Understanding Key Questions

Jeanne L. Narum, Principal
Learning Spaces Collaboratory

Given what has been learned in recent years about shaping new spaces for undergraduate STEM communities and recognizing new challenges and opportunities facing 21st century students and society— including advances in science and technology, what questions should prospective clients be asking you— what are the critical "questions for the future?"

This question was asked in 2005 of architects connected to the work of Project Kaleidoscope as a means to capitalize on lessons learned from experiences with recent facilities projects serving undergraduate learners in STEM fields.

After more than a decade of significant activity in imagining, planning, constructing, and using new spaces for natural science communities on our nation's campuses, it seemed prudent to step back, to ask if old questions are still relevant and what new questions are emerging. It seemed equally important to begin to gather thoughts of architects and other reflective practitioners from the design professional world about questions for the future.

The process for what is called "The Boston Conversation" was in two parts: first inviting and reviewing questions from the community; and second hosting an afternoon discussion with a small group of PKAL colleagues in Boston.

I. Responses

Interdisciplinary & Virtual— Questions for the Future

- How can we build flexibility into the design of our labs for teaching/learning/research, to ensure their long-term viability for the increasingly interdisciplinary nature of how science is practiced?
- Will the science of the future be learned in virtual or physical spaces, or in some combination? What are the alternatives to four walls, bench-casework, and fume hoods?
- As more programs become more interdisciplinary, how can we avoid program-specific spaces that end up sitting idle for many hours of the day?
- Where do we strike the balance between designing custom laboratories for a specific researcher or designing classrooms for specific pedagogies on our campus today, while reducing future costs in time and energy to accommodate new people, new research, new pedagogies, new technologies (renovations)?
- What are the best physical and cultural examples of truly interdisciplinary interactions that promote breakthroughs in collaboration, learning, and discovery? How can we integrate elements of those examples into our culture and buildings?
- What are the new visualization technologies that are transforming how science is practiced that will be used in how science is learned— interactive, computer-based animations, etc., equipping students and teachings to see and understand complex science concepts?

Sustainable & Versatile— Questions for the Future

- Our last science building was designed thirty years ago, and is no longer functional. How can we think broadly enough to ensure that the spaces we are now planning will meet our vision for at least the next thirty years? What can we do so that our colleagues thirty years from now look with pleasure on the spaces we are now designing?
- How will simulations and virtual testing affect the design of future spaces for learning, teaching, and research in STEM fields?
- With the rising costs of energy, and with the energy demands of a new science building (the most complicated and expensive to operate on a campus), how do we build into systems and structures means to maintain and operate efficiently over the long-term?
- We know what works for us now, for the faculty and the students we have today, and recognize the immediate need for space for our growing undergraduate research program. How do we define the kind of flexibility we will be needing in ten, twenty, fifty years; how do we figure out the trade-offs in regard to cost; how do we get community buy-in such a long-view on our planning?

- What is the one design factor that will allow us to do better science ten years from now?
- How can we take the high cost of science facilities/ science education out of the question?
- Value engineering can diminish the project. What are some examples of value engineering activities that you hope to avoid in the future? What are some examples of value engineering that have not moved the project away from its original vision; how were they accomplished?
- We are concerned about environmental stewardship. How can you help us optimize the design and size so to be best stewards of resources?
- Where should we look–outside the traditional undergraduate setting–for environments that can help expand our concept of how human behaviors are served by physical spaces, and thus help us achieve our institutional goals? How can we determine the cultural, technological, and design benchmarks that are meaningful in the lives of our students, and how can we plan so our buildings exceed the expectations signaled by those benchmarks?
- How can we best accommodate the large enrollment courses that we need to have?

Distinction— Questions for the Future

- How can this project help enhance institutional distinction?
- Given that most of our students are not science majors, yet that we are seeking new and more creative ways to engage them in the study of science, is the style of the traditional science lab appropriate for these students? Should we step back and rethink the nature of the physical setting and the requirements for the spaces in which non-majors experience and learn science? How should or could such spaces be designed to evolve as research on learning continues to inform how we shape our programs?
- Is it possible to integrate a sustainability initiative into the process of planning that will help us attract new faculty, new students, new dollars, and at the same time help us save money over the long-term?
- How can a new facility on our campus be a great place for learning science (STEM), but also be in its own physical structure a tangible demonstration of scientific principles, a laboratory for learning, so that students can learn from the building itself?
- We anticipate great difficulty in securing funds needed for building new or undertaking a major renovation. What can we do with limited funds and existing spaces to make a difference now in the quality of student learning, to give today's students opportunity to become part of the 21st century STEM community?

II. The Boston Conversation

This two-hour conversation began with some PKAL history, our persisting attention to getting the questions right at each stage in the process of change, and to keep pushing the edge of what we are comfortable with.

Understanding buildings tell stories, the goal is that, thirty years from now, today's spaces will speak of a community focused on learning and on the future. Small group discussions about specific issues then followed, with a final reporting-out session.

A most interesting new question emerged from one small group: *is the lab ready to explode?*

This group argued that labs being built today are much like those of twenty years ago— in terms of equipment used, curriculum served, budgets required, class size, departmental ownership, etc. From the discussion, it was suggested that the lab will soon become many different things:

- a student-directed studio
- a place for lab/classroom gaming
- a venue for new connections to the humanities and the arts
- a point from which to connect to collaborations within and beyond the campus.

The question "what will learning and teaching be like in the future?" and the question about the long-term efficacy of space were answered by considering the transforming nature of emerging technologies. Here are some of their answers.

It will be:

- a model for how students will be living and working, how we will want them to be living and working
- one that enables synchronous learning and teaching across the globe, 24/7
- a just-in-time remote (virtual) laboratory that provides access to some off-site instrumentation, rather than fitting all equipment into every science building; through webcam, students and faculty will be able to see and control devices remotely
- one that allows the creation of simulations of things very small and very large
- one in which students learn better as faculty understand how to use technologies to serve different styles of student learning.

Some benefits of the remote lab were suggested:

- reduced need for every campus to have every piece of sophisticated, expensive equipment
- promotes 24/7 use of high-cost spaces/equipment— a "serial reusable lab"
- students have the ability to build something complex, using state-of-the-art instrumentation.

Everyone present at the Boston Conversation knew of cutting-edge places and programs that should be examined to determine *what works* and how, for which students and faculty. We all committed to continuing this conversation. ■