniture arrangements, and signs are physical cues that transmit silent messages, and
both teachers and students will respond. These environmental messages stimulate movement, call
attention to some things, but not others, encourage involvement, and invite students to hurry or
move calmly. This environmental influence is continuous, and how well it communicates with the
users will depend on how well the environment is planned. Classroom arrangement is not a mere
technicality, or a part of the teacher’s style. It reflects assumptions about the teaching-learning
process and its outcomes.

The usual classroom seating arrangement of rows headed by a teacher at the front usually assumes
that all information comes from the teacher. This arrangement assumes a teacher-centered classroom
where the learning process depends upon the teacher’s direction. Teachers need to learn how to
question the classroom setting in a constructive way, looking for solutions and feeling in control
over changeable features. Taking control would permit the teacher to experiment with classroom
modifications to determine what works and what does not work, since each teacher and each
group of students will be different. The classroom cannot be considered as a static fixture; it needs
to be questioned and transformed. The ability for teachers to control the classroom environment
leads to feelings of accomplishment and independence, whereas a lack of control may result in
helplessness. Awareness can make a teacher sensitive to subtle aspects of the environment and bring
to light the adverse effects of a poorly organized environment. The goal in developing classroom
awareness is to reach a new understanding of how the environment supports students’ activities
and nurtures their development.

Mobility and centeredness influence teachers’ movement patterns and how they interact with
students in the classroom. Student-centered classrooms are those where there is greater teacher
movement and more interaction with students. The most teacher-centered classrooms, for example,
have a seating arrangement organized in a circle (Horne, 2000).

Although transaction theories of student/teacher participatory interaction have been discussed in
the educational literature for decades (Dewey, 1916; Friere, 1970; Krebs, 1982), more recently there
is research describing a correlation between student/ teacher participatory interaction (STPI) and
student motivation to participate (SMP) in the classroom (Dormody & Sutphin, 1991; Skinner
& Belmont, 1993). Similarly, if students experience the classroom as a supportive place where
there is a sense of belonging, they will tend to participate more fully in the process of learning
(Brophy, 1987).

Research comparing the behavior of effective teachers with that of less effective teachers has
clearly revealed the importance of monitoring the class during seatwork periods. Such monitoring
involves teachers moving around the classroom, being aware of how well or poorly students are
progressing with their assignments, and working with students one-to-one as needed. The most
effective teachers:

• Initiate more interactions with students during seatwork periods, rather than waiting for
  students to ask for help

• Have more substantive interactions with students during seatwork monitoring, stay task-
  oriented, and work through problems with students (Brophy, 1979)

Today there is a strong movement toward the involvement of school community members in defi-
ning their school environment. Participatory workshops that bring people together for collaborative
work has become a useful way to mount a new approach to school design. Workshops let people
share their ideas in small groups among themselves. According to Forester (1999), “Participation
School Building and Learning Performance

processes may enable participants to learn not only from arguments about possibilities, but from multiple issues, alternatives, concerns, and conflicts related to the experiences they discuss with each other. The participation process encourages people to learn from one another, it reminds them of their own concerns, it brings into focus the values they have and the obligations they wish to emphasize or the interests they wish to satisfy - even if they did not foresee this at the beginning of the workshop."

The Millis Road Elementary School

Millis Road Elementary School opened in 1961 with an enrollment of 360 students, 12 teachers, and a principal. The current increase in student population required the construction of five new classrooms including self-contained space for exceptional children. To fulfill the County's elementary school revitalization plan, the school principal and teaching staff agreed to participate in a design process led by Henry Sanoff, a consultant to the Adams Group Architects. Together, Sanoff and the architects (the “design team”) prepared an intensive, three-day series of workshops at the Millis School to underscore the importance of having school community members participate in the design process and demonstrate how the results of the workshops could successfully influence the design of the new classroom addition. The workshop’s intensive nature was meant to foster a high level of energy and interest from the community and encourage students and teachers to interact continuously with the design team.

Teacher's Three-day Workshop

Because the most important part of the school project was the classroom addition, the first day of the workshop focused on classrooms. The 50 or so teachers who attended were provided with drawings of six different classroom arrangements developed from a study of classrooms by the design team, with each arrangement drawn at the same scale. Attendees were organized into four-person groups to encourage discussion and idea sharing (Figure 1). They evaluated the classroom arrangements according to eleven criteria.

Among their comments, the teachers said they needed to use outdoor areas for teaching activities, and they wanted these areas to be directly accessible from the classrooms. They thought about
which classroom arrangements provided sufficient teacher workspace, which classrooms could be used for flexible teaching activities, and which classrooms had sufficient storage space for students and teachers. They wanted the classroom to have good outdoor views and lighting and identified those classroom arrangements allowing for a variety of learning opportunities. After considerable discussion, they selected the “L-shape” classroom arrangement as providing the most flexibility. The L-shape was also judged best for allowing a variety of teaching methods, including team teaching, and encouraging small groups to work independently (Figure 2).

On the second day of the workshop, the design team prepared two alternative design schemes based on the results of the survey, the teachers’ assessment, and their own observations about the school building and its surroundings. Both schemes provided for the team teaching opportunities suggested by the teachers.

On the third day, the design team refined the two design schemes and prepared three-dimensional computer models and plan views of the entire site for an afternoon workshop that was attended by almost 40 teachers. They again formed into groups of four to encourage discussion and idea sharing. The two schemes were presented with the following criteria for their evaluation:

- Safe outdoor environment
- Visual appearance of the new additional classrooms
- Transition spaces inside and outside the additional building
- Relationship of classrooms in the additional building
- Harmony of the additional building with surroundings
- Student and teacher friendly classrooms
- Interesting variation in the addition massing

By comparing and rating the plans with these criteria, the teachers used concepts they had acquired on the first day of the workshop when they discussed such issues as scale, harmony, massing, and spatial relationships.

The teachers unanimously preferred plan B (Figure 3). They liked the unusual shape of the addition and how it connected to the existing school building. They thought the diagonal arrangement of the classrooms allowed for a less formal corridor and liked that it provided alcoves for tutoring. They also felt that the less formal classroom plan would be more student- and teacher-friendly.

From the workshop, the design team learned how the teachers thought their present building functioned and what its key problems were. The teachers were effective in evaluating and accepting innovative classroom and building designs, and they willingly accepted new ideas that were beyond their everyday experiences, but they were less able to creatively plan their own classroom layouts. The teachers commented that this was the first time they had ever been asked to contribute their knowledge and experience to the design process.

Following the three-day teachers workshop, the design team shared its findings with approximately 150 parents during a monthly Parent, Teacher, Student Association (PTSA) meeting.
The parents questioned the teachers’ ability to adapt to the L-shaped classrooms, an obvious departure from traditional layouts. The teachers defended their decision by pointing out the opportunities the L-shape plans gave students to work independently and in small groups. Subsequent facility group reviews were held to examine detailed plans for the new addition. After the plans were approved, the architect was instructed to prepare the construction documents, which were subsequently put out for bidding. Construction began in the fall of 2001, with completion in time for the beginning of school in the fall of 2002 (Figure 4).

Conclusion

The participatory approach to school design recognizes that the building process should include the knowledge and expertise of the people affected by design decisions. Expertise is not only the domain of architects and engineers but of a school’s students, teachers and parents, who have different but equally valid perspectives. Ultimately, the success of any project requires collaborative teamwork, usually among people with diverse expertise. While team members may change throughout the design process, the final design embodies the thought, the challenges, and the successes experienced throughout the project.

Involving the users of a building in the design process is effective for gathering information as well as for influencing design decisions that result in better school buildings. Providing opportunities for teachers, students, and parents to be involved in the initial stages of design recognizes the value of their contribution to the design solution. Such an approach helps teachers increase their awareness of how the school building can accommodate their educational aims and enhance student learning. The expertise of the teachers and students - the actual users of the building - combined with the designer’s knowledge of how to shape their educational wishes into a building form, helps create a successful design and foster a positive school community spirit.

