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Smart Classroom User Manual

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Smart Classroom User Manual

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About

In 2018, Fort Hays State University began building a prototype for a low-cost, portable smart classroom. This project was a collaboration between the library and the Institute for New Media Studies and was funded by the Institute of Museum and Library Services. This manual assumes that you are working with a smart classroom kit with components that have already been collected and set up, either by you or by an organization or consortium. If you are trying to create a smart classroom kit or set up the smart classroom screens, please consult the Smart Classroom Designs document. If you are trying to display content, create an exhibit, or teach a class in the smart classroom, this user manual is for you.

Technical Training

Turn On and Adjust Projectors

Each screen is paired with one rear projector. Press the power button for each projector to turn it on. The power button is usually located on top or side of the projector, or it may have a remote control. It may take a few moments for the lamp to warm up enough to project light onto the screen. If a projector does not turn on, check that the power cord is firmly inserted into the projector and into an outlet or power strip. If you are using a power strip, make sure it is also switched on. If the projector still does not turn on, try pressing and holding the power button for a few seconds.

If the edges of the projection do not align with the edges of the screen, first center the projector from left to right. Then, move the projector forward or back until the right and left edges of the projection touch the edges of the screen. You may need to use the keystone button, which usually looks like a trapezoid, on the projector or remote control if the right and left edges of the projection are not parallel to the edges of the screen.
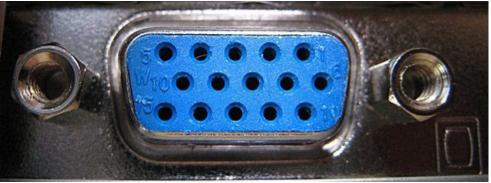
Attach One or More Computers

You will need to connect at least one computer to the smart classroom to provide a source of content.

One Computer

Your computer should have at least one port to connect a display. Depending on the age of your computer, you should have one or more of the following options:

- VGA port: Be aware that VGA doesn't carry sound, so you'll be using the speakers on your computer (not the projector) if you need sound. This is the oldest type of port you are likely to encounter, so it is not the best choice if you have other options.

"A female VGA Connector" CC BY-SA D-Kuru on Wikimedia Commons

- DVI port: Be aware that DVI doesn't carry sound, so you'll be using the speakers on your computer (not the projector) if you need sound.

"DVI D" Public Domain on Wikimedia Commons

- HDMI port: This will provide a high-quality image and is a good choice.

"HDMI connector with logo" CC BY-SA Raimond Spekking on Wikimedia Commons

- DisplayPort: This will provide a high-quality image and is a good choice.

"DisplayPort connector-male-front" CC BY-SA D-Kuru on Wikimedia Commons

- USB-C port: This is the newest type of port you are likely to encounter, so it is a good choice.

"USB-C port" CC BY-SA D-Kuru on Wikimedia Commons

If you don't have sufficient ports on your computer for the number of screens you want to run, you will need a USB to [port type on your projector] adapter. Look for one that says it supports extended desktop functionality, which means that you can display different content on each screen or content that extends across multiple screens. You cannot use a splitter for this purpose unless you want all the screens to display the same content.

If the port(s) on your computer don't match the port(s) on your projector(s), you will need a [port type on your computer] to [port type on your projector] adapter. If you need help, ask your local IT staff or a worker at an electronics store to help you choose an appropriate adapter.

Multiple Computers

If you want to use more than three screens and you do not have a computer with a powerful graphics card, you may need to use multiple computers. If you want to display different content on each screen (for instance, a 3D model on one screen, a spreadsheet on another, and a webpage on a third), you may prefer to use multiple computers. The process for connecting multiple computers is the same as for connecting one computer, but each computer will be connected to a smaller number of screens. You will need a separate peripheral device (such as a mouse) to control each computer. See below for control options.

