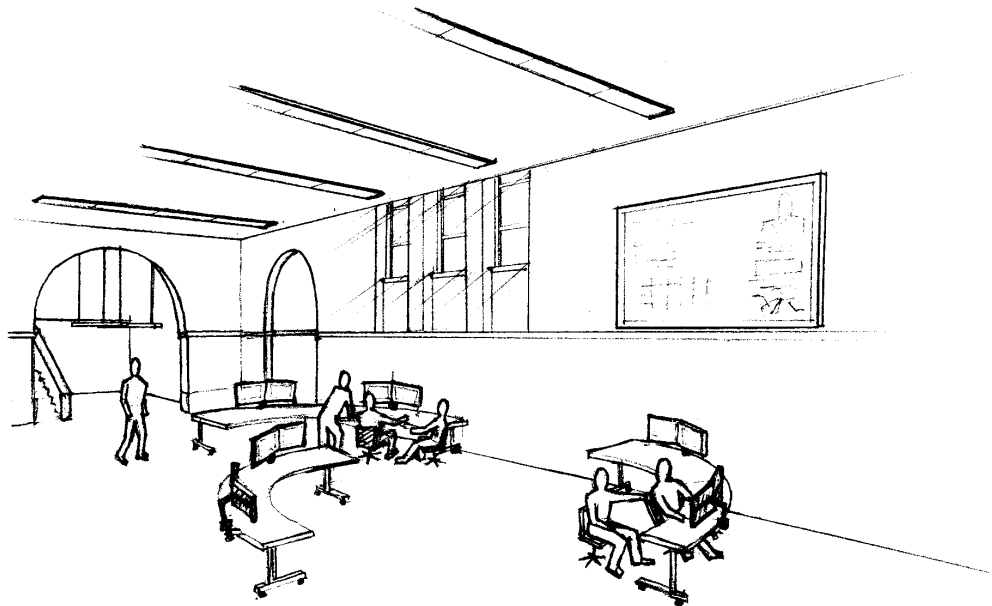


Funding Proposal
for the
Cooperative Learning Computer Lab
at
Cornell University



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1. Abstract

A large-scale, cross-division collaboration of research, learning, and teaching programs at Cornell University has committed over 130K of funds for the construction and two-year implementation of the **Cooperative Learning Computer Laboratory (CLCL)**, <http://clcl.cornell.edu> in the heart of the campus. The CLCL infuses cooperative-based learning and instruction in a computer-oriented environment. To facilitate cooperative learning, our proposed laboratory contains curved computer tables and flexible technology that assist users with group interaction. In this environment, users can customize table configurations, which offers a unique opportunity for research in modern instructional methods and learning spaces.

The primary purpose of CLCL is the development of recommendations for a standard cooperative computing environment. In pursuit of this mission, we have identified specific objectives, as follows:

- To study cooperative instructional models for science, mathematics, and technology.
- To study technological and social interdisciplinary instruction.
- To develop collaborative technology.
- To study after-hours environmental impact on student learning.
- To develop training programs.

We are seeking industry partners to provide funding and/or resources to complete the construction of CLCL. Sponsors will have several direct benefits, as follows:

- Real-world product testing
- Development of new technology
- Immediate access to interim design documents
- High visibility, especially in regard to local and national exposure.

2. Project History and Status

In 2001, Cornell University's Campus Life, Department of Computer Science, and College of Engineering conceived of a design for a new computer laboratory that would host sessions from the *Academic Excellence Workshop (AEW)* program. Early in the process, Cornell University awarded the project leader (David Schwartz) a Faculty Innovation in Teaching Grant. Schwartz and his Academic Technologies co-designer (Steven Weidner) expanded the AEW concept to CLCL in 2002. The project attracted the attention of Cornell's University Library group, who has been seeking to upgrade and expand upon their successful *CreationStation* computer laboratory with donations and a separate grant. In Spring 2003, the design team formed and selected a suitable location in Uris Library, which lies in the heart of Cornell's central campus. Starting in the Fall 2003 semester, the team has investigated the specific hardware and software needs for CLCL for the selected room, as discussed in the next section.

3. Features

The Cooperative Learning Computer Laboratory is designed to optimize the quality of *learning*, not the consumption of space. Rather than aiming for tightly packed rows of "sardines," CLCL uses semi-circular (eighth-round) tables that seat two students who share one computer. In Figure 1, we show how two such tables can allow for one or two groups of students to collaborate. The circular shapes offer a variety of other placements, as shown in Figure 2.

