FORMULATING GUIDELINES TO DESIGN AND TO USE AND MANAGE EDUCATIONAL BUILDINGS IN INNOVATIVE WAYS: A CASE STUDY IN SAUDI ARABIA

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The central intention of this work is to show how the permanent interaction between architects and educators, from the design until the definition of the use and management of school buildings offers as a result new methods of work and more effective solutions in the fields of education and architecture.

The case study here presented refers to an Agreement between UNESCO and the Kingdom of Saudi Arabia focusing on the formulation of Manuals of Design, Maintenance, Use and Management, Physical Comfort and Furniture of Educational Buildings in the Kingdom of Saudi Arabia.

The Agreement indicates the objectives of the Project as follows:

- To enhance the capacity of the Deputy Ministry to prepare, design and implement school construction programmes.
- To provide the Ministry of Education with its national norms and standards for educational buildings and furniture to be applied throughout the Kingdom, for spaces conducive to appropriated learning.
- To develop the capacity of the Ministry of Education to formulate a mid term plan that will ultimately enable rented schools to be replaced with properly designed educational buildings.
- To establish a documentation centre specialised in educational buildings.

The specific output of these objectives is the production of technical Manuals: Design Guidelines and Space Norms, the Use and Management of educational buildings, the Physical Comfort, Maintenance and School furniture. This presentation will illustrate the Design Guidelines and the Use and Management Manuals, which are under preparation.

The Decennial Plan of the Ministry of Education (2004-2014) underlines that the principal aim of the Educational Reform undertaken in the Kingdom of Saudi Arabia is to establish a new relationship among teachers and students; among teachers and teachers, and particularly to renew the relationship among the students themselves. For this purpose, the Decennial Plan states the following objectives:

- Schooling of all the groups of age as from 6 years until the 18 years of age in the cycles of the general education.
- Developing the educational environment and modernising the school plan in an effort to meet the quantitative and qualitative changes which are expected in the near future.

These objectives require specific attention for designing new school buildings and they also demand a new concept of using and managing the present and future school buildings and learning spaces. “Therefore, ascertains The Decennial Plan of the Ministry of Education (2004-2014), new
School buildings will be needed to attend the increasing number of students. Special effort should be done to:

- Establish schools of reduced size: one teaching area multigrade teacher.
- Offer educational services to a larger number of students,
- Prepare new teachers
- Reduce the number of students per teacher. Albeit the proportion is acceptable, since there is a teacher by every 13 students, but when the differences between urban and rural areas are analysed, the disparity is elevated. “

It is interesting to explain that in Saudi Arabia, the Education System offers separated services for male and female, in accordance with the religious principles of the Islam. But this is not a hindrance to widen the approach to design, use and management of school buildings to any other educational system.

Basic principles

The implementation of these Manuals has as well a definite purpose and supports a theoretical thesis: Spaces educate and spaces are ductile when well designed, managed and used for a better education.

Therefore, the objectives of the Manuals are leading to:

- To improve the quality of education, providing educational buildings suited to regional and local needs.
- To introduce a new process of design.
- To have a better efficiency of the capital investment.
- To contribute to reduce the number of rented schools.

The manuals design process

The design process of the manuals followed five principal steps:

- An analysis of the requirements of the Kingdom Educational Programmes and of the community of parents, teachers, students, school managers and supervisors.
- A dialogue between architects and educators including the educational community. This dialogue was carried on with the use of a methodology created by Rodolfo Almeida in which a Matrix for planning and design was applied.
- From these two steps the result is the presentation of diverse alternatives of educational spaces (type, number, utilisation, responding to local situations).
- The next step is the preparation of tables for all spaces needed in new school buildings according to the type, number and area.
- The fifth step consists in the preparation of architect’s brief by specific location, site, climatic conditions.
Finally, the preparation of specific architectural design at regional and local levels.

This process concerns four aspects linking architecture and education which are to be treated in the respective manuals:


The content of this document is a sample of the Design Guidelines and the Use and Management Manuals prepared for the KSA Ministry of Education in May 2005.

The concepts supporting this Project

The central concept of this Project is that spaces “educate” and therefore the school building is to be considered as an educational space as a whole.