REFERENCES


Relating Educational Objectives To Learning Spaces: A Design Games Workshop

Henry Sanoff, 
Professor Emeritus of Architecture, 
North Carolina State University

Introduction

Schools and culture focus most of their attention on linguistic and logical-mathematical intelligence. We esteem the highly articulate or logical people of our culture. However, we should also place equal attention on individuals who show gifts in the other intelligences: the artists, architects, musicians, naturalists, designers, dancers, therapists, entrepreneurs, and others who enrich the world in which we live. Unfortunately, many children who have these gifts don’t receive much reinforcement for them in school. Many of these young people, in fact, end up being labeled “learning disabled,” or simply underachievers, when their unique ways of thinking and learning aren’t addressed by a heavily linguistic or logical-mathematical classroom. The theory of multiple intelligences proposes a major transformation in the way our schools are run (Gardner, 1983). It suggests that teachers be trained to present their lessons in a wide variety of ways using music, cooperative learning, art activities, role play, multimedia, field trips, inner reflection, and much more.

One of the most remarkable features of the theory of multiple intelligences is how it provides eight different potential pathways to learning. If a teacher is having difficulty reaching a student in the more traditional linguistic or logical ways of instruction, the theory of multiple intelligences suggests several other ways in which the material might be presented to facilitate effective learning.

The theory of multiple intelligences suggests that there are a number of distinct forms of intelligence that each individual possesses in varying degrees. Gardner proposes seven primary forms: linguistic, musical, logical-mathematical, spatial, body-kinesthetic, intrapersonal and interpersonal.

According to Gardner, the implication of the theory is that learning/teaching should focus on the particular intelligences of each person. For example, if an individual has strong spatial or musical intelligences, they should be encouraged to develop these abilities. Gardner points out that the different intelligences represent not only different content domains but also learning modalities. A further implication of the theory is that assessment of abilities should measure all forms of intelligence, not just linguistic and logical-mathematical.

Jerome Bruner (1967) suggests that one of the key factors in the learning process is participation—particularly by the use of games that incorporate the formal properties of the phenomena for which the game is an analogue. A game is a simulation of a real situation, allowing participants to act out situations and experience the interactions of a community activity. To this end, a gaming workshop was conducted with colloquium participants to explore connections between educational objectives, learning methods and the physical places where they might occur. The aim of this exercise was to engage participants in an exploration of various ways in which spatial
design can influence and be influenced by learning methods. Embedded in this game were the underlying principles of Gardner’s theory.

**Colloquium Workshop**

The term *workshop* means that participants engage in experiences that provide the opportunity for learning about human relations. Learning is most functional when it grows out of personally involving experiences that require reflecting, developing and testing of new insights and approaches to problem solving. These processes become clear when participants are required to resolve their differences as they pursue a common goal.

Workshops achieve a high level of interaction between people sharing a common purpose. A workshop is a planned event where participants learn from each other as they explore issues. An important component in the development of a workshop is that of building group cohesion. Development of characteristics such as listening and problem solving are skill-building aspects of the workshop goals. They include methods of interpersonal communication, group problem solving, sensory awareness, giving and receiving feedback, and team building.

Antagonism and conflicts arise when groups create together just as they do in ‘real-life’ situations. In both situations negative forces can emerge which can destroy personal relationships and group cohesiveness, or become positive forces for dynamic change and interchange. The core of the issue is to recognize conflict and to make it acceptable and visible, not attempt to squelch it or deny its validity. Conflict, when looked upon as an important resource, can become useful rather than destructive. A group leader or facilitator can help members share activities and learn to work together.

In participatory sessions, opinions, biases and judgments have their place, but their purpose is to allow choice and encourage input rather than to prevent ideas from flowing. Summaries during the session allow the group to perceive what has been happening and to determine how to continue. Agreements can be reached or disagreements can be made visible so they can be constructively resolved.

The workshop game, *Relating Objectives for Learning to Education (ROLE)* helps to create a dialogue between participants in the process of creating a developmentally appropriate learning environment. Participants are involved in exploring aspects of the environment by considering alternative approaches to teaching and learning (Sanoff, 1994). Educational objectives and learning methods were selected from the educational literature to allow participants the possibility of discussing numerous options (Figure 1). They are introduced to stimulate a discussion about the purpose of learning, and the types of physical settings that would enhance student learning. In planning for efficient and effective achievement of educational objectives, it was necessary for participants to consider the learning methods to be used to accomplish the objectives, and the settings or environments in which learning methods will be accomplished.

Figure 1: Educational objectives and learning methods

Workshop participants were divided into groups of five people, since groups of fewer than five people may lack the knowledge
or critical judgments available to analyze the problem and arrive at a decision. As groups become larger than nine people, an opportunity to participate declines and dissatisfaction occurs. Several parallel groups were involved in one location simultaneously, since there is no limit to the number of possible groups in this exercise. To begin, each player individually selected, from the list provided, four objectives that seem to be the most important in the development of middle school children. Participants justifying each choice made brief notes. After each player has made his or her choices, the individual lists were pooled. Through discussion, the group chose from the aggregated list, four objectives that were agreeable to all participants. Group members were urged to forcefully support their individual choices, even if other members did not make the same choice, until they persuade or are persuaded by others that an objective should or should not be included in the final list. When consensus was reached, the group should record its choices.

The game record sheet (Figure 2) was used to report the final decisions. Next, each objective was being examined to identify the appropriate learning methods necessary to accomplish the objective. Three learning methods were selected for each objective. Individual choices were then pooled for a group discussion, and consensus about four learning methods for each objective. (Note: This approach has also been used in many non-English speaking countries).

Combining these two components—objectives and learning methods—the best setting (Figure 3.) was identified to fulfill the requirements established by the group. All decisions were noted on the game record sheet. A final discussion of all groups consisted of representatives from each group reporting their collective decisions, with a total group summation of all decisions.

**Figure 2: Game record sheet**

Combining these two components—objectives and learning methods—the best setting (Figure 3.) was identified to fulfill the requirements established by the group. All decisions were noted on the game record sheet. A final discussion of all groups consisted of representatives from each group reporting their collective decisions, with a total group summation of all decisions.

**Conclusion**

The basic focus of this workshop was to allow participants to rethink classroom design and its impact on student learning. Although there is an extensive literature connecting design features of school buildings to educational outcomes, quite often the most effective approach to behavior and attitude change is face-to-face contact. Consequently, the approach to this concluding session of the colloquium was collaborative group discussions that required consensus decisions, since voting methods create situations that have only two sides. These methods are increasingly more unrealistic and usually force people to take extreme positions in order to influence votes. Moreover, losers in any situation become disgruntled. Therefore, this gaming approach is based on the premise that there should not be winners or losers in the decision-making process. Every participant should be a winner. The consensus process, then, replaces the traditional process of voting.

Gaming methods aim to accomplish specific tasks ranging from increasing people’s awareness to particular environmental design issues, to teaching concepts and relationships, to clarifying value
differences between decision makers. Values are those beliefs we hold to have some intrinsic worth. Value differences between individuals often account for their inability to achieve agreement in group problem-solving situations. Quite often so-called differences of opinions result from basic value differences not made explicit. Values clarification methods encourage people to examine their own beliefs.

In design games the individuals make choices, hold positions, and debate them. In making choices individuals have to examine their feelings, self-concepts, and values. The final goal of the exercise is a plan of action for an entire group of people—a goal that requires some compromising. Participants in these design groups learn about each other’s value differences and use the game props to clarify and reconcile those differences.

References


_A DESIGN GAME IS LIKE A KISS, INTERESTING TO READ ABOUT BUT, MUCH MORE INTERESTING TO PARTICIPATE IN AND, THOSE THAT DO TEND TO REPEAT THE EXPERIENCE_
New Didactic Approaches in Traditional School Buildings

Yolanda Steijns,
Faculty of Architecture, Delft University of Technology, the Netherlands

Educational system in the Netherlands

Secondary education in the Netherlands, which begins at the age of 12 and is compulsory until the age of 16, is offered at several levels and can be divided into two main streams. The vmbo programmes (four years) combine general and vocational education, after which pupils can move on to senior secondary vocational education and training (MBO) lasting one to four years. The two programmes of general education that grant admission to higher education are havo (five years), the minimum requirement for access to HBO, and vwo (six years), which prepares pupils for university.

![Figure 1](image_url)
Educational system in the Netherlands.

