RECOMMENDATIONS FOR FUTURE CLASSROOMS AT WESTERN

The Provost's Ad Hoc Committee on Classroom and Communal Space

May 2009

Table of Contents

MANDATE FOR THE AD HOC COMMITTEE ON CLASSROOM AND COMMUNAL SPACE

The current construction and subsequent renovations at Western provide a special opportunity to visit the current classroom inventory and make recommendations for future classroom design. Western's strategic plan "Engaging the Future"[1] notes that "While much is already being done to implement programs that increase direct student engagement in learning, even more is required both inside and outside the classroom." The recently adopted Campus Master Plan[2] also addresses aspects of classroom planning with emphasis on the use of the centre of campus, design of flexible space, barrier-free accessibility, safety and security, and sustainability.

To convert these principles into action, the Provost directed an *ad hoc* committee to develop a set of principles that would guide in the creation of future classrooms. The intended audience includes faculty, staff and students affected by projects involving construction and/or renovations of classrooms. It is also hoped that this document will provide direction to those members of Physical Plant and Capital Planning Services directly participating in classroom design and construction and will be shared with external consultants. The following principles attempt to summarize the deliberations of the ad hoc committee as further detailed in the consultation report following.

KEY PRINCIPLES FOR FUTURE CLASSROOM DESIGN

- *Target:* The key principles outlined here are aimed around general-university (GU) classrooms at Western, where GU classrooms are defined as centrally booked rooms rather than departmentally controlled rooms. These principles apply to both new classrooms and, whenever possible, to renovations. As teaching laboratories are typically controlled by individual units, they have not been addressed in this report.
- *Growth*: The principles are guided by an assumption that undergraduate intake will remain constant, and thus future growth is focused on graduate students with subsequent demand for an increase in smaller classrooms.
- *Versatility and pedagogical flexibility:* Flexibility in design and variety in the room styles are critical for enabling a spectrum of teaching styles and methodology and to be able to accommodate future teaching styles.
- *Interactive learning:* An increase in numbers of smaller classrooms is also desirable for more interactive and collaborative learning. For the renovation or replacement of existing large classrooms, the aim for interactive learning should also be a guiding principle during the design and building processes, such as moving towards the use of a double-tiered configuration and including more versatile seating.
- *Accessibility:* Classroom design must include accessibility for students, faculty, and staff, which can be aided through proper consultation with the Barrier Free Access Group. Through early consultation and awareness, smart designs can accommodate accessibility within the standard design rather than requiring special accommodation or consideration later.

[1] http://www.uwo.ca/univsec/strategic_plan/report/01.htm, last retrieved October 3, 2008
[2] http://www.uwo.ca/univsec/strategic_plan/documents/MasterPlanFinalSept-07.pdf, last retrieved October 3, 2008

- *Sustainability:* Classrooms should incorporate the principles of sustainable design and incorporate sustainable materials, finishes, furnishings and equipment. Additionally, energy conservation initiatives should be incorporated into the design and operation of classrooms.
- *General preferences:* Overall flexibility in classroom design should consider the following: usage of tab arms should be avoided, movable tables and chairs are preferable, space should be useable for examinations, layout and lighting should enable the simultaneous usage of multiple modalities, and comfortable seating with larger work surfaces.
- *Emphasis on consultation:* Early and frequent consultation with the various users and planners is an essential part of classroom planning. For any renovation, primary users must be consulted, including faculty, staff, and students. Consistent consultation hopefully will also induce an inherent review and update of the current pedagogical principles and teaching technologies as they evolve.
- *Support of upgrade program:* It is recommended that the GU Classroom Upgrade Program continue to be a high priority for the University.

PRINCIPLES FOR THE CREATION OF FUTURE CLASSROOMS

A. Pedagogical Principles of Good Learning Spaces

As discussed in Western's Strategic plan "Engaging the Future", Western participated in 2004 for the first time in the National Survey of Student Engagement (NSSE)[3], which allowed a comparison of Western's student experiences with over 500 participating Canadian and American universities. These results indicated significant gaps between Canadian and American universities including the area of "student-faculty interaction". Western's strategic plan highlighted the commitment that "in order to provide the best student experience, we must offer the best environment for student learning". Since classrooms represent the primary source of contact with the students, it is important that the design of classrooms support the instructor's ability to interact with the students rather than limit it.

NSSE suggests there are five benchmarks that are important to examine when considering student engagement in learning. These benchmarks are broadly based on the work of Chickering and Gamson[4] whose widely cited article on principles of good practice in undergraduate education summarizes what we have learned from over 50 years of educational research, which has been substantiated by many other authors. Several of the key benchmarks or principles may specifically be related to classroom design. They are *active and collaborative learning*, *student-instructor interaction*, *student-centered learning* and *respect for diverse talents and ways of learning.* Our future classroom designs aim to facilitate these activities.

1. Active and collaborative learning: Effective student engagement occurs if students are involved in interactive and collaborative activities in class. Consequently, students should be able to pair up easily with other students or move quickly into groups; movable seating supports

[3] http://nsse.iub.edu/index.cfm, last retrieved October 3, 2008.
[4] Chickering, A., and Gamson, Z. (1987). Seven Principles for Good Practice in Undergraduate Education. *AAHE Bulletin ,March, pp 3-7*

this approach. Thus, there should be a mix of classrooms available, from smaller classrooms with movable tables for group work to larger tiered classrooms with double rows of movable seats (rather than each row being on a separate tier). Wide spacing between rows allows both students and instructors to move easily from group to group. Overall, the instructor, not the classroom, should determine the pedagogical strategies employed.

2. Student-instructor interaction: To optimize faculty-student contact, instructors need to be easily able to wander around the classroom to listen in on group activities. It should be possible to move easily from large-group to small-group activities (i.e. movable tables and chairs for more flexible learning spaces). Having conversation friendly alcoves or study rooms close to more formal learning spaces will also facilitate group activities and the opportunity for the instructor to meet with students in small groups (i.e. break-out and study rooms).

3. Student-centered learning: Traditional classrooms with fixed seating, with few aisles and with screens or blackboards only at the front favour a teacher-centered approach to learning, where learning is viewed simply as the transmission of information. More opportunities are needed for teachers to facilitate learning and activities that focus on the discovery of knowledge. In this model, teachers serve as facilitators of student-centered learning where students become actively involved in making meaning of new concepts. This approach is facilitated by flexible seating arrangements (so students can meet in small and large groups) with writing boards located on several walls rather than just at the front of the room, good acoustics so student comments can be heard when they speak anywhere in the classroom (with sound proofing so that it is not too noisy when students engage in active learning tasks), spaces where technology can be easily accessed, and spaces where projects can be displayed or accessed.

Additionally, the ability to temporarily personalize the classroom is crucial to creating a sense of place attachment or ownership to the space. The ability for the students and instructors to customize lighting (e.g. use of multi-zone and dimmable lighting) and seating arrangement to their personal needs and tastes promotes place attachment. The simple act of moving a chair ever so slightly makes it one's own. By enhancing attachment, people will also take responsibility for, and take better care of, the room.