Each school is a complex organisation; the design and building as well as the management and use of it have to consider the social, economic, cultural circumstances to define new possibilities and new ways to act and interact internally and with the rest of the surrounding society. This phenomenon must be taken into account to establish the basic principles for the preparation of the new proposals put forward in the Manuals:

- “Architecture improves quality of education, and architecture also educates”.
- The incorporation of a new vision of the school building as a whole (as one “house” for all students and all teachers).
- The use of a new flexible tool to define the required number and type of educational spaces (the “Almeida methodology”).
- The participation of educators, architects and community to define their requirements.
- The introduction of a new method for the use and management of the school as a whole.

A very important issue in this proposal refers to the fact that the applications of the mentioned principles do not change the Educational Programmes (same subjects, same number of hours, of students and teachers per school). The proposal rather offers the possibility of giving a new meaning and greater force to the programmatic contents as well as a better efficiency to the use of the spaces of a school building.

Therefore the proposals presented in this document are samples with real flexibility of application which call for a permanent dialogue among architects, educators, authorities and community.

In the development of the Project, an epistemological approach of theory systems affecting educational decisions was considered:

- If education is accepted as a closed controlled system, then all resolutions and activities are taken as in a bi-univocal relationship “cause-effect”.
- On the other hand, if education is considered as an unstable system, all decisions and actions must be analysed with a holistic vision as a complex reality disturbed by external factors. These epistemic oppositions have thorough implications on the sequential results related to the future of education and, therefore to school buildings design, use and management.
A short clarification of this analysis may be useful:

If we take in account that:

- A system is a series of functions or activities ... within an organisation that work together for the aim of the organisation. The mechanical and electrical parts that work to make an automobile or a vacuum form a system. The schools of a city, including public and private schools, parochial schools, trade schools and universities provide an example of components that ought to work together as a system for education.

- There is in almost any system interdependence between the components thereof, as a principle it is important to accept that the greater the interdependence between components is, the greater the need for communication and cooperation between them.

- The components do not need all to be clearly defined and documented: people may merely do what needs to be done. All the people that work within a system can contribute to improvement, and thus enhance their joy in work. Management of a system therefore requires the knowledge of the inter-relationships between all of the components within the system and of the people that work in it.

- The aim of a system must be clear to everyone in the system: if there is no aim, there is no system.

Then, in an analogy with relativistic quantum mechanics we may argue that education as a system may be managed under two main models:

- As a linear model accepted as constant system where all relations are bi-univocal cause-effect results: Teachers teach, then students must learn; lessons are taught then students must know; students learn, then students must pass their exams; managers order, then students and teachers must obey; rules are published, then they must be observed.

- As an unstable complex model, where effects are multi cause results and where complexity demands simple solutions which are always affected by external disturbances not always easy to identify or control.

A summary of some characteristics of both systems may appear like this:

<table>
<thead>
<tr>
<th>CLOSED CONTROLLED SYSTEM</th>
<th>DISSIPATIVE SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hierarchic articulation.</td>
<td>Systemic organisation.</td>
</tr>
<tr>
<td>Indivisible authority.</td>
<td>Shared authority.</td>
</tr>
<tr>
<td>Individually assigned functions.</td>
<td>Functions distributed in group.</td>
</tr>
<tr>
<td>All definitions taken by authority.</td>
<td>Provisional collective definitions.</td>
</tr>
<tr>
<td>Management based on control.</td>
<td>Prospective participative management.</td>
</tr>
<tr>
<td>Distinctive external assessment</td>
<td>Self evaluation and assessment.</td>
</tr>
<tr>
<td>Little external interaction.</td>
<td>External Interaction</td>
</tr>
<tr>
<td>Behaviour totally previewed and regulated by the authority.</td>
<td>Behaviour defined and controlled by group on site.</td>
</tr>
<tr>
<td>Centrally predefined conditions and answers to non historic problems.</td>
<td>Performance assessed by results, participative definitions.</td>
</tr>
<tr>
<td>Obedience to tradition rather than response to</td>
<td>Tradition as a reference: prospective local</td>
</tr>
</tbody>
</table>
real circumstances.
∞ Prevalence of individual work.
∞ Order and respect: the order, the discipline and the control.
∞ Analytical vision: sectored activity and reaction.
∞ Fragmented attention of reality and of problems: *immediacies* for episodic solutions.
∞ Linear relationship cause-effect: direct isolated solutions.
∞ Urgent rather than substantial attention to problems
∞ Quantitative response to problems.

