A PKAL Roundtable: Facilities of the Future

Cranbrook Institute, March 21-23, 2003

Respectfully Submitted by :
Terry Sargent, AIA,
Howard Wertheimer, AIA
Jeffrey L. Schantz, AIA

"What will the spaces and structures for undergraduate science (STEM) look like in ten years, and what are your reasons for making such predictions?"

When pondering the posed question, the following quotation comes to mind, "*Prediction is very difficult, especially about the future.*" Niels Bohr (1885 - 1962)

Introduction

While we cannot predict the future, we can prepare for the future by designing science buildings that are flexible, incrementally adaptable and socially aware. Science buildings of the future will function as the "home base" of scientific information, designed to leverage the "best practices" of teaching, the latest technologies for learning with sensitivity toward student and faculty environments.

To keep pace with continually changing needs, we must create buildings that support the "science of change." A "science of change" building incorporates the following concepts.

Flexibility

Constructing science buildings is expensive. It boasts the highest cost per square foot on campus. Determining the optimal design is paramount. The opportunity to design a science building from the ground up occurs infrequently, once every 50 to 100 years on smaller college campuses. The resulting building must support today's needs and adapt to tomorrow's requirements.

"Science of change" buildings support the needs of the unpredictable future because flexibility is built into the project. A flexible design offers:

- Multiple science disciplines sharing the same building.
- Building thematic interest groupings versus isolating traditional disciplines.
- Universal space that can be configured for teaching, research, or office functions.
- Utilities (water, gas, electricity, and ventilation) accessible anywhere within the universal space.
- Technology available anywhere within the building.
- Supports of ever-advancing informatics capacities.

Recruiting faculty often means offering the right space to that right person. A flexible design makes negotiating office and research areas easier because changes to functional capabilities within a universal space are possible, cost effective, and non-disruptive.

Flexibility facilitates a tailored design initially, but what happens when things change? New building designs must handle new functions more efficiently and cost effectively than traditional structures.

Incremental Adaptability

"Science of change" buildings easily adapt to any functional arrangement. As changes become necessary, universal space can be modified to serve any function: classrooms become research areas; offices become classrooms; or support areas become offices, etc. The building is able to incrementally (and economically) adapt to enhanced teaching methods as the study of biology, physics, chemistry, and computer science advances. The advancing trend of cross-discipline research, such as biophysics or molecular engineering, will force continued re-arrangement of space.

These incremental changes can occur quickly (over a summer) and without disruption to the entire building. Because utilities are readily available via the utility shaft within the universal space, a teaching or research area can be transformed to meet new operational requirements.

An adaptable "science of change" building has:

- utilities accessible to all universal work areas;
- utilities that can be turned on or off quickly, based on the function of the area, without impacting other work areas;
- the ability to modify a room's function without disrupting the entire building;
- adjustable space via "moveable" walls and furniture allowing classrooms and research areas to expand and contract; and
- the capacity to support trends in cross-discipline studies.

Often, these economical changes only involve moving studs, installing drywall and applying paint or issuing a maintenance work order to change utilities.

Building modifications keep pace with the school's changing needs. The design allows fixed structures, such exterior walls and utility shafts, to remain unaltered during renovation, driving down the cost of change. The users will determine the function of their environment.

Social Awareness

While digital alternatives to classroom learning are available, research has shown that the most productive students and faculty work in hands-on, collaborative environments that foster informal communication and frequent interaction. *("SCALEUP," Robert J. Beichner, North Carolina State)* This environment, supportive of collaborative interaction, is essential to developing life-long learners.

People work and learn better in a pleasant and inviting environment. Generous personal space and natural light lead to more productive, efficient students and faculty. Science buildings of the future will offer gathering spaces for collegial interaction. Both large public gathering spaces for socializing and smaller private meeting rooms for group discussions will drive informal communication. *("Space, Science, and Architecture," Thomas Cherubini Celli,CelliFlynnBrennan, 2002.)* This informal, face-to-face environment,enhances student-faculty relationships, thereby enhancing the overall learning experience.

A "science of change" building responds to social and cultural tendencies by providing:

- Access to natural light. The more time faculty or students spend in a work area, the more critical natural light is to morale.
- Communal spaces for student/faculty gathering increase the perception of increased personal space.
- Informal meeting places such as offices, conference rooms and hallway space promote informal communication.
- Universal space promotes new methods of teaching by supporting highly collaborative, hands-on, computer-rich, interactive learning environments. *(Beichner)*

College and universities are marketing to increasingly sophisticated students. This population demands the latest technology. Prospective students, touring campuses with their parents, increasingly cite technologically advanced classrooms and aesthetically pleasing communal spaces as criteria in their school selection. *(Celli)*

A Model of a Science of Change Building

To assist visualizing the "science of change" building, three distinct views are provided: three-dimension, cross-section and "top-down".

Figure 1 supplies a three-dimensional model of the ground floor. To understand the color-coding of the model, the following table details the associated building component with the anticipated years before modification.