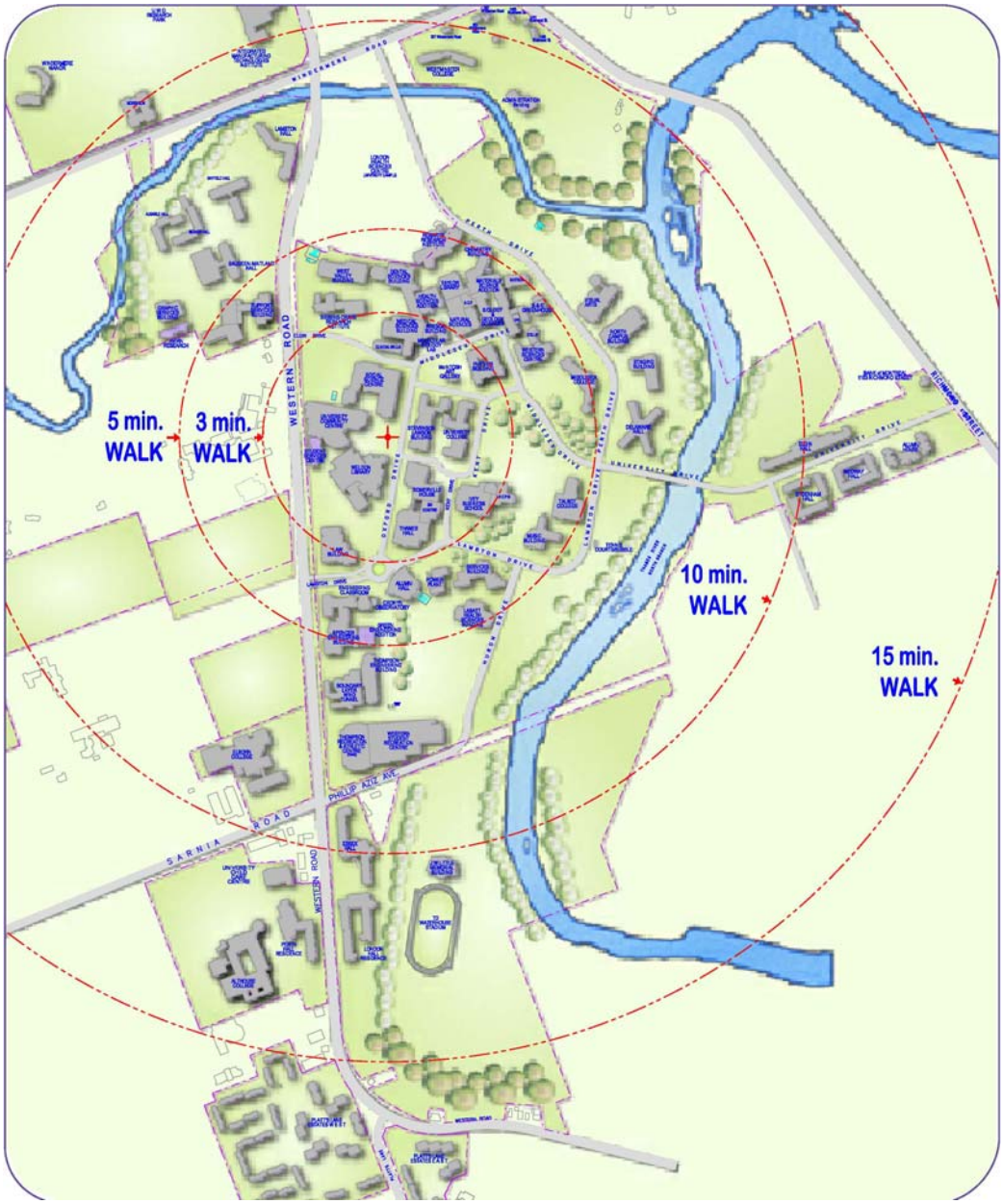
4. *Diverse Talents and Ways of Learning:* Students engaged in diverse forms of learning such as community service, internships and field placements need new supportive learning spaces such as small group spaces which allow multiple conversations and information to be shared or presented with the support of technology.

Therefore, in considering the design of learning spaces it is important that we take into account the activities that will be happening within the space (Chism & Bickford)[5].

[5] Chism, N.V.N. & Bickford, D. J. (2002). The Importance of Physical Space in Creating Supportive Learning Environments. *New Directions for Teaching and Learning*, 92. Jossey Bass.

B. Classes in the Centre of Campus

As stated in Western's Space Planning Principles of the 2007 Campus Master Plan[2], "Space associated with activities that directly support and enhance the student experience should be given the highest priority in the centre of campus." Consequently, it is recommended that, as the opportunity arises through renovation or new construction, classrooms appropriate for undergraduates and graduate students should be created in the centre of campus. Given the ten minute break between most undergraduate classes, it is practical to group classrooms within less than a ten minute walk of each other either in the centre of campus or in precincts. An estimate of walking times centered on the UCC "concrete beach" is shown below and indicates that classrooms near the centre of campus should accommodate timely movement between classes.



C. Physical Principles for Classroom Design

Successful classrooms require careful study and consideration of the following elements, which are considered essential for design:

- Different styles and purposes of classrooms
- Layout and sight lines
- Sustainability
- Classroom accessibility
- Furnishings and interior finishes
- Acoustics
- Heating, ventilation, and air conditioning
- Electrical and lighting
- Integration of classroom technology
- Future technologies
- Crush space
- Safety and security
- Storage

The online Classroom Design Checklist[6] from Western Kentucky University provides useful questions to be considered when planning and designing, with a checklist of design considerations categorized according to the following: goals, instructional methodology, number of users, room configuration, lighting, acoustics, furniture, technology/equipment, equipment/furniture positioning, faculty use, change & maintenance, space outside of the classroom.

Different styles and purposes of classrooms

For planning purposes, classrooms can be categorized in several ways including by capacity, by seating type and by anticipated function. For example the types listed in the Emory College[7] guidelines are: classroom loose seating, classroom seminar, classroom conference, classroom collaborative, classroom fixed seating and auditorium. Analogously, the University of Cincinnati[8] specifies: type (and capacity) as seminar (10-22), classroom (21-199), auditorium (>200), distance learning, classroom service and instructional laboratories. At Western, the latter three types are most frequently non-GU rooms under control of particular academic units. While the categories listed above may be useful for future planning purposes, they do not give a very clear picture of the distribution of existing classrooms at Western which have been created since about 1922 when University College and the Natural Sciences Building were constructed. As presented in Appendix A, Western now has about 120 GU classrooms which cover a large range of capacities from 14 to 800 students with a total capacity of about 13,000 seats.

[6] http://www.wku.edu/teaching/db/cd/classroomdesign/checklist.html, last retrieved October 3, 2008
[7] http://www.college.emory.edu/about/planning/facilities/classroomGuidelines.pdf, last retrieved October 3, 2008
[8] http://www.uc.edu/architect/documents/design/learnenv.pdf, last retrieved October 3, 2008

Appendix A also attempts to categorize classrooms into seven types of seating arrangements each of which shows a large variation in capacity. For example, tab arm configurations are typically associated with auditorium style rooms but the capacities at Western range from 50 to 800. The smaller rooms are more appropriately thought of as standard classrooms with fixed seating. The reader is directed to Appendix A for a more detailed discussion of Western's current classroom inventory, the pros and cons of the seating types and future possibilities.