vision as a guide.
∞ Corporative work.
∞ Permanent search for answers. Self-regulation
∞ Holistic vision; trans-discipline pro-activity and response.
∞ Acceptance of the complexity of the problems: everything has an effect on every thing
∞ Search of simple solutions for complex problems.
∞ Long term vision to solve important problems.
∞ Conceptual and qualitative articulation of problems.

**Application of Almeida’s methodology**

The architectural programming of educational spaces has a primary and vital importance nowadays due to the different factors that are affecting the conception and design of educational buildings: new pedagogical requirements, educational innovations, a more active participation of students, the impact of new technologies of information are changing spaces and generating new ones and new relationships.

**Figure 1. A general view of the Almeida Matrix**

The following section of this document presents some succinct application of this theoretical approach using the methodological instrument developed by Rodolfo Almeida intended to plan and prepare the architectural programme of educational spaces with direct participation of architects, educators, and the local community.

The “Almeida” methodology helps to stimulate the necessary dialogue between educators and architects in the definition of the pedagogical and local needs where the educational building will be located. The methodology is a tool, a simple one, to rapidly permit the analysis of different approaches to educational spaces and to facilitate the most adequate solution and the definition of the list of spaces to be provided.

Two examples of the methodology are presented in the following to tables for an Intermediate school of 540 students (18 classes of 30 students). It is important to signal that these are only examples of how the methodology can be used as a dialogue tool, and that different solutions can come out of the dialogue among educators/architects/community.
Both examples correspond to an Intermediate school with 540 students, with 6 classes per grade, with 30 students per class. The school is open 36 hours per week.

**Figure 2. Matrix showing “Controlled Closed System” example for an Intermediate School for 540 students, 6 classes per grade**

This matrix illustrates a “Controlled Closed System” example, favouring the use of classrooms (see the circles in the matrix); teaching activities are usually privileged in the classroom, and most of the school areas are left “unused”: 63% of the learning hours of the three groups per week. A model like this one centres the learning activities in teachers’ lectures, thus not favouring the implementation of new methods or new learning strategies.

**Figure 3. Matrix showing “Dissipative System” example for an Intermediate School for 540 students, 6 classes per grade**
The second Matrix shows a “Dissipative System” example favouring a more active and dynamic participation of teachers and students using the building as a whole (see the small circles in the matrix), working by groups, half groups, individual work, making more use of information technologies. The educational spaces are diversified and new methods or learning strategies may be easily applied for a better use of all school areas and spaces.

The findings of the analysis for “Closed” and “Dissipative” Systems show that the total built covered area is relatively the same: both come to a total of 3,000 m² and the average area of student is 5.50 m² for both, the “controlled” and the “dissipative” systems functional relationships schemes are provided.

Furthermore, for each system, alternative uses and distribution of the 18 classes or groups, are provided in their corresponding educational spaces (“Controlled” system: 20 spaces; “Dissipative” system: 22 spaces).

It should be noted that the “Dissipative” System responds better to the new requirements of education, new teaching methods, the use of ICT and consequently to a modern management of the school seen as a “whole house”.

The original document also makes proposals of space norms and of different uses of the main educational spaces.

