Technology Update Recommendations for Construction Management Classrooms

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This paper outlines the process of creating the design for technology updates to a classroom with outdated and unreliable equipment. Key features of the design include updates to the classroom's audio and visual display systems, improved connection accessibility for presenters using personal devices, the implementation of modern recording technology to assist with virtual teaching methods, and better support for students using personal technology as their primary note-taking and working mediums. The completed elements of the project include input gathered from students, faculty, and professionals on suggestions for the design, equipment selection and justification, preliminary coordination efforts with project contractors, and recommendations for the implementation of a similar project in additional classrooms. While logistical issues prevented the timely installation of the selected technology in the originally intended classroom, the findings and recommendations outlined in this paper can serve as the foundation for the completion of the original classroom project as well as similar future projects.

Key Words: Classroom Technology, Classroom Updates, Audio Visual Equipment, Design

Background

This project began in the Spring of 2022 when representatives at Clark Construction informed the Cal Poly Construction Management (CM) Department of their intent to provide updates to the Clark Construction classroom (Room B304) in the Construction Innovations Center (Building 186). The Cal Poly CM Department then recruited a student, myself, to serve as a construction management liaison, coordinating logistics for design, demolition, and construction with the general contractors of the project (Clark Construction and their building technology subsidiary, S2N Technology Group). The intent of the project was to identify areas of improvement in the classroom and provide equipment to serve those areas and better the teaching and learning experience for both students and faculty.

Process

Project Team Formation and Conceptual Design

The first step in the process was to establish roles and the conceptual scope of the project. In order to do this, a kick-off meeting was held in March of 2022. Attendees included me, additional representatives from the Cal Poly CM Department, representatives from Clark Construction and S2N Technology Group, and members of the Cal Poly Facilities Management and Development Department. The overall intent of the project was discussed and the general process was outlined. Any new equipment for the classroom, as well as design and installation services, were to be provided by Clark Construction as in-kind gifts to the CM Department. The CM Department and the Cal Poly Facilities Department would be responsible for any necessary demolition prior to installation. My role was defined as a point of contact between the three groups, supplying Clark Construction with any information required for the project, such as existing plans and field measurements, preparing documents for design approval on behalf of the CM Department, and helping with any other logistical or coordination tasks required throughout the project.

After briefly discussing the background of the project and touring the classroom, all parties involved immediately recognized that the biggest area for improvement in the classroom was in its technology. While some classrooms in the building have received recent updates to their technology systems, other classrooms, including B304, operate on technology that is much more outdated. It was clear, even from just a quick visual inspection, that technology accessibility for students in the classroom was lacking and that the presentation technology available to instructors was old and generally inconducive to modern teaching techniques, which rely heavily on the use of computers and online programs.

Identification of Key Features for Improvement

The first step in assisting Clark Construction with the design for the classroom updates was identifying specific pieces of equipment that could be updated to add value to students' and instructors' learning and teaching experiences. In order to develop a better understanding of the exact classroom features that needed improvement, input was first gathered from conversations with students and faculty who use the classroom on a regular basis.

Findings from student and faculty feedback:

- Many students bring their own laptops to use during class to take notes or work on assignments. However, the placement of power outlets in the classroom is inconsistent and does not allow access for students at all desks.

- The overhead projector in the classroom is old and often displays discolored, blurry, and vibrating images. The placement of the single projector screen in the corner of the classroom also makes it difficult for students to view the screen from all desks.

- The existing system for instructors to connect their computers to the overhead projector is unreliable. Either the correct plug-in adapter is not available for their computer or the connection simply does not work once the computer is plugged in.

- The cubicle-style desks at the back of the classroom are no longer used frequently by students. Rearranging these desks into a layout that better supports group work and collaboration could be beneficial and increase their use.

In addition to student and faculty feedback, experts from S2N Technology Group and the Cal Poly Facilities Development team were also consulted. These groups were more familiar with modern classroom technology and could provide input based on their experiences on other projects. I was able to discuss options with these groups, as well as tour existing classrooms across Cal Poly's campus that had recently received the technology updates we were discussing.

