Learning Environments For 21st Century “Learn By Doing”

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FOR COMMENTS

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Learning Environments For 21st Century “Learn By Doing”

Executive Summary

Many of Cal Poly’s classrooms reflect a one-size-fits-all, industrial production model of education from an earlier era, where the dominant pedagogy consisted of professors talking and students listening. That era has passed, as has the dominance of the outdated “transmission” model of teaching. Cal Poly is ready to transition to the next generation of learning environments based on a vision for more effective teaching practices as campus educators update and enhance our signature “Learn By Doing” approach for 21st Century teaching and learning.

This proposal is grounded on the premise that the quality of learning is shaped by how well the classroom environment’s “built pedagogy” supports – or inhibits – the desired activities. The principles and standards proposed here emerge from essential learning goals for Cal Poly students, as articulated by the university and by future employers. The teaching practices that best promote those learning goals are then identified, which point to the settings and technologies that best promote those teaching practices and learning activities.

Learning Goals. Multiple recent surveys on employers’ priorities for today’s college graduates consistently emphasize a set of essential interpersonal and intellectual capabilities that they see as critical to complement knowledge in a specific discipline. Employers emphasize the importance of:

- Teamwork and collaboration
- Critical thinking and analytical reasoning
- Oral and written communication
- Problem solving in real-world settings
- Ethical choices and actions

These priorities parallel closely Cal Poly’s core learning outcomes, as detailed in the university’s various learning outcomes and its strategic plan. Together, these sets of capabilities constitute a compelling agenda for Cal Poly as it builds on its strengths to update its curriculum for a 21st Century education.

Educational Models and Practices. The convergence on essential learning outcomes for Cal Poly students requires educational models and methods selected specifically to help Cal Poly students develop these capabilities. A strong consensus among education experts is that traditional instruction should evolve into a new paradigm of instruction, which will promote Cal Poly’s learning priorities.

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As university-level educators transition to the new paradigm from the old in coming years, teaching practices and learning activities that support the new paradigm will diffuse widely. To foster diffusion at Cal Poly, campus learning environments should be redesigned over time to support the newer set of teaching practices and learning activities in concert with faculty development through CTLT.

**Holistic Approach To Learning Environment Designs.** Learning environments that are designed to enable the new paradigm of teaching are more flexible to accommodate a wider range of learning activities, provide ubiquitous access to technology, promote interaction and a sense of community, and enable formal and informal learning. The classrooms design standards detailed in this proposal enable students and teachers to utilize both the physical and digital worlds in service of active, collaborative, technology-enhanced “Learn By Doing” – much like the innovative, creative workplaces found in successful businesses. This holistic approach is reflected by:

1. Transcending traditional barriers between physical learning spaces (i.e., classrooms) and digital learning spaces (i.e., online learning management systems and internet resources).
2. Supporting faculty’s and students’ capacity to access as well as to produce digital multimedia content in and out of classrooms.
3. Supporting faculty as they develop new instructional practices so that they can take full advantage of the opportunities that the instructional tools and learning environment present and then supporting students as they do the same.
4. Encompassing both instructional technologies for teachers and learning technologies for students as well as the software, infrastructure, and services required for both.

In sum, this proposal describes the instructional spaces, the instructional and learning technologies, the instructional practices, and the digital content and communication resources as an integrated ecosystem. This holistic approach provides the most effective support for updating “Learn By Doing” that will keep Cal Poly at the forefront for decades to come.

Included in the proposal are principles to guide future classroom designs/renovations as well as detailed descriptions of the various classroom design types: Large Lecture Halls, Smart Classrooms, Multimedia Classrooms, Collaborative Classrooms, Distance Learning Classrooms, Studio Lab Classrooms. Given the wide range of disciplines, variations in preferred teaching methods, and differing levels of enthusiasm for utilizing technology that exists across campus, no single set of standards for learning environments can meet all preferences for all stakeholders. This conceptual foundation and the specific proposals for learning environments are intended to meet the highest priority needs for the most stakeholders through designs that allow options and flexibility as well as adaptability over time.

As a blueprint, this document would be the basis for drafting an implementation strategy, estimating costs, and developing a timeline. The principles and standards articulated here, when finalized, will guide the university’s intellectual and financial investment in the next generation of campus learning environments and their use by educators and learners. Implementing this vision will provide students, parents, faculty, staff and other campus stakeholders with visible evidence of Cal Poly’s investment in student success for their 21st Century careers.
I. Purpose and Overview

The purpose of this document is to support Cal Poly students’ success and Cal Poly faculty’s effectiveness by detailing the principles and specific designs for the next generation of learning environments that facilitate powerful instructional practices and transformational learning experiences. It is based on a vision for Cal Poly’s teaching practices through the next decade as campus educators update and enhance the signature “Learn By Doing” approach for 21st Century teaching and learning. The principles and standards articulated here will guide the university’s intellectual and financial investment in renovating existing learning environments and their use by educators and learners.

This proposal embraces a holistic approach that encompasses the entire set of people, things, resources, and activities relevant to teaching and learning both “in the box” of the classroom space and “out of the box” resources available through digital network access (See Figure 1):

Figure 1: Learning Environment

As such, this plan takes into account:

- People and Their Activities: Instructors, students, guests (virtual and physical) doing individual reflection, paired conversations, group work, whole-class discussions, whole-class responses to
prompts (low-tech and high tech methods), content modification/creation, sharing and exchanging content.