Figure 4. List of Educational Spaces: Intermediate Education. Example: “Controlled” Closed System 540 students with 6 classes per grade,

<table>
<thead>
<tr>
<th>Type of Space</th>
<th>Number</th>
<th>Utilization Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td>11</td>
<td>100</td>
</tr>
<tr>
<td>Laboratory</td>
<td>1</td>
<td>86</td>
</tr>
<tr>
<td>Workshop</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>Computer Lab</td>
<td>1</td>
<td>51</td>
</tr>
<tr>
<td>Library/Media Centre</td>
<td>1</td>
<td>86</td>
</tr>
<tr>
<td>Language Lab.</td>
<td>3</td>
<td>86</td>
</tr>
<tr>
<td>Multipurpose Hall</td>
<td>1</td>
<td>51</td>
</tr>
<tr>
<td>External Shaded Spaces</td>
<td>1</td>
<td>17</td>
</tr>
</tbody>
</table>

Demand: 18 classes require 612 weekly hours
Offer: the Building with its 20 educational spaces offers: 700 weekly hours
The Building offers: 30 educational spaces for 27 classes.

Figure 5. List of Educational Spaces: Intermediate Education. Example: “Dissipative” System 540 students with 6 classes per grade, Number of students per class: 30.

<table>
<thead>
<tr>
<th>Type of Space</th>
<th>Number</th>
<th>Utilization Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td>3</td>
<td>74</td>
</tr>
<tr>
<td>Laboratory</td>
<td>2</td>
<td>77</td>
</tr>
<tr>
<td>Workshop</td>
<td>1</td>
<td>69</td>
</tr>
<tr>
<td>Computer Lab</td>
<td>2</td>
<td>86</td>
</tr>
<tr>
<td>Library/Media Centre</td>
<td>6</td>
<td>93</td>
</tr>
<tr>
<td>Language Lab.</td>
<td>3</td>
<td>90</td>
</tr>
<tr>
<td>Multipurpose Hall</td>
<td>2</td>
<td>63</td>
</tr>
<tr>
<td>External Shaded Spaces</td>
<td>2</td>
<td>86</td>
</tr>
<tr>
<td>Outdoor Space</td>
<td>1</td>
<td>34</td>
</tr>
</tbody>
</table>

Total: 22

Demand: 18 classes require 612 weekly hours
Offer: the Building with its 20 educational spaces offers: 700 weekly hours
The Building offers: 30 educational spaces for 27 classes.

The proposed sketches are based on the principle of multi-functional and flexible use of space, facilitated by the same furniture (double desk and individual chair) for all spaces; the directors and teachers will find in this proposal new schools to be designed and built to fulfil their local requirements in a very flexibly way.

The concept of one classroom assigned to one class is no longer applicable with this philosophy. The new vision is to see the school building as a whole and to use more efficiently each available space.
The possibilities of introducing some didactic changes thanks to the consideration of the “school as a whole” even with a “Controlled Closed” System without destroying the existing buildings is one of the many good results of the application of the Almeida’s methodology.

Certainly, a new comprehension of the important role of architecture in education is required.

Another illustration of the same type of intermediate school may help to understand the suggested changes:

The classroom activity is privileged and in some cases classes or groups are divided.

Many school spaces are seldom used for learning activities, thus becoming a waste of space.

On the other hand, if the “Dissipative” System concept is applied, a new distribution of the learning activities demand diversification of spaces and a better use of the same school building.
The Design and Use Manuals are conceived as tools and practical guides for architects, engineers, school supervisors, school managers, teachers and students. At central, regional or local level, the working teams (the educational community and architects) can rapidly and easily prepare the architect’s brief using the Almeida methodology, according to the local needs, climatic, site conditions, and number of students and teaching staff. With this information in hand, the project team can then proceed to elaborate the architectural design using the sketches and examples to be included in the Manuals; the sketches will also provide guidelines for the use and management of the school as a whole.

Schools are micro organisations of society and cannot be designed, regulated, managed or used with universal laws; they are cultural instruments and therefore they are tightly dependant to the scientific meaning and intentions of the people living, studying, teaching in them or managing, supervising them or even more deciding over their existence.

The principles guiding the school organisation represent the way the actors define, understand and manage their own world. There is no a unique organisation of schools but a diversified individual perception of reality: schools are a complex organisation and the management and use of school buildings have to consider the social, economic, cultural circumstances to define new possibilities and new ways to act internally and with the rest of surrounding society.