Control Options

Depending on how your specific smart classroom kit was constructed, you may have access to the following peripheral devices:

1. Keyboard and mouse on table: This is best for use cases where only one person will be using the smart classroom at a time, such as when you are giving a demonstration or presentation. This is also an option when you are using multiple computers and each one is connected to a keyboard/mouse. It is a good choice for users who do not have much experience with other peripheral devices. If you find that using wireless devices causes signal conflicts, try using a wired keyboard/mouse with a USB extension cable.
2. 3D mouse

"Handheld Trackball Mouse" by YUMQUA
This is similar to a normal mouse, but held in midair, with a track-ball and a trigger instead of a flat surface and traditional buttons. Like the traditional mouse, it is best for a single-user-per-machine scenario. It is a particularly good option for displaying content that doesn't require interaction using a keyboard, and most users will find it intuitive. However, it may not be a good choice for users with limited manual dexterity, such as children or individuals with joint or nerve disorders.
3. Touch-enabled tablet or phone: If you are using existing content that pairs with a mobile app, or custom-built content designed to be used with a touch interface, you may want to use a tablet or phone as a control device. If users can use their own phones for interaction, this is a good

multi-user option. If you are providing the tablet or phone, this is best for 1-2 users at a time and is a good choice for users who are not tech savvy.

4. Kinect: Kinect is a line of motion-sensing devices developed by Microsoft. It can detect human bodies and gestures but is best limited to use by 1-3 users at a time. It requires a significant amount of space for users to move around, so it may not be a good option for setups where screens are facing each other. However, it is an excellent option for games and exhibits targeted at younger users.

"Xbox 360 Kinect Standalone" Public Domain on Wikimedia Commons

5. Leap Motion controller

"Leap Motion Controller" by RobotShop

The Leap Motion Controller tracks hand movements when you hold your hand(s) above it. There are a number of games available for the Leap Motion Controller, or you can build custom content to go with it. It is excellent for activities involving gamification and spatial reasoning.

6. UltraLeap 3Di: The UltraLeap 3Di is similar to the Leap Motion Controller in that it tracks hand motions, but it is mounted vertically instead of lying on a flat surface and is more designed for exhibits than for gaming.

UltraLeap 3Di by RobotShop

7. Infrared camera: An infrared camera may be mounted on or behind the screen. Each user then holds an infrared light device that, when on and pointed at the screen, simulates a touch or mouse click. This is a good option for multiple users and provides more exact targeting for interactions than the motion-tracking devices mentioned above.

8. Other: You may also have interaction options based on commercial software, open-source software, or custom-built systems. Consult with the team that built your smart classroom kit to determine what other options you may have.

Program Suggestions

Pedagogy

To take advantage of all its features, the smart classroom is best used for lesson plans that involve interaction with the screens, multiple users, and/or gamification.

Interaction

Interaction with the screens can take place using touch (best for multiple users) or a peripheral device (best for one user at a time or one user per screen). For example, in an exhibit of 3D content, users might interact by rotating the content, zooming in and out, or panning through a large 3D structure. During an interactive lesson, students might work together to complete an activity or solve a problem on a screen. Here are some example use cases:

- Interactive simulation: students explore scientific phenomena, historical events, medical concepts, or other complex systems. They manipulate variables and observe outcomes, gaining understanding through experimentation.
- Coding: students run code they have written to see how it affects a simulation on the screen or objects in the room (e.g. robotics) and then revise based on suggestions from their classmates.
- Adaptive learning: pair the smart screens with adaptive learning platforms to tailor the educational experience to individual users' needs and preferences.
- Art projects: students use the screens as giant drawing tablets, creating digital art, sharing their ideas, and perhaps collaborating on a piece together.