- **Things:** Furnishings for instructor and students; technologies for instructors and students; environmental factors such as ventilation, lighting and acoustics as well as surface colors and textures (i.e., walls, ceilings, floors).

- **Resources:** Physical and digital artifacts; physical forms of course content through tangible media and digital forms of course content through robust wired/wireless network access for instructor and student use, software and media streaming capabilities.

- **Institutional support:** Professional development resources and activities for educators to learn new methods of instruction, new instructional technologies to take full advantage of the learning environments.

Implementing this holistic approach to redeveloping classrooms requires a close partnership with campus stakeholders (e.g., Facilities, Scheduling, ITS, CTLT) to execute design plans, allocate spaces, and implement instruction.

The approach taken here is grounded in the premise that learning activities and learning environments are deeply intertwined. Each classroom’s “built pedagogy” reflects an architectural embodiment of an educational philosophy (Monahan, 2002). As Chisolm (2006) explained, “…(T)he ways in which a space is designed shape the learning that happens in that space. Examples surround us. A room with rows of tablet arm chairs facing an instructor’s desk in front of chalkboards conveys the pedagogical approach ‘I talk or demonstrate; you listen or observe.’ A room of square tables with a chair on each side conveys the importance of teamwork and interaction to learning” (p. 2.2).

Many college classrooms reflect a one-size-fits-all, industrial production model of pedagogy from an earlier era when a professor’s role was to disseminate knowledge through lectures captured in students’ note taking. Interaction between students and teachers was difficult at best, if not prohibited as an interruption, and student collaboration could be considered cheating. Vestiges of that model persist today as teaching traditions, financial efficiencies, and the sunk cost of classrooms and lecture halls built and outfitted to support this model provide the inertia.

A growing body of research from a variety of disciplines is making a compelling case for a new model. Research in cognitive science has illuminated methods most conducive to how the human brain learns; sociological research has documented the distinctive characteristics, capabilities, and culture of today’s generations of college students; research on the influence of physical space on human activity has clarified the specifics of that relationship applied to educational settings.

Design experts advocate beginning the design process with a clear conceptualization of end users’ intended activities and outcomes. In the case of university learning environments, end users are the instructors and students. Intended activities and outcomes depend on the model of education at play in any particular space. The proposed learning environment principles and standards presented here have at their core a new paradigm of teaching and learning, which is expected to diffuse widely across
campus in coming years. The campus needs to prepare learning environments that facilitate teaching and learning activities that maximize achievement of Cal Poly’s priority outcomes for all students.

Given the wide range of disciplines, variations in preferred teaching methods, and differing levels of enthusiasm for utilizing technology that exists across campus, no single set of standards for learning environments can meet all preferences for all stakeholders. The conceptual foundation and the specific proposals for learning environments are intended to meet the highest priority needs for the most stakeholders through designs that allow options and flexibility as well as adaptability over time.

Implementing this plan will provide students, parents, faculty, staff and other campus stakeholders with visible and tangible evidence that Cal Poly is investing in its students’ success. As Chism and Bickford (2002) note, “Creating spaces thoughtfully and with the involvement of users, providing adequate resources for aesthetics, comfort, and functionality, and maintaining them to high standards are actions that say that an institution cares about teaching and learning and regards them as central activities to its mission” (p. 92).

II. Designing Learning Environments

Overview

Classroom design experts advocate renovating classrooms through user-centered design, in which the needs of the end user drive design (Cornell, 2002). End users of university classrooms are, of course, teachers and learners, who need environments that foster effective teaching for effective learning. Therefore, the learning environment proposals in this document begin with the learning goals for Cal Poly students, expand outward to the teaching practices that best promote those learning goals, expand further to the settings and tools that best promote those teaching practices. This section summarizes Cal Poly’s overarching learning goals for all of its students, bridges those to emerging learning goals most valued by society and industry, and ties all of those to new paradigms for teaching and learning rooted in scholarship and supported by research findings.

Learning Goals: Cal Poly and Employers

Language that details Cal Poly’s learning goals are located in the university’s strategic plan as well as in the campus’s officially adopted University Learning Outcomes and Diversity Learning Outcomes. Together, that language creates a web of concepts and intentions that constitute the essence of Cal Poly’s educational agenda. Any plan for the future of learning spaces must align with those outcomes.

Also relevant when envisioning the next generation of learning environments are employers, who know best the high priority learning outcomes needed for success in today’s careers. A critical factor in maintaining Cal Poly’s reputation for strong graduates is to monitor evolving expectations and high priority skill sets among employers to make sure that Cal Poly’s curriculum stays current with expectations and priorities in a rapidly evolving global economy. Survey data from employers have
clarified the key skills and capabilities that they find most important in new graduates, many of which align quite closely with the university’s set of learning objectives.

