C-GOALS: Presenting Content to Students

Assumptions

- We already assume that there is one large, high-resolution digital wall at the front of the room in large seminar styled classrooms or a smaller display in mid-sized/ break out room classrooms.
- Digital multi touch-tablets are present for each student and professor and they come with an Apple Pencil for writing and sketching.
- We assume that in our environment, all students have Apple devices. Our Classroom is designed by Apple and is part of their Education for All initiative to reinvent the standard classroom setup.
- Personal devices brought in by students and faculty, including MacBooks, iPads, iPhones, and Apple Vision Pro Glasses.
- Sensors/microphones that capture mid-air gestures, speech, faces/facial expressions are already present.

Part 1, C-Goals: Presenting content to students

A. Pre-design work: Design an interface that will enable faculty to present course content to students in the Classroom of the Future during class.

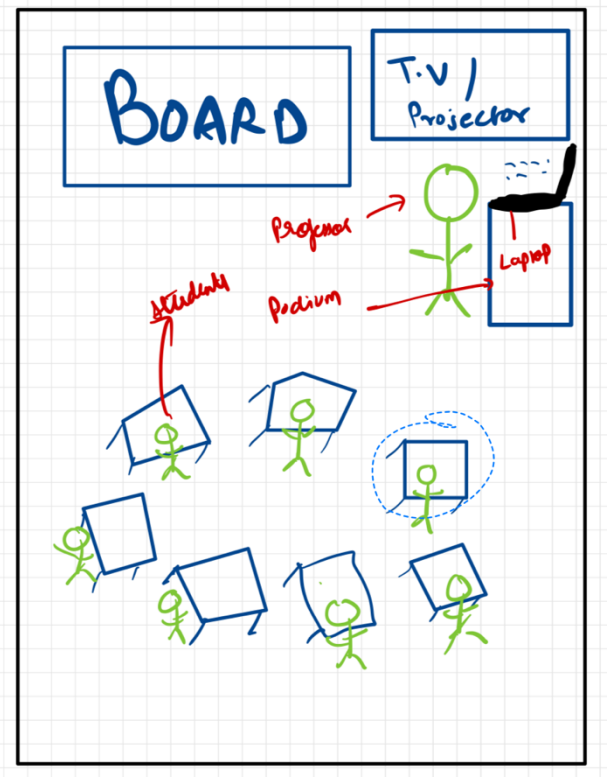
- Consider **where they would want to present this information,** given that they have many choices in the room:
    - Would they present content solely on the large physical display at the front of the room? It is a large display, where would they place this content?
    - Would they share content to the touch-tables? Where on the touch-tables?
    - Would they share content to student devices?
    - Would they share information in AR?
- **When would they create this content**: Would they design and curate the content they plan to present in advance? Would they want to draw, sketch, type live during the class?
- **What kinds of content** might they share? Just PowerPoint or pdfs? Or other kinds of content- 3D models, videos, interactive applications, interactive data visualizations?
- **How would they share this content?** From their personal computers and devices? From a teacher's station connected to the cloud?
- **What kinds of control** would they need over the room?

To answer these questions:

1. Sample the real world to understand what professors currently share with students, and how they share it.

- Use sketching to capture ways in which professors currently present content to students.

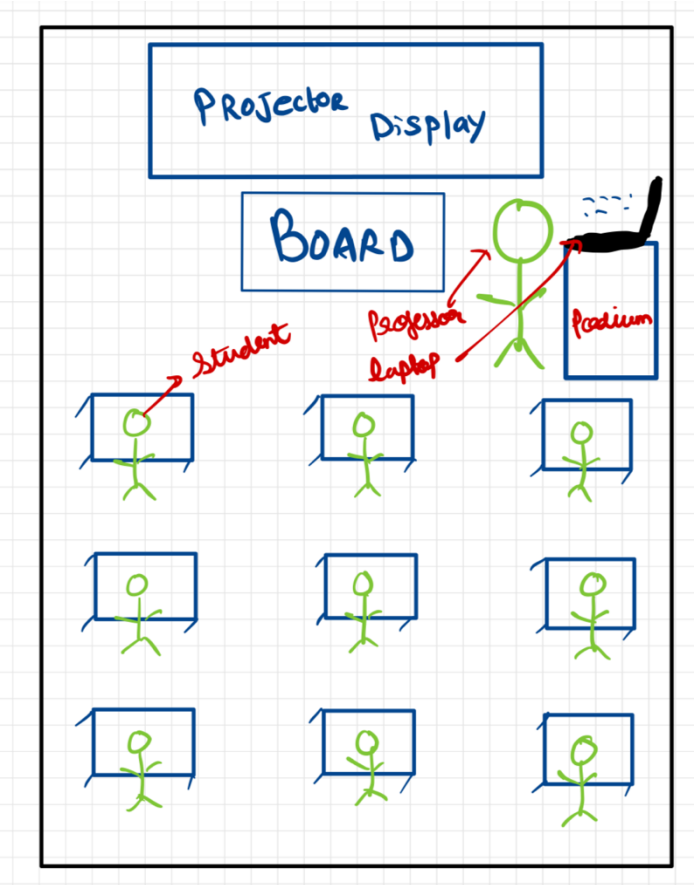
1) Small classroom setup with small TV or projector, laptop for professor and close group seating



Themes, Codes, and Learnings:

- A close-knit circle of students and a small board for the professor
- A small TV or projector for presenting
- We can use the circular seating for the students for more personalized classes
- Cons are that the TV and Projector is static and too small

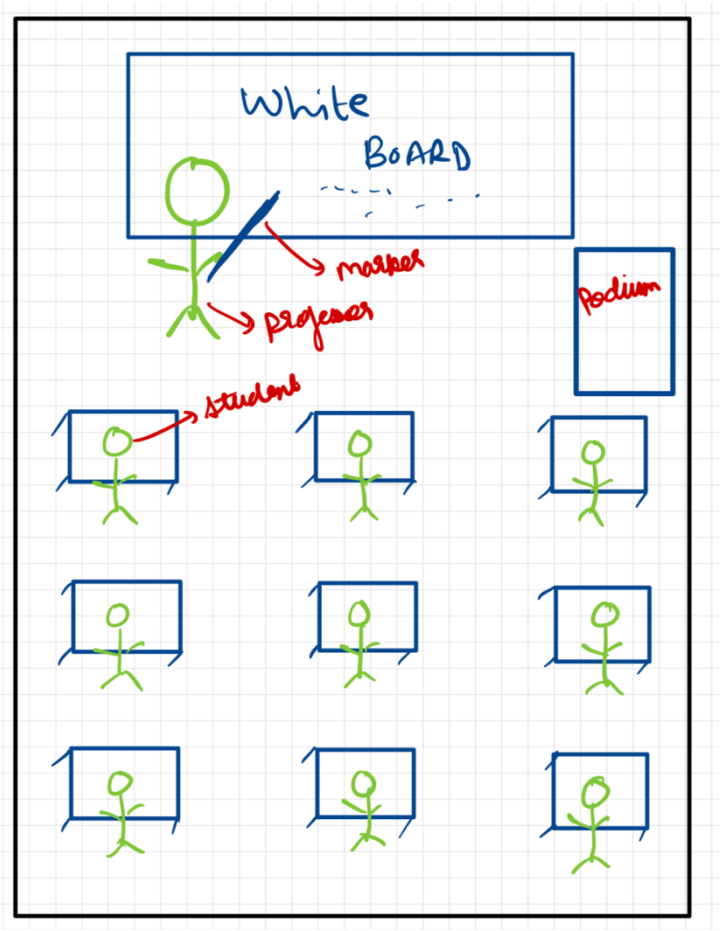
2) Projector Screen and white board with laptop for professor and regular student seating



