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2020: The Future Classroom Today

The new remote learning module

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Over the last few years classrooms have been evolving. Classrooms of the future are talking points with various layouts from neatly lined up tables and desks to breakout groups and huddle spaces. All have medium to large video displays located to suit the room layout. These ideas, once future, are here now. Remote learning is the new normal and here to stay which means a new holistic approach to classroom design.

Remote Learning

Remote learning can be divided into three modes. Synchronous, Hybrid Synchronous and Asynchronous.

Synchronous

Synchronous learning is real time, where teachers and some students are in the classroom while other students are located remotely. The video conference technology supports both remote students and classroom students, making sure the spirit of the classroom is present.

Hybrid Synchronous

Hybrid Synchronous learning is in real time like Synchronous but adds the use of the most effective resources whether online or from other sources for given learning objectives. This solution will require more bandwidth and a second device (laptop, tablet, etc.,) to support the added online needs.

Asynchronous

Asynchronous learning is on demand, the students can access lessons at any time. This creates a sense of isolation—no one is listening nor sharing ideas. With no structure students can progress at their own pace which could be good or bad as handling distractions at home and spending more time on social media adversely affect keeping up.

Concept

While distance learning is common in higher education, it is a new frontier for elementary and high schools that not only impacts teachers, but includes administrators, support staffs, and IT departments.

To complicate matters remote learning is like video conferencing, one dimensional. Teachers are now “On Screen” personalities that need to look at the camera while trying to focus on presenting lessons. This takes some getting used to and more detail on how to do this is presented in the “Helpful Hints” Section.

Design of a Synchronous or Hybrid Synchronous classroom is different from that of a traditional classroom. It must be a balance of the traditional classroom and a remote learning classroom. The remote learning classroom has cameras to capture the teacher and students. Lighting and acoustics should be addressed with the goal to create an environment that keeps the remote students engaged, making them feel like they are in the same room.

While much of this document supports renovation of existing classrooms, the fundamentals presented serve as recommendations and guidelines for new construction.

Sense of Hearing

Hearing is a wonderful sense, it protects us, and allows us to communicate. Hearing starts at 12 weeks after gestation and works 24/7/365—it cannot be turned off. The saying "I'll sleep with one eye open" is a moot point because our ears are always "on".

Our ears pick up vibrations in the air and the brain converts them to Sound. The brain then converts Sound to Speech and does a great job as long as it is not overwhelmed by too many sounds arriving at the same time. We can discriminate multiple sounds up to a point but above that threshold it becomes impossible to understand what is being said. Also, if the fricatives or affricates (T's P's, S's, etc.), cannot be heard we cannot understand what is being said.

"Good" sounding classrooms are key to understanding the spoken word. This is why Acoustics plays a major role in education. Acoustical consulting is required.

Sense of Vision

Vision is the most complex of our senses and when teamed with hearing enhances our retention.

> We retain 20% of what we hear.
>
> We retain 30% of what we see.
>
> We retain 50% of what we hear and see.
>
> *Dr. Donald E. Wetmore*

This is why *good audio* and *good video* are of prime importance for remote learning.

Classroom Design

Studies have shown students may "hear" the spoken word but not understand it. Audio and acoustics directly affect the intelligibility of the spoken word and are paramount in having a successful learning experience.

Acoustics

The importance of acoustics in new and existing classrooms is at the highest level and is independent of the modality. The acoustical performance of room is directly related to the physical design. Room shape; rectangle, square or polygon. Wall construction; cement blocks, drywall (most common) or glass. Each affects the sound quality as their surfaces are "reflective". If the room sounds hollow, like a tin can or has echoes it will need acoustical treatment. For existing classrooms cost effective solutions are available.

A more difficult problem to solve is noise from air conditioning systems and mechanical devices which include motors and pumps. This is heard as hum, rattle or "wind noise" and usually comes and goes. Minor problems can often be resolved by minor adjustments while major problems will require more costly repairs. An acoustical consultant can review room acoustics and mechanical systems and provide solutions

Teaching Location

Background

The teacher's position is the focal point of the classroom and the goal is getting the classroom students engaged with the teacher and remote students to create a sense of everyone in the same room.

The background wall behind the teacher's position should not be too cluttered or distracting. Bright or shiny objects including white boards should be removed or covered. Backdrops and fabrics are readily available.

Video Display

A large flat panel or projection screen is located here. The displayed image should be the same as the remote students are seeing.

It is safe to say that flat panels are outpacing projector installations at this time. They keep getting bigger and cheaper and ambient light is not a problem like it is for projectors. Projectors and the other hand now use laser and LED light sources instead of a lamp, and the life cycle is 25,000 hours, meaning the cost of ownership is greatly reduced.

Another consideration is viewing angle. It is important to note that the viewing angle of a flat panel is much greater than the viewing angle of a projection screen. 170 degrees for the flat panel verses 60 degrees for the projection screen. This means more viewable coverage for a flat panel meaning more usable space.

The industry standard rule states that for viewing presentations and websites, the furthest viewer should be less than six times the height of the image. As an example, an 86" flat panel (38" high) means the furthest viewer should be no further than 22 feet away. Following this rule means all students should be able to read what is being presented.

Currently, if a larger image is required beyond the 86" flat panel size, a projector and screen should be used. Determining factors driving the projector selection will be managing room ambient light levels, projection screen costs, and projector brightness requirements.

In either case the deciding factor should be the required screen size.

Locating the video display to the left or right of the teaching desk will create an over-the-shoulder scenario making it easy for students in the classroom to view both the teacher and the video display.

The teacher can switch the image on the video display between the camera (head shot) or the laptop. When Q and A or discussions take place, a switch to a classroom or remote student can be made. This keeps the video display as a focus point.

