

Construction Management Computer Lab Redesign

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This project looked to take an inventory of the current Construction Management computer lab, communicate with students and other stakeholders about how the computer lab is used, look ahead to how the lab will be used in the future, and create a new design that best suits the Construction Management department.

Keywords: construction technology, computer lab, education, redesign, collaboration

Introduction

The computer lab in the Construction Management building has become a hub of activity for both CM majors and minors. Every day there is at least one class being taught in the computer lab. Students use the Mac computers with provided software to complete course work. Collaborative groups work on projects and individual students complete other work at the tables in the back of the lab.

With all this activity taking place in one room there exists the potential for conflict. This project looks to analyze the current state of the computer lab in building 186, determine what stakeholders think of the current design, seek out potential upgrades, and recommend potential courses of action to improve the design of the computer lab.

Current State of the Computer Lab

With students printing out coursework, classes such as CM 280 (Building Information Modeling) and CM 450 (Integrated Project, Design and Program Management) being taught, students working on assignments, and groups collaborating on projects in the same space, it is inevitable that the existing design of the computer lab not suit one or more of these listed groups. Each of these groups of students uses one or more portions of the computer lab to complete their work for various classes. These portions of the lab are the twenty-five Mac computers, the tables in the back of the lab, and the printer and two plotters.

There are currently twenty-five Mac computers in the computer lab. Twenty-four of these desktop computers are situated in four rows that face the front of the computer lab. The twenty-fifth computer is inside of a podium that faces the opposite direction. This computer is linked to the projector and projector screen in the lab so that an instructor can teach a class. Students and instructors log into these computers with their Cal Poly login. All the desktop computers run on the Windows 10 operating system and have programs like Bluebeam Revu, Revit, Navisworks, ArchiCAD, and Tekla pre-installed.

Behind the set-up of the Mac computers and projector screen are four groups of tables that can seat approximately thirty-five students. These table groups are made of smaller tables and are organized into four larger tables where students can pull up a chair and work. Although these tables can move as they are not secured to the concrete slab below, they are rarely moved by users of the computer lab. Students work individually and collaboratively at these tables.

Students who do work in the computer lab work either at the computers or the tables depending on the task at hand and the tools they need to complete their tasks. Some students need to use the provided computers for one of the programs that is installed. For classes like CM 450 where Destini Profiler is installed and licensed on the Mac computers, students must use a Mac computer. Some, but not all, of the programs that are on the Mac computers are available for students to access for free on their personal computer. For example, a student license for SketchUp currently costs \$50, meaning a student who does not wish to pay for a license has to use a Mac computer. A student who wishes to use Revit can download a free student license, but their personal computer may not have the power to run the program, forcing the student to use a Mac computer.

The last portion of the computer lab is the printer and two plotters. Users can send files to these three printing devices from any of the Mac computers in the lab or from their personal computer via IP address. The printer is by far the most popular device of the three when looking at activity. The plotters are used mainly for senior project poster boards other documents with large page sizes.

Methodology

Since the CM computer lab is already a functional space, the objective was to survey users that currently use the space and understand what portions of the lab are most important to them. A survey was created with Microsoft Forms and sent out via email to all students who are majoring or minoring in Construction Management. A flyer was also created and placed in multiple locations around the computer lab that reminded students to take the survey and provided a QR code that linked directly to the survey.

The survey had a total of 12 questions geared towards understanding each respondent's use of the computer lab at a deeper level. Users were asked to evaluate the current design as a whole and the current design when looking at CM 280 or other classes taught in the computer lab. Open ended questions asked users to share their thoughts on what could be improved in the computer lab. The survey was closed after a week of being open. The responses were used to understand how the computer lab is used and inform a revised design of the lab.

Analysis of Survey Results

When asked to rate the overall effectiveness of the computer lab the average response was a 3.55 on a scale of 1 to 5, with 1 denoting not effective, 3 denoting neutral, and 5 denoting extremely effective. Students indicated that they are neutral but leaning towards positive about the current computer lab design. However, when asked how effective the lab is for classes like CM 280 the rating dropped slightly to 3.34 on the same 1-5 scale. Students feel that the lab is less effective for classes like CM 280 and CM 450 than for the other functions of the lab. A common critique of the current design was that it is hard to follow along in classes in the lab. Whether it is because the projector screen is hard to see from the back two rows of Mac computers or it is difficult for students to try and pay attention to the projector screen in addition to their own computer screen, multiple students suggested changes involving the way students follow the screen of the lecturer.