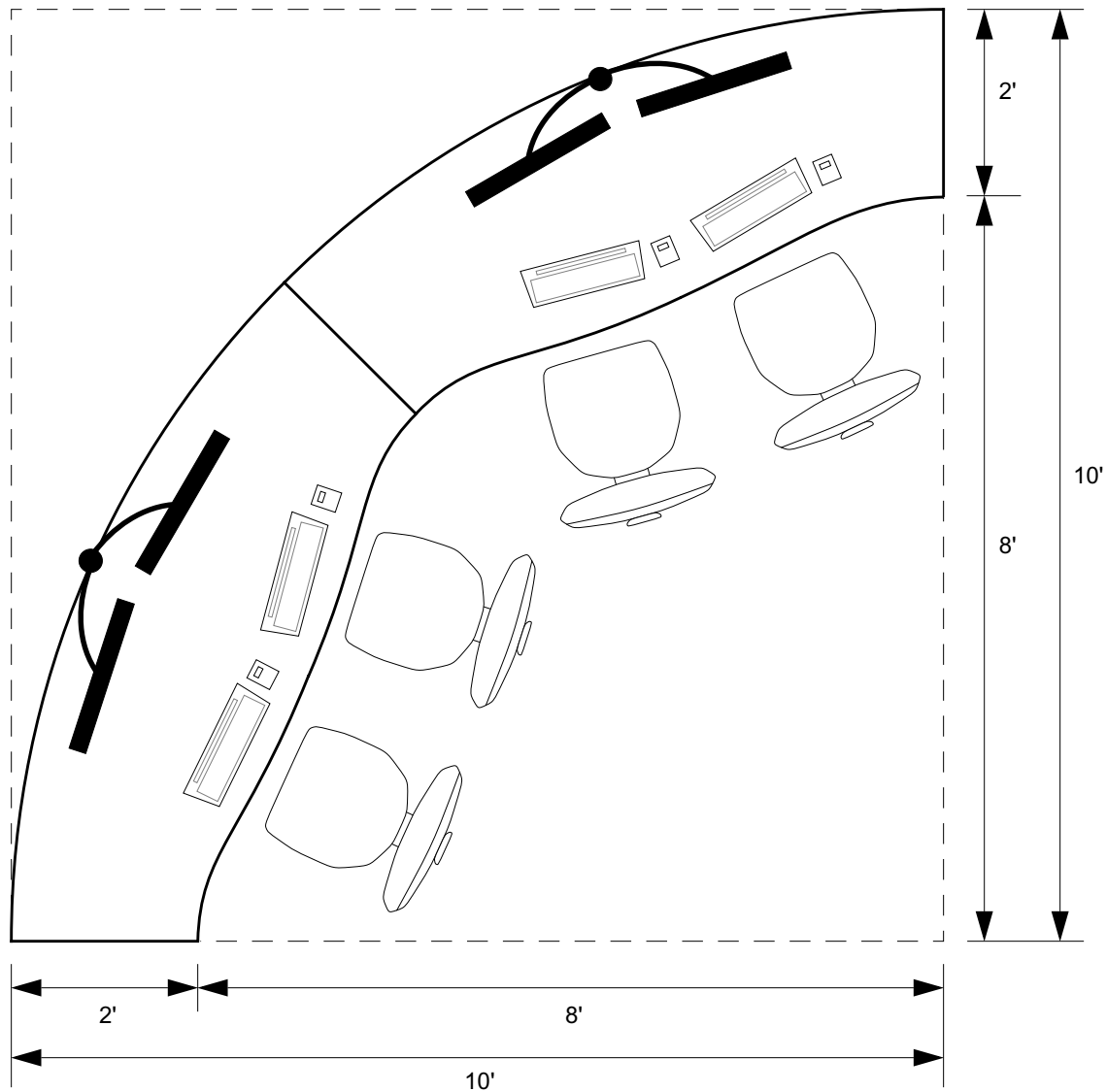
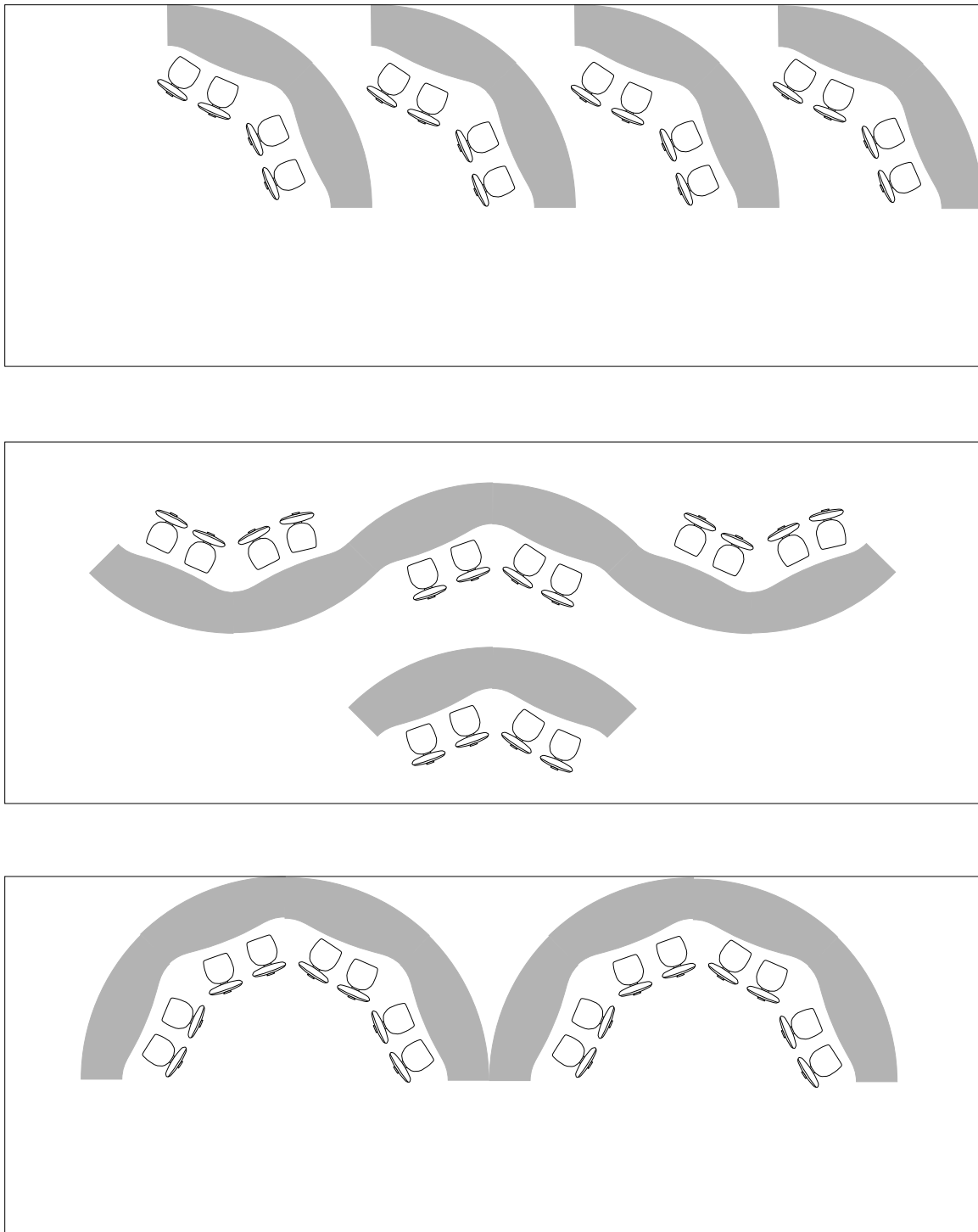