Lighting

Lighting is important and is needed to overcome shading and glare from windows and reflective surfaces. Front lighting means a well-lit face and helps to make the remote students feel more present. Front lighting can overcome changes as clouds pass over and seasons change. Windows or other distracting light sources should not be in the background behind the teacher.

A side light called a "key light" which is located above and off to one side will add realism by making the teacher "stand out" from the background.

Lighting does not have to be expensive. Using available lamps will work.

Cameras

The requirements for the Synchronous and Hybrid Synchronous mode are the most demanding for video. The camera at the teacher's position it the most important as it is the most used. Location and height of the teacher's camera should be aligned to match eye level. This will give a more lifelike image. Positioning the camera too high or low means poor eye contact and seeing double chins and shiny foreheads.

For mobility, a tracking camera which automatically follows movement of the teacher is the choice. These cameras work in one of two ways. The first is the teacher wears a lanyard or some sort of clip-on with a tracking device. The second is a camera with built in image tracking. This solution will add cost over a fixed camera but adds a sense of being in the classroom keeping the students more focused on the lesson.

Selecting a camera is more complex since many variations come into play. Image quality, light levels and automatic features must be sorted out, but image quality, resolution and panning ability should be the deciding factors.

There should also be another camera to cover the in-room students as they respond to questions. Selecting the location for this camera can be problematic. Camera or cameras located on the side walls of the room often capture poor images compared locating it on the background wall behind the teacher. This will cover the students head-on, as long as the room is not too wide for the camera to cover all of the students. More than two cameras may be required, and a consultant should be engaged to make recommendations while holding number of cameras to your budget. Remember the goal is getting the classroom students engaged with the teacher and the remote students to create a sense of everyone in the same room.

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Microphones

Hearing can be difficult and is interdependent on many variables, physical properties of the room, distance to and the quality of the sound emitter(s) (loudspeaker), distance to and quality of the microphone and the transmission medium. The end point quality cannot be better that the weakest link. Since the teacher's microphone is at the front of the line care should be taken to assure the quality starts here and will support the task.

The laws of physics will prevail when using a microphone. The closer to the desired source, the clearer the quality and the rejection of unwanted sounds maximized. The microphone for the teacher should be as close as possible to the teacher, at least within 24 inches.

For mobility, moving around teaching desk, there are two types of microphones to consider. Both are wireless so cables will not get in the way. These solutions require the use of an automatic tracking camera.

The lanyard or clip-one microphone is one solution. This choice is more demanding from a wardrobe standpoint as a jewelry, necklaces, buttons, or other objects that come into contact with the microphone will interfere with the sound quality. Changing from a standing to a sitting position or vice versa can also cause interference.

The head-worn microphone is an excellent choice, and some prefer this over the lanyard. Whether sitting, standing, or walking about, it is always in the optimum position and provides the most consistent sound quality.

The desk top model will work for stationary teaching. As the microphone is in a fixed position, moving or turning away will make the voice sound soft or less intelligible. Try to keep facing the microphone as you present.

Speakers

The most common classroom speaker is the ceiling-mounted speaker. The laws of physics prevails here as well. It is important to check that intelligibility is maintained for the area that needs to be covered. All speakers are not the same. Some will cover more area than others. This is a technical consideration that the consultant should review.

Network

Streaming video and conferencing require sufficient bandwidth meaning fast internet connectivity. This can be problematic for some remote students and should be factored into the equation by the IT department. It only takes momentary glitches to affect the overall retention of a lesson.

Systems should be turned on 10 minutes ahead of scheduled learning sessions and be tested at regular intervals because troubleshooting problems 'on the go' can take up valuable time and are very distracting.

Helpful Hints

Preparation is the key to feeling at ease during remote learning sessions. Practice makes perfect. We recommend a classroom be available for practice sessions. The IT department or staff person that is familiar with the remote learning system should be available to assist you and a simple operation sheet should be available. The operation sheet should also be available in each classroom.

Your material, files and lessons should be reviewed ready. Plan "B" should be in place should things not go as you expected. Get comfortable with your microphone and camera and find a comfortable seating position with important items in reach.

All you need to do is bring a laptop and log into your session. Set the laptop where you can see the screen and turn the volume all the way off. At first you may not like what you see, and the experience may be awkward. By practicing this process will become second nature to you.

Systems

Remote Learning Systems can be tailored to pedagogy and budget requirements. To accomplish this, meetings with the school district are scheduled to set goals, standards, and budget. This is followed by engaging the staff and teachers, presenting various remote learning systems and options that fit within the established budgetary information.

HJSA Consulting has had great success with coordinating a "Technology Fair" where manufacturers are invited to display their products and teachers and staff can have "hand's on" experience in a real time environment. After the Fair, information is gathered, and a consensus determines the final solution. The final documents include estimated capital expenditure, cost of ownership and operating costs for the refresh cycle.

Classroom Shape

In order to bring classrooms into the new reality, grade and high schools will have to make budget adjustments to support remote learning.

The number one objective is all students in the classroom must have a good view of the screen, along with clear properly sized text. Starting with the room shape, the furthest distance a viewer is from a screen is measured and the screen size is picked accordingly. Industry standard design criteria is used here which will determine readable font sizes per distance from the screen. The number of screens is directly related to the student seating layout.

One idea would be to make each classroom a pie shape, smaller than quarter section of a circle. Students would be seated in a semi-circular fashion, mimicking a lecture hall. The front of the room will have a teacher's desk. A large screen would be located behind and to the side of the teacher's desk. There is ample space behind the desk for the teacher to move from side to side. The camera can track movement, keeping the teacher centered in the screen.