In addition to the effectiveness rating of the computer lab being lower when looking classes being taught in the lab, there are other issues that stem from classes being taught in the lab with the current design. Most of the time when a class is being taught all twenty-four computers are reserved for that class. This means that during class time for CM 280 and other classes reserving the lab frequently students are not able to access the Mac computers. Students responded on the survey that they are between sometimes and moderately often having to change the times when work on assignments because the Mac computers are reserved for class. On a 1-5 scale with 1 being never, 2 being rarely, 3 being sometimes, 4 being moderately often, and 5 being frequently the twenty-nine respondents had an average ranking of 3.48.

There is another consequence that is the result of the computer lab only having twenty-four computers: classes that use the lab regularly are required to cap the size of the class at twenty-four students. Without the ability to add additional students these classes are forced to turn away students who do not make it off the waitlist for these classes. Among respondents to the survey, the number of computers was a common suggestion for an area of improvement. One student responded that the lab "need(s) more computers" and expanded by saying that "it is difficult when I want to work on programs and all (computers) are taken for CM 280 Class." Another student said the lab needs both "more computers and more area next to each computer."

When asked to rank what aspects of the lab they thought were most important students responded with the following results.

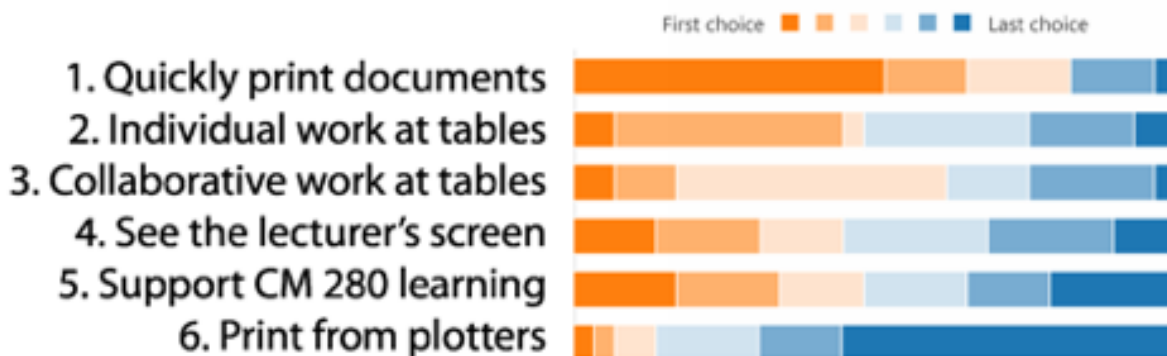


Figure 1 – Survey Results

Students view being able to log on to the Mac computers to do work or quickly print documents as the most important function of the computer lab. Students then view using the tables behind the Mac computers as the next most important functions of the lab.

Lastly, there were common improvements that students chose in the survey. Out of twenty-nine responses twenty-two said that seeing the lecturers screen somewhere closer than the projector screen would benefit users of the computer lab. Twenty-one students said that having the ability to plug in their personal computer into a monitor or screen would help them. Nineteen students said adding more computers to the lab would be beneficial.

From the survey results it is clear that students who use the computer lab have the same ideas for how the lab can be improved. Students have echoed that the lab needs more computers and that the way the computers are orientated currently makes it difficult to follow along during CM 280 or other classes. Since students did not comment on the tables in the back or on the printer and two plotters it is clear that students would like to see a change to the area with the Mac computers.

Analysis of Redesigned Computer Lab

This revised design has a few notable changes when comparing it to the existing design. These changes revolve around the Mac computers and lecturers computer. First, with the current design it is difficult for the lecturer to see what their class is doing while they are lecturing. Through conversation with lecturers for CM 280 it became clear that the current design leads to students falling behind since the lecturer is physically separated from the students and their screens. One lecturer likened the lecturer's computer to a "bunker" from World War II as they felt it proved to be a barrier between them and the students. With the lecturer being in the middle of the room and having student's screens at a 90 degree offset versus an 180 degree offset the lecturer will be more connected to the students they are teaching.

