FUTURE

Projectors Versus Flat Panels—What K-12 Districts Need to Know When Choosing Classroom Displays

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The drive to digital curriculum and blended learning has made the choice of the right classroom display more critical than ever. Flat panels have cost advantages in some cases, but projector prices are competitive and offer hands-down better viewability.

— By Annie Galvin Teich

INTRODUCTION

The school technology landscape has shifted from viewing technology as an add-on to teaching and learning to the idea that technology should be integrated into curriculum lessons. More importantly, best practices demonstrate that the most effective technology implementations are those where instruction and learning needs drive technology decisions and not the other way around. As classrooms increasingly shift from a teacher-lecture instruction model to a student-directed learning model, the big dilemma is not really which technology to select, but how to support the right visual environments that best support this changing landscape. Districts should establish their instructional priorities first and then determine the kind of technology that will support them. This strategy also helps districts decide the best way to build a digital ecosystem that supports instruction and learning in the digital age.

In searching out the best classroom display options, it's important to note that display size matters. Radius Research found that 58 percent of students can't see content on a 70-inch flat panel well enough to read it.[1] This ebook will consider the key factors involved in selecting the right kind of display, the 4/6/8 viewing standard, the relative costs of flat panels and projectors, and the impact of displays on learning.

On average, 70 percent of students will have an inferior viewing experience with a 65-inch display. More than 1/3 of the students, on average, will sit outside the 8x maximum viewing area.

Display Size Matters: Selecting the Right Display Size for Classrooms

SECTION 1:

KEY FACTORS IN CHOOSING THE RIGHT DISPLAY

Both flat panels and projectors offer opportunities for interactivity and collaboration in the classroom. Most flat panels, like projectors, enable students to interact with the display's content through their own remote device, such as a tablet or laptop. However, projectors provide more flexibility in terms of image size, where flat panel displays offer only a fixed size. Most short-throw projectors can create images from 60 to 100", allowing the display to fit the available space in the classroom. Also, in many cases, an interactive projector allows you to use an existing whiteboard as your projection surface. The advantage here is that the whiteboard can still used when the interactive projector is powered off. With a flat panel display, once the device is turned off, the user is left with a space they can no longer use.

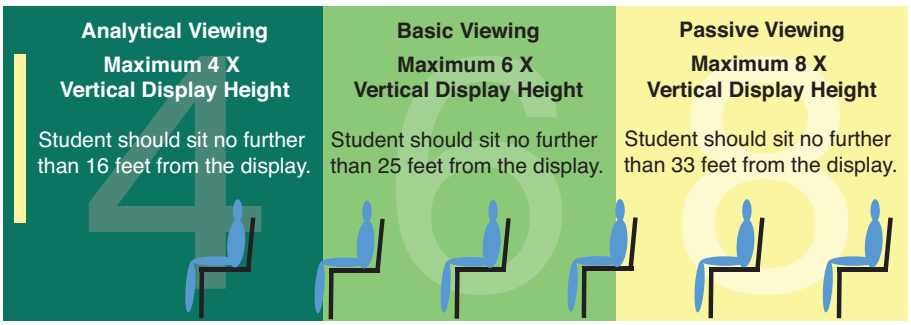
The size and shape of the classroom also need to be considered when selecting the right display for the classroom, as distance impacts the students ability to view displayed content and remain engaged. If 20/20 is the vision standard, then the further away a student is, the larger the content should appear to maintain 20/20 vision. In the audiovisual world, there is also a common standard for setting screen size, known as the 4/6/8 Rule. Application of the rule means that for different types of student engagement with the content presented, the recommended distance the view should be from the screen should be equal to or less than, 4, 6, or 8 times the vertical height of the display. For example:

- **Analytical viewing**—for this type of viewing, the recommended distance is a maximum of four times (4x) the vertical display height. Students can make critical decisions because they can analyze details within the displayed image. The student is able to be analytical and fully engaged with the details of the content, such as small-font texts and numbers, and can inspect photos closely. Examples would be the display of charts or Web content browsing.