Findings from expert input:

- The key piece of technology that has been proven helpful in other classroom projects has been a central podium with an easy-access connectivity box that allows presenters to connect their devices to the classroom display system through a variety of different connections, such as USB, HDMI, or RJ cables. These boxes make it easy for presenters to connect nearly any personal device to the display system with minimal complications. However, it should be noted that a wired connection from the connectivity box to the television screens because the current alternatives available for wireless connection technology have been relatively unreliable in previous projects.

- One technology feature that has become somewhat popular and trendy in the classroom space is a smart whiteboard that captures writing and connects to computer devices. However, they often develop technological issues and are not functionally reliable over time. Based on their attempted use in other classrooms on campus, they are not currently advised for future updates because of their high cost and potential for malfunction.

- One newer technology element that could be useful is a tracking camera to record lectures. Many classes are now being offered in partially or fully virtual formats, and a high-quality tracking camera would allow instructors to record presentations and lectures to be used for virtual classes. One similar camera has already been installed in Room B202 of the Construction Innovations Center. It has yet to receive extensive use but provides a convenience that could be beneficial to have in additional classrooms.

- Television screens would be an excellent alternative to projector systems. They provide high-quality images and are relatively simple to connect to each other or to computer setups. Television screens have also already been installed in Room B202 of the building and have been received well by students and presenters.

Equipment Selection

Based on the above findings, the following key items were selected for implementation into the classroom update's design.

1. Individual power receptacles at each student desk

Figures 1 and 2: Steelcase Powerstrip "Intro"

Unit Cost: $160/ea.

These individual power receptacles allow students to conveniently charge their laptops or other mobile devices in the classroom. The receptacles come in various configurations to fit the project's specific needs and each include a 90° NEMA plug with overcurrent protection. For clean installation, conduit or raceway can be installed along the underside of the desks and down the desk legs to enclose the power cords.

2. Television Screens

Figures 3 and 4: Ceiling-Mounted Television Screens in Room B202

Unit Cost (Television Screen with Mount): $750-1050/ea.

As previously noted, four television screens have already been installed in Room B202 and provide students with high-quality images that can be seen throughout the entire classroom. For a classroom

that typically hosts smaller lectures, only two television screens would likely be required. The television screens may be wall or ceiling mounted at the front of the room but should be large enough to be seen by students in the furthest row of desks in the lecture space.

3. Updated podium with pop-up data connection system

Figures 5 and 6: Conference Table Boxes Model TNP327 Pop-Up Conference Table AV Box

Unit Cost: $400/ea.

Similar data connection boxes have already been installed in other classrooms around Cal Poly's campus, and provide a convenient way for presenters to connect their personal devices to classroom display systems. The AV box would need to be installed in either the existing classroom presenter's desk or a new podium. Wiring from the box would then be run along the floor from the podium to the classroom's front wall, then within the wall to reach the television screens.

4. Tracking Camera

Figures 7 and 8: Logitech "Rally" Camera

Unit Cost: $1,399/ea.

In an age where virtual and hybrid instruction are becoming increasingly popular, instructors should be provided with the tools they need to create high-quality virtual learning material. A tracking camera with a remote can be mounted to the classroom ceiling and connected to the podium system to allow instructors to easily record classroom lectures to make them available for students participating in classes virtually.

Deliverables

The originally intended deliverables of this project included the completed installation of the selected equipment and a full commissioning and training sequence to integrate the equipment and introduce instructors to the new classroom features. The completion of these deliverables relied heavily on the efforts and contributions of the project contractors, as they were the parties responsible for the finalized design, material procurement, and installation.
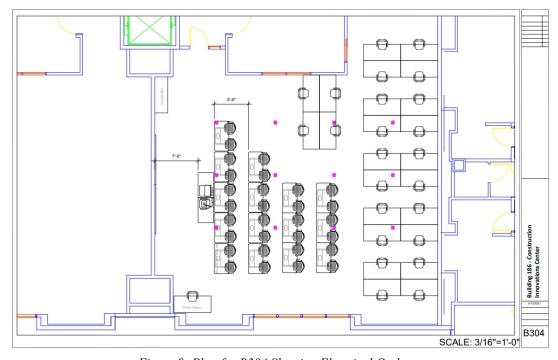

Figure 9: Plan for B304 Showing Electrical Outlets

For the first year of the project, I followed the role outlined previously in this paper. I facilitated the above conversations with students, faculty, and industry support for input, provided field measurements and as-built plans as needed (see above), and communicated via email and virtual meetings with the project contractors for progress updates. However, it became clear towards the second half of the project that the installation would not be completed within my time as a student at Cal Poly. Clark Construction and S2N Technology Group were experiencing long-term delays

internally, as well as long lead times on the specified equipment, and were unable to provide a final, approved design before my expected graduation term.