Themes, Codes, and learnings:

- A large projector screen for all the students.
- Individual seating for all students
- We can use the large projector screen set up
- We can use the professor's personal set up
- CONS are that white board is too small

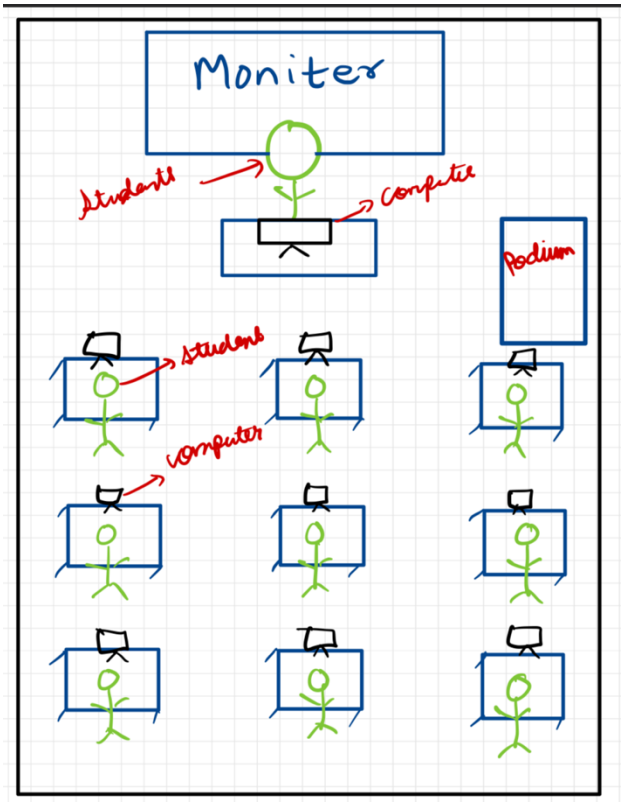
3) White board only instruction for students with regular students seating



Themes, Codes, and learnings:

- A big white board
- Cons are that white board is not very intuitive and visible

(4) Computer Lab set up with professor with computer and students with computers on the table. Monitor for projection.

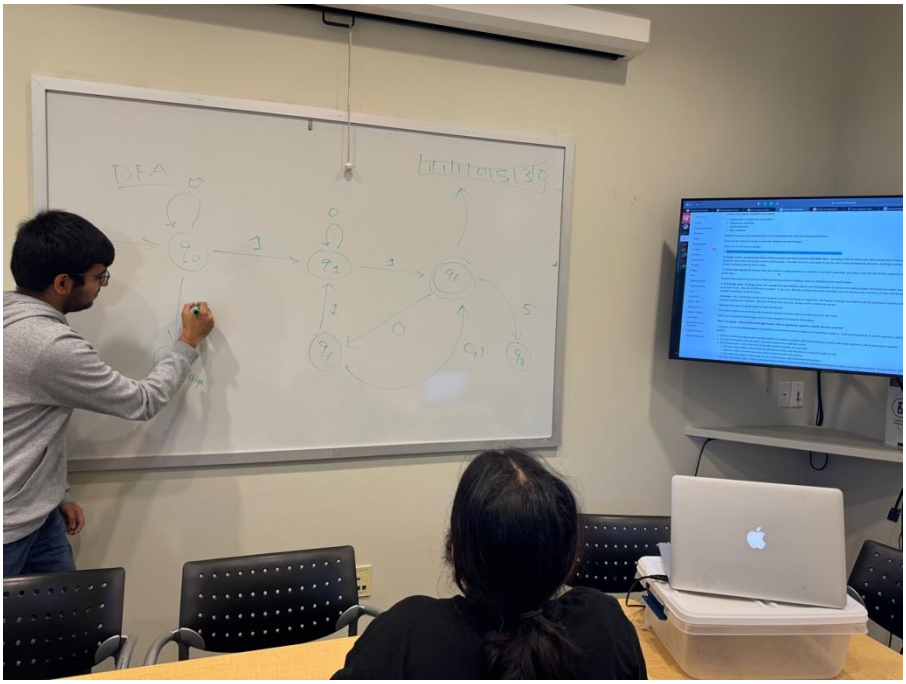


Themes, Codes, and learnings:

- A monitor for each student
- A con for this is students cannot code live
- We can use the individual set up for each student

Use photographs to document the set-up of current UC classrooms, and the kinds of content professors share (please only photograph professors and students with their permission)

(1). Small room in-class white board and monitor setup used by Teaching Assistants



Themes, Codes, and learnings:

- Instead of this small board setup, we can use a pen-tablet interface
- The white board is barely visible, and students cannot collaborate

(2). Breakout rooms used by students to present projects and work on senior design projects

Themes, Codes, and learnings:

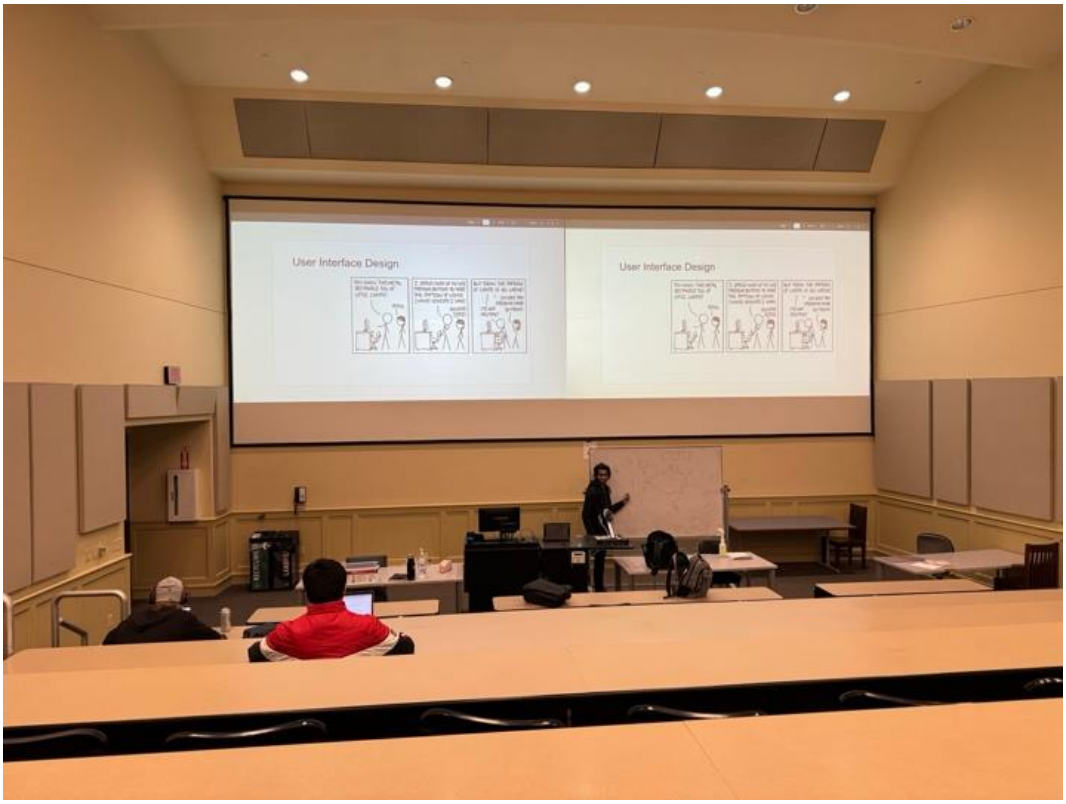
- A TV monitor is only static display and connecting with cables is a hassle