- **Basic viewing**—the recommendation here is that the viewing distance be a maximum of six times (6x) the vertical display height. Students can make basic decisions from the displayed image. The decisions are not dependent on critical details from the displayed image, but there is assimilation and retention of the information so the viewer is actively engaged in the content.

Example of the 4/6/8 Rule with a 100-inch display at the front of the classroom

Using a 100" Display (87" Wide x 49" Tall viewable area), applying the rule yields the following guidelines:



Classroom Viewing Distances Summary—The green columns are the 4x and 8x recommended viewing distances, the red indicates students seated beyond the 8x viewing distance. At the bottom, the room results are averaged.

Room Type	Room Size (Feet)			Percentage of Students in Range 65-inch Diagonal Display				
	Width	Depth	Square Feet	4x	6x	8x	Beyond 8x	Total % in acceptable viewing distance
Square	30	28	840	0%	20%	40%	40%	20%
Wide	22	44	968	7%	27%	47%	20%	33%
Deep	32	28	896	0%	27%	23%	50%	27%
Average			901	2%	24%	37%	37%	27%

Acceptable Viewing Distance

Unacceptable Viewing Distance

- **Passive viewing**—the final part of the 4/6/8 rule is eight times (8x) the vertical display height. Here the viewer is able to recognize the images on display and can separate the text or the main image from the background. The content does not require assimilation and retention of detail, but students can understand the general intent of the content.

The recommended viewing distance is illustrated in the chart above:
On average, 70 percent of students will have an inferior viewing experience with a 65-inch display. More than 1/3 of the students, on average, will sit outside the 8x maximum viewing area. The size of the display in the classroom matters—and the larger the screen size, the better. In any room configuration, choosing the smaller 65-inch display will result in a significant reduction in the quality of the viewing experience for students and could impede their learning. The 100-inch displays (and larger) are often more affordable with projection technology and have proven the better option in many K–12 classrooms.

FLAT PANELS HAVE LIMITED FLEXIBILITY

Most classrooms today integrate multimedia and other technologies into the learning environment. Student collaboration and interactive activities are driving the use of projection displays. Even though flat panel TVs support students interacting with content through their mobile devices, the flat panel's smaller display area can be an issue for students in the back of the class, and the display size cannot be adjusted.

To maximize student collaboration and engagement, the trend is for teachers to move throughout the classroom working with individual students and small groups. Projectors are more flexible in supporting this instruction environment as they can be mounted on the wall or ceiling or they can be placed on a tabletop and moved anywhere in the classroom to project displays for small or large groups. While

flat panels can be a good choice for smaller classrooms or a dedicated viewing area, most classrooms are better served by projectors.

Another consideration is that the initial cost for flat panel TVs is higher than for projectors. This makes flat panels cost prohibitive for many districts. Even though the flat panels have low maintenance costs after the initial purchase, they are still more expensive than projectors—meaning a higher cost of ownership for districts. Laser projection is an emerging technology that offers a maintenance free product but has the additional benefit of allowing for larger displays, making them a good alternative to flat panels.

SECTION 3:

WHY PROJECTORS WITH LAMPS AND LASER PROJECTORS ARE BETTER OPTIONS

With projectors, teachers can expand the display area to 100 inches or more. Because of the cost differential between projectors and flat panel TVs, some districts have installed two projectors in some classrooms. These can be mounted side by side for collaborative exercises, such as comparing and contrasting two different documents or math exercises. They can also be mounted one in the front of the classroom and one in the back, effectively providing a front-row seat to more students. This provides many more opportunities for student engagement in a collaborative learning environment and facilitates moving away from the teacher lecture format.