Figure 1: Top View of Two Eighth-Round Tables

The proposed laboratory is designed to have the following features:

- A raised floor to support flexibility for rapid table rearrangements.
- Teaching space to accommodate 16–20 students.
- Ability to split students into cooperative learning groups of two to eight students.
- An assistant to help users with furniture and technology.
- One high-end computer with a pair of shared monitors and dual keyboards and mice for each eighth-round table.
- Computers and other technology for the instructor and lab operator.
- Wireless networking and a flexible power grid.
- Adjustable and flexible audio/visual equipment and software for multimedia development, shared presentation, clear sound, and adjustable lighting.

We provide a more detailed component list in Table 1. We will also gladly provide detailed construction plans to corporate sponsors.



**Figure 2: Example Table Configurations
(16 Students)**

Table 1: Itemized List of CLCL Components

Furniture

ten computer tables
twenty chairs
instructor station
CPU slings
monitor arms and clamps
four side tables and seating
four portable whiteboards
storage cabinet

Hardware

ten mobile workstations
net printer
color printer
snap server
sound system and four speakers
rack media playback
rack switcher amplifier
rack XGA D/A
cart scanner
cart media playback DV/VCR
instructor controller in wall
computer projector
projector screen
screen sharing software
podium wireless keyboard/mouse
three wireless access points
ten uninterruptible power supplies

Software

multimedia development
office productivity
3-D modelling
audio recording and mixing

4. Program Development

CLCL is a two-year proof-of-concept study to test its effectiveness in improving computer-based learning environments. We propose the following research directives as part of our program.

Study of cooperative instructional models for science, mathematics, and technology.

Academic Excellence Workshops at Cornell focus on cooperative and collaborative learning for many introductory science, mathematics, and technology courses. However, traditional computer labs do not encourage group work with solitary monitor and keyboard. We intend to investigate how group computing models, such as pair programming¹, can be improved with CLCL's cooperative infrastructure and technology.

