Learning Space - a definition

- A learning space is either a classroom or a physical location dedicated to curricular activity. It is a room that is designed for face-to-face meetings of instructors and students.

- Accordingly, a learning space is
  - a room routinely used and officially scheduled (e.g., by the registrar) for regular class meetings;
  - a room designed to host instructors and the students for face-to-face sessions
### Summary of Def’ns

<table>
<thead>
<tr>
<th>CONCEPT</th>
<th>EXAMPLE</th>
</tr>
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<tbody>
<tr>
<td><strong>Activity</strong></td>
<td>Discussion</td>
</tr>
<tr>
<td><strong>Learning principle</strong> (How activity causes learning)</td>
<td>Discussion helps students model new ideas for one another</td>
</tr>
<tr>
<td><strong>Design principle</strong> (How “space” supports activity)</td>
<td>Discussions can go better when students have a place to draw (Easel? Huddle Boards, Laptop + shared display)</td>
</tr>
</tbody>
</table>
Design Principles

• Describe what (some) faculty and students should be able to do, ideally (their activities).
• May conflict with one another.
• Are complemented by other kinds of design inputs (e.g., the budget; need for flexibility)
• Design principles do not describe specific spaces or tools used to carry out those activities.
Design Principles

• Examples:
  – Enable students to move into small, face-to-face groups w/o too much tripping over backpacks, etc.
  – Enable any student in the room to display a set of images to all other students and point to elements of those images while discussing them.

• These are not examples of design principles:
  – U-shaped seating in tiers
  – Students learn well
  – Faculty not embarrassed
Good Teaching Can Sometimes Overcome Bad Spaces
knowledge of how people learn

- lecture based
  - oral
  - written
  - narrative videos

- skills based
  - isolated drill and practice
  - contextualized practice
  - modeling

- technology enhanced
  - simulations
  - electronic tools
  - assessment opportunities
  - communication environments

- individual vs. group
  - self-study
  - cooperative learning
  - jigsaw learning

- inquiry based
  - learning by design
  - projects
  - case studies
  - problems

From: *How People Learn* (expanded edition), p. 22
What types of activities are important in building deeper learning?

Designing Learning Environments Based on the NRC’s *How People Learn*
Making Classrooms Learner-Centered

• Learners use current knowledge to construct new knowledge

• Effective instruction takes into account what students bring to the classroom

• Active engagement in learning supports the construction of knowledge
• Learners should be assisted in developing *metacognitive* strategies

• “Metacognition refers to people’s abilities to predict their performances on various tasks… and to monitor their current levels of mastery and understanding.” (HPL pg. 12)

• Transfer of learning can be improved when students are aware of themselves as learners and monitor their learning and performance strategies
Making Classrooms Learner-Centered (3)

• Students need opportunities to practice skilled problem solving
• Students need feedback to monitor progress & support to ensure progress
Making Classrooms Knowledge-Centered

• Students are not blank slates; teach based on students’ current knowledge and skills

• Instruction should help students organize knowledge for efficient recall and application in solving problems

• Aim instruction for deep understanding of major concepts and principles rather than acquisition of facts and skills
Encouraging deeper learning in technology enhanced classrooms

• Help students construct and organize their knowledge
• Illustrate multiple contexts in which knowledge can be applied
• Perform continuous formative assessment during the course of instruction
• Help students develop metacognitive strategies so they monitor their own learning
• Teach interactively!
#1 Encouragement of student autonomy and initiative

- Classroom design implications
  - paired tables vs. fixed individual seats
  - mobile computing for the Geek chorus
#2 Elaboration of student responses

- Post-it charts equivalents
- Virtual whiteboard
- Board capture and distribution
What is the most sacrosanct space on a university campus?

• The 10 sq. ft. around a professor in the midst of teaching....

Ed Crawley, MIT
Building the Integrated Learning Center
A Case Study of Planning a Learning Space
1993-95 – The Landscape

- Approximately 25% of our freshman did not return for second year
- University redefined as a “Student Centered Research Institution”
- Five year, $10 million classroom upgrade project defined new classroom standards
- Undergraduate curriculum revamped
- Student Orientation revamped
- Needed a technologically-advanced first-year home that supported learning
The Visionary

We will build a state-of-the-art facility called the Integrated Instructional Facility.

