Reynolds 3321 Cybersecurity Lab

Assessment of AV System, Viewing Distances, and Viewing Angles

Comments on Increasing the Number of Student Workstations

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Summary of Existing Conditions and Requirements from Dana Rea

- 2 Existing 80" monitors, Sharp PN-LE801
- Any new TV's would mirror the original, I wouldn't rule out multiple signals though.
- They have to be able read fine text on the TV's (computer terminal output, log files, etc)
    - Students will be viewing computer code.
- For the seating, we would like to know what a sensible maximum seating number would be
    - The projected amount of seating needed for the MCTI program is 40 seats (concurrent)
    - The students need 2-3' of horizontal desk space, they will each be using a laptop, keyboard and 24" external monitor
    - Minimal furniture reconfiguration, each table has electrical outlets
- The students using this space are paying professional-program tuition rates, so their learning experience should be ***reasonably*** good

Viewing Criteria

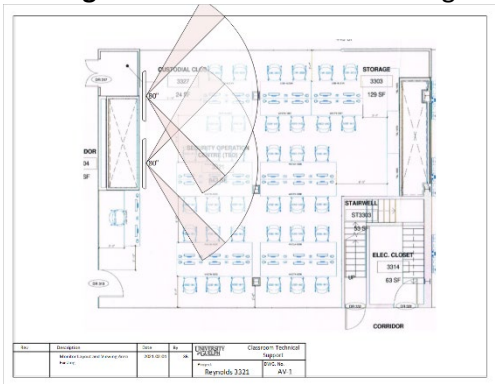
Viewing distance to a monitor is determined by viewing task and image size. Reading computer code falls into the detailed inspection viewing task. The maximum viewing distance for detailed inspection should be no more than 4 times the height of the monitor image.
e.g. An 80" diagonal monitor, like the Sharp PN-LE801, has an image approximately 40" high. This yields a maximum viewing distance of 13'-4" for the detailed inspection viewing task.

Horizontal viewing angle should be contained to 90 degrees (45 degrees off axis each side) from the monitor centreline. Beyond 120 degrees (60 degrees off axis each side) the image becomes unreadable.

Horizontal viewing angle for the student should be generally in front of the student's normal seated position. Beyond 90 degrees off axis from the student's normal seated position should be considered behind the student and not readily viewable while completing course work.

Vertical viewing angle is based on the observer and should be no more than 30 degrees above eye level.

Existing Monitors: Horizontal Viewing Cone and Viewing Distance – Detailed Inspection Viewing Task

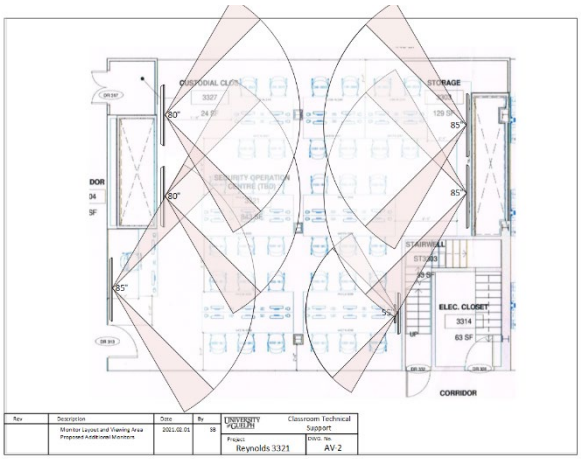


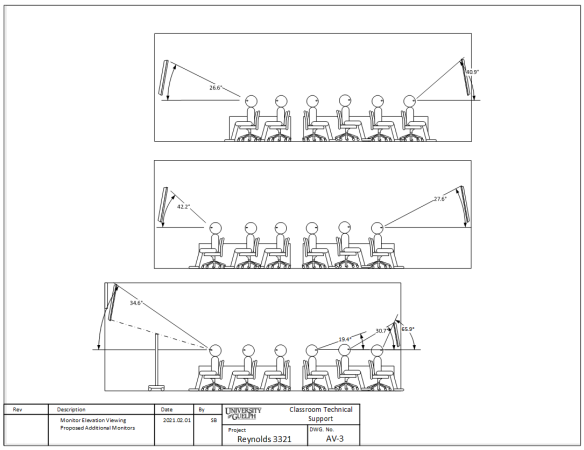
Note:
For several seats one of the monitors is located behind the student.
Most seats are beyond the maximum viewing distance.

New Monitors – All Showing the Same Image

Additional monitors can be added to the room so that as many of the students as possible:

- Have proper viewing distance for the detailed inspection viewing task,
- Are within the 90-degree viewing cone,
- Do not need to look behind to see a monitor.





This plan adds 3 – 85” monitors, and 1 – 55” monitor, for a total of 6 monitors. This layout is suitable for all monitors showing the same image. A new AV distribution system is needed to connect all the monitors. An AV control system is recommended for controlling the monitors and selecting the input to be distributed.

As you can see in figures AV-2 and AV-3 it is not possible to achieve perfect results with respect to viewing distance and vertical angle even with 6 monitors in the room.

Number of Workstations

Ontario Building Code identifies minimum floor area per person in a room.

For classrooms the minimum floor area per person is 1.85m^2 (19.9ft^2).

For laboratories in a school the minimum floor area per person is 4.6m^2 (49.5ft^2).

Room 3321 is 843ft^2. It contains 36 student computer stations, 3 student forensic electronics stations, and 1 professor station for a total of 40 workstations.

This works out to 21ft^2 per workstation, which is very close to the classroom minimum, and far below the laboratory minimum.

Adding 4 additional computer workstations would put the floor area per workstation at 19.1ft^2 which falls below the OBC minimum standard for a classroom.