In the past at Western, the number of GU classrooms and their location has been in constant but slow flux as academic units sought to encroach upon classroom space to meet their increasing faculty and student complements. The "Superbuild" initiative of the mid 90s provided an opportunity to create some larger classrooms such as NSC 145, LHSB 40 and NCB 101. It is anticipated that the current inventory of large classrooms should serve Western's needs as long as the cap on first-year undergraduate intake remains in place. Over the last few years, there has been continued demand for classrooms of the 50- to 60-person capacity, with smaller GU rooms being too small and hence underutilized. It is anticipated that 50-60 seat rooms will find increased demand as graduate student enrollment climbs particularly in course-based graduate programs. Rooms of this size have the flexibility to handle fewer students effectively and, as mentioned earlier, can be used for examination purposes for smaller classes.

Layout and sight lines

- As stated in the University of Cincinnati Design Guidance: Learning Environments[8], "To develop learning rooms with good sight lines and efficient seating layouts, design professionals should design from the inside out, not from the outside in."
- *Planning and consultation:* Learning spaces need to be large enough to comfortably accommodate the number of students planned for each type of room using the types and sizes of furnishings anticipated for instructors, students, and audio-visual components. While other mandates often set the criterion for the number of seats to be fit into a room, this shouldn't be forced at the cost of sight lines and usability. The seating layout should not compromise the functionality of the room by trying to accommodate too many seats. Experts within the Facilities Engineering Department of PPD are involved in all aspects of planning and consultation. Depending on the size of the classroom or the scope of work, outside consultants, including architects, engineers and acousticians, may be required. It is also important to talk to faculty and staff both during the design stage and when final decisions on outfitting are made.
- *Drawings:* All floor plans and cross sections should include scaled drawings of the location of furnishings, media projectors and carts, wall and floor junction boxes, lectern(s), and sight lines for all rooms.
- *Multi-modality friendly:* Presentations and lectures are becoming increasingly 'multi-modality'. Classroom layout should be able to accommodate simultaneous projection and board usage, with the projection screen preferably at the opposite side as lectern, e.g. lectern at far left, boards in center, screen at far right. In small rooms, this may require two screens with a central main screen for single projection and an offset angled screen for dual screen or screen-board combo. Additionally, in large classrooms, consideration should be made for providing dual projection of two different documents.
- *Posted layout:* Rooms with moveable furniture should include guidelines for users to encourage a culture of returning furnishings to place, including maps of the default furniture

arrangement to be reset after use, as well as other possible furniture arrangements that might be used.

- *Dual access:* Rooms should have access through *both* front and back, particularly to avoid disruptions by latecomers, and should include barrier-free seating at both front and back at least. It should be noted that students raised the concern that the time available between classes can lead to unavoidable lateness and entering through a back door would be preferable.
- *Sight lines:* Staff members within the Classroom Management Group (CMG) of the Office of Institutional Planning & Budgeting (IPB) should be consulted with respect to acceptable sight lines for audio-visual equipment. The University of Cincinnati Design Guidance document also gives examples of both good and bad layouts.
- *Accessibility:* Careful consideration should include sight lines around barrier-free accessible seating where wheelchair users may sit higher than a person in standard seating.

Sustainability

As stated in Master Planning Principles of the 2007 Campus Master Plan, "In planning the campus of the future, the University will incorporate sustainability of the environment in the planning and design process." Accordingly the University has adopted a policy of following the principles of sustainability as delineated in the Leadership in Energy and Environmental Design (LEED®) certification procedures whether this results in an application for LEED® certification or not. LEED® is a market-based rating system that facilitates and certifies higher energy and environmental performance of buildings and communities. A rapidly growing number of governments and private-sector organizations are adopting LEED® certification in their policies, programming and operations, aimed at achieving and demonstrating sustainability, and the University is committed to being recognized as a leader in the green-building sector. LEED® fosters a whole-building approach to sustainability by targeting performance in five key areas of human and environmental health[9]:

- sustainable site development
- water efficiency
- energy efficiency
- materials selection
- indoor environmental quality

For classrooms, considerations include paints and adhesives that are low in volatile organic compounds (VOCs), carpets with high recycled content and low VOCs and furniture supplied from manufacturers that demonstrate a commitment to sustainability from product design and manufacturing, to packaging and delivery.

Classroom accessibility

Smart barrier-free designs should aim to enable special-needs considerations to be achieved through standard designs, without the need for adaptation or specialized design. The University of Western Ontario has committed to achieving barrier-free accessibility beyond minimum legislated requirements for persons with disabilities who are studying, visiting and working at Western. As part of this commitment, there are a variety of services, groups and committees on

[9] http://www.cagbc.ca/leed, last retrieved December 11, 2008

campus devoted to promoting accessibility, which can be reviewed online at Accessibility at Western[10], which includes the Campus Accessibility Review and Enhancement (CARE) Committee, Western's Ontarians with Disabilities Act Committee (WODAC), Barrier Free Access Committee (BFAC)[11]. The Committee with the most direct involvement in classroom design is BFAC, which is an advisory committee to Western's Physical Plant and Capital Planning Services. This committee makes recommendations to ensure that disability issues are addressed when existing buildings are renovated or new buildings are built on campus. BFAC welcomes persons with disabilities from the campus community to join the committee. The mandate of the Accessibility for Ontarians with Disabilities Act (2005) is to remove and prevent creation of barriers that block Ontarians with disabilities from accessing the province's built environment by 2025. It should be noted that upon recommendation from the Services for Students with Disabilities or Occupational Health and Safety, IPB and PPD will make accommodations for special requirements.

Furnishings and interior finishes

The type, size and arrangement of furnishings determine how large each classroom must be to accommodate the number of students programmed and where different types of lights, diffusers, and power/data receptacles need to be located.

Successful learning rooms require general consideration of:

- The type, size, and location of furnishings should be planned carefully for each type of room.
- Aisle widths and seat spacing.
- How computers and audio-visual components will be accommodated.
- Seating: Tablet-arm, movable, seminar, computer, lounge, auditorium, and lecture hall chairs.
- Work surfaces/Tables: Basic classroom, seminar, training, computer, breakout and lecture room tables.
- Media Support & Storage: Lecterns, mobile A/V computer carts, storage and work-surface carts.

Specific considerations include:

- *Maintenance*: Designs should pay attention to the ease of routine maintenance by incorporating cleanable surfaces, avoiding small and inaccessible spaces and configurations that encourage graffiti but the academic versatility of the room should have priority (e.g. preference for moveable tables and chairs despite increased difficulty of maintenance).
- *Tack board:* Strips of tack board above the writing boards enables poster/project presentations Small tack board outside of each room is useful for posting signage and notices.
- *Sustainability:* recycling facilities that fit into décor, or move recycling outside room,.
- *Sustainability:* it has been shown that nicer furnishings get more respect and thus actually last longer.
- *Sustainability/maintenance:* wall rails or protectors in rooms with movable furnishing.

[10] http://accessibility.uwo.ca/, last retrieved October 3, 2008
[11] http://accessibility.uwo.ca/committees.htm, last retrieved October 3, 2008

- *Accessibility:* accommodations for students and faculty members with disabilities.
- *Adaptability:* Mobile furnishings enable adaptation for different pedagogical styles and for wheelchair accessibility. Also adjustable-height desks should be included to accommodate people of different sizes and needs (e.g. wheelchair).
- *Winter friendly:* A majority of the school year is during the winter, and we recommend that special consideration should be given to this fact. Recommendations include: warmer wall colors, appropriate lighting, and adequate space for winter gear. In small rooms, coat hooks should be considered; in large rooms this is not recommended, as students are reluctant to be separated from their personal effects.