(3). Large seminar Hall with two large split screens, instructors with computer or laptop

Themes, Codes, and learnings:

- Content not visible from the back end of the class
- White board not visible
- Use can use the large screen setup

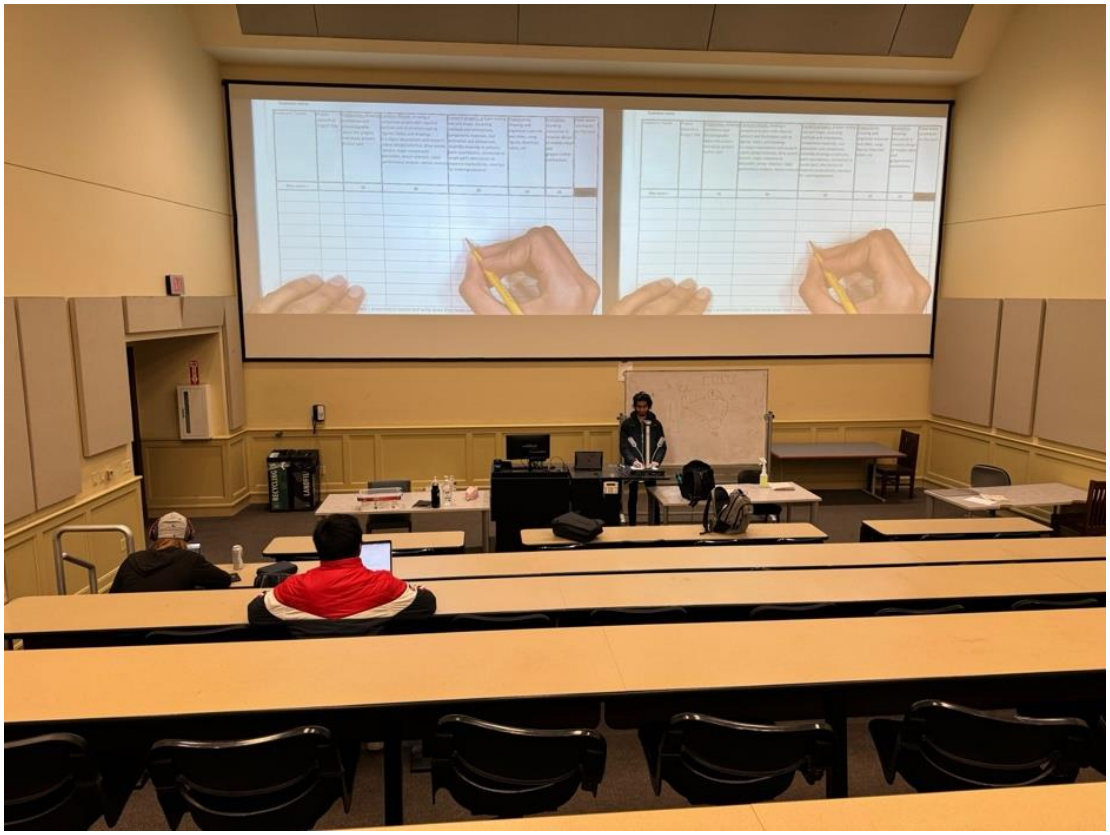
(4). Large Seminar Hall with a white board for written presentation on the board



Themes, Codes, and learnings:

- White board for the entire class is not visible at the end.
- The slides are barely visible.
- But the seating layout is good.

(5). Large Seminar Hall with DocuCam for displaying the page documents and annotating them.



Themes, Codes, and learnings:

- Instead of Doc Cam we can use a digital tablet for sketching and writing stuff

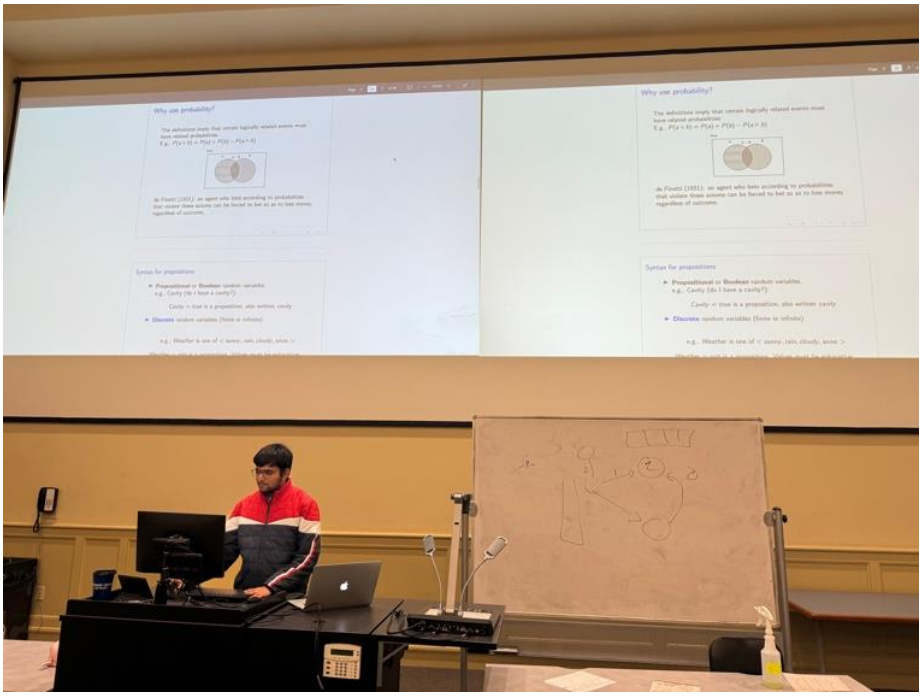
(6). Computer Lab with computers for students, and projector for displaying content.

Themes, Codes, and learnings:

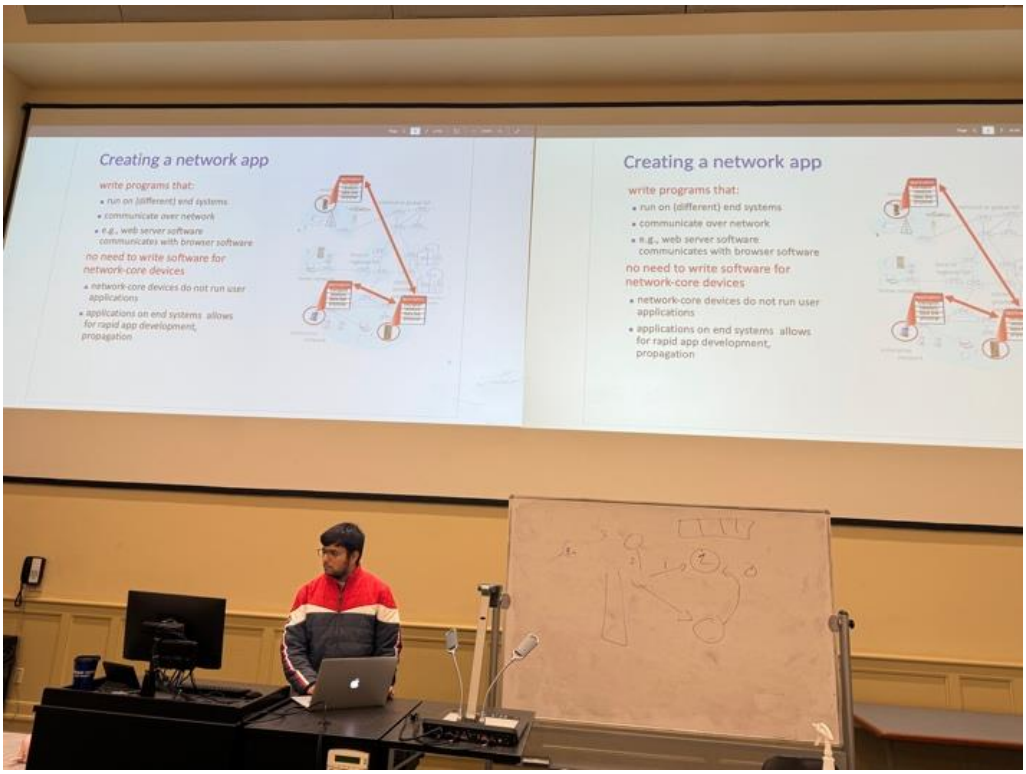
- A classroom with computer can be replicated to get a similar personal device set up for each student

Capture real material presented by professors in their classes- both PowerPoints and chalk-board lectures.