Didactic changes

For a number of decades Dutch secondary education has been characterized by what conservative educators considered to be stability, while progressive ones thought of it as stagnation. In 1995 this situation changed radically with the introduction of the vmbo, Second Phase and the Study House, which were the result of general social and technological developments, like the electronic revolution (Stuurgroep Profiel Tweede Fase Voortgezet Onderwijs, 1994). The new teaching models resulted in significant alterations in the ways of teaching and learning, new programs and different, new facilities. One of the fundamental assumptions of the educational renewal is that the learning process focuses on the student. Instead of amassing knowledge the emphasis was now on obtaining skills and developing the learning process. The traditional school with mainly passive, listening students was transformed into a school with actively learning students (Schiel and Gier, 1996, MesoConsult, 1997). Probably the most lasting influence of the reformations is that it opened the floodgates to didactic and pedagogical innovation. Where previously most schools seemed perfectly happy to follow the established path, it now appeared that practically every school was interested in some new, even novel ideas for modernizing at least a significant part of their education. At the moment of writing this, several Dutch secondary schools are known to pursue different didactic innovative models in the form of pilot projects, while the vast majority follows with interest.

The basic building block in most existing school buildings still is the conventional classroom, a space virtually unchanged from its Victorian ancestors. The high ceilings, the extensive fenestration
and the arrangement of pupils as a more or less passive audience to a single teacher are features that refer to a mix of good intentions and humanistic principles with arbitrary, mostly metaphorical architectural interpretations (the healing power of sunlight and fresh air – clearly a direct reaction to the slums of the time) and authoritarian approaches to knowledge dissemination that befitted the social structure of the period. This mix makes the classroom a constant in school architecture for almost two centuries, despite its widely acknowledged limitations in e.g. acoustics and thermal stability (Dudek, 2000). Similarly, the way classrooms were put together in wings and pavilions on the basis of the principles of the corridor type remained largely unchanged.

The recent educational revolutions in The Netherlands were not followed by a similar wave of radical changes in Dutch school buildings. The most obvious changes have been the profusion of individual, generally computerized individual work places (usually spread around the circulation areas or crammed into a few spaces and especially the school library) and the addition of facilities for working in small groups (generally in some amorphous larger space). Many central halls (originally mainly used for circulation) have been transformed into a centrally located study house, with a variety of working places. These include individual computerized work places and group work places, which can be used by teachers with a small group of students or by several students working together on their assignments.

Thus new elements are introduced in ways that may conflict with existing spatial arrangements and may cause lower performance of the building. There has been no thorough performance analysis of existing types, despite the frequent complaints about e.g. acoustic and thermal aspects of the conventional classrooms. This is of particular importance for re-use of existing forms and buildings and not merely falling back to established solutions (Dudek, 2000, Horne, 1999).

The spatial structure of existing school types and of the classroom remained unchallenged, with the exception of a few small-scale experiments that used metaphors such as the living room as a classroom. UniC is a school where they have dispensed with traditional classrooms in favour of interconnected large and small work spaces. Each group of 75 students is accommodated in a wing of the building with their own living room and a number of different work spaces (Figure 2). The school is housed in an adapted office building.

![Figure 2. UniC: 1 = Living room, 2 = Large workplace, 3 = Small workplace](image)

**Vmbo**

One of the main changes was the introduction of the vmbo level. Decreasing the level gap between secondary education and MBO and adjusting the education to the demands of the time were two of the main reasons. As a consequence all the subjects have been adjusted. The emphasis now lies more on acquiring skills which are necessary in general and specifically in certain professions. Information technology takes an important role; pupils use the computer to look for information, they learn the role of ICT in society and how ICT is used in specific professions. The way of learning has also changed. They want pupils to learn competences, skills and knowledge in their own individual way. The teacher incorporates the choices of the pupil in the learning process and by doing so, the responsibility for it lies not only by the teacher but also by the pupil.
himself. By asking the right reflective questions he teaches the pupil to make the right decisions (Stevens, 2002). By creating a workplace structure for example pupils learn theory in businesslike surroundings. At this moment (2006) the government is investing 100 million euros in improving these practical training rooms. The main question is how to implement new spaces in traditional school buildings.

**Bredero College**

The Bredero College is a public school for secondary education in Amsterdam for the levels havo, vwo and vmbo. The location discussed here is designed for 670 students of the lowest level vmbo. De Architectengroep designed both the extension of the existing school building of the thirties and a replacement of technically and functionally unsuitable building parts. These adaptations of the building were used to give the whole location a new impulse. In the new building part the department of consumptive techniques is situated (a kitchen and a restaurant) and also the two gyms and an auditorium.

In both the new development and the existing building part a digital infrastructure is installed which makes it possible to realise information technology facilities in the teaching spaces as well as the auditorium. Near the kitchen there is a separate computer space for use during cooking classes. The school rents out the auditorium for cultural activities (play, musical recital) and for the neighbourhood (like the local card club). The school is located in the middle of a residential area. In order to involve the local residents the restaurant of the school is situated on the corner and opens up to the outside. It is possible for the locals to have a meal at the school.

![Figure 3. Bredero College, Amsterdam (picture by Christian Richters)](image)

**Types and analysis**

As said before the dynamic character of educational changes in Dutch secondary education contrasts with the stability of school building typology in The Netherlands. The rather lengthy period of relative educational stagnation that preceded the recent changes had arguably resulted into a standardization of programmatic requirements, spatial conditions and architectural precedents that led to the development of a small number of readily discernible types. Most Dutch secondary education buildings belong to one of the basic three types (Boersma et al., 1996):

1. the archetypal corridor type, where classrooms are arranged sequentially along a corridor (either on the one side or on both sides),
2. the hall type, where circulation space and classrooms are organized around a central hall,
3. the *pavilion* type, where classrooms are clustered into semi-independent wings or parts. Such small standardization implies on the one hand restrictions that may act as an impediment to the development of new school buildings. On the other hand, the compactness of this typology gives rise to the hypothesis that, rather than exploring the applicability of new design briefs to individual buildings, we can correlate these briefs to types. The correlation explores the consequences of appropriate or possible modifications both at the abstract levels of global spatial articulation and at more specific levels of individual spaces and activities. The products of the correlation are general guidelines concerning the possible transformations of instances belonging to a known type. The guidelines describe the transformability, adaptability and flexibility a type affords with respect to possible educational changes. They also provide instruments for the treatment of common (usually fundamental) elements and aspects, such as the ergonomics and climatic behaviour of individual workplaces or the flexibility of a conventional classroom.

The matching of programmatic requirements to building types and their instances presupposes analysis of the buildings with respect to:

- **Geometry:** Figure 4 shows the geometric representation of all relevant entities (spaces and building elements) as integral objects that can be automatically recognized and measured (Koutamanis and Mitossi, 2001). This permits matching to quantifiable demands (e.g. floor area) and also facilitates automatic recognition of relationships between the entities, as e.g. in routing (i.e. identification of sequences of spaces and doors) or with respect to day lighting (on the basis of adjacency between spaces and external windows) (Koutamanis et al., 2001).

![Figure 4. Geometric representation of Esdal College](image1)

- **Topology:** adjacency and access graphs of spaces and building elements (Steadman, 1983) are produced automatically on the basis of the geometric representation (Figure 5). Topological representations serve two ends: (1) the development of a typology of parts common to all building types, and (2) the primary matching with the brief, which is also automatically transformed from a database of activities into a graph.

![Figure 5. Normalized topological representation of Esdal College](image2)

- **Zoning:** the identification of use space, circulation and service zones in the geometric and topological representations is instrumental for the analysis of flexibility and adaptability in different parts of a building and with respect to different activities and functions (Figure 6).

![Figure 6. Zoning scheme of Esdal College](image3)
References


In recent years, discussions on school architecture as a tool in the learning process have spurred many architects to come up with ideas about how to design environments that assist learning. On the other hand, the alienation of children living in cities from their environment has resulted in global concern and has brought professionals from the field of architecture, psychology, and education to focus on child-school-city interrelations. There are many questions around this relationship, how it influences children’s learning, and about how school architecture can mediate the way in which children learn about the broader social context in which they live their lives. There are various methods to identify the architectural connections between school and the context and my doctoral dissertation\(^1\) is an example of the investigation of school architecture as the connecting link between the child and the context. It is the discussions of the way a school’s pedagogical philosophy is translated into architectural form, and how school architecture manifests the sociocultural aspects of the context. It emphasizes on the physical environment of the school being the projection of a specific pedagogical philosophy. For the purpose of identification, investigation and comparison in some examples of school architecture, it coins the concept of Learnscape, with the definition of an environment that has architectural characteristics of a landscape for learning or a ‘learning landscape’. In a Learnscape school architecture is the physical response to a pedagogical philosophy. Learnscape conceives of architecture as a medium connecting the child to the context, and can be interpreted as school architecture that reflects or embodies the spatial and socio-cultural aspects of the context.