Acoustics

Classrooms are spaces in which good hearing conditions are particularly critical to the use of the space and the exchange of aural information. Good hearing conditions depend on the amount of noise entering the room, the loudness of various sources within the room, the distribution of the sound to all parts of the room and the clarity of the sound. Acoustic consultants should be considered for large classroom designs and HVAC system designs should focus on reducing ambient noise.

- *Carpeting:* In general, carpeting should be avoided due to more demanding maintenance, especially in the winter, but may be considered in rooms where sound absorption is important, such as for distance-learning, conferencing, or computer labs.

Heating, ventilation and air conditioning (HVAC)

HVAC systems should be designed to provide a comfortable environment for learning without creating too much noise or wasting energy. HVAC systems must conform to the Ontario Building Code and ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers) design requirements for air quality.

Electrical and lighting

- *Electrical outlets for every user:* From discussions with both undergraduate and graduate students, laptop usage in classrooms, such as for note taking, has become a mainstay, which has led to power-supply issues. For fixed-table seating, the cost to install power to individual seats is estimated to be relatively small (estimated at approx. $50 per seat), and hence convenient access to a power outlet should be provided for every seat. For moveable tables, it becomes a challenge to provide power to every table and flexibility in table configurations is compromised. Wherever possible, recessed power receptacles in the floor should be considered but this must be balanced against improved accessibility to all persons and cleanliness.
- *Equipment outlets:* Numerous outlets should be provided at the front of the room to avoid the danger of cables across the floor from instructional equipment.
- *Lighting zones:* Proper lighting is an important and complicated aspect of classroom design. Lighting needs are dependent on factors such as room size and shape, whiteboard/chalkboard size, AV configuration, ceiling height and windows. Consideration should be given to organizing lighting into a number of zones to create different lighting scenarios. For example, rooms should have dimmable lighting across two zones at the front of the room for multi-modality activities, such as simultaneous use of board and screen (i.e. requiring well-lit

board plus dimmed screen, not just dimmed lighting across entire front of room, or lighting across entire board but screen in front of lighting).

- *Flexibility to accommodate sensitivities:* Flexible lighting options as a consideration to people who cannot tolerate fluorescent lighting due to light sensitivities, noise issues, migraines, or seizure disorders.
- *Shading blinds:* Mechanically or electronically controlled shading blinds for dimming the room should be incorporated.

Integration of classroom technology

- Technology should not stand out or be distractive.
- *Consultation:* Open and frequent consultation should be made with Institutional Planning and Budgeting (IPB) and Information Technology Services (ITS).
- *Standard technologies:* The standard technologies that should be included in the design considerations are: lectern, computer, data projector, document camera, VCR, DVD, projection screen (electric rather than manual, with switch near lectern), video monitor, connections (VGA, sound, power, network), transparency projector, slide projector, and internet connection (data line).
- *Training:* It is important to get people comfortable with the technology in order for it to be properly and fully utilized, and hence training should be provided to maximize the benefit from these technology investments. Note, this is currently done at the start of each term by the Office of Institutional Planning & Budgeting.
- *Computer Labs:* Contrary to expectations, wireless technology and laptops have not replaced computer labs, and in fact, computer lab usage is increasing.
- *Alarms:* VOIP phones may enable phones to be utilized as audio alarms and public-announcement systems for safety.
- *Writing surfaces:* The debate between blackboard and white board is ongoing. Chalk dust is unlikely to be any worse than other particulate in terms of electronics contamination. Allergies or sensitivities to chalk dust and to fumes from whiteboard markers are both a concern. Hence, a balance of the two writing surfaces should be incorporated. Some rooms with adjustable-height boards should be considered for easier accessibility by all users, improved good sight lines from the back of room, and flexibility for instructors to keep notes up longer. Horizontal sliding boards, such as can be found in some of our case-method classrooms on campus, should be considered. Whenever appropriate, side writing boards should be provided.
- *Clock:* Appropriately placed clocks should always be included. This is particularly important for rooms being used for exams.
- *Special needs:* An inactive data and phone line should be included which can be activated when needed to accommodate special needs, e.g. for audio or visual aids.
- *Lecterns:*
  - Wiring for lecterns or podiums should be built in (e.g. covered floor mount) for maximum versatility of the room (or future implementation if a lectern is not included initially).
  - Lectern should be movable to accommodate different users and pedagogical styles.
  - The University may want to consider a custom-designed lectern and then standardize the workstation and user-interface design for all classrooms, as has been suggested elsewhere (Emory College Classroom Design Guidelines[7]).

- The orientation should enable the instructor to maintain eye contact with the audience while using keyboards and to view the projection screen. The height should be limited to avoid blocking audience view,
- The lectern height should accommodate an instructor who is sitting, standing or in wheelchair.
- The lectern should include a space for instructor references and handouts, AV touch panel, computer monitor, cable chase or interface, and a task light. An adjustable surface provides the flexibility to angle for notes or lay flat for a laptop.
- Flexible and extendable connectors are important considerations for tension relief and versatility.

Future technologies

It is difficult to predict which technologies will become "state-of-the art" in the near future. However, we should consider that the movement is toward more flexibility, personalization and portability. Laptops are replacing desktops (and Apple has an increasing market share of this sector). Wireless is becoming the standard (even wireless power sources are likely to be in the market place in the near future). How can this be accommodated in classroom design? First and foremost is the infrastructure to accommodate new technologies, e.g., wireless access to data projection, the ability to deliver streaming audio and video to students, sufficient high-speed access points, etc. The streaming of audio may be of particular value to students with special auditory needs. It is increasingly likely that instructors will bring their own technology to the classroom, rather than use the existing equipment in a classroom. Nonetheless, we should "upgrade" hard-wired equipment, and consider technologies such as Smart Board, Sympodium (an interactive tablet screen to annotate Powerpoint), tablet PC, and large (plasma or flat panel) screens rather than projectors. Large touch-screen monitors would be ideal in medium-sized classrooms. Versatile designs should enable better flexibility to respond to future needs.

Crush space

Wherever possible, classrooms should be located as close to building ground levels as possible to improve access and reduce noise levels in other parts of the building. Circulation spaces, such as corridors and lobbies, should be large enough to accommodate students waiting for the next class, as well as the transitioning period with groups simultaneously entering and leaving class. They should be considered as more than passageways and be carefully integrated into the planning and design process. They should be considered as networking and social areas and be designed to provide thoughtful common spaces for social interaction. For example, see: Emory College Classroom Design Guidelines[7].

Storage

- *Equipment:* A storage closet for audio-visual equipment should be included for security, optimally with an electronic keypad entrance to enable access by AV staff or by instructor.
- *For accessibility requirements:* Storage space for ergonomic chairs for special needs, CCTVs

Safety and security

Concerns about health and safety fall under the purview of the Occupational Health and Safety and Physical Plant. All classroom design must meet the requirements of the Ontario Building Code and must be adhered to during the design and construction stages. These requirements are a routine part of the building code considered by both Physical Plant and the architects.