Surveys commissioned by the Association of American Colleges and Universities (AAC&U) show a notable consistency over time in identifying the skills most valued by employers in college graduates they seek to hire. When asked to weight the relative importance of skills that potential new hires bring, employers consistently emphasize the following capabilities:

- Teamwork
- Critical thinking and analytical reasoning
- Oral and written communication
- Collaboration
- Problem solving in real-world settings
- Ethical choices and actions

The common thread is the need for a deep emphasis on core interpersonal and intellectual capabilities that complement knowledge in a specific field or major. “While these employers are somewhat concerned about recent college graduates’ not having necessary specific job or technical skills, they express the greatest frustration with the challenges of finding ‘360 degree people’ who have both the specific job/technical skills and the broader skills (communication skills, teamwork skills, problem-solving skills, and work ethic) necessary to promise greater success for both the individual and their employer” (Hart Research Associates, 2006, p. 7).

When juxtaposed, the close alignment of employers’ priorities for college graduates with Cal Poly’s current learning outcomes is illustrated below.

<table>
<thead>
<tr>
<th>Employers’ Top Priorities1</th>
<th>Cal Poly ULOs</th>
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<tbody>
<tr>
<td>Critical thinking and analytical reasoning</td>
<td>ULO1 Think critically and creatively</td>
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<tr>
<td>Oral and written communication</td>
<td>ULO2 Communicate effectively</td>
</tr>
<tr>
<td>Teamwork, Collaboration</td>
<td>ULO4 Work productively as individuals and in groups</td>
</tr>
<tr>
<td></td>
<td>DLO2 Consider perspectives of diverse groups when making decisions</td>
</tr>
<tr>
<td></td>
<td>DLO Function as members of society and as professionals with people who have ideas, beliefs, attitudes, and behaviors that are different from their own</td>
</tr>
<tr>
<td>Problem solving in real-world settings</td>
<td>ULO5 Use their knowledge and skills to make a positive contribution to society</td>
</tr>
<tr>
<td>Ethical choices and actions</td>
<td>ULO6 Make reasoned decisions based on an understanding of ethics, a respect for diversity, and an awareness of issues related to sustainability</td>
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1 Aggregated from multiple years of surveys conducted by Peter Hart Associates under contract from AAC&U.
This review of campus’s and employers’ perspectives demonstrates a close alignment of Cal Poly’s core learning outcomes and those skills and capabilities sought by employers. This alignment is likely a major contributor to Cal Poly’s strong reputation as a university that graduates career-ready students. Together they comprise a clear and compelling agenda for Cal Poly as it builds on its current strengths to update its curriculum for 21st Century educational priorities.

Teaching Models for High-Priority Learning Outcomes

Next are the specific educational models and methods designed to help Cal Poly students to achieve those goals. A strong emerging consensus among education experts is helping to evolve basic models of university-level instruction away from a narrow set of traditional but less effective teaching methods and toward a broader set of instructional practices, which happen to fit well with university and employer priorities. Fink (2003) summarizes the differences between the old “transmission model” paradigm and the new “active learning” paradigm:

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<tr>
<td>Relationships</td>
<td>Impersonal relationships among students and between faculty and students</td>
<td>Personal relationships among students and between faculty and students</td>
</tr>
<tr>
<td>Context</td>
<td>Competitive, individualistic</td>
<td>Cooperative, collaborative</td>
</tr>
<tr>
<td>Power</td>
<td>Faculty holds and exercises power, authority and control</td>
<td>Students are empowered; power is shared among students and between students and faculty</td>
</tr>
<tr>
<td>Epistemology</td>
<td>Reductionist: facts and memorization</td>
<td>Constructivist: inquiry and intervention</td>
</tr>
<tr>
<td>Technology Use</td>
<td>Drill and practice; textbook substitute; chalk-and-talk substitute</td>
<td>Problem solving, communication, collaboration, information access, expression</td>
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What is immediately apparent from this comparison is that the elements of the new instruction paradigm dovetail quite closely with not only Cal Poly’s “Learn By Doing” tradition and its current set of learning goals but also the critical skills that today’s employers seek in tomorrow’s graduates. The close alignment with Cal Poly’s learning goals and employers’ priorities for graduates expressed consistently over time makes a strong case for embracing the new paradigm as a valuable model for evolving Cal Poly’s instruction.

Of relevance is the fact that a large proportion of veteran higher education faculty members learned (and succeeded to the point of earning advanced degrees and establishing a career in academia) under
the old paradigm. Teaching methods that align with the new paradigm are less familiar than those of the old paradigm, which means that instructors need to develop new course design and instruction skills. To support university educators as they make the decisions regarding evolving their teaching to respond to these trends, faculty need support in refining new skills as well as to have access to learning environments that facilitate, not hinder, these new methods while not constraining faculty from practicing conventional, familiar methods. This next section details the characteristics of learning environments that best support the new paradigm of teaching and learning.

Learning Environments for High Priority Goals

Overview

Chism and Bickford (2002) observe what they call a “remarkable confluence” of ideas among scholars of learning environments and education researchers:

“Through brain research we understand better now than ever before the value of active learning. External competition from corporate and for-profit universities is creating an awareness that change is needed. … A significant portion of our classrooms nationwide are in need of renovation or replacement. And a new paradigm favoring learning over teaching and active learning over passive knowledge absorption is making headway in changing our assumptions about how learning takes place …” (p. 96).