**Mediation through architecture – architecture as a medium**

Architecture as a medium has been examined by Adrian Forty\(^2\) in *Words and Buildings*, where he mentions different aspects of architecture through which communication occurs: character, context, design, flexibility, form, formality, function, history, memory, nature, order, simplicity, space, structure, transparency, truth, type and users. He compares architecture to language, arguing that architecture communicates in a similar way as does language: it is an ordered system like grammar and it is a semiotic system that carries meaning. Similar arguments are put forward in *Metaphors We Live By* where George Lakoff and Mark Johnson\(^3\) postulate that the language we use is made up of cognitive metaphors\(^4\). In many respects we do not pay attention to metaphors

\(^1\) Presented on December 9th, 2005 at the Oslo School of Architecture and Design in Norway


\(^3\) Lakoff, George and Mark Johnson. *Metaphors We Live By*

\(^4\) Metaphor is a systematic, partial structuring of one concept in terms of another and forms a coherent system that shapes our understanding of the world.
because they are an integral part of our thinking. The same can often be said about architecture, the metaphorical aspects are latent. Architecture serves many functions, apart from the basic function of providing shelter, it embodies the history, the cultural setting, the intended use through building’s appearance, the elements that have composed it and finally it evokes emotions in the users. In summary it communicates certain impressions to the user or viewer and thus becomes a medium between the viewer or user and the world, so that it can effectively be ‘read’.

‘Reading’ of Architecture

The methodology of reading architecture is addressed in Way-finding in Architecture5, a review based on Kevin Lynch’s study of city structure. Lynch suggests that the way people navigate through the city is by relying on a reading of the city structure. Through the elements of paths, nodes, landmarks, edges and districts people undertake a mental mapping process of the physicality of the city and this enables them to find their way around by reading the city. His views are shared by the legendary architect Aldo Van Eyck: In the Amsterdam Orphanage Van Eyck6 emphasizes the analogy between the city and the orphanage by comparing corridors in the building to streets in the city and the public square of the city to the living room in an orphanage. Apart from the form he is interested in the psychological aspects of buildings such as the hearth and the threshold. In the design of the Orphanage for Children in Amsterdam (Figure 1), Van Eyck makes the analogy of the building and the city, the starting point for design with the aim to reflect:

*A small world within a large, a large world within a small one, a house as a city, a city as a house, a home for children-to create that was my goal.7*

The Italian Learnscapes

In June 2001 I organized a workshop on Learnscapes at the exhibition of “The Hundred Languages of Children” in Hong Kong. This well-known exhibition, which travels around the world, is a collection of the works made by children at the pre-primary schools in the city of Reggio Emilia in the region of Emilia Romagna in northern part of Italy. What makes this exhibition different from many other child-art exhibitions is that this collection of children’s work emphasizes on “making learning visible”. That is through these artworks, children at the Reggio Emilia schools exhibit the process of their learning and not only the product, as it is usually the case. These schools are perceived as highly successful within the world of education8 and their methodology has been copied, to a greater or lesser extent, by many schools around the world for many decades. They claim that architecture, both in the planning of school buildings and as a source of educational resources, forms an important part of their philosophy and is deeply embedded in the socio-cultural as well as physical specificities of the city of Reggio Emilia.

The city of Reggio Emilia

The city of Reggio Emilia is located in the region of Emilia Romagna in the northern part of Italy. This region is according to Robert D Putnam, in Making Democracy Work9, one of the two most

---

5 Passini, Romedi. Wayfinding in Architecture, 1992
7 Udo Kultermann, Architecture in the 20th Century, p138
8 A search for Reggio Emilia School in Yahoo search engine gives more than 300,000 sites.
9 Putnam, Robert D.; Making Democracy Work
To the casual onlooker the glass-walled Diana School could be mistaken for a cheerful greenhouse rather than a public kindergarten. From my first-hand experience, the most striking factor is the profundity of children’s art on display. Art works appear everywhere – on walls, painted on windows, hanging from the ceilings, spread across tables as well as handmade ceramic tiles representing living creatures, mobiles of human profiles made of wire and beads, and clay sculptures of trees and leaves. A comprehensive part of the Diana School’s design is the presence of a variety of architectural characteristics such as the piazza, transitional spaces, courtyards, porticoes, verandas and porches as well as the wall-sized windows and glass doors that create a horizontal and transparent environment. (Figure 2) These architectural characteristics are also present in the city of Reggio Emilia. The main architectural feature incorporated in the Diana School, the piazza, the central space in the building, is the representation of the piazza of the city and these specificities of architectural elements are shared by the school and the city. Piazza has the connotation of the centre for community and gathering, a democratic space shared by everybody in the city and in Diana School (Figure 3). From the analysis of the architectural specificities of the Diana School and the city of Reggio Emilia it becomes evident, and it is suggested here, that the Diana School is a successful example of Learnscape: a “learning landscape” where architecture mirrors the physical as well as socio-cultural aspects of the city of Reggio Emilia and that the socio-cultural and physical aspects of the context are translated into the architectural elements of the school, reflecting the four qualities of democracy, community, horizontality and transparency used by Putnam to describe the city.

Diana School within context in Reggio Emilia

The Diana School was built in 1970 in the heart of the city of Reggio Emilia. The school is a one-story building and the whole school can be perceived in a single view upon entering the school building. The entrance area introduces visitors to the school through displays, information about the history of the school, work diaries, as well as photographs, drawings and discussions of the children. The entrance opens to piazza, the open space that extends and connects the spaces inside the school: the kitchen, the dining room, the work and play space, the shop, the theatre, and the ateliers. There is one central atelier, and each classroom has its own mini-atelier.
serviced by an art teacher. The function of these spaces is to integrate classroom activities with more specific artistic work, expressive and aesthetic education for on-site research and study, and for collective didactic planning and professional development meetings on specific topics involving all the staff or groups of teachers. The atelier is also used for working on administrative tasks related to the various activities carried out by the school, and particularly those that focus on the methods employed by children for expressing all their ‘languages’.

Each classroom is divided into two or three adjacent spaces used for different activities where the children can work in small or large groups, independently or supervised by teachers. One of the significant features of the design of the Diana School is that it is a “transparent” building, meaning that there is easy access to the piazza and outside area as there is high level of accessibility and visibility between classrooms and other spaces. There are many interconnections allowing free movement both in and around the school and the outside. Connected to the piazza, there is a shop, space for a dressing area, and a theatre. There are two courtyards on both sides of the piazza, with direct access to the piazza, that function as outdoor classrooms.

The Diana school in itself is a classic example of the architectural characteristics that form an integral part of the Reggio Emilia educational philosophy i.e. transparency, horizontality, community and democracy are reflected through design features. The notion of transparency has been interpreted into the architectural form through the spatial relationships between all the spaces inside as well as between the internal and external aspects of the school. Horizontality is represented by the single storey structure of the building. The notion of community has been translated into architectural terms as the piazza, a social space and public meeting place with extensive public life. The notion of democracy is achieved by giving all the spaces in the school the same value, the office, the classroom, the atelier, the kitchen, and the restrooms. Where possible all the spaces also have an educational function assigned to them. This school was planned as a physical manifestation of the concept of a democratic society that forms part of the cultural heritage of the city of Reggio Emilia.

In simple terms the Reggio Emilia approach differs from conventional pedagogical methodology because their learning is based on process rather than product. In the planning of their curriculum the Reggio Emilia educators ensure that their educational projects follow three rules:

1. Careful planning of the process of learning offering the possibility for observation, interpretation, reflection and revisiting. This is important not only for the teachers but also for the children themselves, as it helps them retrace their work and the process adopted for achieving the result.

2. The formation of small working groups that offer rich communicative and relational potential and stimulate the exchange of ideas and thoughts.

3. The encouragement of creativity that emerges when the school successfully blends learning and self-expression. It is important for teachers and parents, as well as for social policy and the culture as a whole, to have these kinds of expectations, that are in this way perceived by the children.