D. Consultation

Classroom design and planning should make use of all levels of expertise. There are many lessons to be learned from previous mistakes. It is imperative to talk to faculty and staff both during the design stage and when final decisions on outfitting are made. In particular, ITS staff should be consulted early during the design stage in order to better incorporate technology, rather than looking to retrofit after completion of construction. However, it is advisable to wait as long as possible before purchasing technical equipment because of rapid technology changes.

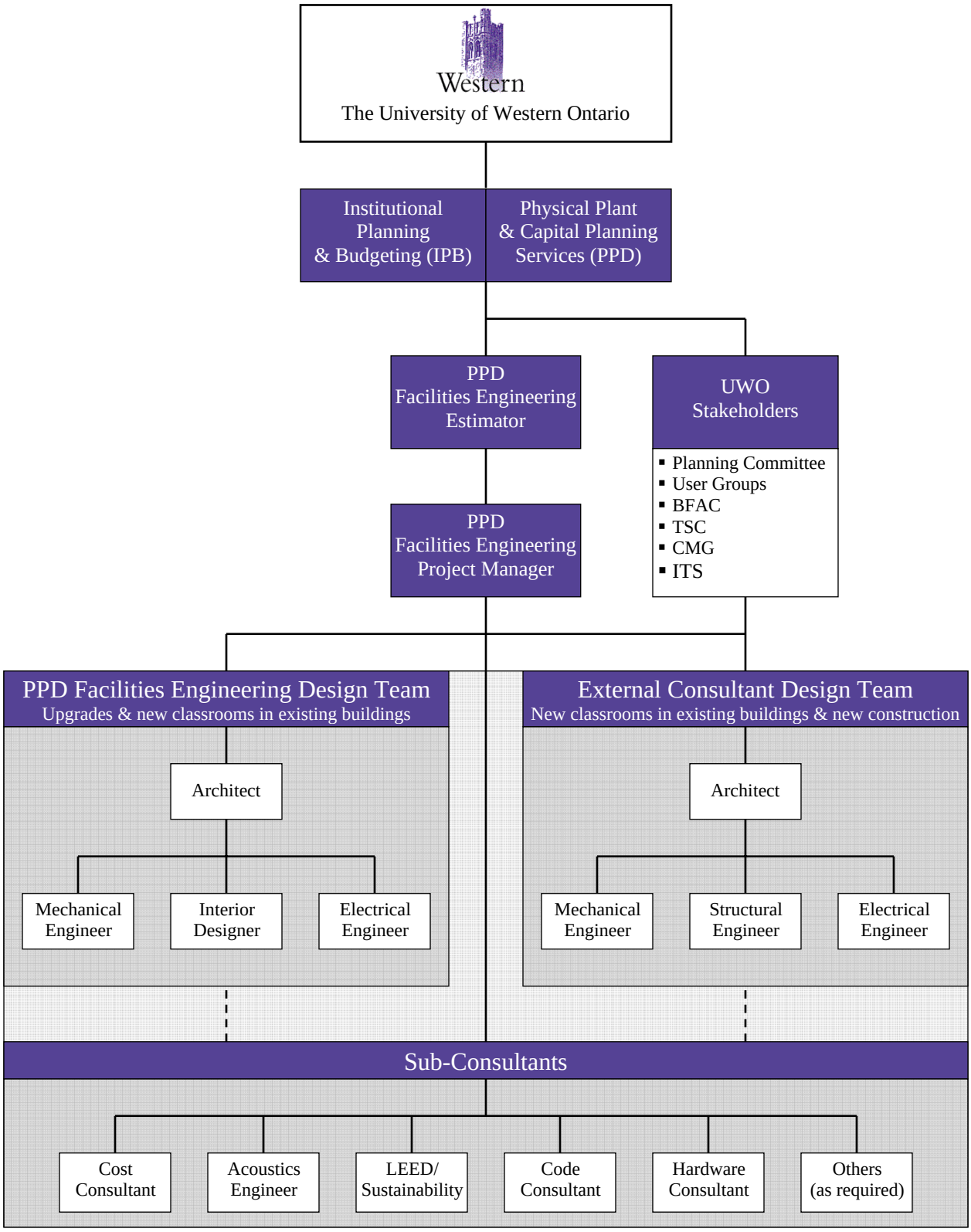
Groups involved and to be consulted:

- Physical Plant & Capital Planning Services (PPD) on architectural and interior design, mechanical and electrical engineering, and costing.
- Information Technology Services (ITS) on design, construction, and fitting stages.
- Institutional Planning and Budgeting (IPB) should be consulted on classroom design and configuration at early stages in addition to the usual later stage. Faculty, staff and users should be consulted during the early planning stages and again prior to the furnishing and finishing.
- Barrier Free Accessibility Committee (BFAC) to ensure that classrooms are appropriately designed for accessibility.
- Teaching Support Centre (TSC) for major renovations so that they can provide information to enhance the design of student-centered learning spaces.
- *Other resources:* A list of useful resources is included at the end of this document. Also, consult the online site Classroom Design – Higher Education[12], by National Clearinghouse for Educational Facilities, for an extensive resource list of books, articles, and websites related to the design and layout of classrooms for colleges and universities.

The following chart identifies the various departments, stakeholders, key personnel and consultants involved in the design and planning process for classroom construction and upgrades.

[12] http://www.edfacilities.org/rl/classroom_design_HE.cfm, last retrieved October 3, 2008

CLASSROOM CONSTRUCTION AND UPGRADE ORGANIZATION CHART



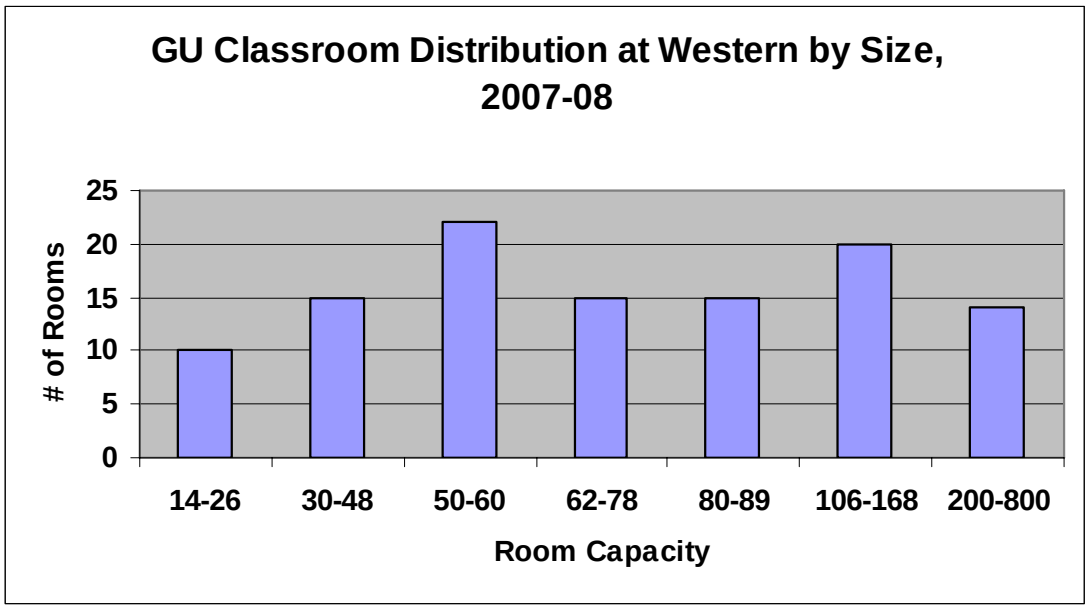
MODERNIZATION OF EXISTING CLASSROOMS

As described in Appendix B, each year, through the University's planning process, IPB in consultation with PPD carries out an assessment of Western's general university (GU) classrooms. The outcome of this assessment is a set of recommendations for general and technology improvements to the GU classrooms, which are incorporated into the University's annual budgets.

