Teaching for Learning: A Philosophical Approach to Classroom Design - Five Basic Principles

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1. **Classrooms should facilitate student engagement**
    a. Highly accessible furnishings for all students including those with disabilities
    b. Many electrical outlets
    c. Multiple display/work surfaces (white boards, etc.)
    d. Comfortable furniture
    e. Rolling and swiveling chairs
    f. Movable tables
    g. Mobile/multiple whiteboards to record student work
    h. Robust lighting control

2. **Classrooms should facilitate student collaboration**
    a. Use of modular tables
    b. Rolling and swiveling chairs
    c. Movable tables
    d. Semi-private breakout spaces connected to main learning space
    e. Mobile/multiple whiteboards to record student work

3. **Classrooms should facilitate connections between teachers & students**
    a. Wide aisles both horizontally and vertically
    b. Movable tables
    c. Rolling and swiveling chairs
    d. All students easily visible, seating begins near to instructor area
    e. Semi-private breakout spaces connected to main learning space
    f. Many electrical outlets
    g. Multiple, simultaneously visible display/work surfaces (white bds, etc.)

4. **Classrooms should incorporate appropriate technology**
    a. Many electrical outlets
    b. Instructor station with Tablet PC-like technology
    c. Multiple electronic display surfaces (LCD projectors, etc.)
    d. Reliable network connectivity
    e. Printing/copying availability
    f. Robust lighting controls

5. **Classrooms should have flexible physical arrangement**
    a. Wide aisles both horizontally and vertically
    b. Movable tables
    c. Rolling and swiveling chairs
    d. Highly accessible furnishings for all students including those with disabilities
    e. Reconfigurable space for lecture/lab work via multi-modal pedagogical approaches and multi-disciplinary teaching teams
    f. Multiple, simultaneously visible display/work surfaces (white bds, etc.)

Specific preferences, directly from GT instructors

Things they like (ranked in rough order of most commonly mentioned)

- Robust "podium" space
  - Tablet PC-like options (Sympodium, smartboard, tablet) for display an notations by instructors and/or students
  - Document camera (Elmo)
  - Large, long, flat table at front
  - Easy laptop connection (including at a front table)
  - Standard technology podium (know what to expect)
  - PRS system (RF) built in
  - Cameras and net-meeting capability
  - Microphone always available
- Lots of Display/Work Surfaces
  - Multiple projection screens to show different things simultaneously
  - Screens do not cover whiteboards (or screens you can write on)
  - Large projection screens
  - Walls made of whiteboard
  - Layered whiteboards
  - Space to place student posters and other visuals
  - Multiple colored markers for whiteboards always in room
- Easy use of electronic materials
  - Students can share electronic files (via Table PC, for ex)
  - Many student computer hookups
- Flexible and Collaborative Layout
  - Diverse yet flexible room configurations for both traditional lecture and very different approaches
  - Breakout rooms or conference areas for student group work
  - All students can see screens
  - Wide rather than deep room dimensions, but not too wide
  - More aisles than usual – easy access to and for all students
  - Front row close enough to feel connected to students
  - All students visible to instructor (slight rise can help)
  - Space between desks
  - Good student flow for exit, entry
  - Flexible furniture
  - Flexible technology
  - Non-teacher focused layout options
  - Technology focused layout

- Flexible and collaborative furnishings
    - Tables for groups of 4-6 to work at easily and face-to-face
    - Swivel, unattached, movable, comfortable chairs (even in large lectures)
    - Tables that can be moved easily and are not too large/heavy (even in large lectures)
    - Clock(s) that work
- Quality Acoustics and Lighting
    - All students can hear instructor and vice versa
    - Lighting controls
    - Quality sound system

Things to avoid (ranked in rough order of most commonly mentioned)