The President
Mental Models and our lens on the world

We will build a state-of-the-art facility called the Integrated Instructional Facility.

- Improve freshman retention
- Provide world-class instruction
- I can be proud of it
- It won’t cost me much or cause me trouble

The President
The Allies

Project Inception - ‘93 to ‘95

CIO ————————————> Advanced

Provost ————————————> Faculty concerns

VP ————————————> Undergraduate

Undergraduate Education

Dean of Libraries ————————————> Information literacy
The Grounded Dreamers

Project Inception - '95

Conceptual Design - '95 to '97

Faculty

Students

Technology Specialists

Teaching Specialists

Central Computing Staff

Facilities Design Staff

Information Specialists
The Planners

Project Inception - '95

Project Design - '97 to '99

Conceptual Design - '97

New Provost

New President

Architect

Project Manager
The Builders

Project Inception - '95

Project Design - '97 to '99

Conceptual Design - '97

Construction - '99 to '01

Contractor
Subcontractors

New VP
The Promoters

Project Inception - '95

Project Design - '97 to '99

Opening Year - '02

Conceptual Design - '97

Construction - '99 to '01
Key People We Missed

• Facilities Management
  – Custodial/Grounds
  – Furniture
• Room and Course Scheduling
• Assessment Specialists
Dealing With Multiple Perspectives
Development of Design Principles

Conceptual Design

Maximize the ability of faculty to get into the social space of every student participant.

Students have adequate and functional personal work space.

Enable students to work in small groups.

Flexibility to reflect (future) changes in program, pedagogy, technology.

Permit participants to see and hear the instructor or any other human focal point.
Development of Design Principles

Maximize the ability of faculty to get into the social space of every student participant.

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Permit participants to see and hear the instructor or any other human focal point.
Key Learnings

• Develop and embrace a set of design principles to guide the project
• Make sure people understand the vision and design principles and can articulate them to others
• Be aware of the potential impact on the rest of campus - who and what
• As much as you can, keep everyone involved throughout the entire process, especially your allies and vision keepers
Understand the institutional values/culture

Localize learning principles
“01101001, 00111011, 00011010, but, but!”
MIT’s Strategic Vision

- Expand MIT’s reach and influence
- Improve the experience “at home”
- Transform the learning experience to promote active inquiry
“Drinking from the Fire Hose”
Student patterns of room use by time

Room Usage

- 9 to 5: 44
- 5 to 11: 32
- 11 to 9: 25
LSD Process - Design

• Determine the design principles that support the pedagogy
  – For example, through a design charrette MIT identified the following design principles
Design Principles

- Design for people not ephemeral technologies
  - Transparency, natural light, operable windows
- Enable technologies brought to spaces rather than provide technologies for spaces
Design Principles

• Space cycles prevail over machine cycles
• Spaces vary from hard to soft - emphasize soft spaces
• Design for a 24 hour day
• Identify learning modes enabled
Design Principles

• Spaces should be “zoned” for sound/activity -
  – quiet/noisy;
  – High/low turnover;

• Adaptability over fixed
TRADITIONAL BUILDING PROCESS

• Request from department to the university
• Formal approval by university
• University project manager hires architects and construction company
• Architect elicits needs of the department in programming phase
• Design performed by architects, focusing on offices, labs, classrooms, building systems, driven by space needs
• Periodic reviews with representatives of department and university

A sequential process with up and over communications, driven by less than complete and consistent requirements centered on the change of space
A New Process

• The new learning environment can be viewed as a **product** that must be developed
• The client is expert in **product/system development**
• The architect is expert in **space development**
• Faculty **synthesized** the process of architecture and product development in the conceive/design phase for the new lab
A New Process

• Department appoints a full time project engineer with departmental and domain expertise
• **System engineering** identifies needs, goals, visions, concepts and design requirements, then the architects are hired
• Formal approval by the university
• Create an **integrated product team** of all necessary stakeholders (Client, Architect, Builder) to resolve design questions in real-time
• Designing flexible learning spaces, driven by a holistic focus on learning