However, while working through the completed stages of design and preconstruction with the project team, a strong focus was also placed on discovering solutions that could be effectively implemented in other classrooms throughout the building. Because of this, the focus of the final deliverables for this project shifted into compiling a resource for these future projects and organizing the information collected in an accessible format.

Future Projects

Implementation of Findings

The above findings and equipment selection can be applied to future improvement projects in additional construction management classrooms or in classrooms in other buildings. While the equipment selected for this project was done so with a college-level construction management class in mind, the same equipment would likely be useful in a variety of different types of classrooms. For example, replacing projector systems with television screens could enhance the learning experience for students in any lecture or presentation-based class. Individual power receptacles for students could be used even in middle or high school level classrooms, where many schools are transitioning to paperless classes and students are provided with their own devices to work from. The above pieces of equipment were selected for their effectiveness and ease of implementation, and these qualities can provide benefits to all sorts of classrooms.

Potential Alternatives

It is worth mentioning some potential alternatives to the aforementioned items, as well as some up-and-coming pieces of technology, that may be implemented in future projects. As mentioned earlier, modern technology such as smart whiteboards or televisions with touch screens are not currently recommended because of issues with functionality that have arisen in previous projects. Similar issues have been seen with most currently available wireless connection setups between presenters' devices and the television screens or projector display systems. While the current models available for these sorts of technology are not recommended for installation, models will likely be developed in the future that are more refined and eliminate the issues seen previously. The ideas of a smart board that can easily track writing and of a wireless connection that seamlessly allows presenters to cast their screens onto the classroom display system are highly appealing and could bring a great deal of efficiency into the teaching experience. These are just a couple of new technology features that could be considered in projects later down the line. In any future project, it would be worthwhile to consult with an industry expert about the latest technology and which pieces would be worth including.

Next Steps - Design Development and Permitting

After a general project scope is defined, funding is secured, and equipment is selected, the next steps in completing a full classroom technology update project would be to put together a finalized design and receive approval from the Cal Poly Facilities Management and Development Department. The finalized design would include plan and section views of the intended equipment layout, as well as rough electrical drawings. Once the drawings are complete, they must be submitted along with a building permit application form (pictured below and available on the Facilities Management and Development website).

Figure 10: Cal Poly Facilities Management Building Permit Application Form

Construction

After design development and approval, the next step would be the actual construction of the project. Preconstruction work would include coordinating the work with a specialized contractor, finalizing a project budget, and creating a schedule for the work that takes school schedules into consideration. Based on information from the current project's contractor, a project of this scope would likely require around five days to install the equipment and five days for commissioning. Because of this, it would be most feasible for the project to be completed during an academic break, such as over the summer or potentially during the winter break. Any necessary demolition must also be completed prior to installation, and this work can typically be performed by the campus facilities department. During construction, work should be monitored and documented to ensure that equipment is being installed according to the plans. Once the equipment is installed, a guide should also be produced and provided for classroom users demonstrating how to properly use the new equipment.

Lessons Learned and Conclusion

The biggest lesson learned throughout this project has to do with dealing with a contractor providing the equipment and installation as a donation. Because there was no contract or consideration between the contractors of the project and the owner, the contractors had little to no incentives to complete the project in a timely manner. The project was not a high priority for them, and so the work was continuously delayed to the point that it would not be installed by my graduation term. If someone were to perform a similar project in the future, I would strongly recommend getting some sort of assurance, whether it be written, verbal, or financial, that the contractor will be able to perform the work in the time period given. You can always attempt to push the project along from the owner's side, but without any financial leverage, those pleas will have little weight.

Nevertheless, the work completed in this project sets a solid foundation for technology updates to classrooms throughout the Construction Management building and potentially classrooms across the whole community. Technology is continuously evolving, and classroom technology everywhere will only continue to become outdated over time and need to be replaced. The information gathered from students, faculty, and industry professionals represents the most effective, current options for general equipment upgrades in such classrooms. It is my hope that this project will enable those future projects and provide the background necessary to facilitate their full completion.