While paradigm shifts are underway in the models and methods of instruction, classrooms have largely remained unchanged from their original designs based on the transmission model of instruction. University classrooms (including hundreds at Cal Poly) would be instantly recognized by students from the 1950s: straight rows of tab-armed desks, chalkboards or whiteboards at the front for instructor use, and any display technology (overhead projectors or digital projectors) at the front of the room under the instructor’s control. The message that this environment sends students is clear: You are expected to sit (mostly) silently listening and taking notes. The setting also sends a message to instructors: You are expected to be the focus of the activities and the source of knowledge while exercising complete control over the content as well as the pace and sequence of activities (Cornell, 2002). These outdated classrooms likely persist for a variety of factors: financial constraints, comfort with traditional teaching methods and spaces, a lack of vision for change, etc. Teachers and students learn to make do when striving to collaborate during active learning (e.g., asking students move desks into groups to encourage group work and letting students use the chalkboard/whiteboard on occasion). But these workarounds fall short of learning environments that truly promote and support new paradigms of teaching and learning. And they fail to take advantage of digital networks that provide multimedia resources and support interactions that can enhance learning in powerful ways.

In the new paradigm of education, teachers are envisioned to serve at various times as facilitators for active student engagement. Instructor and students share access to display technologies (e.g., whiteboards, digital projectors) and to online materials. Learning environments designed to enable the new paradigm for teaching need to be dynamic and flexible to accommodate a wider range of learning
activities, provide ubiquitous access to technology, promote interaction and a sense of community, and that enable formal and informal learning.

A key distinction between classrooms remodeled with new furniture and learning environments for 21st Century learning is the infusion of digital technologies. Students’ rapid adoption of mobile computing power in the forms of laptops, tablets and smart phones combined with wireless networks provide in-class access to online multimedia course materials and opportunities for powerful collaborative learning activities (Brown & Lippincott, 2003). Learning spaces that are designed to utilize both the physical and digital worlds in service of active, collaborative, technology-enhanced “Learn By Doing” become learning environments that meet today’s needs and expectations of students, faculty, and society.

These ideas have been implemented and studied in cutting-edge projects documenting their efficacy in achieving enhanced student learning. Examples include the SCALE-UP (“Student Centered Active Learning Environment for Upside-Down Pedagogies”) model implemented at more than 50 universities (details available at http://scaleup.ncsu.edu/). Another prominent approach is the TEAL (“Technology Enabled Active Learning”) (details available at http://icampus.mit.edu/projects/teal/). Accumulating evidence from studies of these models indicates significant cognitive and affective gains such as increased conceptual understanding, improved ability to solve problems, and improve attitudes. Enhanced inclusiveness has been documented as well, with reduced failure rates (especially for women and minoritites) and improved success for at risk students in later courses (Beichner et al., 2007).

These new learning environments are much like the innovative, creative workplaces found in successful businesses. They require a holistic approach that:

1. Transcends traditional barriers between physical learning spaces (i.e., classrooms) and digital learning spaces (i.e., online learning management systems and internet resources for content and collaboration) to better leverage both for powerful learning experiences in a world of mobile computing.

2. Supports faculty’s and students’ capacity to produce and exchange digital multimedia content in and out of classrooms as a core component of learning, and to access the wide array of high-quality multimedia content available online anytime, anywhere.

3. Supports faculty as they develop new instructional practices to take full advantage of the opportunities that the instructional tools and learning environment present, and then supporting students as they do the same.

4. Encompasses both instructional technologies for teachers and learning technologies for students as well as the software, infrastructure, and support services required for both.

This holistic design that provides the most effective approach to supporting opportunities for change given the inertia of traditional teaching and learning.

Learning Environment Principles
The following principles are proposed to guide design of learning environments. The principles emerge from the scholarly literature, years of experience managing Cal Poly’s classroom technologies, resource considerations, existing policies, and consultations with educators, learners, and other campus stakeholders. They are intended to inform decisions regarding technology and environmental upgrades as well as ongoing refresh of classroom technologies – all intended to enhance the quality of students’ learning experiences. Each learning space is unique and these principles will guide learning space design and implementation that is responsive to distinctive situations.

**Learning Centered**

Learning outcomes, and the intended learning activities and instructional practices designed to achieve those outcomes, should be the central focus of all learning environment designs and elements within those learning environments.

**Reliability**

Learning environments represent mission critical spaces that require maximum reliability to minimize down time. Greater reliability is achieved through selection of equipment and systems and design of support services and remote monitoring tools so that support staff can be responsive to issues. Reliability maximizes time on task for faculty and students to focus on learning activities.

**Low Complexity**

Low complexity instructional technologies are preferred so that they can be understood and operated by faculty and by students with minimal preparation and minimal need for the expense of ongoing, in-class/on-call tech support.

**Consistency**

The array of instructional technologies should be consistent in function and operation across classrooms to minimize time diverted from teaching and learning activities. Design and deployment should be replicated to provide a consistent user interfaces for same room types across campus that look and function in familiar ways for faculty and students. Consistency maximizes time on task for faculty and students while also allowing for efficiencies in purchasing, maintenance, and refresh.

**Flexible Functionality**

Designs should strive to accommodate the wide range of (newer and older) teaching methods that are in use in university classrooms. Furnishings should be easily movable and technologies should allow quick, low-effort reconfiguration between classes and within a class session so that arrangements can facilitate intended learning experiences.

**Technology for Instruction/Instructors and Learning/Learners**

Learning environments should provide, and provide for, hardware and software technologies that enhance both teaching and learning. Instructional technologies and related software should be provided to instructors to allow options for methods and materials fitting a wide range of
pedagogical approaches. Learning technologies (e.g., mobile digital technologies such as laptops, tablets, smart phones used by students) and related software should be available through robust wireless networking access and furnishings that accommodate their use by students and instructors.