- Implicit (or even explicit) separation of instructor and/or students
    - Chairs bolted down or fixed
    - Aisles only in one direction or with more than 4-6 students in a row
    - Tight aisles
    - Too steep of incline obscures students in back
    - Narrow, deep, and tall room layout
    - Stages
- Limitations on Displaying Information
    - Can’t use projection screens and whiteboard at same time
    - Too wide such that students on ends can’t see screens
    - Too little white board space
    - Projection screens too small
    - Projection screens not located along main lines of sight
    - Inability to share electronic documents
    - Projection lighting at the expense of whiteboard lighting
    - Can’t change slides when not at podium
    - Podium or projection equipment which obstructs student/instructor views
    - Insufficient projection distance (ex under 10 ft)
- Lack of flexibility
    - Tables that cannot be re-arranged
    - Inability for students to brainstorm in coherent groups
    - Chairs in completely linear arrangement
    - Board and podium too far from students
    - Podium/AV cart stuck in a corner and/or immobile
    - Acoustics where room gets too noisy during group discussions
    - Holes in the ground or wires all over floor

Annotated STEM Classroom Design Literature Survey

1. General Classroom Design Resources

Herman Miller Research Summaries – Engaging Students
http://www.hermanmiller.com/hm/content/research_summaries/pdfs/wp_Engaging_Students.pdf

A strong review of factors identified in the literature that impact or affect learning for millennial students along with an introduction to Herman Miller's "Learning Studio" concept which focuses on:

- Comfort via seating choices
- Social/collaborative settings
- Changing focal points
- Visual stimulation
- Robust technology
- Lighting control

EducauseConnect – Classroom Blueprint
http://connect.educause.edu/Library/Abstract/ACollaborativeBlueprintfo/43365

A ppt presentation describing different classroom types at Emory University with following description of an "ideal" classroom:

- Comfortable for students and faculty
- A bounty of user-friendly AV options
- Dependable network connections
- Good lighting
- Acoustically sound
- Loads of "boarding" surfaces
- Flexible

Classroom Technologies (CT) – Cornell University
http://www2.cit.cornell.edu/computer/instruct/classtech/design/details.html

An older set of information but with a few lasting recommendations:

- Several projection screens that do not entirely block blackboard
- Acoustics: focus on reducing ambient noise
- Accessibility: Rooms should be handicapped accessible and contain a minimum of 10% left-handed tablet arms on seats
- Adequate Electrical Outlets

- Lighting:
  - Controls should be simple and located near the teaching station
  - Fluorescent ballasts that operate at frequencies greater than 30 Khz. can interfere with infrared controls
  - Note-taking should be possible with dimmable incandescent or fluorescent lights, or switchable floor/ceiling fluorescent fixtures
  - Studio fluorescent lights should be used in interactive video rooms
  - Window Coverings - There should be two types of coverings; drapes/blinds, shades/blinds, shades/shades
  - Zoned from front to back of the room to be able to switch off light in the projection screen area

Office of Classroom Management – University of Minnesota
http://www.classroom.umn.edu/foodforthought.asp
An organized set of links to information about many aspects of classroom design

National Clearinghouse for Educational Facilities (NCEF)
http://www.edfacilities.org/rl/classroom_design_HE.cfm
An annotated bibliography of electronic information about classroom design

2. STEM Classroom Design – specific ideas for Science, Technology, Engineering and Mathematics

Constructing STEM Facilities
www.pkal.org/collections/FacilitiesPlanning.cfm
This link's content is about early stages of planning for a new or renovated building. Under a section about flexibility it states:

- Can laboratories and classrooms be reoutfitted to support interdisciplinary work?
- Is conduit installed so electrical and computer networks can be repositioned whenever the furniture is completely rearranged?
- Is the furniture modular and sturdy?
- Are there spaces for large, medium and small groups to work collaboratively?

- Are there spaces where individuals can pull away to ponder and reflect?
- What about ceiling and floor hooks?
- What about access to computer media? Internet? Telephones? The outdoors?
- The metaphor for the science laboratory-classroom of the future is that of a giant electrical Lego set capable of being constructed in an endless array of fractal patterns to enhance learning through both collaboration and individual discovery.