Study technological and social interdisciplinary instruction.

Courses that bridge technology and the humanities can present difficulties because many students lack a balanced education and/or attitude. The infrastructure and location of CLCL would serve as neutral environment where students could exploit library resources in the design and development of collaborative computing projects. The room's central location, high-end computing *CreationStations*, and immediate access to works of fine arts and humanities will merge technology and the humanities. We intend to test CLCL's effectiveness in facilitating an interdisciplinary course with Schwartz's experimental course in computer game design². This course engages a wide variety of students from fields that include engineering, computer science, fine arts, music, and writing. As we learn about CLCL's environmental impact, we can develop other models of interdisciplinary instruction that bridge technology with other subjects.

Development of collaborative technology.

The demands of highly flexible furniture and student/instructor presentation are generating interesting questions about instructional technology. In the design and construction of CLCL, we intend to analyze our choice of products and test their effectiveness to aid future lab designers and manufacturers. In particular, the tables require in-situ research to measure their flexibility and durability for movement and to discover which configurations maximize the effectiveness of group collaborations. Given that CLCL would continue to serve as new *CreationStations*, we have an ideal opportunity to study how cooperative infrastructure and technology affects design of multimedia.

Study of after-hours environmental impact on student learning.

Research in cooperative learning has shown for many years that it improves student motivation and retention, as Cornell's AEW program demonstrates. However, much research has occurred *inside* the classroom. We intend to study the "exterior" environments in which most learning occurs from homework assignments. Given that courses increasingly require group work outside of the classroom, we intend to leave blocks of time for self-selected use by student groups. Evaluating student-chosen configurations and usage patterns will help with future recommendations of CLCL.

Development of training programs.

Within the university and from the local community there are many needs for staff, faculty, and other types of training, which requires different material and approaches than courses. In particular, the trepidation that engineering students have for introductory computer courses magnifies for some groups. Traditional technical learning environments typically dissuade women and under-represented minorities such that few pursue careers in computer science and engineering³. We wish to research the environmental impact of CLCL in training sessions because of their differences with standard college courses.

1. <http://www.extremeprogramming.org>

2. <http://www.cs.cornell.edu/projects/game/index.html>

3. *Unlocking The Clubhouse: Women in Computing*, J. Margolis & A. Fisher, The MIT Press, Cambridge, 2002.

5. Evaluation Methodology

To accomplish our research directives, we propose the following evaluation methodologies:

- *Surveys*: A common thread throughout most of our directives is the environmental impact of CLCL. We intend to collect surveys from users.
- *Pedagogy*: We intend to compare and contrast instructional styles, curricula, and grade trends for courses that have been taught outside of CLCL.
- *Monitoring*: During advertised times, we intend to record patterns of furniture placement to learn about optimum configurations, which will help to analyze the curved furniture concept.
- *Repairs*: Given the desired flexibility of CLCL, we intend to measure the durability of our equipment choices to produce recommended specifications at the end of our study.
- *Affiliation*: Although the two-year time frame will preclude most tracking of diversity selecting first-year courses or a technical career, we can track first-year students who affiliate with their majors in their second year.
- *Popularity*: We will measure usage patterns during open hours.

At the end of the two year study, we propose to generate a set of recommendations, including updated designs if CLCL proves worthy.

6. Sponsor Benefits

The proposed cooperative learning computer laboratory is an excellent opportunity for corporate sponsors to participate in an extremely practical and important experiment for relatively small funding commitments. Given the planned two-year research phase, corporate sponsors will benefit from strong publicity and free advertising via the following features of the project:

- A central location of the laboratory.
- Popularity with students based on demand for cooperative spaces.
- Academic publications and alumni magazines.

Furthermore, our corporate partners will participate in technological development that would include the following advantages:

- Large-scale product testing of advanced laboratory concepts.
- Development of new technology.
- Immediate access to interim design documents and progress reports.
- Free consumer demand for supplied resources.

We believe that the results of the experiment will help us to devise labs that we market not just to the university, but all schools as we publish our design plans and philosophies.

7. Conclusions

We believe that our proposed Cooperative Learning Computer Laboratory will become a new standard for instructional computer environments. By providing a flexible environment in which designers and users can arrange tables in customized configurations, CLCL offers a unique opportunity for research in modern instructional methods. Research goals include analyzing different classroom placements, technology for computer sharing, models of group dynamics with computers, and environmental impact on student motivation.

In this proposal, we have outlined the potential for research and development of our CLCL. Our comprehensive plan focuses on studying environmental impact of cooperative technology in computer laboratories. We envision that CLCL will serve as a proof-of-concept that leads to the development of similar cooperative spaces at Cornell and other locations. We look forward to working with partners in industry who wish to be a part of this educational and research vision.