SHAPING *STEM* LEARNING SPACES: CRITICAL FIRST QUESTIONS

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The process of planning new spaces for science, either new or renovated, is complex and time-consuming. The importance of identifying and addressing the right questions, in a timely manner, has been one of the major lessons learned over PKAL's fifteen years of focusing on what works in planning spaces for undergraduate STEM learning communities. From the beginning we have emphasized that 'building community' is both the process and the outcome of a successful planning effort, understanding that the communal wrestling with key questions is essential, if the process is to achieve that outcome.

Then and now, however, we have realized the importance of revisiting and reshaping questions in ways that reflect the changing context, the new challenges and opportunities on the horizon. We are also recognizing the growing number of peer organizations and forward-thinking individuals, departments, and institutions beginning to grapple with new kinds of questions about the relationship between the quality of space and the quality of learning. The opportunity to begin to capture some of the cutting-edge theories and practices evidence in their work is exciting.

The questions below are excerpted from a discussion sparked by the question, "what kind of renovations might serve programmatic goals to promote creativity, to promote entrepreneurial skills of students?" There will be more coming from this seminar, but these initial questions can serve as an updated roadmap for campuses at any stage of the planning journey.

This seminar, in conjunction with the National Collegiate Inventors & Innovators Alliance (NCIAA) and co-sponsored by Herman Miller, was part of a series of PKAL activities focusing on the relationship of space and learning.

These questions and insights are being incorporated into planning for upcoming PKAL activities relating to planning facilities for undergraduate learners.

The seminar was held in April 2009.

I. Questions

Questions about Learners & Learning:

- What are your measures of successful learning? Do they include engaged learners, flexible and adaptable learners, life-long learners?
- What are the learning outcomes (artifacts) that provide evidence of successful learning?

Questions about Auditing Current Spaces:

- What are your measures of a successful space for learning: what works? What evidence do you have that spaces work, or do not?
- How is a vision of undergraduate research/discovery-based learning reflected in your current spaces?
- Do your spaces foster creative, innovative, self-directed learning?
- Do your spaces enable and enhance engaged learning and pedagogical practices based on research on how people learn?
- Do your spaces accommodate the need for solitude and reflection as well as 'Brownian' motion?
- Do your spaces foster collaborations between disciplines, between practitioners, between naïve and expert learners?

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- How would you answer the question 'why should people be in a particular space?'
- In what ways can your spaces change behavior, enable desired behavior?
- What kind of learners work best in your spaces? What kind of learning is impeded by your spaces?
- What would you like to change about your space? Why?
- Where are the spaces that have 'failed' as venues for learning? What lessons learned have been learned from those failures?
- Who is empowered to make changes in your spaces?
- What is your most valuable learning 'real estate' on your campus? Are you taking best advantage of it? If so, how?

Questions Relevant to Renovation:

- What would elevate an existing space to become a 'brain-changing' space?
- What changes would be needed in an existing space to improve social conditions for the learning community?
- What technologies need to be incorporated into these spaces to foster learning and innovation, building new kinds of on-site and virtual communities?
- What reorganization of a current space would dissolve boundaries between lecture and lab, between on-site and virtual communities?
- What compromises will have to be made for the sake of renovation?
- What is the minimal level of renovation needed to promote creative, innovative, self-directed learning?
- What can be easily given up in order to make the renovation affordable and doable ASAP?
- How will questions about sustainability inform decisions about renovations?
- How will an anticipated renovation project fit into the larger vision of your institutional future?
- What can be taken out of a space to make it a better space for learning? How can the learner be given ownership of his/her space for learning?
- How will the building infrastructure support renovation prototyping ('trial runs')?
- What is the intended life-span of the space/s to be renovated?
- How do spaces of your inspirational peers serve goals for student learning?
- How can existing budgets for maintenance or physical plants be reallocated (used) for purposes of prototyping, of making low-cost and high-impact changes?
- What are the emerging possibilities/necessities for shared spaces? What are the barriers to eliminating 'owned' spaces?
- What is the desired level of flexibility and adaptability?
- What possibilities exist to make every space on campus a learning space?
- What can be learned from registrar's record about space utilization that will inform our planning for renovation? Could modest changes in class schedules change our renovation needs?
- What is our institutional aesthetic?

Questions about People:

- Who needs to be at the table in the process of exploring renovations, of planning renovations, of making renovations happen?
- Do we have the right people in place? What questions should we be asking: students, faculty, admissions and development officers, alumni, prospective employers?