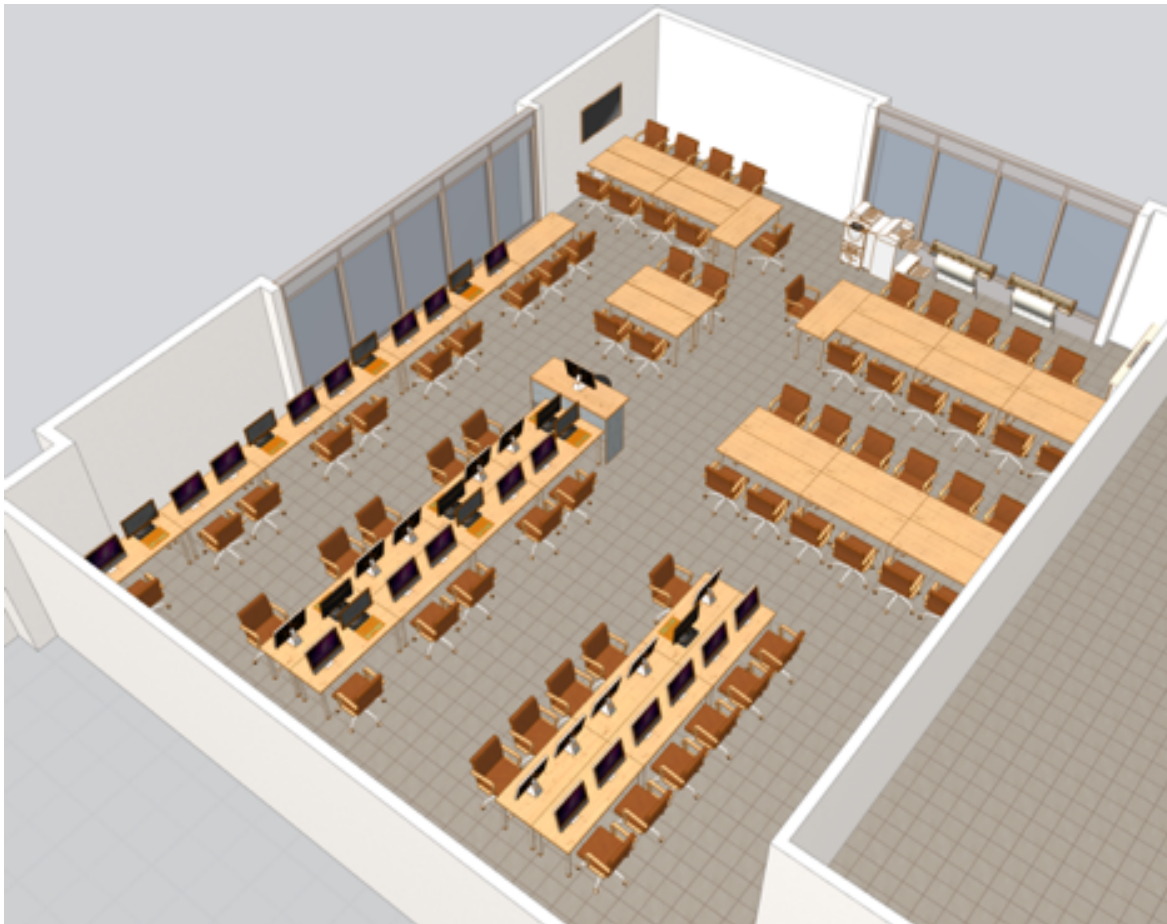


Figure 2 – Rendering of Redesigned Computer Lab

Secondly, to accomplish the goals of adding computers while satisfying the desire for having the lecturer's screen closer to students it was necessary that all of the Mac computers were not facing the same direction. To solve the problem of the projector screen being hard to see the revised design does not have a projector and projector screen but instead has designated computer monitors that mirror the lecturer's computer screen placed between the Mac computers students sit at. In the figure below each of the monitors has a laptop computer placed in front of it to represent the ability to connect a personal computer to the monitor. With this design the monitors become a flexible part of the computer lab that add value both during times when a class is being taught and when there is no class in session.



Figure 3 – Monitors Placed Between Mac Computers

Additionally, this revised design adds five Mac computers, bringing the total up to twenty-nine. By adding these computers two design goals are achieved. With the additional five computers, classes that use the computer lab regularly can add more than twenty-four students if desired. By utilizing a TV screen to broadcast the instructor's computer screen, the design allows for the group of tables in the below figure to be flexible depending on the size of the class in the lab. In addition to the class size being more flexible, these extra computers can be used by any students during times when most computers are reserved for classes like CM 280. Survey respondents indicated that they would like to be able to use computers to both do work and quickly log on to print documents even if a class is going on, so by adding five Mac computers these student desires can be realized.