**Inclusiveness**
A core principle of teaching and learning at Cal Poly is the embrace of diversity (broadly defined) and maximizing engagement and success of all students. Learning space designs need to recognize the diversity among students: physical capabilities, existing skills and abilities with teaching and learning technologies, and areas needing development. The goal is to maximize inclusiveness in campus learning environments.

**Coordinated Aesthetics, Comfort and Functionality**
Designs should encompass factors affecting student learning along with factors affecting faculty teaching, including technologies for teaching and learning as well as physical components such as comfortable furnishings for instructors and students, aesthetically attractive décor, and basic environmental factors (e.g., light, air, temperature) in ways that complement each other to maximize the effectiveness of each.

Implementation of the final version of this plan will be more effective if it includes the following principles:

**Rapid Response Support for Critical Systems**
Critical systems, those needed for common and core learning experiences, should be prioritized by support staff for rapid response to problems, with the goal of minimizing the loss of instructional time. Networked monitoring and control systems should be installed for instructional technology where feasible to allow for quick, effective remote support response.

**Phased Obsolescence**
When older classroom technologies become obsolete to the point where support is no longer sustainable financially or operationally, they will be phased out on a schedule that is shared widely with stakeholders. Faculty should be provided support for format migration of instructional materials and evolution of instructional methods.

**Life Cycle Expense Analyses**
Design decisions should encompass long-term analyses of costs for hardware and software maintenance, refresh, and updating to ensure that associated expenses are manageable over time.

The principles will guide renovations and upgrades in existing classrooms. Full functionality and full benefits are dependent on a supporting infrastructure that includes:

1. A robust wireless network
2. Streaming media server storage and delivery capacity
3. Support for students and faculty as they adopt new teaching and learning activities and new technologies.

The network enables student-held mobile devices and should be able to accommodate concurrent, data-intensive multimedia downloading and uploading by all students in a classroom (assuming multiple devices each) as well as intensive use of online collaboration tools. Media server capacity is required to deliver and receive multimedia content over the network for use in the learning spaces. This complementary infrastructure will turn the set of discrete learning environments across campus into an ecosystem for innovation in teaching and learning. The evolution of teaching and learning requires new skills to use technology with effectiveness and sophistication in the service of learning outcomes, through support from CTLT programs and services.
Appendix A

Proposed Revision to “Bring Your Own Device” Classroom Technology Policy

These new standards propose that BYOD continues to be the policy for student-owned technologies for classroom use but that BYOD becomes an option for faculty along with an option to use the installed device. The rationale is explained below.

“Bring Your Own Device” policies for instructor computers presents a number of potential failure points that can derail classroom learning. Broken cables, bent pins, dead batteries, screen resolution issues, forgotten adapters, laptop hardware or software issues, non-patched systems, and network connectivity issues are a few examples of the challenges that an instructor may face in the classroom. Any one of these failures can interfere with the mission critical priority of protecting instructional time and undermines the “Reliability” design principle.

Utilizing installed and networked computers enhances the reliability of computer-dependent technology systems. Support software allows remote access to classroom computers by support staff to provide help to instructors in the classroom on demand. Networked computers across campus can be patched and maintained from a central location. Classroom Technologies can keep “hot” computer spares ready to install in case of a hardware failure. Centrally managed computers facilitate use of ensures that campus licensed software is updated and secure. Hardwired network connections ensure optimum bandwidth and connectivity, without needing to rely on wireless networking connections. Installed computers allow for the classroom media systems to be configured for optimal performance with projectors and other technologies. Many technologies that instructors wish to use tools in the classroom that are web-based such as the Polylearn LMS and other “cloud” based tools as well as instructor materials accessed through the network. Installed computers allow instructors to focus on teaching instead of troubleshooting connectivity or functionality of university-issued or personal laptops.

A second BYOD drawback is that several highly desirable technology-related pedagogical functions in the next generation university classroom are far more cumbersome, time-consuming, and problem-prone without an installed computer maintained by the university: document cameras, reliable on-demand videoconferencing, classroom response systems, lecture capture. Common communication tools (e.g., Skype or Collaborate) allow guest lecturers to be brought into the classroom from anywhere in the world. This can be accomplish with an instructor-provided laptop, but to make such engagements interactive also requires a web cam, microphone, and cables in addition to their laptop to the classroom and set it up, by themselves, in-between classes. This is complicated and can interfere with valuable instruction time. Classroom response systems and lecture capture can both be functional with instructor-provided laptops but configuration and operation requirements pose significant challenges even to technology-savvy instructors and can interfere with instruction time.

Utilizing installed and networked computers enhances the ease of use for a range of newer technology-related functions and minimizes the need for faculty to troubleshoot connectivity or digital peripheral functions.
A third BYOD shortcoming is the high resources required to monitor and maintain technologies in classrooms across campus. Currently, little data can be collected about the amount and frequency of use for various components (e.g., digital projectors, DVD players) or about wear and tear leading to maintenance needs.