Interactive projectors offer new levels of collaboration and engagement. Using accompanying software, students can interact with the content projected on the screen using a special pen or only their fingers. “It gets the teacher presenting the information in a more interesting way,” says Julie Judd, chief technology officer for the Ventura County Office of Education in Camarillo, California, where interactive projectors are used in the classrooms. “It’s not just teachers talking at the students. They are interacting with them.” This also helps with classroom management; teachers know immediately when students get off task.

Projectors can project onto any surface: a wall, a table, even the ceiling, while teachers control and display student content. When students work at “the board,” the learning environment is livelier and engaging. Teachers can make notes and annotate as they lecture, saving material online to share with students. Content is easily shared as projectors interact with student devices allowing students to project their screens and get immediate feedback whether from their seat or at the board.

The cost of interactive projectors varies but they start at $1,500 (compared to $3,500 for an interactive flat panel display.) Maintenance costs for new interactive projectors are much less than in the past. Newer lamps last up to 10,000 hours and cost as little as $49 to replace.

Laser projectors remove the lamp altogether, and allow display using a solid-state laser light source rather than a lamp. A laser light source that lasts up to 20,000 hours, making projectors a cost-effective option.

Often the projectors include additional software. When the additional software is factored in, projectors are even more cost effective. Additional technology can be connected to the projector:

Room Type	Room Size (Feet)			Percentage of Students in Range 100-inch Diagonal Display				
	Width	Depth	Square Feet	4x	6x	8x	Beyond 8x	Total % in acceptable viewing distance
Square	30	28	840	27%	67%	7%	0%	93%
Wide	22	44	968	40%	60%	0%	0%	100%
Deep	32	28	896	37%	47%	17%	0%	83%
Average			901	34%	58%	8%	0%	92%

Acceptable Viewing Distance

Unacceptable Viewing Distance

document cameras, mobile devices, audio equipment—all of which facilitate additional instruction models such as lesson capture. This has helped teachers adopt the flipped classroom teaching model as a different way to engage students as well as build a library of video lessons. Virtual field trips and meetups with other classes are also good ways to incorporate the interactive technology into lessons.

One of the primary benefits of a projector is that the display size is adjustable. The table above illustrates the number of students who are in the acceptable viewing range with a projected image of 100 inches. With the various classroom configurations, the ideal maximum viewing in K-12 classrooms should be less than or equal to six times (6x) the vertical display height.

SECTION 4:

EVIDENCE OF SUCCESS

In 2014, Michigan's Walled Lake Consolidated Schools passed a bond that included significant upgrades to classroom technology. As part of that bond, the district wanted to outfit 850 classrooms with high-quality digital products. Mark Hess, executive director of instruction, technology, and assessment, says that with the bond, they were able to implement technology simultaneously for the first time. "We began our process by forming a committee of principals, teachers, curriculum developers, and technology leaders and asking, *What do we want in a projector*? How will it augment instruction?"

The team developed a list of what they were looking for, invited vendors, and narrowed their choices down to just a few products. They then set up mock classrooms at the district office and invited teachers in. Epson immediately rose to the top. Educators are familiar with the Epson brand and trust it. "That hallmark brand reputation reassured our team that the company would be there for years to come and would be able to stand behind their products," says Hess. "We chose the Epson® touch-enabled BrightLink® projectors as they can integrate into the curriculum, making it easy for students and teachers to interact with the lessons—really bringing learning alive in the classroom."

One of the reasons Walled Lake chose the BrightLink projectors was because the projectors allowed some flexibility. As new technology is developed, it will be easy to connect speakers and other inputs, for example, to the projectors. "We also purchased Epson document cameras and an integrated speaker system and audio enhancement for teachers as part of our digital ecosystem," says Hess. "We wanted to make sure we're engaging students appropriately with the technology. It's not an add-on but has to be integrated into the curriculum."

"Look at the technology through the lens of instruction," Hess advises other districts considering their classroom display options. "Instruction and learning should drive your tech decisions. We began with our instructional priorities and then determined what technology could support them."