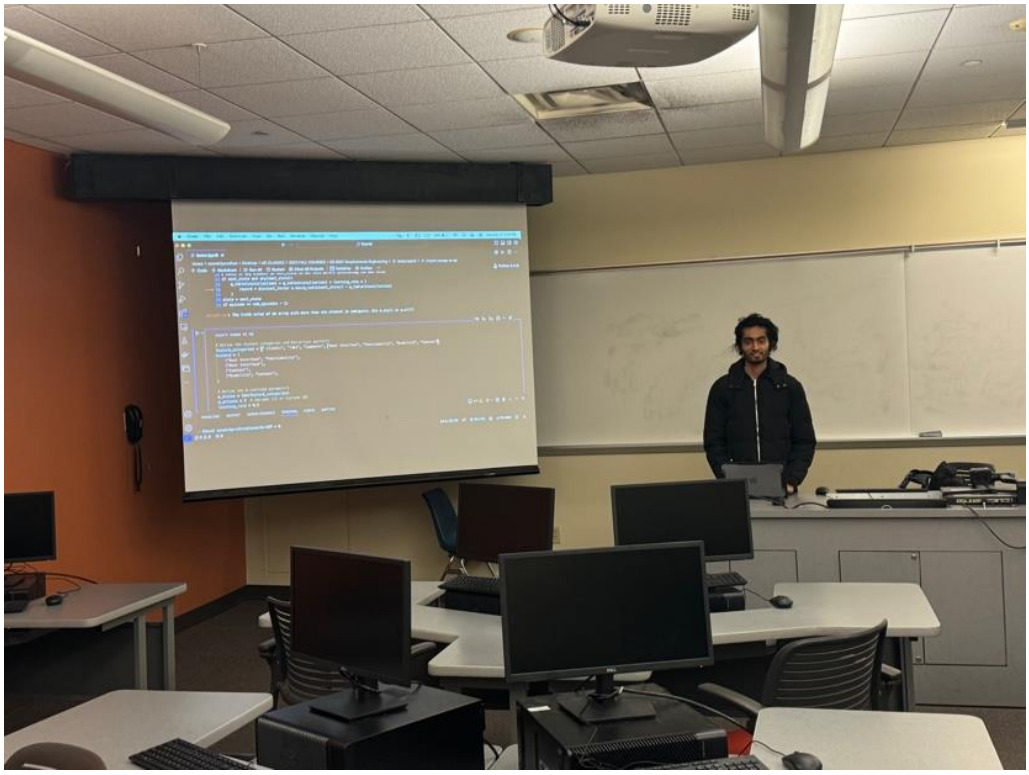
(1). Presenting PDFs with diagrams



(2). Presenting Diagrams of circuits



(3). Live coding by simply screensharing



- Identify themes in what you have captured that can be translated into codes. Apply these codes to your captured content.

- What did you learn? Summarize your findings. Include the captured images, your process for arriving at themes and codes, and your final results.

Final Results

Looking at the current classroom setups and mode of teaching, these are some implementation points we want to focus on. The images of the existing themes and their codes and learnings are associated with every image in our case study above.

- For our larger classes, we want a larger screen which is not split into two but like a movie theatre.
- We will be giving a suite of device set up for each student and professor (listed in the ideation above)
- We will use a tablet with apple pencil instead of Doc Cam
- We can use an intimate classroom setup for smaller classes
- To avoid technical troubleshooting in class, an AI assistant can be implemented.
- The themes we want are:
    - Collaboration
    - Clarity in vision
    - easy sharing of documents
    - Digital notes
    - Easy of displaying content
    - Gesture based actions
    - Tech troubleshooting, etc.

- Some of the Codes are
    - Small class set up
    - Large seminar style set up
    - Breakout room set up
    - Computer Labs
    - Science's Lab
    - Music Labs, etc.

2. Consider how professors could share their content in this new kind of classroom

    - What does it mean to have a larger and higher resolution display for presenting content to students?

- What role could personal devices or the touch-tables play in how professors present things?

From the above Themes, Codes, and Learnings, we decided to go with an easy-to-learn interface. Hence, we decided to use an Apple iOS-based interface as it helps with Learnability.

Ways professors can share the content are given in the following sections. We have a multi modal approach to presenting and collaborating.

As we saw from our current classroom examples, a large screen with higher resolution is required for clarity of vision at the back of the class. Our examples show how a big lecture hall has less clarity at the back with poor displays.

We will discuss the roles of personal devices and how collaborating, sharing, and collecting data becomes convenient with it. **The following is an in-depth overview of our "Classroom From The Future"!**

Our Classroom is inspired by Apple's Education program. Our classroom integrates Apple devices seamlessly and uses some of Apple's software features.

We know there are several types of classroom formats, and each requires a different approach/ mode of instruction for the professors. This means different ways to display the content in different modes.

While working towards our project, we have kept in mind the following (types) of classes and based our work on that:

CLASSES TO THINK ABOUT:

- Biology +Chemistry + Physics + Laboratory
- Problem solving/ math/ Automata
- Public Speaking
- Music
- Programming Data Structures and Algorithms
- Kahoot (used in some class)

- User Interface and Arts

Pre-design work:
Design an interface that will enable faculty to present course content to students in the Classroom of the Future during class.

Consider **where they would want to present this information,** given that they have many choices in the room:

- Would they present content solely on the large physical display at the front of the room? It is a large display, where would they place this content?
- Would they share content to the touch-tables? Where on the touch-tables?
- Would they share content to student devices?
- Would they share information in AR?

Our platform will involve four types of interaction displays for the students and professors. Each of these modes serves a different purpose and can be used simultaneously. The four modes of display are:

1) Large Display:
    - Display common purpose content for the entire class.
    - Educational content present in the middle with Lecture info details and other relevant details on the left top. The right top has presenters name and QR code to present (one of the ways)
    - Presenters may choose to display their in-class video on the right and live captions on the bottom.
2) Touch Tablets with Apple Pencil:
    - Acts as in-class workbook/ scratch pad. Synced with the professor's personal/work devices.
    - Professor can display personalized content to students on the display like exams, quizzes, in class assignments, Math Problem solving, etc.
    - Students can use the Apple pencil or the in-display keyboard to work on these tasks and interact.
    - Professor can choose to make students interact with the content from the large screen on the Touch Tablets. Like Annotate the presentations, write on the shared screen etc.
3) Personal Devices:
    - iPhone and iPad: A data collection device for clicking pictures, scanning documents, Measure App to get data for Labs, etc., Use AR Camera to capture Spatial Video. Air drop to share files by Tapping. Swipe up Share Play to broadcast content on the large screen. Personal Sketching and work, not to be shared in the class. iPad can be used to copy in class Touch Tablet work on to it and take home. Each device has a broadcast and Airdrop/ Share Play button

- MacBook: Main computer with a Keyboard interface. Used for live coding on the large screen. Essay Reponses. Connected to all other devices. Has a broadcast and Airdrop/ Share Play button

4) Apple Vision Pro Spatial Vision glasses:
    - AR-VR glasses for visualizing in class. Each student has these and they are connected to all their devices. Professor can choose to show which content to display.