Modern trends in education recognise the importance of social planning of schools since they admit that schools are to serve society and not viceversa. Spaces are the environment of the human being, but humans are able to modify their surrounding in order to make it more livable, more comfortable and more useful for their needs. The spaces thus modified by humans represent an ideal of living, an ideal of being, an ideal of developing to become more human. This is one of the reasons of recognising spaces as educational tools: it is in those spaces designed or selected by men where the human beings we are becoming day after day take place.

The same is true for the specific spaces planned, designed and used to educate our children and youngsters:

∞ It should be a peculiarity of the school buildings to reflect and manifest the ideal of human being we plan to be and we expect our children to become.
The school building as a whole manifests our values, our expectations, and our way to be humans: free or slaves; submitted or sovereign, controlled or innovative; happy or anguished.

Because the environment limits or expands the educational methods, the didactic procedures and all the possible relationship of teachers and students:

The arrangement of furniture, the distribution of learning spaces, the design of the building itself with its colours, its ornaments, its open or closed spaces, with facilities for exchanging affection, knowledge, ideas, ideals in a ludic way is very important to achieve quality of education while having a real quality of life.

Note. The original presentation made in Tel-Chac included photographs of new architectural designs in different countries, illustrating how the above mentioned concepts are being implemented; it also included photographs of Design Manuals in different countries where both authors have been involved.
## APPENDIX A
### BASIC CHARACTERISTICS OF SOME DIDACTIC STYLES

<table>
<thead>
<tr>
<th>DIMENSIONS</th>
<th>TRADICIONAL DIDACTIC STYLE</th>
<th>TECHNOLOGIC DIDACTIC STYLE</th>
<th>SPONTANEOUS DIDACTIC STYLE</th>
<th>EDUCATIONAL DEVELOPMENT STYLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why to teach</td>
<td>To provide the fundamental information of the current culture. Obsession for the contents</td>
<td>To provide a modern and effective formation. Obsession for teachers’ objectives following a detailed programming.</td>
<td>To educate the pupil imbuing in him the immediate reality. Importance of the ideological factor.</td>
<td>Progressive enrichment of the knowledge of the student and of the teacher towards more complex models of understanding the world and of acting in it. Importance of the educational option involved: long-life education.</td>
</tr>
<tr>
<td>What to teach</td>
<td>Synthesis of curricular content data. Text books become the only source of learning. Predominance of information on concepts to be memorised. Importance given to learning how to pass exams.</td>
<td>Updated data of curricular content data adding some knowledge references out of curriculum. Absolute reliance on texts prepared by “experts” to be used by the teachers. Importance of the conceptual aspects with little relevance of learning of skills.</td>
<td>Learning contents of the curriculum connected with the surrounding reality, often without systematic configuration. Special importance given to the learning of skills and attitudes.</td>
<td>Learning &quot;School&quot; proposals integrate diverse sources of information (scientific knowledge; daily life, social and environmental problems, knowledge created by trans-disciplinary-academic areas: chemistry + biology + physics + mathematics + ethics). The tactic to learning is progressive and “inter-subjectively” (collectively) constructed.</td>
</tr>
<tr>
<td>What to do with the ideas and interests of the students</td>
<td>Neither the interests nor the ideas of the students are important to be paid attention. What they have to learn is decided by “those who know”.</td>
<td>The interests of the students are not taken in consideration. Sometimes the ideas of the students are allowed considering them to be « errors » that it is necessary to replace with the suitable knowledge.</td>
<td>The immediate interests of the students are usually responded. The ideas of the students are Sometimes regarded and taken as an issue for reflection.</td>
<td>The interests and the ideas of the students are considered of great importance in order to increase knowledge or to construct it: interests and ideas become a new source of information or research.</td>
</tr>
<tr>
<td>How to teach</td>
<td>Methodology based on the transmission of the teacher. Activities focused on the exposition of the teacher, with the support of the contents of textbooks and replication exercises. The role of the student consists of attentively listening.</td>
<td>Methodology linked to the methods of the curricular subject or sciences. Activities that combine the teacher’s exposition and practices, frequently in the shape of sequence of guided discovery (and in occasions of spontaneous discovery).</td>
<td>Methodology based on the « spontaneous discovery» of new ideas or hypothesis by the student. Achievement on part of the student of multiple activities (frequently in groups) of open and flexible character. The student has a central role in learning and becomes the protagonist who fulfils great diversity</td>
<td>Methodology based on the idea of helping the student to learn how to investigate and organise his thoughts. School learning proposals focused on problems, with a sequence of activities related to the treatment and solution of such problems. Active role of the student as constructor (and re-constructor) of his knowledge: never alone,</td>
</tr>
</tbody>
</table>