An integrative process with direct communications, driven by a more holistic and informed view of the expected outcome — substantial improvements in education
Learning Mode Analysis

• Learning modes are the practical clustering of learning activities and their physical/spatial dependencies

• An example:
  – Mode: Project Design
  – Attributes:
    • Size - is it a big or small project?
    • Length - does it take a term or a class session?
    • Space - does it require dedicated space?
    • Interaction requirements - do students need to work in groups and report back as a class?
Learning modes and related characteristics

**Class Lab Mode**
- Occasional use
- Week duration
- Storable

**62X/UROP Mode**
- Desktop project
- 1 to 2 terms
- Student developed

**Large Systems Mode**
(MEng, SDM)
- Year scale
- Design intensive
- Dedicated space
- Product thrust
- Close connectivity to outside

**Design Project Mode**
(16.82, 83, 89)
- Large scale project
- Term length
- Virtual design
- Dedicated space
- Breakout / report-back space

**Tinkering Mode**
- Occasional
- Temporary work space

**Outreach Mode**
- Weekly
- Accommodate visits, lectures, presentations

**Teaching in Labs**
- Occasional
- Presentation area
- Demonstrations

**Large Student Project Mode**
- Large scale project
- Dedicated space
- Large components
- After hours

**Research Design Support Mode**
- In and out capability
- Temporary design space use by team
- Weeks to months

**Grad Thesis Mode**
- 1+ years
- Equipment needs
- Dedicated space
- In and out capability

**Linked Projects Mode**
- Connectivity (multidisciplinary)
- Term or less
- Multi use lab experiments
- Joint labs/designs

**Income Generating External Mode**
- Ongoing
- In and out testing
- Days/weeks
- Dedicated space
### Modes as a Design Tool

**Requirements**

<table>
<thead>
<tr>
<th>Modes</th>
<th>Space</th>
<th>Services</th>
<th>Equipment</th>
<th>Staff</th>
<th>Operations</th>
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*Design Requirements for Architects*
<table>
<thead>
<tr>
<th>Report Number</th>
<th>Operational Mode</th>
<th>Revised Mission Relevance Score</th>
<th>Revised Mission Relevance Ranking</th>
<th>Mission Relevance Score</th>
<th>Mission Relevance Ranking</th>
<th>Visit</th>
<th>Grad/Undergr</th>
<th>Paper/Hardware</th>
<th>Space-Class/Lab</th>
<th>Space-Big/Small</th>
<th>Dedication</th>
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<tr>
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<td>Large Systems Mode (M.Eng, LFM, SDM)</td>
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<td>3</td>
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</table>
EDUCATION MODES

Community Building

Knowledge Discovery

System Building

Reinforcing Disciplinary Knowledge
Consider This Schematic

- Learning Principles 1
- Design Principles 2
- Learning Modes 3
- Localize to Institutional Culture
- Localized to Curriculum & neighborhood
Explore: look at other facilities
Mock Up: explore ideas and test assumptions
Model Your Ideas:

25 seat instruction room

45 nsf per student

Option 1
Key Learnings

- Change is possible only with externally referential systems
- Localize learning/design principles for your culture
Key Learnings

• Build for change, including after the project is completed
• The entire campus is an interactive learning device
• Flexibility without time is meaningless
Education is the only career that has an apprenticeship that starts at age 5.

M Frank Pajares

"Teachers Beliefs and Educational Research: Cleaning up a Messy Construct"
“The future of higher education lies outside the classroom.”

Chronicle Higher Ed, circa 1999
Focus of Cambridge LSD workshop

- Easily supports learner-centered principles
- Classrooms (lecture, seminar, discussion, or small classroom)
- Science labs, studios, computer labs, performance spaces
- Current
- Other spaces
Focus of the NLII 2005 session

Easily supports learner-centered principles

- Classrooms (lecture, seminar, discussion, or small classroom)
- Science labs, studios, computer labs, performance spaces
- Other spaces (library, student union, dorms, hallways, conversation areas, outdoors)