Color Code	Building Component	Anticipated Years before Modification
	Exterior walls and support structures	100 years
Green	Communal spaces	100 years
Red	"Fixed" structures - utility shafts, elevators	25 years
Blue	Universal space – interior walls	5 years
Olive	Lab benches, casework, and furniture	5 years

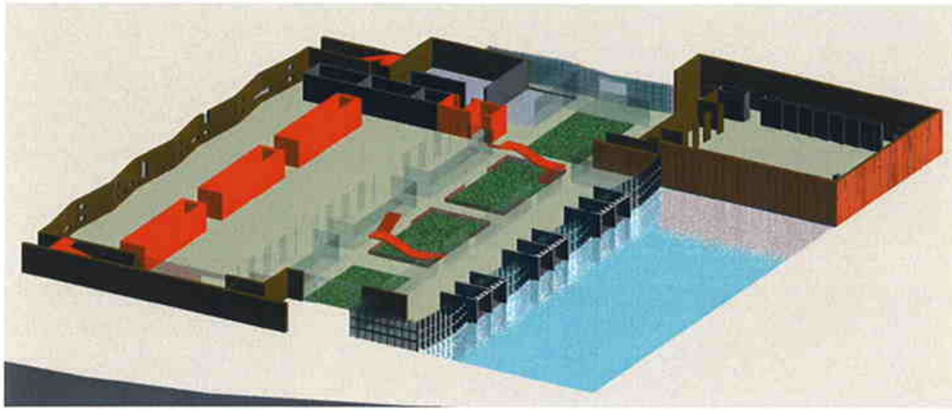


Figure 2 details a vertical cross-section of the building identifying the 100-year support structures and the "fixed" utility shaft. The figure depicts how utilities are delivered to each of the universal spaces. Access to the utility shaft occurs on each floor and in each functional area to accelerate the delivery of utilities with minimal disruption.

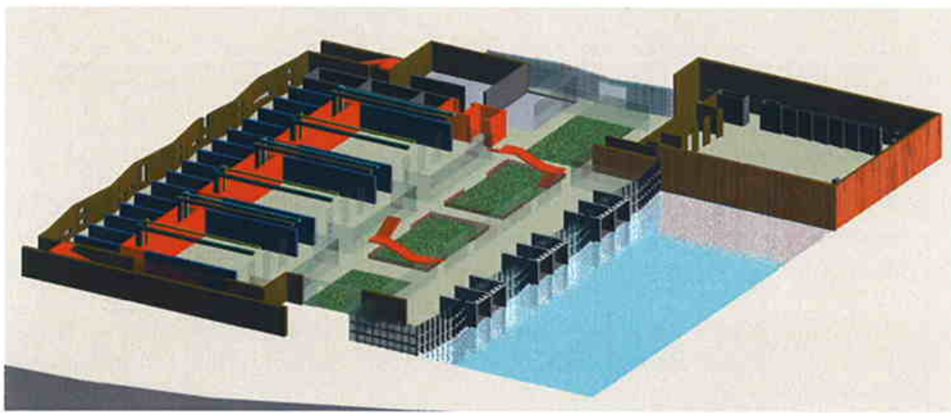
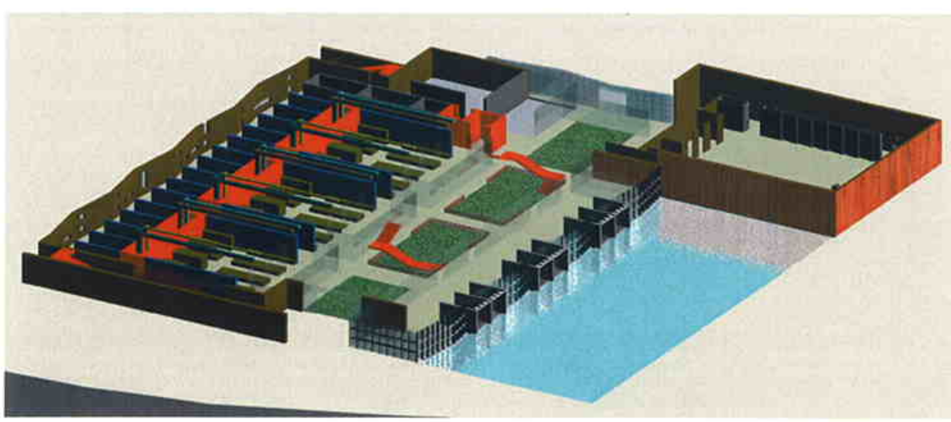


Figure 3 presents a top-down view of a typical science building floor plan. This floor plan provides a representative design of lab space, meeting areas, faculty offices, and support space. Because the interior walls are "moveable," the universal space can be designed to fit any functional requirement.



Conclusion

Designing a "science of change" building that will function well into the 22^{nd} century presupposes the following characteristics.

1. Building an exterior structure to last 100 years without modification.

2. Fabricating "moveable" walls and furniture to keep pace with advances in science, teaching and technology.

3. Providing utilities such as electricity, gas, water and ventilation, to all working areas of the structure even if the function of the area changes.

4. Promoting cross-disciplinary collaboration with multi-disciplinary spaces and communal areas.

5. Creating a pleasant environment with informatics technology to attract and retain faculty and increasingly sophisticated students.

College and university planners can be certain that future students and faculty will absolutely need: a roof over their heads, air, water, and warmth. Beyond that, college and university planners can only imagine. But they have the power to plan for the unknown. A plan for the spaces and structures of undergraduate science buildings of the future must be flexible, incrementally adaptable, and socially aware to take advantage of all the future promises.