Control systems with remote monitoring and programming allow support staff to monitor important systems remotely and provide real time classroom support from a distance, such as switching an input or checking equipment status. Support staff can schedule shutdown time in digital projectors to conserve lamp life, monitor lamp life, and preventatively change lamps instead of waiting for one to fail, which can cost class sessions. In addition to more the rapid response, which preserves instructional time, this capability reduces the personnel required to monitor equipment and to respond in person to classrooms experiencing technical problems. Control systems with remote monitoring and programming also deliver valuable reporting statistics for which inputs are being used and how often the equipment is in use. It also serves as a valuable security system, alerting support staff if system components get disconnected.
Resources


Hart Research Associates (2013). *It takes more than a major: Employer priorities for college learning and student success*. Washington, DC.


Learning Environment Types

Overview

This section describes the set of learning environment types at Cal Poly, including listing specific instructional technologies included in each type. These descriptions also include a standard set of technologies consistent across all environment types.

Currently Cal Poly has outfitted all of its university-scheduled classrooms with a basic set of technology for what has been labeled “smart classrooms”: a digital projector, a control panel, a DVD/VCR player, and connection points for laptop or mobile devices. Connection points are provided in lieu of an installed computer based on the Bring Your Own Device (“BYOD”) policy in place. In a BYOD setting, an essential piece of equipment for presentation content is the instructor’s laptop. This must be connected and configured to connect to each classroom system each class session. While this is a common and potentially cost-effective implementation of classroom technology, it has drawbacks in terms of reliability, functionality and maintenance. This plan proposes revising the campus BYOD policy. In brief, it recommends modifying the policy so that it continues to apply to students but no longer applies to instructors. It envisions provisioning classrooms with reliable, well-maintained computing power that is networked for updates and troubleshooting and permanently connected to the expanded set of digital peripherals proposed for the new classroom technology standards (e.g., optical media players, document cameras, web cams and microphones for videoconferencing). Rational for this proposal is detailed in Appendix A.

These new learning environment types operate under two major constraints.

1. Applying these standards will focus on renovation of existing spaces as new completely new buildings are expected. This reduces the set of design options that would be under consideration for new spaces.

2. Another constraint is the classroom utilization formulas for student density from the California State University system. These formulas dictate the number of students who must be accommodated in a learning space, based on decades-old assumptions about individual students in tab-armed desks arranged in rows. These formulas determine use of instructional space and limit flexibility for design options. A change in the formulas or opportunities for exceptions would provide important capacity to innovate and experiment with learning space designs.

Consistent with the discussion above, the following capabilities are proposed for all learning spaces:

1. Robust wireless network with sufficient in-room wireless access points to provide bandwidth that can support a fully-occupied classroom of students, each with multiple digital mobile devices, simultaneously accessing the most data intensive content (e.g., video).

2. Installed computer with hardwired network connections and options for multiple peripherals.

3. Optical drive (e.g., DVD player).


5. Easy to use control system with web-based remote monitoring for support.
6. Digital display technology (e.g., digital projector).
7. Wireless laptop or tablet presentation capabilities (e.g., airplay)
8. Speakers for presentation audio and ADA audio support functions.
9. Sufficient power circuits and power outlets by use of students for their digital devices.
10. Installed classroom technologies networked to allow remote troubleshooting and support.

1. **Large Lecture Hall**

The large lecture represents our largest seating capacity classrooms. These spaces will incorporate the broadest range of installed technologies (e.g., installed computer hardwired to the network, digital projector, optical media player, document camera, web cam and microphone) to reach the maximum number of students across a variety of disciplines. Large display(s) and tiered seating will provide good sightlines and viewing angles of presentations to the students. Student seating areas should allow for interactions between nearby students, adequate space for student-provided technology (such as laptops or tablets), and access to power. These will be enhanced with environmental upgrades to the learning environment such as zoned lighting and acoustic enhancements.

2. **Smart Classrooms**

The Smart classroom offers the basic instructional needs for campus learning environments. Movable furniture will allow reorganization of the space for various activities and group interactions. An installed computer hardwired to the network an easy to use control system, digital projector, optical media player, installed computer and AV inputs allow for a variety of instructional pedagogies.

3. **Collaborative Classrooms**

The Collaborative Classroom offers an enhanced set of installed technology for instructional and student use. This learning space is geared towards enhancing the classroom interaction through flexible seating arrangements and technologies that promote activity-based learning. These classrooms will allow students to interact and collaborate while being able to see presentation materials regardless of seat location. The space should allow for easy access to displays, whiteboards, power and network needs in a variety of configurations for its users. The environment should be comfortable with good acoustics, controllable lighting, and appealing aesthetics. Instructors will be able to present the class concepts on multiple displays as well as allowing for students to work in teams around shared displays.

4. **Multimedia Classrooms**

The Multimedia classroom offers an enhanced set of installed technology for instructional use. Flexible furniture allows for multiple seating arrangements, depending on lecture, presentations, and/or collaborative group work. This will allow faculty to deploy a variety of instructional pedagogies, ranging from traditional lectures to the “flipped classroom” model. The classroom environment will feature controlled lighting zones, carpet, acoustic panels window treatments, refreshed paint and comfortable seats. Creating a learning space that is functional comfortable and supportive of “learn by doing” for students and instructors alike.
5. Distance Learning Classrooms

The distance learning classroom creates a special environment for classes that are designed to capture and broadcast out class sessions. These learning spaces are designed around enhancing the production values such as lighting and acoustics to increase the quality of captured lectures. A very specific set of installed instructional technologies such as high quality cameras and audio processing will allow for the instructor, students and course materials to be seen and heard where ever the end user may be. The classroom will allow users to communicate over a variety of distance learning, web or video conferencing systems.