When would they create this content: Would they design and curate the content they plan to present in advance? Would they want to draw, sketch, type live during the class?

Content creation:

- There is a wide range of flexibility with the content creation. For large screen, the professor can upload the content from their laptop or any other device.
- The content can be prepared beforehand, or professor can Share play content from their laptop.
- Students can also actively complement in content creation form their devices.
- The classroom is Siri AI enabled and can be activated by the professor with voice commands to perform tasks like tech logistics, classroom handling, room logistics etc. This is a teacher's assistant
- Professor can use the above-mentioned devices to type, sketch or present the content.

What kinds of content might they share? Just PowerPoint or pdfs? Or other kinds of content- 3D models, videos, interactive applications, interactive data visualizations?

Content type (Please refer the displays section as well for additional ideas)

- Along with pdfs and ppts, professors can also present live sketches (from their touch tablet and Apple Pencil), coding demos from laptop.
- Math problem solving can be
- For the Spatial video content, the professor can create:
    - Human Anatomy models for Bio class
    - Chemistry Atoms visualization
    - Physics motion visualization
    - Virtual Lab sessions
    - Student's physical simulation if they are at home for public speaking class
    - Instruments for Music class
    - Visualization of User Interfaces, etc.

How would they share this content? From their personal computers and devices? From a teacher's station connected to the cloud?

As mentioned earlier, all the devices and displays are connected. One can share their content via Air Drop or Share play. Each device has a button for this that can be used to select the device to share it to.

What kinds of control would they need over the room?
Controls needed:

- All the devices
- The AI Teaching assistant
- Professor's laptop, which automatically connects to the classroom's setup

3. Write 3 short scenarios involving an imagined professor. What classes do they teach? What kinds of content do they need to present?

We are taking an imaginary professor who teaches three classes. Biology Lab, Computer Science Algorithms and Arts

1) In the Biology Lab class, the professor will show the AR – VR spatial reality models of the Human Anatomy using the Apple Vision Pro glasses. The students can use their hands to simulate and play with the shapes in real time
2) For the Computer Science Algorithm class, the professor uses live Code along on the large screen and students can follow it, make additions to professor's screen, and share their content from their devices. Parallel editing is possible here.
3) In the Arts class, the professor can sketch using the in-class Touch Tablet and Apple Pencil. The professor can pass out assignments to students via Airdrop and students can continue sketching on their touch tablets as well.

B. Design: Use sketching and vector graphics or wire-framing (in an application like Figma) to design (not implement) the professor's 1) content sharing, 2) content creation, 3) room control user interface.

Use your findings from your pre-design work to inform the design. I would expect that your user needs to be able to:

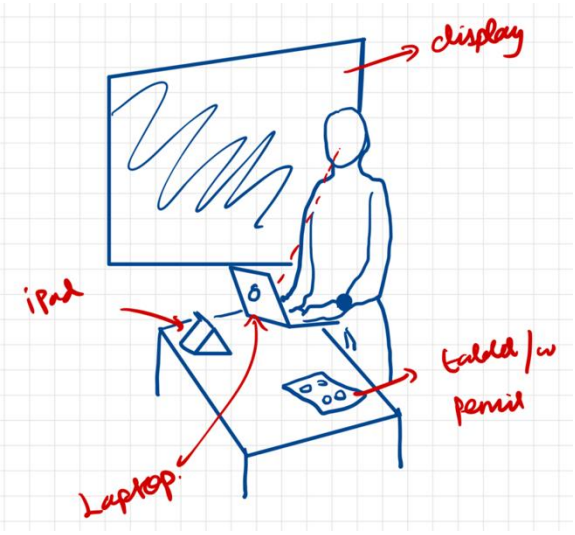
- Upload or create content
- Designate where to display this content
    - Which display

    - Where on the display
- Control the room

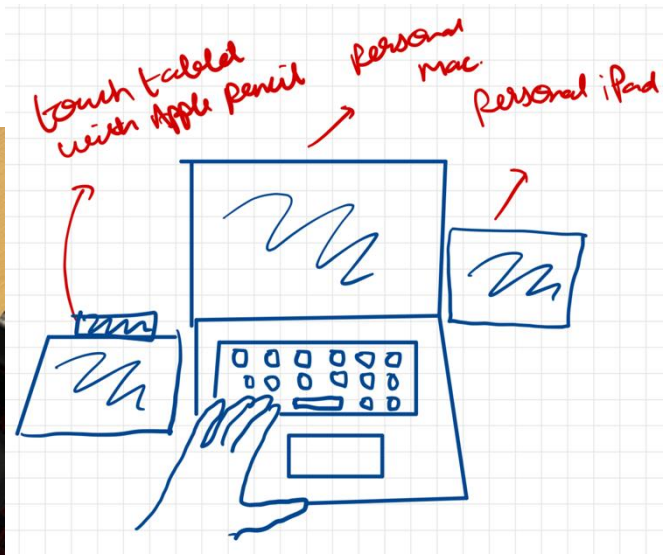
Illustrate how your UI would work through storyboards.

Use **hybrid sketches** to show how the teachers interact with the many devices in the room.

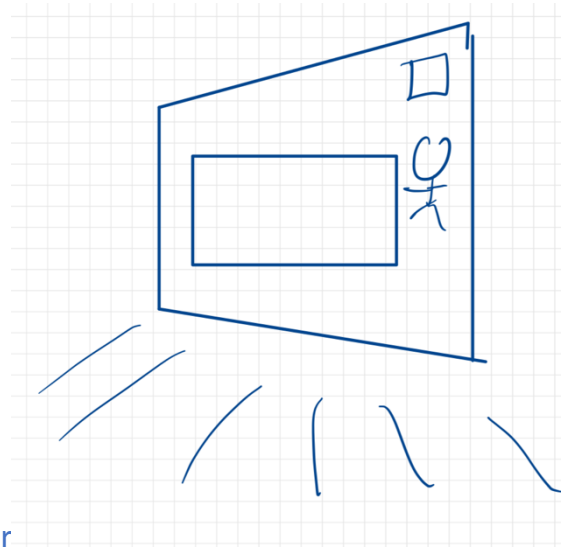
The Following is the **Hybrid sketch** for the initial set up in a classroom



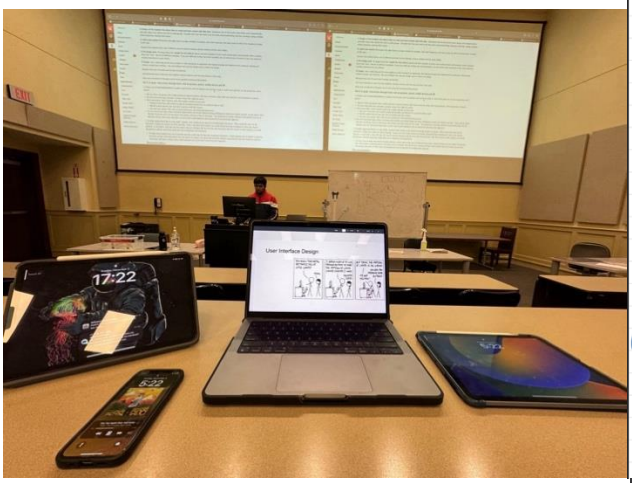
This is the first-person perspective of our set up. Each student and faculty have this.