As a follow up to the discussions which led to this report, IPB and PPD carried out a study to understand the costs of bringing our (GU) classrooms to modern standards following on the principles outlined in this report. The estimated cost is $15 million, and will involve 48 GU classrooms -- as listed in Appendix C.

APPENDIX A: CURRENT CLASSROOM INVENTORY – 2008

As of spring 2008 at Western, there were about 120 general-use (GU) classrooms with a total seating capacity of about 13,000 and which typically run at about 70% usage. "Usage" is defined as the percentage of daytime hours that the classrooms are being used in a 45 h week. These classrooms cover a wide range of sizes from 12 to 800, and the distribution of classrooms by size is summarized in the graph below. This distribution reflects the distribution of courses offered at Western from the larger first-year courses to the smaller senior and graduate courses. The GU classrooms are complemented by non-GU classrooms under control of the individual units or departments and tend to be used for smaller graduate classes, unit meetings and seminars. There are at least 50 such rooms with about 80% of these having a capacity of 50 or less.



The table on the following page provides information on categories of classrooms currently available at Western with a link to a typical example at Western. In each case the number of these types of classrooms is shown along with an indication of the range of seating capacities from the smallest to the largest and the average seating capacity. The total seating capacity that these rooms provide is also given. For each type there is a large range in seating capacities, but the majority fall close to the average size. It is interesting to note that the total seating capacity represents about half of the undergraduate population so that, in principle, half of the students could be in class at one time.

Tab-arm lecture halls provide the largest seating capacity and are typically theatre style with higher seating capacities with a few exceptions. These tend to be used for larger first- and second-year courses and for other large gatherings. This style of classroom provides the space-efficient seating needed for large groups, but tab arms have proven to be susceptible to breakage. Tab arms have proven to be quite acceptable for lecturing but not for tests and exams. There is

also the problem of providing the correct mix of left- and right-handed tabs, particularly for examinations. Provision of adequate seating for exams continues to be an essential consideration when planning new classrooms. Fixed and movable table configurations do meet this need but, because these rooms tend to be smaller, exams for large classes are frequently distributed over several rooms. Fixed table arrangements easily allow for power and IT connections at each seat while movable tables allow for the flexibility of using different classroom configurations. Currently tabled rooms are the predominant classrooms representing about 70% of the total classrooms and about 50% of the available seating.

As indicated below, there are a few GU rooms with conference-style tables, and it is likely there are considerably more unit-controlled rooms in this style. Conron Hall is included as a separate category since it is one of the few rooms containing mostly tab arms seats in the theatre style with a balcony, and also a significant number of movable tab-arm seats.

Western has just begun to create "two-tiered" classrooms designed for interactive teaching of large classes for which there seems to be a growing demand. These classrooms are characterized by two rows of seats on each tier with seating that allows the two groups on each tier to turn and face each other for small group discussion. Similar flexibility is also provided by the movable table/movable chair design but these rooms are usually for smaller classes. The tiered design allows the interactive approach to teaching to be applied to larger classes as has been implemented elsewhere with classes of up to 250 (e.g. Jordan Hall of Science at Notre Dame[13]). There are Canadian examples as well at the University of Guelph's Rozanski Hall and the University of Victoria's Harry Hickman Building[14].

GU Classroom Distribution at Western by Type and Seating Capacity
2007-08

Classrooms		Classroom Seating Capacity			
Type	**Number**	**Smallest**	**Largest**	**Average**	**Total**
Tab Arm[15]	27	48	789	223	6,020
Fixed Table, Fixed Chair[16]	20	35	243	90	1,796
Fixed Table, Movable Chair[17]	42	30	384	86	3,637
Movable Table, Movable Chair[18]	23	12	140	38	866
Conference Table[19] (e.g. UC 213)	5	15	26	20	100
Conron Hall[15] (UC 224)	1			225	225
Two-tiered[20] (WL 258)	1			96	96
Totals	119				12,740

[13] http://science.nd.edu/jordan/about/twin-lecture-halls.shtml, last retrieved October 3, 2008
[14] http://web.uvic.ca/mediaservices/classrooms/hhb_105.htm, last retrieved October 3, 2008
[15] http://www.ipb.uwo.ca/cmg/view.php?buildingname=b_ncb, last retrieved October 3, 2008
[16] http://www.ipb.uwo.ca/cmg/view.php?buildingname=b_sh, last retrieved October 3, 2008
[17] http://www.ipb.uwo.ca/cmg/view.php?buildingname=b_ssc, last retrieved October 3, 2008
[18] http://www.ipb.uwo.ca/cmg/view.php?buildingname=b_weldon, last retrieved October 3, 2008
[19] http://www.ipb.uwo.ca/cmg/view.php?buildingname=b_uc, last retrieved October 3, 2008
[20] http://www.ipb.uwo.ca/cmg/view.php?buildingname=b_weldon#259, last retrieved October 3, 2008

The adoption in 2006 of the long-range space plan and its subsequent implementation is another major influence on the change in classroom distribution and represents an impetus for the development of this report. Concurrent with the moves initiated by the long-range space plan are ongoing renovations to the Biology & Geology Building and renovations to the Physics & Astronomy Building in the planning stage. In each case the number of classrooms remains fairly constant in these buildings, but the opportunity arises to modernize the rooms. Also in the planning stages, as part of the long-range space plan, is conversion to academic use of the Stevenson-Lawson Building and parts of the University Community Centre. Each of these will allow for the creation of several new classrooms. Looking somewhat further down the road, it is anticipated that renovations to the Natural Science Centre will allow for modernization of existing classrooms, and renovations to the current Services Building will allow for creation of new classrooms.

APPENDIX B: GU CLASSROOM CONSTRUCTION AND UPGRADE PROCESS

The Office of Institutional Planning & Budgeting (IPB) is responsible for the planning involved with new GU classrooms and for the upgrade program, which includes both technical and general classroom upgrades. Academic units are responsible for upgrades to departmentally controlled instructional facilities including classrooms and laboratories. As part of the annual budgeting and planning process, proceeding from the individual units or departments to the Dean's Offices to the Provost, priorities are determined and choices are made.

The upgrade program is crucial for the revamping of old and less versatile rooms, which are disliked by students and instructors. Technical upgrades include instructional-system installations and upgrades. General upgrades include paint, flooring, ceiling, lights, whiteboards, projection screens, furniture, etc. The program is developed from IPB site visits to classrooms, input received from members of the community, and input from the timetable coordinator. Surveys have also been done in the past, seeking instructor input on classroom conditions. However, this has not been done on a consistent basis. Further ideas on the evaluation of learning spaces can be found on the JISC infoNet[21]

Once a list of classroom upgrades has been identified, the list of general upgrades is sent to the Physical Plant Department (PPD) for cost estimates and implementation as described below. The list of technical upgrades is estimated by the CMG and outside equipment vendors. Technical upgrades include new audio-visual installations, as well as upgrades to existing systems. The Central Administration approves a capital budget for the classroom upgrades. For 2008-09, $250K has been approved for technical upgrades and $100K for general upgrades.