6. Studio Lab Classrooms

The studio lab brings “learn by doing” to a lab environment. These spaces seek to bring a fusion of the traditional computer lab and collaborative learning space. Students will be seated around tables with computers and desk space to work on in-class problems. Students will be able to view presented content on displays around the lab or on their computer screens. Instructors will be able to present new material or “flip” the class and focus on problem-based learning.
will address a2a needs.
- Accessible instructor stations, seating and assistive listening systems
- Remote support of instructors and technology
- Display via whiteboard capture system
- Basic whiteboard lectures will be able to be captured and viewed on
classroom to guest speakers and remote participants
- Ability to leverage web-based conferencing tools for expanding the
  simple storage of these including rch media
- Problem: Student Response Systems (SRS), lecture capture and
simultaneous access to an ecosystem of instructional tools such as
allow them to easily present, annotate, and record presentations
Instructors will have easy access to presentation systems that will

Goals

coverage.
- Deco: zoned lighting, acoustic enhancements, and maximized Wi-Fi
- Enhanced with ambiental features such as aesthetically appealing
- Student seating areas should allow for interactions between needy
  variety of disciplines. Larger display(s) and tiered seating will provide
  to reach the maximum number of students across a
  projection, audiovisual devices, document camera, web cam and
  projectors, optical media player, document camera, web cam and
  networked digital

Purpose

Large Lecture Hall
### Notes
Currently constrained to existing lecture spaces

### Current Existing: 6
- Size: 100+ seats

### ADA
- Assistive listening system and accessible seating

### Furniture & Environment
- Maximum 1.5m density to accommodate all students
- White board camera and lecture capture
- Enhanced presentation capture systems with interactive touchscreens monitors
- Articulating tripod/ceiling projector and wireless projector connectivity
- Projector and white board camera, audio system, all lighting
- Large digital display screen and confidence monitor for good viewing sightlines

### Technology
- University scheduled classes and events
- Remote management and support services
- On-call technical support and maintenance services

### Classroom Components

---

**Large Lecture Hall**
goals

Media player and digital display allow for a variety of instructional media to be played. Digital systems, digital projection, and audio equipment space for various activities and groups interactions. Learning environments.

The Smart Classroom offers the basic instructional needs for campus.

purpose

address accessibility needs.

- Accessible instructor stations, seating, and assistive listening systems.
- Remote support of instructors and technology.
- Upgraded classroom decor.
- Upgraded wireless display connectivity to allow instructors and students to display content.
- Authentic faculty-student collaboration and interaction.
- Flexible Furniture will allow for various room configurations while easily connect to any display.
- Instructors will have easy access to a basic presentation systems that will allow them to bring in their own laptop, tablet, or other device.

Winter 2014
### Classroom Components

#### Technology
- University scheduled classes and events
- Remote management and support tools
- On call technical support and maintenance

#### Furniture & Environment
- Maximum Wi-Fi density
- High tech classroom technology system with DVI player, laptop, connections

#### Projector
- Instructor workstation/podium with plenty of instructional space for various
- Comfortable mobile seating with power for student devices

#### Audio/Video System
- Lighting controls, window shades, carpet, acoustic ceiling, colored accent
- Pedestals

#### ADA Accessible
- Assistive listening system and accessible seating

### Notes: Currently constrained to existing lecture spaces

### Projected Installations: 1xx

**Size:** 18-30 seats

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**Smart Classroom 2.0**
Collaboration Classroom

Purpose

Students seated in teams around shared displays. These collaboration learning spaces allow instructors to interact with students in real-time, allowing for immediate feedback and real-time learning. The collaboration classroom offers an enhanced set of instructional technologies for instructors and student use. The learning space is equipped with state-of-the-art audiovisual equipment and flexible seating arrangements and technologies that promote effective learning environments and student interaction. The classroom is designed to support group collaboration and individual learning, creating a dynamic and engaging learning space.
<table>
<thead>
<tr>
<th>Class</th>
<th>Notes: Currently constrained to existing lecture spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Currently Existing: 0</td>
</tr>
<tr>
<td></td>
<td>Size: 35-45 seats</td>
</tr>
<tr>
<td>Current Environment</td>
<td>ADA: Assistive Listening System and accessible seating</td>
</tr>
<tr>
<td></td>
<td>Lighting controls, window shades, carpet, acoustic ceiling, colored accent</td>
</tr>
<tr>
<td></td>
<td>Pedestals</td>
</tr>
<tr>
<td></td>
<td>Instructor workstation/dock with plenty of instructional space for various</td>
</tr>
<tr>
<td></td>
<td>Computerizable, flexible seating and tables, Power for student devices</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Furniture &amp; Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum WI-FI density</td>
</tr>
<tr>
<td>Student collaboration software &amp; displays</td>
</tr>
<tr>
<td>Audio interface (6”) (40”) and wireless presentation connectivity</td>
</tr>
<tr>
<td>Videoconference, document cameras, audio systems, auxiliary</td>
</tr>
<tr>
<td>Interactive blackboard system with easy-to-use control system</td>
</tr>
<tr>
<td>LCD display(s) and conference monitor for good viewing reflections</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>University scheduled classes and events</td>
</tr>
<tr>
<td>Remote management and support services</td>
</tr>
<tr>
<td>On-call technical support and maintenance services</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Services</th>
<th>Classroom Components</th>
</tr>
</thead>
</table>

Collaboration Classroom

image of a modern classroom environment
Cal Poly Learning Environments Proposal | Winter 2024

Purpose

The Multimedia Classroom offers an enhanced set of multimedia tools.