OECD/PEB  
Evaluating Quality in Educational Facilities 2005
"of" "studying" and of reproducing in the examinations the transmitted contents. The role of the teacher consists of explaining the topics determined by the curriculum and of warranting order and discipline in the class. of activities). The role of the teacher is not to be the manager; he coordinates the general dynamics of the class as a social and affective leader. always with interaction with other people. Active role of the teacher like coordinator of the processes and as “education researcher.”

<table>
<thead>
<tr>
<th>Where to teach</th>
<th>In the classroom or in specialised laboratory.</th>
<th>In the classroom or in specialised laboratory. Some activities may occasionally occupy a different space, but always without making clamor.</th>
<th>From time to time in the classroom, but frequently in some other places according to the episode detonated by spontaneous subjects derived from the curriculum.</th>
<th>Diversification on the use of learning spaces. Occasionally in the classroom. Not all students doing the same things at the same time requires flexibility in the using of spaces.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment and evaluation</td>
<td>Concentrated in &quot;remembering&quot; the transmitted contents. Fixed attention to control the learning product. Accomplished by means of examinations.</td>
<td>Focused on the detailed and “objective” measurement of what the students learned. Importance given to the learning product, but occasionally worried on measuring some processes for instance: initial and final test). Carried out by means of tests and specific exercises.</td>
<td>Focused to registering the development of skills and partly, of the attitudes of the students. It pays attention to the learning process, though not systematically. It is carried out by means of the direct observation and the analysis of students' works (especially of groups of students).</td>
<td>Emphasis given, simultaneously, to the pursuit of the evolution of the knowledge of the students, to the performance of the teacher and to the development of the learning project. Systematical alertness to the processes of research and to the hypotheses of work. Formulation of new problems from the conclusions that are obtained. Evaluation by means of diversity of instruments of detection (productions of the pupils, logbook of investigation, diary of the teacher, diverse remarks ...).</td>
</tr>
<tr>
<td>Social participation</td>
<td>Non-existing. Only &quot;school notes&quot; or &quot;reports&quot; are sent to parents or tutors. &quot;Bad students&quot; are excluded from school.</td>
<td>Non-existing. In addition to school notes and reports, statistical comparative information is sent to education authorities and parents or tutors. The school “grants” new opportunities to failing students to repeat courses or examinations.</td>
<td>The parents or tutors are summoned by the school to announce the school notes and the educational situation of the students and of the school. The school (through managers, teachers, and counsellors) listens individually to the problems of the parents with regard to their children and, if possible, it cooperates in the solution.</td>
<td>The school assumes to collaborate in the community project. Therefore it establishes a permanent contact with parents, tutors and other educational agents. The school publishes and strives to impel students, teachers, parents and managers, to attain social and learning performances expected by society and it invites all to assume them as shared commitment.</td>
</tr>
</tbody>
</table>
APPENDIX B
EXAMPLES OF DIVERSE DISTRIBUTION ARRANGEMENTS IN CLASSROOMS

Examples of learning

Dialog learning. Students are distributed into three similar groups; a different item may be discussed by every group; learning activities: theme discussion, demonstration, oral communication, taking notes, brain storm, science, history or geography themes.

Binary learning: Students are distributed by pairs: one or several subjects or items to be studied; learning activities: research, writing essays, art, problem solving, mathematics, science.

Laboratories. Examples of diverse distribution arrangements

Experience analysis. Students systematise experiences, explaining what they have perceived; teacher provokes students to question their perceptions; outdoor shaded spaces becomes useful for discussions;

Learning activities. Observation accuracy; reinforcement of group ties; respect of diversity of opinions and perceptions; comparison and analogies in several processes.