Most construction and renovation on campus begins with the Estimator in the Facilities Engineering Department of Physical Plant & Capital Planning Services. The Estimator is involved in establishing preliminary budgets for capital projects such as major renovations, additions or new buildings. The proposed work is estimated and sent to the requesting individual or department for approval prior to being implemented.

Almost all estimates require a meeting between the PPD Estimator and the requesting party to review the site and discuss the needs and parameters. This allows for clarity and adjustments to be made by both sides to ensure the most successful project possible. In many cases, preliminary designs are developed to better establish the full scope of work. The estimate includes allowances for meeting all code and regulation (building, fire, electrical, plumbing, barrier free, lab safety, etc) requirements as well as the best standards of materials and trade practices in the industry.

The estimate request will be assigned a work order number for tracking and correspondence purposes within Facilities Engineering. A detailed written package is then prepared and sent to the requesting party for approval. If the proposal receives approval, a signed response is returned along with an account number. Depending on the overall scope of the project, Facilities Engineering or a team of selected design consultants transforms the text and sketches of an

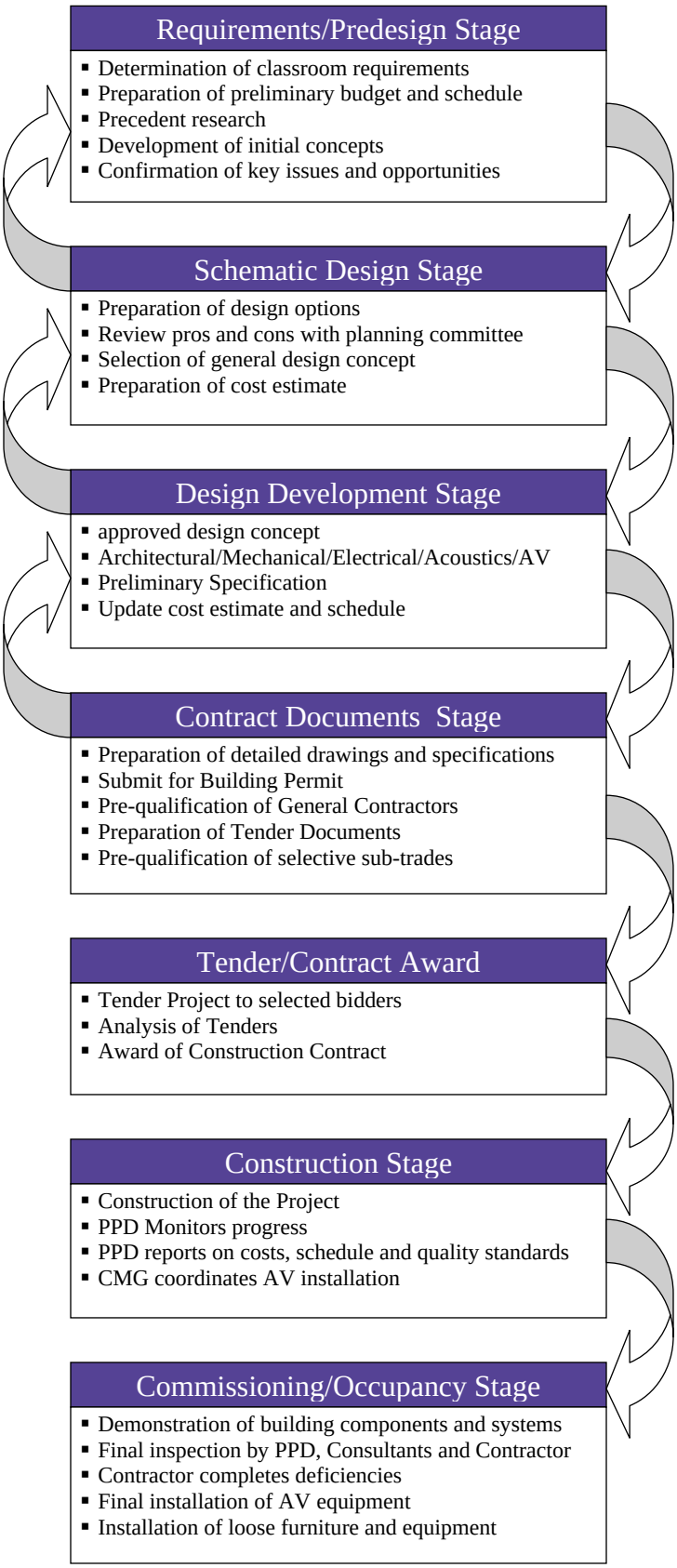
[21] http://www.jiscinfonet.ac.uk/infokits/learning-space-design/evaluation/index_html, last retrieved October 3, 2008

approved estimate into drawings and specifications, which are then used by construction trades to implement the work. In addition to the needs of the requesting party, this group must also ensure the compliance to all codes, regulations and University standards in their designs.

Classroom upgrades are completed in the summer months when classrooms are not as heavily scheduled. PPD is responsible for completion of general upgrades and the CMG is responsible for completion of the technical upgrades. All upgrades must be completed before fall classes begin.

The following chart identifies the classroom construction and upgrade process, from project inception to occupancy.

CLASSROOM CONSTRUCTION AND UPGRADE WORK PLAN



The University *of* Western Ontario

Physical Plant & Capital Planning Services

Appendix C

Estimated Cost of Modernizing General University Classrooms

		Area		Budget
1	NSC -1 Classroom	4846	SF	$1,650,000.00
2	NSC -7 Classroom	2120	SF	$750,000.00
3	UC 30 - Classroom	1600	SF	$315,000.00
4	UC 85 - Classroom	1225	SF	$350,000.00
5	UC 202 – Classroom	661	SF	$225,000.00
6	UC 287 - Seminar Room	480	SF	$135,000.00
7	UC 288 - Seminar Room	480	SF	$135,000.00
8	SEB - 1059 - Classroom	2820	SF	$500,000.00
9	SSC 2050 - Classroom	5320	SF	$700,000.00
10	MC 110 - Classroom	3580	SF	$875,000.00
11	KB 106 – Classroom	1195	SF	$175,000.00
12	KB 208 – Seminar Room	1206	SF	$100,000.00
13	KB 103 - Classroom	1175	SF	$95,000.00
14	KB 203 - Classroom	1175	SF	$85,000.00
15	SH 3345 - Classroom	2580	SF	$80,000.00
16	TH 4185 - Classroom	973	SF	$230,000.00
17	TH 3154 - Classroom	701	SF	$160,000.00
18	SSC 2020 - Classroom	1210	SF	$266,000.00