Goals

- Accessible instructor stations, seating and assistive listening systems to address ADA needs.
- Remote support of instructors and technology.
- Upgraded decor.
- Enhanced faculty/student collaboration and interaction.
- Flexible furniture will allow for various room configurations while providing the ability to leverage web-based collaboration tools for expanding the classroom to guest speakers and remote participants.
- Enhanced wireless display connectivity to allow instructors and students to display content.
- Powerpoint, student response systems (SRS), and ample storage of media.
- Simultaneous access to an ecosystem of instructional tools such as.

Students and Instructors alike.

- is functional, comfortable, and supportive of learning by doing.
- is a learning environment that is comfortable and flexible.
- is a learning environment that is comfortable and flexible.
- is a learning environment that is comfortable and flexible.
- is a learning environment that is comfortable and flexible.
- is a learning environment that is comfortable and flexible.
- is a learning environment that is comfortable and flexible.
### Notes: Currently transitioning to existing lecture spaces

### Current Existing:

- **Size:** 40-99 seats
- **ADA:** Assistive listening system and accessible seating

### Furniture & Environment:

- Maximize WTR density
- Display images (e.g., flipchart) and wireless presentation connectivity
- Swivel computer displays, document camera, audio system, auxiliary
- Integrated classroom technology system with easy-to-use control system
- Large display(s) and confidence monitor for good viewing situation

### Technology:

- University's Archival Classes and Events
- Remote management and support tools
- On-call technical support and maintenance

### Services:

- Multimedia Classroom Components
**Goals**

Communicating effectively through a variety of distance learning options such as video conferencing, webinars, and virtual classrooms will allow instructors to offer courses to students in real-time or asynchronously. This will enable students to access course materials and participate in discussions at their own pace and convenience.

The distance learning classroom creates a special environment for students to engage with course content and interact with instructors and peers remotely. It also provides a platform for collaborative learning and project-based work, fostering a dynamic and interactive educational experience.
<table>
<thead>
<tr>
<th>Notes: Currently constrained to existing lecture spaces</th>
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<tbody>
<tr>
<td><strong>Projected Installation:</strong> 4</td>
</tr>
<tr>
<td><strong>Size:</strong> 30-50 seats</td>
</tr>
<tr>
<td><strong>ADA:</strong> Assistive Listening system and accessible seating</td>
</tr>
</tbody>
</table>

**Furniture & Environment**
- Video production control room
- Studio lighting, carpet, acoustic treatment, colored accent wall
- Pedestals
- Instructors' workstation podium with plenty of instructional space for various
- Comfortable, fixed seating for student developers

**Technology**
- Maximum 180 student
- Video production system
- Whiteboard, computer, audio controls, and lecture capture
- Integrated presentation control systems with interactive touchscreens
- Audio/visual, and interactive presentation controls
- Integrated classroom technology system with instructor's desk, document camera, and projection system for good viewing situations

**Services**
- University scheduled classes and events
- Remote management and support tools
- On-call technical support and maintenance

Classroom Components

Distance Learning Classroom
goals

on problembased learning

will be able to present new material or topic. The class and focus
will include active learning. The class will be based on group work and
in-class activities. The class will also include lectures and discussions.

purposes

The studio lab brings "team" by doing to a lab environment.

Cal Poly Learning Environments Proposal Winter 2014
<table>
<thead>
<tr>
<th>Notes: currently constrained to existing lecture spaces</th>
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<tbody>
<tr>
<td>Projected Installation: XX</td>
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<tr>
<td>Size: 32 x 48 in.</td>
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<tr>
<td>ADA: Assistive listening system and accessible seating</td>
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<td>Text:</td>
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</tbody>
</table>
systems to address ADA needs.

- Accessible instruction stations, seating, and assistive listening
- Remote support of instructors and technology
- Upgraded decor

Enhancing faculty-student collaboration and interaction
- Flexible seating will allow for various room configurations while students display content
- Leverage wireless display connectivity to allow instructors and classroom to guest speakers and remote participants

- Ability to leverage web-based conferencing tools for expanding the initiative

Polylearn, Student Response Systems (SRS), and ample storage of media
- Simulated access to an ecosystem of instructional tools such as Polylearn, SRS, and ample storage of media

- Allow them to easily present course lecture slides utilizing a variety of presentation systems that will

Goals

Students and instructors alike
- is functional, comfortable, and supportive of "team by doing"
- fostered with collaborative work, teaching a learning space that students and instructors alike
- collaborative learning zones, carpet, acoustic panels with innovative technologies
- Tipped classroom model. The classroom environment will feature innovative pedagogies, ranging from traditional lecture to the collaborative group work. This will allow faculty to deploy a variety of technologies for instruction. Use flexible furniture allows for multiple seating arrangements, depending on lecture, presentation, and/or collaboration.

Purpose

Multimedia Classroom