Reggio Emilia educators use the term constructivism to define the increased awareness of the world that is achieved during the process of cognitive and cultural development in young children. According to Piagetian and post-Piagetian genetic epistemology, knowledge is an ongoing construction. Perception, action, and reflection become the fundamental instruments for individual cognition, and individual knowledge is constructed as a result of exchange and relations with others (social

---

11 Means of expression
12 As claimed by Reggio Emilia educators
13 According to Loris Malaguzzi, the founder of the Reggio Emilia philosophy and other Reggio Emilia educators
constructivism). Architecture of the Diana school allows the greatest possibility of maximising the composition of knowledge by providing a stimulating environment that comprises a wide variety of visual stimuli for the children. Due to the transparency of the building the visual images are constantly changing. This is different from the limited visual stimuli available in many conventional classrooms and play areas where children are often encouraged to focus on a central point, e.g. the teacher, the blackboard or even the video screen. High windows and plain walls in conventional classrooms have also tunnelled the participant’s vision on a common focal point. In Diana school it is the presence of light and transparency that are the key differences that distinguish the architectural specificities of this school from others. It is the constant use of the piazza in the daily activities of the school that is unique. This area is not just a space for ‘play’ and the classroom used for ‘work’, rather the use of space combined with its accessibility in visual terms from other areas of the building converts this space to the central feature of the school, in other words the focal point. In many other educational institutions it is a central hall or assembly room that serves as the central gathering point and is rarely used throughout the day.

Evidence of the everyday life of the school comes from the pamphlet Advisories that is prepared by the elder children (5 or 6 year olds), from Diana School, just before they move on to elementary school, as a guide for the new entrants (3 year olds). In many respects this guide is the clearest indication of how the children react to their environment within the school in that, largely written in their own words, they explain how the physical structure and layout of the school functions from day to day.

The most interesting features are the way the children begin by describing the location of the school and its historical context. They point out that the school occupies the site of an old cinema and they also identify other landmarks such as the university, as well as the mechanics of getting to school such as the special importance of the “orange parking permit” as distinguished from a “blue city one”.

Moving on to the school itself the children give a clear guide to each area of the school and combine this with practical advice on how they use the spaces. They describe how they incorporate various spaces, equipment, trees, etc in their games and present what they believe the new beginning young pupils would enjoy (e.g. mirrors) or need to stay clear of until they are much older (e.g. five years old). The piazza, lunchroom, atelier and classrooms are given a similar treatment combining a physical description with added information about their experiences. The concept of ‘transparency’ is reinforced by descriptions of the classrooms: The doors are all made of glass, so you can see inside…

Although the educators in Reggio Emilia welcome visitors to observe how the system operates and listen to lectures about their philosophy, principles, and practices, they emphasize that the Reggio Emilia approach is not a method that can be taught. This approach evolved within a particular cultural context, it was further shaped by historical forces and was nurtured by social conditions present only at that time and place. These forces came together to enable the development of an approach that some educators today believe in being one of the best early childhood practices in the world. From the architectural point of view the success of the system is heavily dependent on innovative design thinking which breaks away from the conventional school building model. The key is that the schools are designed to maximise the social constructions of understanding the lives of those who inhabit the space. Despite the difference in design, the Reggio Emilia schools all embody characteristics central to the Reggio ethos.

All spaces from floor, ceiling, windows manifest the concern for providing a stimulating and aesthetically pleasant environment for children. The choice of architectural elements, as well as the
arrangement of the furniture, serve to achieve this purpose and are assigned an educational role. Light is used purposefully everywhere: natural, reflected and artificial. In some areas coloured glass is used, something that infuses the spaces surrounding it with mood creating colours. The presence of light, coming through large windows, and elements that reflect light, such as mirrors, are used on floors, ceilings, walls, and provide a sense of overall transparency throughout the building. The purpose behind this is that children should experience ‘seeing and rediscovering themselves and their multiplications’. Parents and visitors are able to get a clear view into the classrooms through windows situated in the interior walls of the buildings.

Apart from its function to illuminate, light plays an important role in creating a sense of transparency in that the children can see and be seen. This physical transparency can be seen as a metaphor for the Reggio philosophy of creating a form of mental and emotional transparency and horizontality between all the participants.

Another manifestation of ‘transparency’ is created by the availability of school buildings for purposes other than teaching. These schools are inhabited by children during the day and are used for parents’ meetings or other community gatherings in the evening. Children’s work is constantly exhibited in the piazza of the school where parents and visitors can observe it and be involved in the process of learning. Reggio Emilia educators firmly believe in allowing parents to have their voices heard.

Like in most Italian cities the piazzas of Reggio Emilia serve as gathering points for social events, markets, political discussions and information exchange as well as simply an open-air gathering space to spend leisure time.

The Piazza as Cultural Entity

The piazza is a particularly Italian concept dating back to Greco-Roman city planning. Although the concept of providing central squares, meeting places or parks has been copied or developed independently in other locations there are few cultures that attributed such social, political, religious and economic significance to a central, open city space as the Ancient Romans. It holds with Mumford’s view that “the city is the best place for holding meaningful conversations” and that this can best be achieved in an easily accessible open space like a piazza.

In architectural terms the piazza possesses certain attributes that are common to both the city-piazza and the school-piazza:

1. It forms the central point and provides space for interaction.
2. It provides links to other spaces, effectively acting as a ‘cross-roads’ within the school and, more literally, within the city.
3. Enables clear views of activities within the school or city.
4. Provides a light and pleasant environment.
5. It provides a spacious area that allows circulation without interrupting the activities.

Large spacious places such as piazzas are stimulating and are designated for public interaction while smaller, more intimate spaces are used for a more private interaction between small groups of people. In the school context the piazza provides more opportunities for group activities whilst a classroom would enable more concentrated learning opportunities. The comprehensive elements of the Diana School’s design are a variety of architectural characteristics, such as transitional spaces, courtyards, porticoes, verandas and porches. It can be argued that the Reggio Emilia children become familiar with their city through the architecture of their school, both physically and
socio-culturally. The construction of these interconnections – physical, social and cultural – is the major success of the Diana School as a successful example of a Learnscape where the school architecture creates an “invisible city” for the children, one that they understand and relate to. Loris Malaguzzi, the founder of the revolutionary Reggio Emilia approach, emphasizes on the importance of the school environment:

The environment is architecturally and functionally designed and equipped to provide for this system of interconnections and interaction. We see the traditional isolation of teachers and school staff, and their isolation from families and the social environment, as a sort of longstanding existential imprisonment, an obstacle to the professional growth and knowledge of the individual that is constructed by means of the comparison of experiences and background. This isolation is an autistic and unproductive model with respect to the family and not in the least reassuring or exemplary for the autonomy and socialization of the children.

Malaguzzi believes that the traditional educational theory of separation must give way to the theory of participation. By this he means that the relationship between the school staff and the children’s families must be consolidated through multi-dimensional forms, exchanges and dialogues that can provide a grounding for the educational and didactic ideas at stake. He termed this relational strategy as “a working epistemology”. This espoused the concept of constantly bringing together the many points of view and acts of participation which ensure that the relationships, problems and possibilities of education, as well as the living and learning styles utilised in the growth and development of children continue to stay active and open. Loris Malaguzzi’s famous declaration is that:

The future belongs to those who will be able, in a school, to join the strength of criticism, democratic participation and imagination, with the organizational, cultural, scientific, and operative requirements.

He defines the idea behind the “Reggio Emilia Approach” as “genetic-constructivist” by which he means that a perspective is created because “the brain is not imprisoned by genes, that thought can be modified in as much as it interacts with the environment, and that intelligence is the result of the synergistic cooperation of the various parts of the brain”. This theory was based on the firm belief that children are born with all their “languages of life”14 and that “these languages are interactive by nature and equipped with the exploratory and perceptive tools for organizing information and sensations and for seeking out exchange and reciprocity. They embody the incipient semiologist and detective, the ability to use investigative methods, to hypothesize ‘missing’ explanations and to reconstruct facts”.