It is not recommended to add more seats to room 3321.

To increase course enrollment, given the space constraints in room 3321, perhaps two cohorts of the course could be offered.

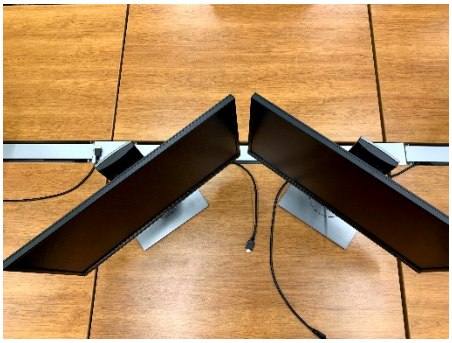
Immediately post-COVID there may still be gathering limits and social distancing requirements. Two cohorts may be necessary to maintain current enrollment numbers.

Additional Conditions and Requirements

When measuring the room and reviewing the existing equipment and conditions Dr. Ali Dehghandanha approached me, wondering why I was in his lab. Through our conversation he identified these additional items.

- Students need 2 monitors plus a laptop to do the course work.
- Students are in the room for full days to complete course work.
- Professors need to show 2 images simultaneously.
- Additional network cables must be laid on the floor to complete the course work because the simulated cyber-attacks cannot be done on the University's live network.
- Extension cords must be run on the floor for the forensic electronics stations.
- Electrical connections at the student desks can only be accessed by crawling under the desks. Students connect and disconnect laptops each time the room is used.

2 Monitors for Students



Currently the student workstations are 3' wide.
The monitors in the room are 21-3/4" wide.
Using 2 monitors plus a laptop to for course work requires a wider workstation. The 36-workstation count would need to be decreased by approximately 12 to accommodate 2 monitors and a laptop per station.
Two cohorts of 24 would make total enrollment 48 students.

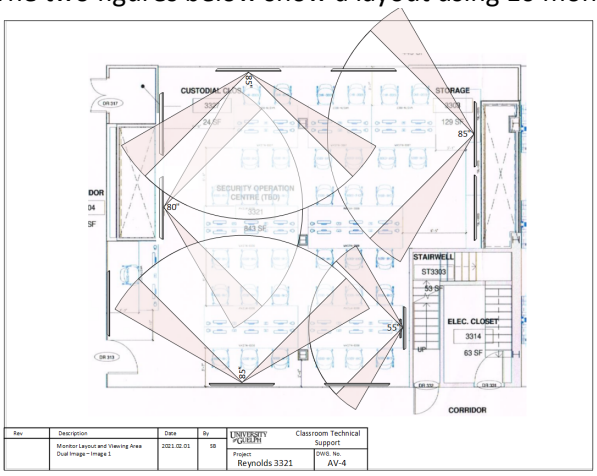
Students Working Full Days in the Lab

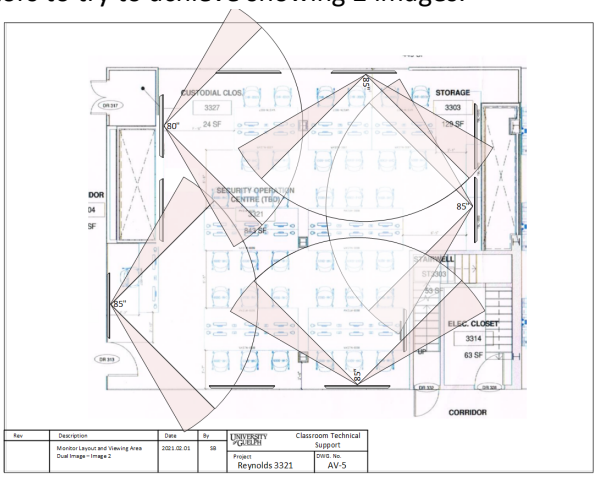
In my opinion 3' wide workstations and 21ft^2 floor area per student is very tight for working full days. There is no specific floor area standard for computer labs and/or length of time working per day. As a reference, the University's office standard for graduate students is 32ft^2 each in a large, shared office. Perhaps this could serve be an analog for minimum student space for working full days.

Reducing the capacity to 24 computer workstations, 3 forensic electronics stations, and 1 professor station (28 total) yields 30ft^2 of floor space per workstation.

Show 2 Images Simultaneously

The two figures below show a layout using 10 monitors to try to achieve showing 2 images.





The result is that approximately 11 seats in each layout are:

- Outside the viewing cone,
- Beyond the maximum viewing distance,
- Have the monitor located behind the student.

If showing 2 images is a key requirement further discussion and exploration of options is necessary.

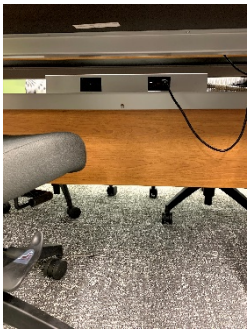
Additional Network Cables on the Floor

This could be solved by installing additional network cables and some network switches. If the decision is taken to proceed with additional AV then network cables could be added at that time.
Further discussion, planning and exploration of options is needed.

Electrical Extension Cords

This could be solved by adding surface raceway and receptacles in the affected area. If the decision is taken to proceed with additional AV electrical receptacles will be needed for new monitors. The raceway could be done at the same time.
Further discussion is needed.

Electrical Connections at Student Desks



This could be solved by adding work surface power connections. This should be coordinated with other network work at the student desks, and electrical work in the room.

Next Steps

1. Further discussions regarding 1 or 2 displayed images, 1 or 2 student monitors per station, reasonable room occupancy, simulated cyber-attack network wiring, power at the student computer and forensic electronics workstations.
2. Prepare an AV and other work upgrade plan and budget.