Multiple Users

As the screens are extra large, they are ideal for multiple users to view or use at the same time. For instance, a group of students working on a project together might share their screens using the

smart classroom. As there are multiple screens, it allows for multiple students or multiple groups to share content at the same time. If you are using peripheral device(s) that allow multiple users to interact with the same screen at the same time, users could collaborate by moving content around, promoting spatial literacy. Here are some example use cases:

- Group projects: a group books a time to use the smart classroom, then uses the shared digital canvas to brainstorm and create presentations or other multimedia projects. They can easily collaborate with absent or distance group members in real time.
- Lab groups: students design, conduct, and analyze the results of experiments together in a simulated lab, where any mistakes they might make have less impact and several groups can work close together at low cost.
- Design lab: students in an engineering or applied technology courses work together to create a digital plan or 3D model and run simulations to see how it performs in action.
- Digital curation: students work together to add resources on a specific topic to a shared digital space, such as a document, slide set, or pinboard.
- Case studies: students work together to solve a case study with multimedia elements, such as a video interview with an entrepreneur or a set of company financial documents.

Gamification

Being surrounded by the smart classroom screens can promote immersion using gamified content. Some of the peripheral devices we recommend, such as the Leap Motion controller or the Kinect, were originally designed for gaming. Gamified content is particularly effective with younger users or when practicing spatial reasoning. Here are some example use cases:

- Language learning: students use the screens for vocabulary or grammar games. Multiple screens enable multiple users to participate or compete more easily.
- Music games: students play games related to rhythm, tone, and other musical concepts. They can collaborate on a composition or have a digital ensemble experience.
- Math games: students work together to solve math problems and analyze visual aids (graphs, charts, diagrams) to advance a gamified goal, such as in a timed or racing game.

Instruction

The pedagogical suggestions above focus primarily on interactive, student-led activities and content. However, the smart classroom is also suitable for more traditional instruction where the teacher is sharing content with students. Since the space enclosed by the screens is limited, both active learning groups and traditional classes must be relatively small, but a hexagonal or trapezoid setup with seating allows for a larger group of students. The smart classroom is particularly effective for sharing multiple pieces of content at once. For instance, a literature instructor might show different versions of a text for close reading, a geography instructor might share multiple maps of the same area over time, or a math instructor might share a spreadsheet, charts, and interactive data visualization. Here are some additional example use cases:

- Visualization: the instructor uses the screens to visualize complex concepts or share large amounts of data, such as in a STEM course.
- Virtual field trip: the instructor shares augmented reality (AR) content, such as through Google Earth, allowing virtual field trips to historical landmarks, museums, culturally immersive spaces, or inaccessible regions such as space or deep ocean.
- Digital storytelling: the instructor takes advantage of multimedia content to share a digitally illustrated story with embedded videos, images, and audio clips. For instance, a history instructor could share an interactive timeline or map.

- Art instruction: the instructor uses multiple screens to demonstrate and compare different techniques for making art, perhaps sharing examples created by other artists.
- Accessibility: the instructor magnifies text or images for students with visual impairments and uses the extra space to add live captioning to lectures or display full video transcripts.

Events

As a small but versatile space, the smart classroom is best used for events that either engage a small group of people or engage a larger number of people on a rotating basis, like a come-and-go event.

Small Groups

The smart classroom is designed for active use by a small group of users. If you are making a presentation, consider bringing in chairs for your attendees; if they are on their feet, try to keep them moving to maintain engagement and avoid fatigue by keeping your event short. Here are some example use cases:
- Workshop: attendees watch a demonstration by an instructor, then try their hand at creating content on the smart screens, such as digital art or computer code.
- Training session: attendees follow along with an instructor to learn a new skill, such as using specialized software.
- Interactive storytelling: a lead storyteller begins a story and asks for audience members to contribute elements or make choices along the way, incorporating digital assets to illustrate or add sound effects to the collaborative story.