Attributes of a K-12 STEM Classroom
www.tiesteach.org/documents/Attributes%20of%20STEM%20Education%20with%20Cover.doc

Some aspects of K-12 classroom design can be applied in Higher Education. Some of these general ideas are:

- Active and student-centered
- Equipped to support spontaneous questioning as well as planned investigation
- Center for innovation and invention
- Classroom, laboratory and engineering lab are physically one
- Supportive of teaching in multiple modalities
- Furniture is easily reconfigured
- Electricity is accessible from the ceiling and the floor. Serves students with a variety of learning styles and disabilities

AccessSTEM – The Alliance for Students with Disabilities in Science, Technology and Mathematics
http://www.washington.edu/doit/Stem/ud.html

A site describing the concept of universal design (of materials, instructional approaches, lab, classroom, and other learning spaces, etc.) for students learning in the STEM disciplines. They offer the following ideas relevant to classroom design:

- Ensure physical access, comfort, and safety within an environment that is welcoming to visitors with a variety of abilities, racial and ethnic backgrounds, genders, and ages.
- __ Are there ample high-contrast, large-print directional signs to and throughout the lab? Is Braille signage available when appropriate?
- __ Is at least part of a service counter or desk at a height accessible from a seated position?
- __ Are aisles wide and clear of obstructions for wheelchair users who have mobility or visual impairments?

- __ Is lighting adjustable by the individual?
- __ Are there quiet work or meeting areas where noise and other distractions are minimized.
- __ Are telecommunication devices (TTY/TDD) available?
- __ Can at least one public telephone be reached from a seated position?

STEM Classroom Specifications
http://www.ric.edu/capitalProjects/pdf/STEM%20FloorPlan.pdf

Example layout for 28 students
www.mde.k12.ms.us/vocational/OVTE/PDF/STEMSpec50908.pdf
Contains very specific recommendations for STEM classroom furniture and has a diagram with three layouts (with desktop computers for each student).

3. SCALE–UP - Student-Centered Active Learning Environment for Undergraduate Programs

"**Classroom design:** The learning environment is an important component of the SCALE-UP classroom. The spaces are designed to promote active, collaborative learning. Classrooms look more like restaurants than traditional classrooms with round tables and comfortable chairs. Though most adopters use round tables, some institutions have adopted X- / T-shaped tables or bean-shaped tables. Three teams of three share a table and have white boards nearby. These are either large and mounted on the walls or smaller and portable. Because students do their "thinking" on these public spaces, the instructor can more easily see how teams are progressing during an activity. In addition, students can view/critique each other's work while working or as a tool for presentation to the entire class. In some institutions, each team has a laptop for web access. At North Carolina State University, the original site, classes usually have 11 tables of nine students. Many institutions that have adopted SCALE-UP have smaller classes while a few have larger ones."
http://serc.carleton.edu/sp/pkal/scaleup/how_implement_scale-up.html

Scale-UP Facilities
http://www.ncsu.edu/per/SCALEUP/Classrooms.html
medium to large classrooms

http://www.ncsu.edu/per/facilities.html
smaller research space

http://scaleup.ncsu.edu/
page with an MIT classroom photo and links to more info

Enhancing Learning Through Scale-Up – description of implementation and data
http://serc.carleton.edu/sp/pkal/scaleup/index.html
http://fie-conference.org/fie2008/papers/1638.pdf

4. **TEAL** – Technology Enhanced Active Learning
   This is very similar to Scale-UP with a room designed to allow students to combine lecture, recitation, lab-work, visualization activities, and collaborative learning.

   TEAL Philosophy and Learning Outcomes
   www.masteringphysics.com/assets/site/res/ppt/P.Dourmashkin_Phys.ppt

   TEAL Setup
   http://web.mit.edu/edtech/casestudies/teal.html

   http://icampus.mit.edu/TEAL/

5. **The Lin**k – A flexible classroom space at Duke
   http://cit.duke.edu/about/current/tlc/index.html
   Pictures of the facility in different setups to accommodate strategies such as:
   - multiple projection for advanced classroom presentations (including the ability to include students' work in the projections)
   - collaborative small group breakout sessions
   - traditional lecture/seminar based configurations
   - project-based learning sessions focusing on student-developed content
   - role-playing exercises

6. **ATLAS** – Alliance for Technology, Learning, & Society at UC-Boulder
   A building with flexible classrooms of varying size serving multiple disciplines, much like the CULC.
   http://www.colorado.edu/atlas/building/classrooms/