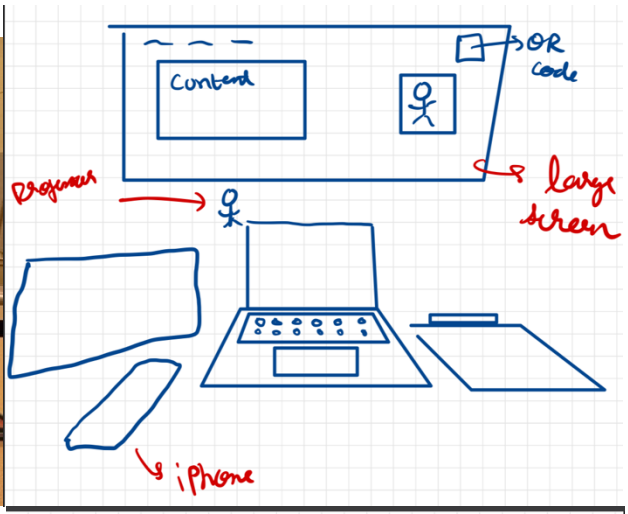


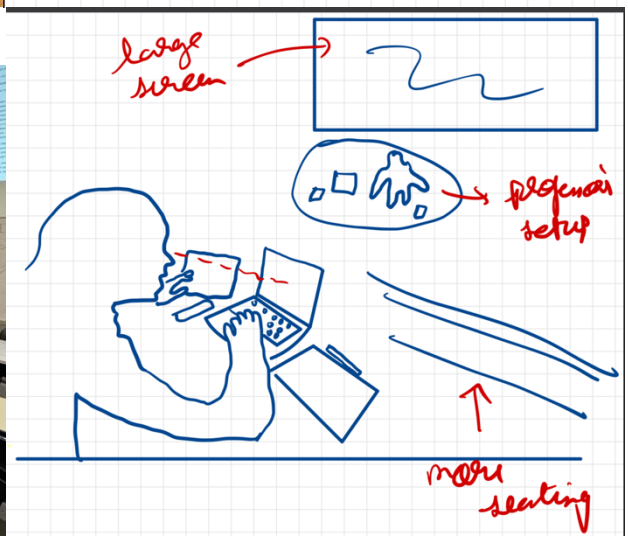
This is a small version of our large screen set up



This is the large screen set up from a student perspective.