Florida's Tampa Preparatory School took a similar path to choosing their technology. Chad Lewis, director of technology, says the school wanted technology that could make a real impact on learning. They wanted to move away from teacher-directed learning to a more collaborative classroom where students would drive their own learning. Because the school was concerned with auditory and visual equity, they chose to put two interactive projectors in each class—one in the front of the room and one in the back. They were able to put two Epson BrightLink projectors in each classroom for less than the cost of one flat panel TV. "Two displays per room with wireless has been a game changer," says Lewis. "You can't tell where the front of the class is." The combination of technology, mobile furniture, and the adoption of project based learning has been transformative for the learning experience. "I'm not sure that one display per class would have caused teachers to move away from the teacher lecture format so completely," reflects Lewis. "It's been more transformative than putting iPads in their hands. When you walk by a classroom, you can see it . . . every kid is engaged."

EPSON'S CLASSROOM DISPLAY SOLUTIONS

Epson has 40 years of experience developing groundbreaking education tools to help engage students, promote collaboration, and support faculty and administrators. Schools can enhance every student's learning experience with dynamic, user-friendly imaging technology that invites participation and engages students. Epson visual solutions are an ideal fit for any learning space, with large, easy-to-see images and the latest in connectivity and support for Chromebooks, tablets, and smartphones. The ultra short-throw BrightLink projectors ensure bright, vivid lessons with 4,400 lumens of both color and white brightness.[2] With touch- and pen-based interactivity, the projectors make it easy to draw or collaborate using any wall and familiar, intuitive gestures. Epson's new laser projectors offer projection within the 4,000 to 6,000 lumen range and up to 20,000 hours of maintenance-free operation.[2] For more information, visit https://epson.com/projectors-education

Epson has exceptional functionality and includes classroom management software. Epson's free Epson iProjection™ app is available for teachers and students using PC, Mac®, Android™, Chromebook™, and iOS® devices. It allows teachers to quickly and easily establish a wireless connection with the projector, and then connect and manage up to 50 student devices simultaneously.[3] The Moderator feature will allow up to 50 devices to connect and the simultaneous display of up to four devices on the projection screen. Now that they can do lesson capture, many teachers have embraced the flipped classroom model and are building a library of video lessons.[4]

"We are three-and-a-half years into our Epson projectors and they have required absolutely no maintenance," reports Walled Lake's Hess. "However, we will transition to the laser projectors next year. They're brighter, require no bulbs, and have a much longer product life."

CONCLUSION

It's clear that all potential education technology should be viewed through the lens of its impact on instruction and learning. This impact should be the primary driver of school and district technology decisions. Educators know that interactive collaboration impacts the classroom environment by shifting the mode of teaching and increasing student engagement. Many educators are moving away from the teacher-lecture instruction model to a student-directed learning model. Using the district's learning goals as the filter for viewing technology options will help decision makers choose the right products. In determining classroom display needs, it's been demonstrated that display size impacts the degree of student interactivity based on distance from the display. Smart districts will incorporate a review of this research into their technology search in order to build a first-rate digital ecosystem to support their district's learning goals. ■

ABOUT THE AUTHOR

Annie Galvin Teich is a writer, editor, and content marketer who specializes in writing about education and technology.

1. Leading 70" class, 4K resolution flat panel in a 22' (width) by 27' classroom-style arrangement. When asked to copy down size short items of information from slides being displayed, 58% of students ages 12-22 copied at least one item incorrectly. Based on U.S. research conducted by Radius Research.
2. Color brightness (color light output) and white brightness (white light output) will vary depending on usage conditions. Color light output measured in accordance with IDMS 15.4; white light output measured in accordance with ISO 21118.
3. Check your owner's manual to determine if a wireless LAN module must be purchased separately to enable wireless connection on your Epson projector. Epson projectors can be networked either through the Ethernet port on the projector (check model specifications for availability) or via a wireless connection. Not all Epson projectors are able to be networked. Availability varies depending on model.
4. Moderator control, connecting via QR code, and Projector Remote are not available on iProjection for Chromebooks.