19	SSC 2024 - Classroom	1902	SF	$418,000.00
20	SSC 2028 - Classroom	1925	SF	$424,000.00
21	SSC 2032 - Classroom	1925	SF	$424,000.00
22	SSC 2036 - Classroom	1917	SF	$422,000.00
23	SSC 2050 - Classroom	6271	SF	$1,380,000.00
24	SSC 3006 - Classroom	971	SF	$214,000.00
25	SSC 3010 - Classroom	962	SF	$212,000.00
26	SSC 3014 - Classroom	953	SF	$210,000.00
27	SSC 3018 - Classroom	1192	SF	$262,000.00
28	SSC 3022 - Classroom	1897	SF	$417,000.00
29	SSC 3024 - Classroom	1105	SF	$243,000.00
30	SSC 3026 – Classroom	1111	SF	$245,000.00
31	SSC 3028 - Classroom	1104	SF	$243,000.00
32	SSC 3102 - Classroom	872	SF	$192,000.00
33	SSC 3103 – Seminar Room	457	SF	$101,000.00
34	SSC 3107 – Seminar Room	456	SF	$101,000.00
35	SSC 3108 - Classroom	872	SF	$192,000.00
36	SSC 3116 - Classroom	889	SF	$196,000.00
37	SSC 4103 – Seminar Room	377	SF	$83,000.00
38	TC 201 - Classroom	735	SF	$162,000.00
39	TC 202 - Classroom	728	SF	$160,000.00
40	TC 203 - Classroom	1132	SF	$249,000.00
41	TC 204 - Classroom	1085	SF	$239,000.00
42	TC 205 - Classroom	1085	SF	$239,000.00

43	TC 303 - Classroom	748	SF	$165,000.00
44	TC 304 - Classroom	735	SF	$162,000.00
45	TC 309 - Classroom	1085	SF	$239,000.00
46	TC 341 - Classroom	1003	SF	$221,000.00
47	TC 342 - Classroom	990	SF	$218,000.00
48	TC 343 - Classroom	990	SF	$218,000.00
	Budget Grand Total	70821	SF	**$15,077,000.00**

COMMITTEE COMPOSITION

Mike Atkinson, Professor, Department of Psychology
Debra Dawson, Director of Teaching Support Centre
Flemming Galberg, former Director of PPD Facilities Engineering, member of BFAC and WODAC,
Duncan Hunter (Chair), Coordinator of Academic Space Planning
Mark Hurley, Manager of Space Management and Planning, member of CARE
Mark McDayter, Professor, Department of English
Mike McLean, Architect, PPD Facilities Engineering, member of CARE, BFAC and WODAC
Tamie Poepping, Professor, Department of Physics & Astronomy

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In the preparation of the consultation draft, the committee met biweekly starting in October 2007. As part of the process of creating the consultation draft, the committee toured existing classrooms, both off and on campus, consulted externally and internally, reviewed literature on the pedagogical design of classrooms, and met with local experts on various aspects of classroom design.

The committee would particularly like to acknowledge the following people for their helpful discussions:

- Dr. Wendy Dickinson, Services for Students with Disabilities (member of BFAC and CARE),
- Debbie Jones, Director of Information Technology Services
- Chris Jordan, Office of Institutional Planning & Budgeting
- Professor Lisa Klinger, Occupational Therapy (member of WODAC)

The consultation draft was circulated as widely as possible, including undergraduate students, graduate students, faculty members, and PPD staff. More specifically, the undergraduates were contacted through focus groups organized by the University Student Council. Graduate students were consulted through the Society of Graduate Students (SOGS) and representatives from the Graduate Teaching Assistants (GTA) union. Faculty members were contacted through a meeting with the Deans, through a focus group organized by the Teaching Support Centre (TSC), and through the University of Western Ontario Faculty Association (UWOFA). Staff groups consulted included Information Technology Services (ITS), the Classroom Management Group (CMG), and the PPD Facilities Engineering Department.

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RESOURCES FOR CLASSROOM DESIGN AND PLANNING

City of London: Facility Accessibility Design Standards (FADS)
(http://www.london.ca/d.aspx?s=/Accessibility/accessibilitystandards.htm)
Technical document used by the City of London when planning and designing municipal facilities.

Classroom Design – Higher Education National Clearinghouse for Educational Facilities
(http://www.edfacilities.org/rl/classroom_design_HE.cfm)
Extensive list of resources, including links, books, and journal articles, on the design and layout of classrooms.

Classroom Guidelines for the Design and Construction of Classrooms at the University of California, Santa Cruz (University of California, Santa Cruz, 2003)
(http://media.ucsc.edu/contact/UCSC_Classroom_Guidelines03.pdf)
Condensed document of guidelines with specific design criteria for intended use by architects, engineers, and designers.

Future of the Learning Space: Breaking Out of the Box (Long, P.D. and Ehrmann, S.C., EDUCAUSE Review, 40(4):42–58, 2005.)
(http://connect.educause.edu/Library/EDUCAUSE+Review/FutureoftheLearningSpaceB/40565)
A discussion of the inadequacies of traditional classrooms and ideas to inspire the design and use of pioneering learning spaces.

Joint Information Systems Committee (JISC, London, United Kingdom) (http://jisc.ac.uk/)
Selected JISC resources:

- Designing Spaces for Effective Learning: A Guide to 21st Century Learning Space Design. (2006) (http://www.jisc.ac.uk/uploaded_documents/JISClearningspaces.pdf)
  Examples of design of entrances, teaching spaces, vocational teaching spaces, learning centres, and social spaces in higher education facilities.
- Planning & Designing Technology-Rich Learning Spaces (JISC infoNet)
  (http://www.jiscinfonet.ac.uk/infokits/learning-space-design)
  Toolkit to assist individuals and institutions with the design and development of technology-enabled learning spaces, including useful case studies and a photo library demonstrating how "good practice" models can be applied.

Learning Spaces (Oblinger, D., Ed., Educause, Boulder, CO, 2006)
(http://www.educause.edu/learningspaces)
Educause e-book covering learning space design principles, case studies, and links to examples of innovative learning spaces.

Spaces for Learning: A Review of Learning Spaces in Further and Higher Education. (Scottish Funding council, Edinburgh, Feb 2006)
(http://www.sfc.ac.uk/publications/spaces_for_learning_report.pdf)
Discusses trends in learning and teaching, designing new environments, and research-based evidence on the effectiveness of learning spaces.

Teaching with Cases (Erskine, J.A., Leenders, M.R., and Mauffette-Leenders, L.A., Richard Ivey School of Business, London, ON 1998)
Discusses the factors for optimal design of case-method classrooms.

Universal Design Principles (Center for Universal Design, College of Design, North Carolina State University, 2008)
(http://www.design.ncsu.edu/cud/about_ud/udprinciplestmlformat.html)
Seven principles of universal design aimed at the development of products and environments to be usable by everyone, without the need for adaptation or specialized design.

University of Western Ontario: Accessibility @Western (http://accessibility.uwo.ca/)
Information on accessibility issues including lists of services, groups and committees on campus dedicated to promoting accessibility at Western.

University of Western Ontario: Classroom Management Group
(http://www.ipb.uwo.ca/cmg/buildings.php)
Division of Western's Institutional Planning and Budgeting (IPB) that handles installation and maintenance of audiovisual and media technology systems in general university (GU) classrooms.

University of Western Ontario: Information Technology Services (ITS)
(http://www.uwo.ca/its/)
Supports information technology-related services across campus at Western.

University of Western Ontario: Physical Plant & Capital Planning Services (PP&CPS)
(http://www.uwo.ca/ppd/)
Also known as the Physical Plant Department, the PPD is responsible for the planning, development, construction, operation, maintenance and stewardship of all the buildings, infrastructure, sites and services within the campus community.