17:22
User Interface Design

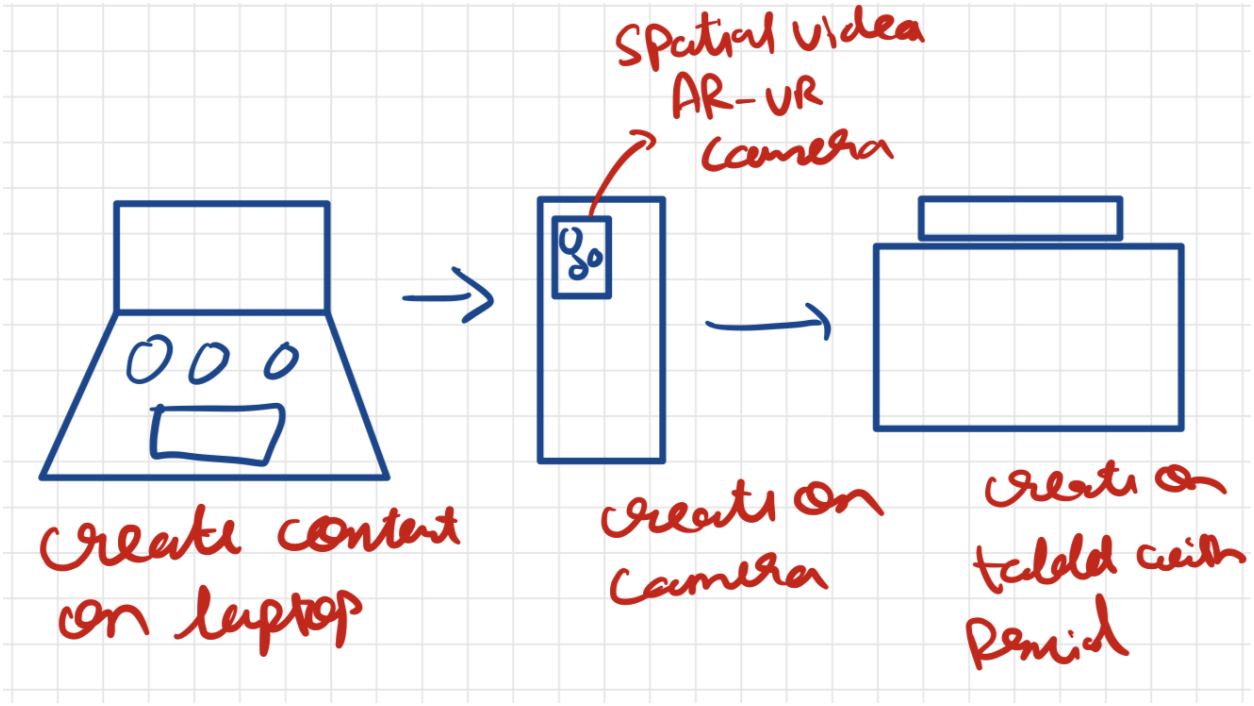

Content
QR code
Programmer
large screen
iPhone


large screen
programmer setup
more seating

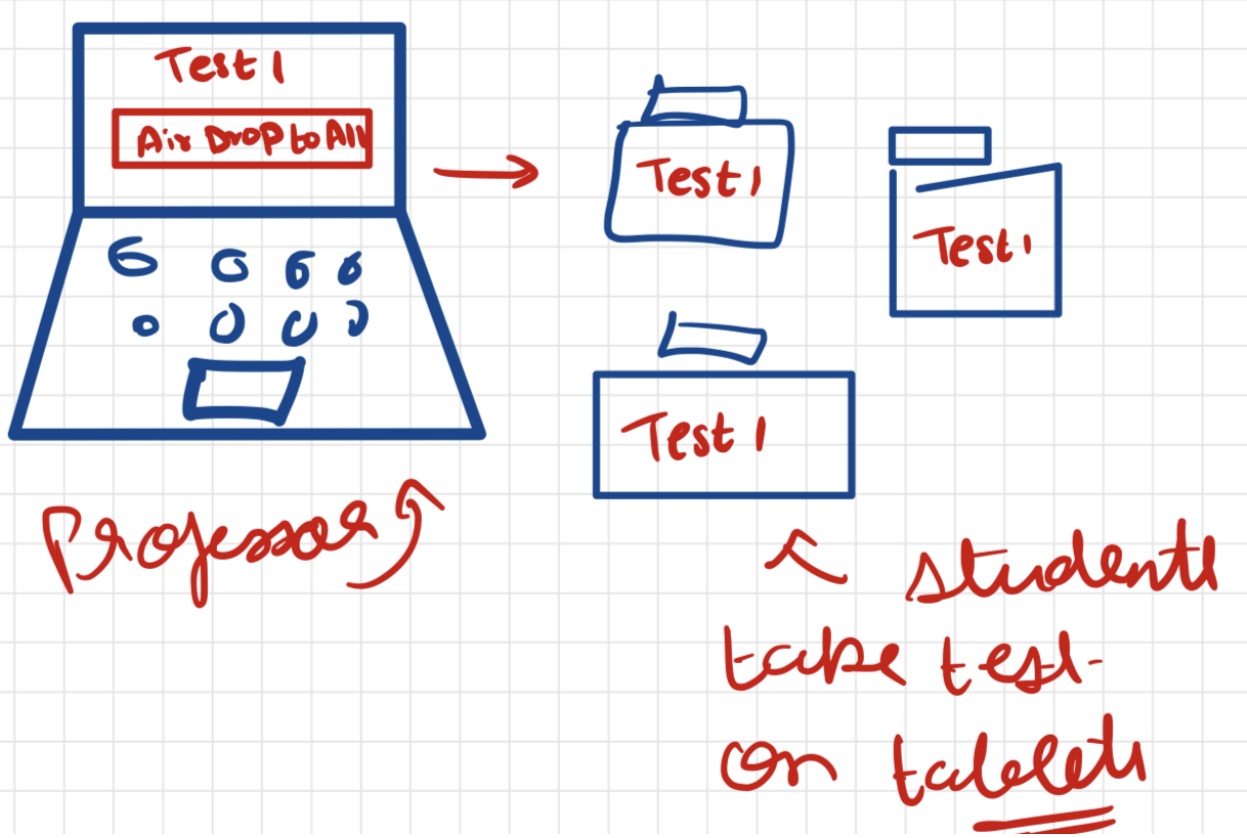

User Interface Design
17:23

STORY BOARD AND HYBRID SKETCHING

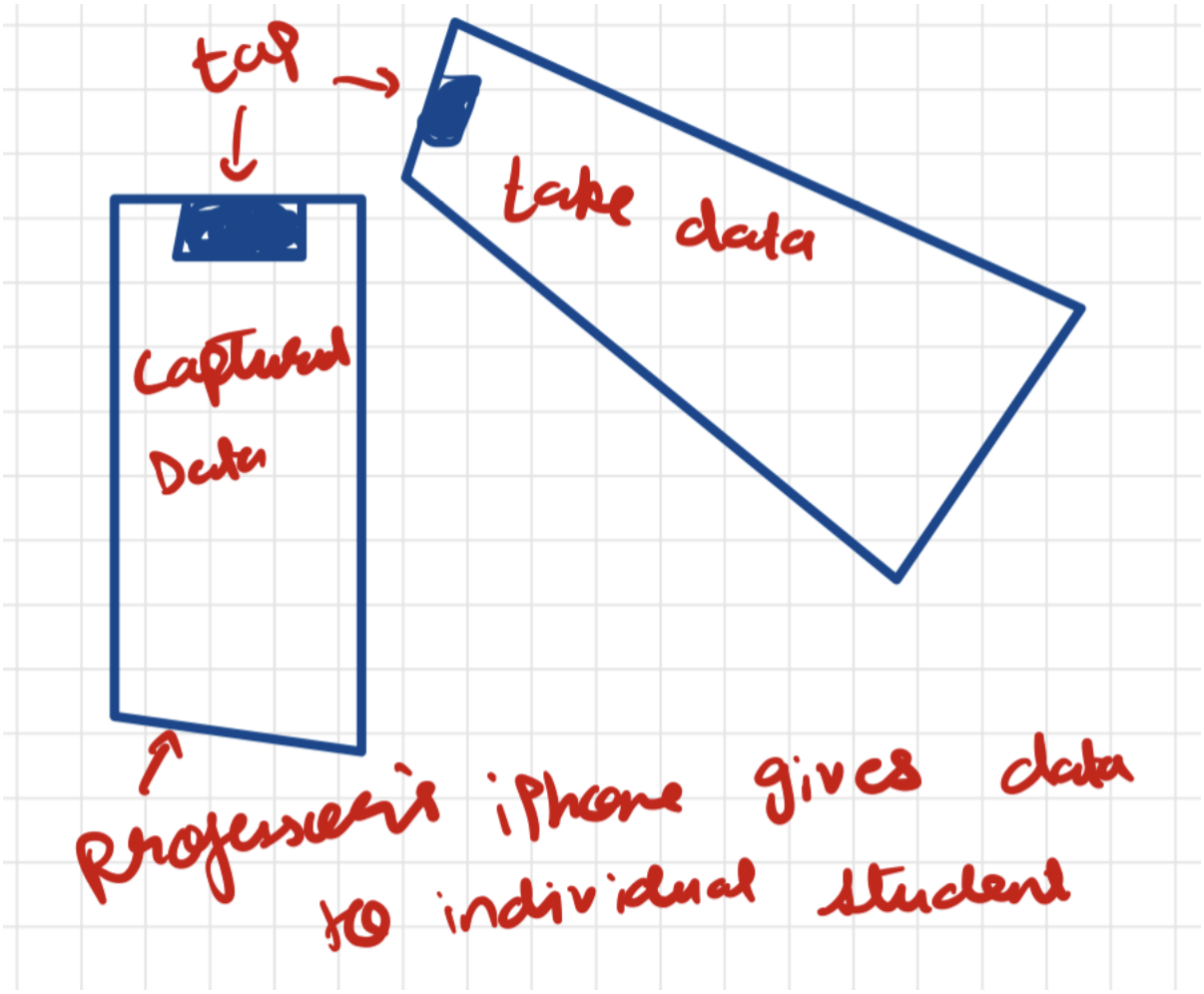
(1). To create the content, simply create on the MacBook traditionally or using the Spatial video capturing feature on the iPhone. Or the professor can also sketch on the tablet with the Apple Pencil.



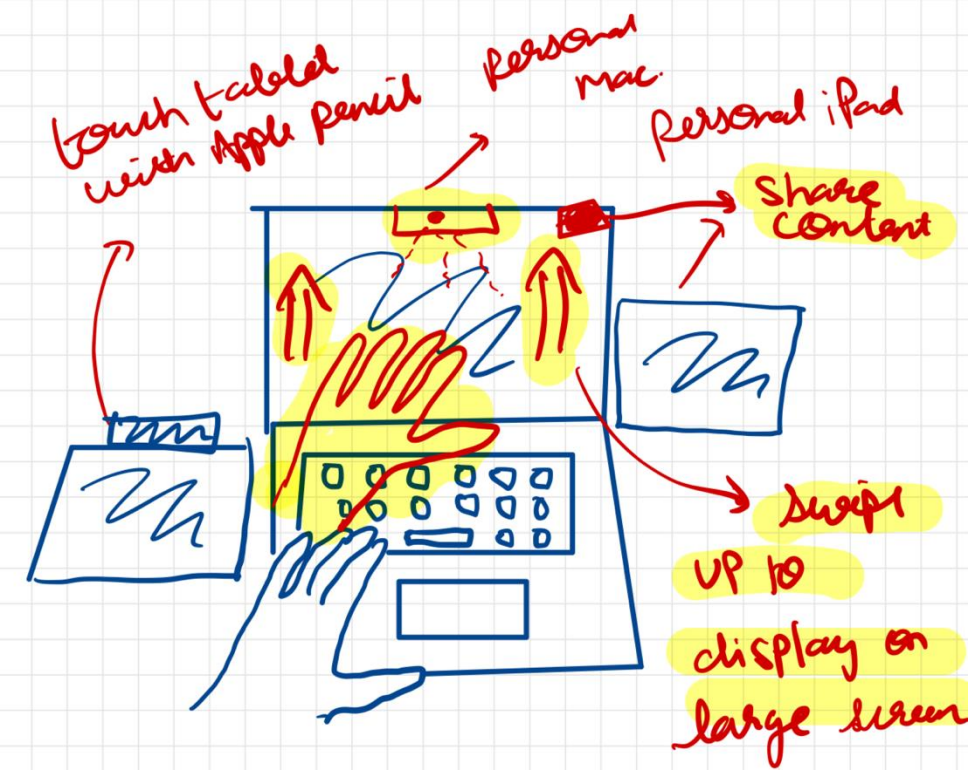
(2). To share and designate the content, the professor can airdrop it.