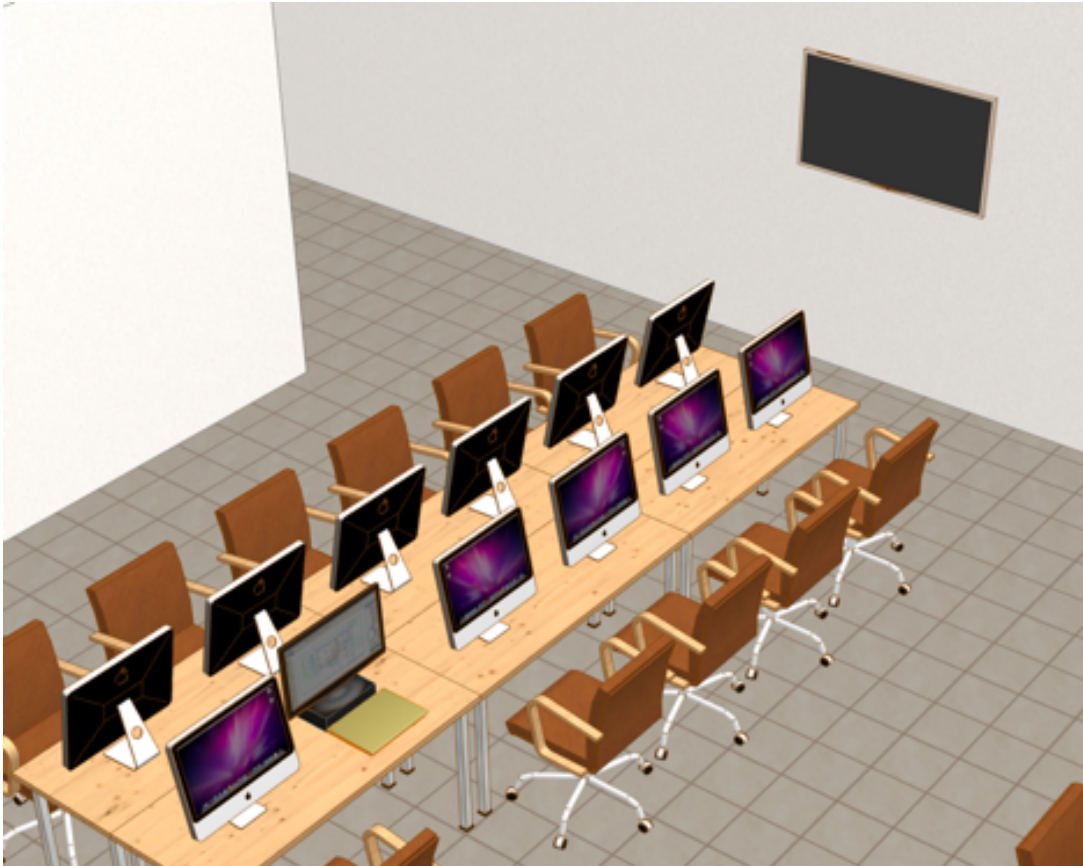


Figure 4 – Flexible Table Space

To make room for these changes the printer and two plotters have been moved to the back of the room in this design. The tables where students work individually and collaboratively were left mostly unchanged as survey results indicated that students valued the ability to work there.

Conclusion and Future Research

Conclusion

This revised design was mainly addressed at solving issues with the computer lab that stem from the classes that take place in the space. When modeling this design in ArchiCAD, attempts were made to keep potential costs to a minimum. Furniture that already exists in the lab was measured and modeled. By using similar furniture, it is possible to rearrange the existing tables and move the existing Mac computers. This revised design is the ideal set up for the computer lab based on student and stakeholder feedback.

If the Construction Management department were to wish for a lower cost alternative for making changes to the computer lab the survey results still provide small changes that would still enhance the design of the lab. A simple addition would be to add an additional computer near the printers and reserve that computer for printing. Another fix would be to add more computers to the existing twenty-five as there are some tables that have one computer on it versus the typical two.

Future Research

One aspect of the design process is that it is iterative versus being linear. This iterative process lends itself to the potential for future research to be done on the topic. Future research could be looking to create a cost estimate and schedule for these upgrades. Another possibility is adding to the design altogether. Ideas such as stadium style seating and raised access floors have been tossed around by students and faculty in the past, and a design implementing those features could serve the Construction Management program better.