Questions for People:

- Students
  - What do you like about the spaces for learning you have today?
  - What do you not like about the spaces for learning you have today?
  - What would you like to do in spaces for learning but cannot do now?
  - What kind of learning experiences do you have in a typical day?
  - What was your best learning experience?

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- Faculty
  - What do you like about the spaces for learning you have today?
  - What do you not like about the spaces for learning you have today?
  - What would you like to do in spaces for learning but cannot do now?
  - What kind of learning experiences do you/your students have in a typical day?
  - If you could really push-the-envelope to arrive at a better learning space, what would that space be like? How would you describe it?
  - What keeps you up at night when thinking about learning and spaces for learning?
  - What changes do you see on the horizon that will affect the planning of programs and that will need to be respected in the process of planning renovations?
- Facilities Officers
  - How different are your existing spaces for learning from those of past years?
  - How different are you now designing and thinking about spaces for learning than in past years?
  - How is the process different? What are the issues? Who are the people that need to be involved?
  - How integrated is your campus thinking about people/program/space? Is there a campus-wide understanding of the relationship between the quality of space and the quality of learning?
  - What measures do you use to determine the impact, the success of a space for learning?
  - What changes do you see on the horizon that will need to be respected in the process of planning renovations?
  - What are the constraints and boundary conditions that must be dealt with in planning spaces for learning?
  - What is the tension on your campus between cost and usability?
- Potential Employers
  - What do you wish our graduates would know and be able to do? Upon graduation? Into the future?
  - How long does it take for a graduate to be of value to your community?
  - What kind of learning experiences make that happen?
  - Do you know what makes a space an environment for creative, productive, collaborative endeavors?
  - What were the best learning experiences you had in school?
  - What changes do you see on the horizon that will need to be respected in the process of planning programs and spaces to serve those programs?
- Public and Parents
  - What do you value about the learning experiences our campus offers to students and to the community?
  - What do you know about our programs in science and engineering, mathematics and technology?
  - What kind of world do you see on the horizon that needs to be reflected in our academic program and in our spaces for learning?

II. Quick Fixes (No Cost; Low Cost):

- Make it easy to move tables around; add wheels.
- Buy lots of flexible lockers to reduce actual and visual clutter.
- Make visible and accessible spaces to play; (aka Herman Miller 'toys').
- Make creative use of the transformative power of color; invite art faculty and students to advise (and create).
- Build a visible digital playground that gives students 24/7 access to real and virtual learning communities.
- Use student power to make an institutional audit of spaces for learning; send students around campus with cameras and report back (reward them with pizza).

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- Embed questions about insights about space into standard end-of-course evaluations; have them analyzed as information for space planners.
- Put white boards, on wheels and on walls, as many places as you can. Create spaces for group work, collaboration and communication. Add flowers and great photos.
- Find unused or poorly used spaces for prototyping renovation ideas (accommodating interdisciplinary groups, technologies, messy activity, etc.)
- Let students compete for 'skunk-works' spaces, and/or for use by established student group.
- Encourage faculty toward the inverted classroom: having student do in the course period the collaborative work that is usually 'homework,' and have the homework be reviewing course materials/lectures on-line.
- Provide a budget for 'failure' to encourage creative exploration of spaces that work.
- Build a for-credit seminar course for students around the nature of spaces for learning.
- Have facilities officers talk with students about options for student-owned spaces around campus.
- Expand the hours of access to spaces.
- Make the doing of science/engineering pervasively (and unavoidably) visible: posters, artifacts, sculptures, displays, windows into labs.
- Show student work in 'real time' with pictures from cameras in lab featured on screens in lobbies.
- Build new kinds of connections between existing spaces, knocking down walls, opening up windows, clarifying traffic patterns, opening a new stairway between floors of the building.

III. What Works:

- A team responsible for the quality and character of all learning spaces on campus.
- A goal that spaces enhance institutional distinctive, reflect the unique context, circumstance, mission and identity of the college/university.
- A strong, credible and creative shepherd, someone with a vision but without an ego.
- A culture ready to turn constraints into something positive.
- A culture supportive of risk-taking, experimenting (easy to do with prototyping).
- A serious attempt to measure if/how spaces work (evidence of engagement; linking evaluations of space to measures of learning; time-lapse photography; student/faculty feedback; density and nodes of social networks; demographics of faculty/students; enrollments, success and failure of students; diversity of building use; output of collaborative work; etc.). ■

Seminar Participants

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