Malaguzzi believes in the “never-ending-ness” of children’s curiosity and claims that children take pleasure in discovery and in transgressing the boundaries of relations, changing the meanings of things and creating their own analogies, metaphors, anthropomorphic and realistic-logical meanings. He compares education to “a voyage within a voyage” and that “the problem of the education of children cannot be set apart from history, and depends on many variables that are never independent of the universe of discourse within which it is formulated.” By ‘variables’ he includes the things that are affected by one’s cultural heritage, by theories and experience, by literature, art and economics, by scientific research and technology. His educational ideas are clarified through the exhibition “The Hundred Languages of Children” where the main objectives are to demonstrate a visible learning experience through interaction with the environment.

14 Other means of expression addition to the verbal language
The Best School in the World

In December 1991, the American magazine Newsweek nominated the Diana School as the “best in the world”. In 1992 the prestigious Lego Prize and in 1993 the Chicago University ‘Kohl Award’ was given to Loris Malaguzzi, the founder of the Reggio Emilia approach in education. In 1994 he received the Hans Christian Andersen Prize and he was posthumously awarded the international certificate of recognition from MAIS (Mediterranean Association of International Schools) following his unexpected death of a heart attack on January 30th 1994. He is particularly praised for his ‘charter of rights’ incorporating the rights of children, the rights of teachers and the rights of parents, and particularly his belief in “The Hundred Languages of Children”:

No way. The hundred is there…

(By Loris Malaguzzi)

The child is made of one hundred.
The child has a hundred languages
A hundred hands
A hundred thoughts
A hundred ways of thinking
Of playing, of speaking
A hundred always a hundred
Ways of listening
Of marveling, of loving
A hundred joys
For singing and understanding
A hundred worlds to discover
A hundred worlds to invent
A hundred worlds to dream.
The child has a hundred languages
… and a hundred, hundred, hundred more
But they steal ninety-nine.
The school and the culture
Separate the head from the body.
They tell the child:
To think without hands

To do without head
To listen and not to speak
To understand without joy
To love and to marvel
Only at Easter and Christmas.
They tell the child:
To discover the world already there
And of the hundred
They steal the ninety-nine.
They tell the child:
That work and play
Reality and fantasy
Science and imagination
Sky and earth
Reason and dream
Are things that do not belong together.
And thus they tell the child
That the hundred is not there.
The child says:
No way. The hundred is there.
Urban clusters as strategy for the university campus in Lugano

Enrico Sassi, architect,
Institute for the Contemporary Urban Project,
Academy of Architecture, Mendrisio,
USI Università della Svizzera italiana

1. Educational system in Switzerland

Education in Switzerland is organized along parallel tracks: secondary education (lyceum or professional training) and higher education (universities and polytechnics with different missions from the Professional University Schools or SUPs). At a federal level, the Bologna framework (a 3-year bachelors degree worth 180 ECTS credits followed by a 2-year masters degree worth 90/120 ECTS credits) has been adopted. In the Canton of Ticino, there are two university organizations: the USI (Università della Svizzera Italiana – University of Italian-speaking Switzerland) and the SUPSI (Scuola Universitaria Professionale della Svizzera Italiana – Professional University School of Italian-speaking Switzerland). The Università della Svizzera italiana (USI) was founded in 1996 and is self-governing. It has joined the existing nine cantonal universities and the two federal polytechnics, becoming an integral part of the Swiss university system. It is the only Italian-speaking university outside of Italy. At present the USI has four faculties: Economics, Communications and Information Technology in Lugano, and the Academy of Architecture based in Mendrisio.

The Scuola Universitaria Professionale della Svizzera Italiana (SUPSI) is one of seven such professional university schools (also known as Fachhochschule, Haute école spécialisée or University of Applied Sciences). The SUPSI is a self-governing organisation subject to public law, set up by the Canton of Ticino under the law of 11th March 1997 which brought together the pre-existent public and private specialized schools and research institutes. The SUPSI has a university status, oriented towards professional training and applied research.

2. Strategy for the university campus in Ticino

The Canton of Ticino’s university policy has, since the setting up of the two institutes, focused on developing synergies and co-operation. This policy is centered on a precise strategic goal which aims to develop synergies to such an extent as to create a single Italian-speaking university complex, bringing together the 3’000-odd students currently studying in the Lugano region.

Table with the actual situation of the Lugano and Mendrisio USI Campus

<table>
<thead>
<tr>
<th>School</th>
<th>Localization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facoltà di Economia – USI – Faculty of Economics</td>
<td>Campus Lugano</td>
</tr>
<tr>
<td>Facoltà di Comunicazione – USI – Faculty of Communications</td>
<td></td>
</tr>
<tr>
<td>Facoltà di Informatica – Faculty of Information Technology</td>
<td></td>
</tr>
<tr>
<td>Accademia di architettura – USI – Academy of architecture</td>
<td>Campus Mendrisio</td>
</tr>
</tbody>
</table>
One of the key features of this strategy is the building of the future common USI-SUPSI campus, with two centers: one in Lugano, one in Mendrisio.

### Table with the actual and future localization of schools

<table>
<thead>
<tr>
<th>School</th>
<th>Actual localization</th>
<th>Future localization</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUPSI – Direzione + post-formazione - Administration and Advanced Studies</td>
<td>Manno – Gerre</td>
<td>Campus Lugano</td>
</tr>
<tr>
<td>DSAS - Dipartimento Scienze Aziendali e Sociali – SUPSI - Department of Company and Social Sciences</td>
<td>Manno – palazzo E</td>
<td>Campus Lugano</td>
</tr>
<tr>
<td>DTI – Dipartimento Tecnologie Innovative – SUPSI – Department of Innovative Technology</td>
<td>Manno – Galleria 2</td>
<td>Campus Lugano</td>
</tr>
<tr>
<td>CSI – Conservatorio della Svizzera Italiana – SUPSI - Italian-speaking Swiss Conservatory</td>
<td>Lugano – Via Soldino 9</td>
<td>Campus Lugano</td>
</tr>
<tr>
<td>CSCS – Centro Svizzero di Calcolo Scientifico ETHZ - Swiss Centre for Scientific Calculation</td>
<td>Manno – Galleria 2</td>
<td>Campus Lugano</td>
</tr>
<tr>
<td>ISPFP – Istituto Svizzero di Pedagogia per la Formazione Professionale - Swiss Institute for Education and Professional Training</td>
<td>Lugano - Via Besso 84</td>
<td>Campus Lugano</td>
</tr>
<tr>
<td>DS – Dipartimento Sanità – SUPSI - Health Department</td>
<td>Actually 3 different schools (Mendrisio, Trevano, Bellinzona, Lugano)</td>
<td>Campus Lugano</td>
</tr>
<tr>
<td>USI – 5a facoltà – 5th faculty</td>
<td>Prevision</td>
<td>Campus Lugano</td>
</tr>
<tr>
<td>DACD – Dipartimento Ambiente, Costruzioni e Design – SUPSI – Department Environment, Buildings and Design</td>
<td>Trevano</td>
<td>Campus Mendrisio</td>
</tr>
<tr>
<td>LTS - Laboratorio Tecnico Sperimentale (DACD SUPSI) – Experimental Laboratory</td>
<td>Trevano</td>
<td>Campus Mendrisio</td>
</tr>
<tr>
<td>LEE – Laboratorio Energia, Ecologia, Economia (DACD SUPSI) – Laboratory Energy, Ecology, Economy</td>
<td>Trevano</td>
<td>Campus Mendrisio</td>
</tr>
<tr>
<td>IST – Istituto Scienze della Terra – SUPSI (DACD SUPSI) – Institute of Earth Sciences</td>
<td>Trevano</td>
<td>Campus Mendrisio</td>
</tr>
<tr>
<td>Comunicazione Visiva - SUPSI (DACD SUPSI) – Visual communication</td>
<td>Lugano – Vignola</td>
<td>Campus Mendrisio</td>
</tr>
</tbody>
</table>

### 3. Concept of the Masterplan

In the month of December 2004, the Ticino Council of State gave a mandate to the Academy of Architecture’s institute for the Contemporary Urban Project (i.CUP) to make a study for a general concept of the future organization of two university campuses: one in Lugano and one in Mendrisio. The study was to bear in mind future training needs and university research activities, considering the hypothesis that the Campus could be implemented in different phases over a lengthy time-scale (2015). The i.CUP, headed by professor architect Josep Acebillo, has developed plans to complete the current Lugano University Campus, creating a dense, integrated fabric (an urban cluster) able to establish a complementary and synergic relationship with the pre-existing campus. The current USI campus area covers 25’000 square meters and lies on the right bank of the River Cassarate. To
this site, a new 18’000 square meters plot has been added, located on the left bank of the river, together giving an overall area of 43’000 square meters.