Rotating Groups

If your event has more attendees than will fit in the smart classroom space and it takes place in a short, fixed time frame, you may want to consider implementing a rotation with other activities outside of the smart classroom, such as a tour, active game, or exhibit. Alternatively, if it is a come-and-go event, you may want to consider using content in the smart classroom that is easy to interact with on a flexible timeline, such as a repeating video or multiple hands-on activities that can be used by different users on different screens. Here are some example use cases for rotating groups:
- Interactive timeline: run a timeline with multiple nodes across all of the screens. Attendees can move along the walls of the smart classroom interacting with each node, which maintains an active and consistent flow through the space.
-

Exhibits

If you have a large space for exhibits and frequently have multiple exhibits at once, setting up a Smart Classroom space can be a nice supplement to existing exhibits. On the other hand, if you have a small space or don't frequently host exhibits, the Smart Classroom can be a good way to bring in traveling exhibits and have a big impact with a small footprint.

Smart Classroom as Supplement to Exhibit

Here are some example use cases:
- Preview: a museum places the smart classroom near the entrance to provide an overview of the different exhibits currently available, with interactive maps and perhaps teaser videos.
- Extra information: a museum places the smart classroom in a more traditional exhibit to provide background information about the exhibit, such as how the museum decided to host or build

the exhibit, where the exhibited items came from, and obstacles the staff encountered during the planning stages.
- Digital book nook: a library uses the smart classroom screens to display cover images, marketing blurbs, and locations (perhaps on a map) for new books; allow visitors to read previews and author interviews for highlighted books in a collection; or flip pages in virtual storybooks.

Smart Classroom as Main Exhibit

Here are some example use cases:
- Augmented reality gallery: Exhibit born-digital or digitized artifacts or art (we had success with 3D scans of fragile artifacts from our special collections) and allow attendees to interact with them using smartphones via an app or QR code to get more information and/or manipulate the artifacts (e.g. zoom in, rotate, change virtual light conditions).
- Research showcase: an academic library displays posters, videos, data visualizations, and interactive content related to recent research conducted by students and faculty at the institution.

Appendices

Appendix A: Where to find existing content

This section focuses primarily on free options on the assumption that libraries and museums may not have a large budget for digital content. If that's not the case for you, this section still provides a good overview of types of content that work well in the smart classroom (geospatial tools, 3D models, interactive data visualizations, and games).

Google Earth: https://earth.google.com/web/

Google Earth, which can be used via an internet browser or as free downloadable software, uses satellite imagery to display the Earth on an interactive 3D globe. Since it can zoom in to incredible levels of detail, viewing the image across multiple screens provides a strong feeling of immersion. Google Earth can be used for teaching about geography or history and to take virtual field trips. A favorite activity of users is to find and share their hometowns and previous and current homes. This is an easy way to get new users engaged with the smart classroom.

3D Repositories

- Sketchfab: https://sketchfab.com/3d-models/
- SketchUp 3D Warehouse: https://3dwarehouse.sketchup.com/
- MakerBot Thingiverse: https://www.thingiverse.com/

3D repositories are great places to find free-to-use or purchasable 3D content for use in the smart classroom. You can view 3D models in your browser or download a free 3D viewer if you want to use them as-is. If you want to edit or combine the models, you will need special software. Sketchup is a good free option for beginners.

Tableau

Tableau Public (https://public.tableau.com/) is a great source for interesting, interactive data visualizations on a variety of topics. There is also a free version of the software if you want to create your own data visualizations.

Leap Motion Games

If you have a Leap Motion controller, described above under "control options," you can find a variety of free and low-cost games at https://itch.io/games/leap-motion. Even the ones that are not explicitly designed to be educational provide a good opportunity for younger users to work on their fine motor control and spatial logic skills.

Appendix B: How to create content

Any content that can be shared on a computer can also be shared using the smart classroom, including any content you may already have the skills to make, such as spreadsheets, textual documents, and websites. However, building content that extends seamlessly across multiple screens can be a challenge without more advanced technical skills. You can use PowerPoint to create point-and-click interactive content across multiple screens with a wide custom slide size. If you want to create more elaborate immersive interactive content, we recommend a game engine such as Unity (https://unity.com/).