The concept of urban cluster is useful in the definition of a new element in the city’s urban fabric, characterised by a high degree of morphological and functional complexity, intensity uses and symbolic and representational capacity. The building proposal in question is very compact, making it possible to use the available surface area in a rational way while enhancing the whole complex with the addition of new, quality public space.

The new complex defines and organises the synergies between the current university campus – which is home to the library, the refectory and the main hall – and the future campus, whose students will be able to share the existing Campus’s main common facilities. The combined USI/SUPSI Campus is located in an area made up partly of lots owned either by the Canton Ticino or by the Fondazione per le Facoltà di Lugano dell’Università della Svizzera italiana (“Foundation for the Lugano Faculties of the University of Italian-speaking Switzerland”) and an area of privately-owned land. The project entails the purchase of part of this land to complete the overall planned area and to assimilate the required surface areas. The total area is bound to the south by Via La Santa, to the north by the extension of Via GB Dominione, to the west by the River Cassarate, and to the east by the proposed new route for Via Boscioro which will cut across some of the land to be purchased.

4. Functional and morphological aspects of the Masterplan

The future campus USI/SUPSI will contain various educational institutions, grouped in two distinct areas (northern and southern centers). The northern centre is formed by the CSCS (Centro Svizzero di Calcolo Scientifico – Swiss Centre for Scientific Calculation, by the ETHZ Polytechnic of Zurich) and the CSI (Conservatorio della Svizzera Italiana (SUPSI) – Italian-speaking Swiss Conservatory), the gym, the Fifth Faculty (USI) and a hall of residence; the southern centre has the teaching facilities with a day nursery, the DSAS (Dipartimento Scienze Aziendali e Sociali (SUPSI) – Department of Company and Social Sciences), the DTI (Dipartimento Tecnologie Innovative (SUPSI) – Department of Innovative Technology), the ISPFP (Istituto Svizzero di Pedagogia per la Formazione Professionale – Swiss Institute for Education and Professional Training), the DS (Dipartamento Sanità (SUPSI) – Health Department) and the bridge-building with bar which links the two parts of the campus and the two sides of the river.
As far as the functions of the new buildings are concerned, the same approach as that of the present USI Campus has been maintained: a single building has been envisaged (the “Aulario”, a building with “aula”: teaching rooms) containing all teaching facilities for the various schools and faculties. At the same time, separate departmental buildings have been foreseen for each institution to house administrative offices, staff offices and specialized laboratories. The buildings have been arranged around a common park area at the centre of the campus, suitably angled to the sunlight and looking out onto the river. This park area is the heart of the new part of the campus, overlooked by all the buildings, and also provides a useful new open public space for the city.

The entrance in the Campus from north is defined by the buildings of the CSCS (Centro Svizzero di Calcolo Scientifico) and the CSI (Conservatorio della Svizzera Italiana); their shapes are designed for defining an entrance door, their position in relationship with the street alignment design a public square outside the campus external limits.

This small square acts as a public, civic space and is the external space that provides access to the Conservatory or from where it is possible to go through the covered gallery that leads into the campus; it is bound from above and on the left by the Conservatory itself, and on the right by the Centre for Scientific Calculation. A 7-storey residential building is planned for the northeastern edge of the campus. The area for sports is located above the buildings that will house the Fifth USI Faculty and the Swiss Centre for Scientific Calculation; the sports facility is covered and heated and can be reached using two elevators or an independent flight of steps that starts on the campus and goes up alongside the building that houses the Centre for Calculation. The Gym has a useful area of 23 x 32 meters and can house, in turn, a football pitch, a basketball court, a handball court, a tennis court, a volleyball court, three bowling strips, or three archery stands for nine archers.

The southern centre access is the point where the main crossing axis of the campus begins.

The entrance is bound on the right by the Aulario and on the left by the base of the bridge-building that is home to the bar on the ground floor. The bridge-building is an important hub and link; it is home to a gallery and to meeting spaces for the students, and acts a direct physical link between two distinct parts of the Campus that would otherwise remain separated, at street level, by the heavy flow of vehicle traffic. The sequence of buildings has been planned in such a way as to ensure that their size and bulk create minimum visual impact for people living in the neighborhood and that their position takes existing vistas and prospects into consideration. The main geometric lines of the project correspond to the organization of the existing urban layout; the main campus axis, which the buildings give onto, coincides with the extension of the road that arrives from the north (Via Boscioro); the public green space opens out towards the river and the existing campus, while the buildings are aligned with the setback space of the facades along Via la Santa. Below the buildings in the southern cluster is located an underground car park, reached by a ramp. The structure supporting the car park cover coincides with the structure of the buildings above.

5. Planning procedures and construction phases

The intended use of the area upon which the new part of the University Campus will stand has been established in the Local Zoning Plan; construction parameters for the area are currently those for zones R7S and R7E (Special Commercial Residential Zone and Extended Residential Zone), with a maximum height limit of 22.5 meters, and a minimum limit of 17 meters, a net used surface index (“indice di sfruttamento, IS”) of 1.4, and an occupancy index (“indice di occupazione, IO”) of 35%. In order to carry out the project, a formal change in intended use has been applied for,
to zone the area for use as Public Area and Public Buildings (“AP-EP”).

As specifically requested in the survey brief, the master plan proposal may be carried out in phases. The first phase of the project involves the construction of the buildings that will make up the southern cluster and will be home to the teaching facilities currently located in Manno, while bearing in mind the requirements of the future Health department, under construction.

6. Competition

The mandates to design the individual buildings that make up the first phase of the new campus (south cluster) will be assigned on the basis of an open architecture competition. The aim of the open competition is to find the people who will construct four buildings with their own architectural style but which will fit into the overall campus concept, in terms of size and shape, set out in the master plan. In keeping with the philosophy already used in the USI Campus – made up of nine separate buildings; two older ones and seven recent constructions – the designer of each building has been selected on the basis of an open architect competition. As regards the new extension, a similar principle has been proposed and adopted whereby the complex will be made up of buildings which are different from each other with the aim of expressing the complexity and diversity of the architectural styles and approaches involved in the block. This decision was taken to make it possible to build a new part of the city with a distinctive and varied architectural character. A call for proposals is currently being drafted that will allow participants to compete to build one of the four buildings that make up the block.
Conclusions to the Colloquium

Conventional wisdom has it that good school education requires three basic ingredients:

* A qualified teacher(s),
* Good teaching material;
* A well-defined curriculum.

The classroom or place where such education takes place is generally considered to be of subordinate importance.

The teacher is probably the key person in any child’s educational process. “Teachers play a central role in Education For All achievement” as the 2005 Report emphasises.” Indeed, a long-term vision, strong governmental leadership and a sufficient supply of motivated, respected, supported and supervised teachers are all crucial to the success of education policies and reforms focusing on expansion and quality improvement. ... The teacher issue is not just one of numbers; it is also one of training and conditions of service... Large proportions of primary school teachers lack adequate academic qualifications, training and mastery of content, especially in developing countries.”

Similarly, textbooks and teaching materials are essential in assisting the educational process. Unfortunately, this “ingredient” is often found to be deficient, both in quantity and in quality. For example, it is not uncommon to come across a classroom of 50 or more children but with only 10 – 20 textbooks.

Finally, a comprehensive and well-defined curriculum will provide the framework for the development of the overall educational cycle of a child, starting in pre-primary school and, possibly, leading up to tertiary-level education.

But does it really hold true, that the classroom, the physical environment, in which education takes place, is of scarce relevance? Is it possible to discount the sense of physical comfort one experiences in a pleasant environment in terms of its relevance to students’ learning performance? Would it not be appropriate to pay more attention to the quality of this “ingredient”? At the Colloquium the discussion was about this fourth aspect for ensuring quality education: the physical environment, including buildings and schoolyard, within which schooling takes place.

It should also be noted that in any educational budget, expenditure for infrastructure constitutes a major item - and it is frequently the main item for cuts and reductions. This is particularly so in contexts where the notion holds that the design of a school is of little relevance to scholarly achievement.

In part one of the volume, the views of three authors who have an extended experience in working for or with agencies, that are funding school construction in developing countries, offer an overview of what’s going on and about the main issues confronting actors involved in this arena. Eberhard Knapp, Michael Wilson and Kirtee Shah express themselves personally but rely on examples and cases that they know thoroughly.

In the second part of the volume, to begin with, results from a large questionnaire study com-
praising a large number of OECD countries indicate – as related by Hannah von Ahlefeld - that the physical environment within which education takes place is of little relevance to the academic achievement of learners. With respect to the “quality of a school’s physical infrastructure” the analysis of results shows:

- On average across OECD countries, this index explains only 1 percent of the variation in the performance of students in mathematics.
- In only eleven out of the 41 participating countries is student performance between schools in the top and bottom quarters on the index of the quality of the schools’ physical infrastructure significantly different (which would still be 54%).
- The correlation between GDP per capita and “quality-index” is very weak.

However, this analysis of the questionnaire study is based solely on responses given by school principals, who were asked about the extent to which they believed that their school’s capacity to provide instruction was hindered by a shortage or inadequacy of, inter alia, the school’s physical infrastructure, its school buildings and grounds, etc. As the author herself remarks these responses do not adequately address the specific interrelationship between physical infrastructure and academic achievement. In particular, neither the actual performance of students nor their views were taken into consideration.

In opposition to these results, two other researchers show that the physical environment in which education takes place is of considerable importance.

This is the case in the study presented by Nicole Simon – Simon, Evans and Maxwell in this volume – concerning primary schools in poorer districts of New York, and in the study by Celen Pasalar. Scholarly performances are directly related to how the characteristics of the built environment are perceived and consequently taken care of by teachers and students. These two contrasting views were referred to by all following presentations and discussions.

The four country presentations (on Yemen, Jordan, Egypt and Palestine) - in the third part of the volume - confronted all participants not only with impressive figures on the reality of the educational situation and its immense challenges in these countries, but also with their authors’ views on priorities and choices in solving the problems. Quality of school buildings was not evidently a central issue for the country representatives present at the Colloquium although two days of intensive exchanges made it clear for all that it is under all circumstances related in manifold ways to learning and may successfully improve learning processes. To put it simply: if students feel concern and involvement in taking care of their school setting he or she will learn better – but this is not often achieved nor easy to achieve in contexts where so many factors don’t allow for such an approach.

Grouped in the fourth part of the volume, a series of presentations demonstrate manifold experiences of school and school-yard designs and constructions where users – teachers, students and parents as well as authorities – have been involved in different stages and to different extents. All cases show a benefit of these processes also for learning and well-being in general. This very rich and varied material was thoroughly discussed during the Colloquium. Bernhard Kogel with a long experience of school design and building in the Middle East offers illustrations and analysis of his approach and questions about involving users. Beatriz Fedrizzi discusses cases of school-yard and garden design together with user communities in Brazil.

Henry Sanoff presents an example of community participation from the United States in the design of new school classes and, later during the Colloquium, involved the participants in a workshop on “Relating educational objectives to learning spaces”.
Two important European pedagogical projects – from the Netherlands and Reggio Emilia in Italy – directly concerned with improving spatial layouts for teaching were presented by authors, Yolanda Steijns and Mitra Hedman, who have done their dissertations on these subjects. Enrico Sassi, who took part in the Colloquium from the newly established Università della Svizzera Italiana, gave a presentation on how the architectural design competition for the new University campus is being dealt with, in an already existing context of buildings.

Taken together, all these presentation make a strong case for the importance of quality of space for improving learning environments.

Yet, the dramatic reality of many developing countries and contexts where existence of and access to schools are still the main issues seemed at times, during the discussions, to sweep all quality issues under the carpet of quantitative needs.

The contradictory implications of these two divergent views or, as it appeared, educational concepts are far-reaching and point to the difficulties faced by politicians and decision-makers in the field of education nearly every day.

These choices become particularly difficult in any poor environment where very often not even the three basic ingredients first mentioned above are available to all learners, i.e. resources are very scarce and the average educator or administrator will frown upon notions of “enhanced architectural design” or “pleasant school environment”, where these notions imply additional cost. Therefore, in the typical developing environment, one design will usually be considered appropriate only if it can be reproduced on many, often very different, sites.

On the other hand, in the typically first-world environment, parents, communities and governments are very sensitive to the role of proper school design and place considerable value on high-quality educational architecture. Designs of schools are usually developed with the help of architectural competitions - where a number of architects may propose different designs for a given site, with the best proposal ultimately selected as a basis for the actual school construction.

Let us sum up by saying that the Colloquium did not bring about a clear-cut evidence that architecture of school-buildings is indeed a decisive factor in the educational process in all contexts. However, it was shown that where this has been a concern there is considerable evidence that involvement and learning is enhanced. This volume brings testimony to this view and it was decided by the participants to not only make the proceedings of the Colloquium available to a larger audience but to keep the debate alive through an internet forum where ongoing experiences and experiments may be related and further discussed (look at www.colloquia.ch). It is foreseen that the participants will meet again in 2008 to share their experiences “back in the field” and to draw up some more specific recommendations and conclusions on this anyhow important topic.
XII Architecture & Behaviour Colloquium at Monte Verità
Ascona, Lake Maggiore, Switzerland
March 30th – April 1st, 2006

List of participants:

Ahmad Al-Tashi, AED/Equip 1, Sana‘a, Yemen; raleigh@smtp.aed.org
Sabria Al-THAWR, AED/Equip 1, Sana‘a, Yemen; raleigh@smtp.aed.org
Didier Bosman, European Investment Bank, Luxembourg; d.bosman@eib.org
Beatriz Fedrizzi, University of Rio Grande, Porto Alegre, Brazil; beatrizfedrizzi@terra.com.br
Mitra Hedman, Oslo School of Architecture, Oslo, Norway; hedman_m@yahoo.co.uk
Mohamed Nabil Helmy, General Authority of Educational Buildings, Cairo, Egypt
Christopher Horn, archis gmbh, Karlsruhe, Germany
Eberhard Knapp, KfW-Bankengruppe, Frankfurt, Germany; eberhard.knapp@kfw.de
Bernhard Kogel, University of Würzburg, Würzburg, Germany; b.kogel@web.de
Ziyad Kollab, Ministry of Education + Higher Educ. Gaza, Palestine; feucivil@yahoo.com
Walter Kuoni, Lippsmieier Partner, architects, Nairobi, Kenya; lpkenya@africaonline.co.ke
Pirkko-Liisa LinTilä, Colloquia Sàrl, Lausanne, Switzerland; p-l.lintila@colloquia.ch
Osama Maghaydah, Governmental School Buildings, Amman, Jordania; omaghaydah@yahoo.com
Fawaz Mujahed, Ministry of Education + Higher Educ. Ramallah, Palestine; fawazmujahed@yahoo.com
Kaj Noschis, Swiss Federal Institute of Technology, Lausanne, Switzerland; kaj.noschis@epfl.ch
Celen Pasalar, North Carolina State University, United States; cpasalar@mindspring.com
Pascal Peter, Kocks Consultants, Koblenz, Germany; buth@kocks-ing.de
Ueli Salzmann, Swiss Development and Cooperation Agency, Bern, Switzerland; sa@atelier-gs.ch
Henry Sanoff, North Carolina State University, United States; hsanoff@bellsouth.net
Enrico Sassi, Università della Svizzera Italiana, Lugano, Switzerland; enrico.sassi@arch.unisi.ch
Susanne Schroth, KfW-Bankengruppe, Frankfurt, Germany; susanne.schroth@kfw.de
Horst Schöning, Billo + Shönig Architekten, Berlin, Germany; mail@billo-schoenig.de
Kirtee Shah, KSA Design & Planning Services, Ahmedabad, India; kirtee@ksadps.com
Hatem Zaghloul Attia Shalaby, Design Department, GAEB, Cairo, Egypt; hatemgaeb@gaeb.org
Nicole Simon, Cornell University, Ithaca, United States; nsimon@sljhs.org
Yolande Steijns, Technische Universiteit, Delft, Netherlands; y.p.m.steijns@bk.tudelft.nl
Hannah Von Ahlefeld, OECD, Paris, France; hannah.vonahlefeld@ocezd.org
Michael Wilson, World Bank, United States; mwilson6@worldbank.org
Stephan Wunderlich, European Investment Bank, Luxembourg; wunderli@eib.org