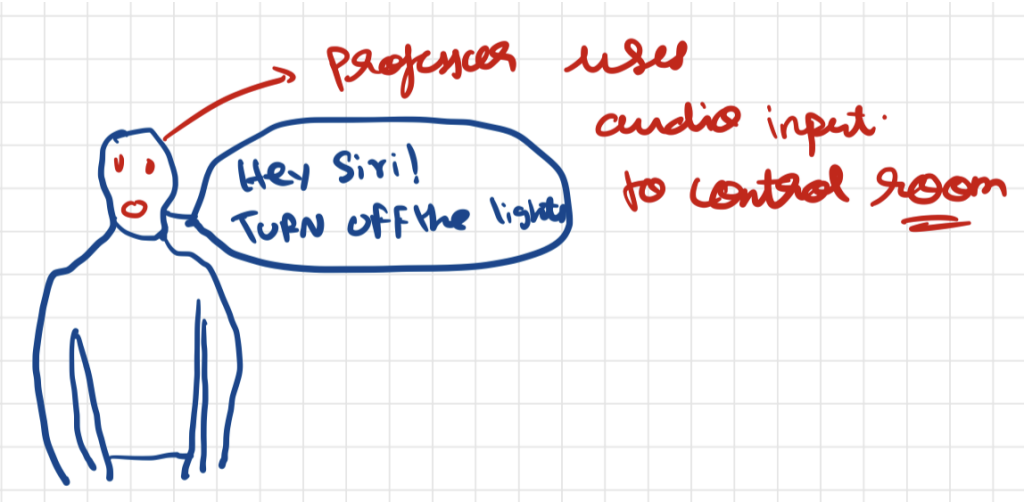
(3). Sharing can also take place by tapping



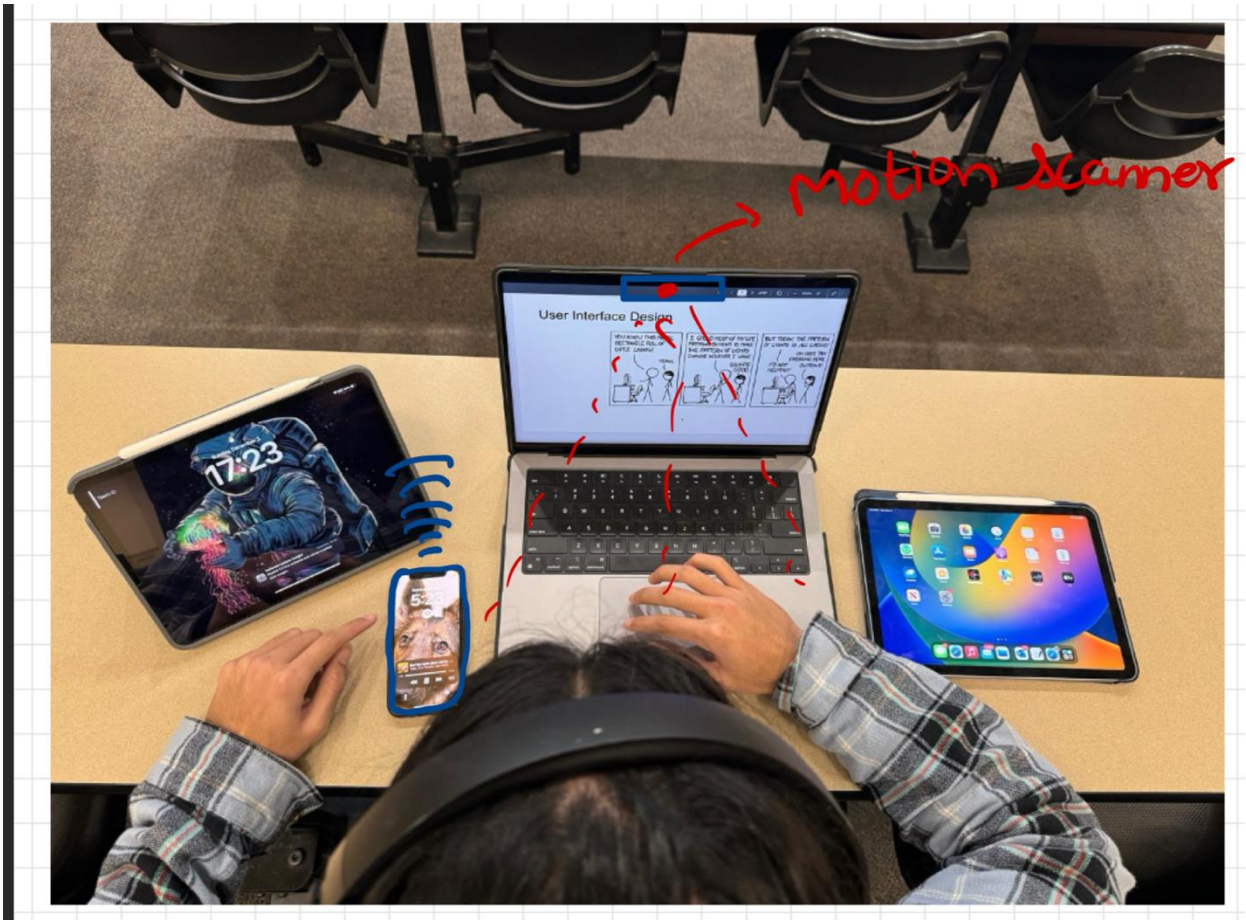
(4). To choose the display, simply use hand gestures to drag and drop the content to various displays. After clicking the share content button swipe up to share on large screen or swipe right to share on tablets for all students.



(5). We have an AI assistant in the class which can be used to control basic troubleshooting and logistics in class

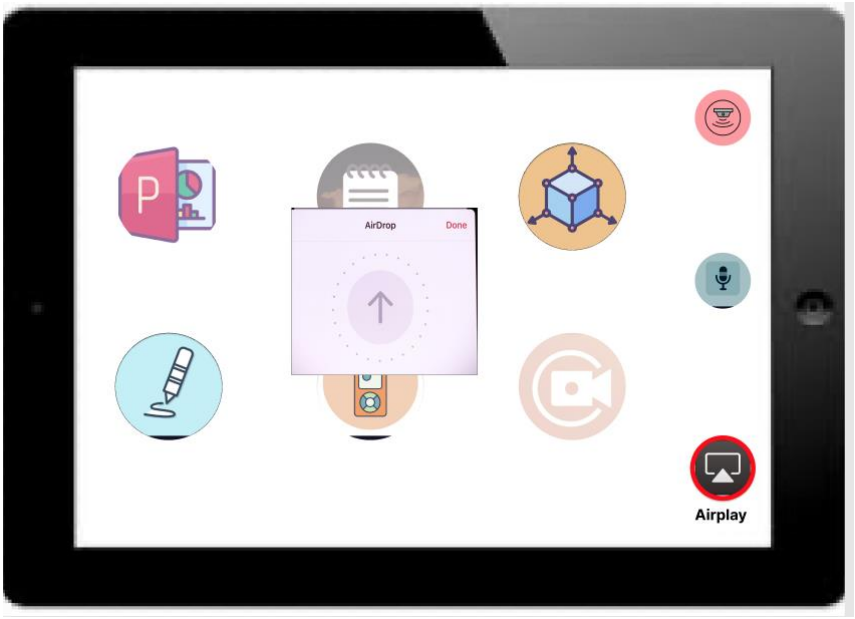


See it in action!

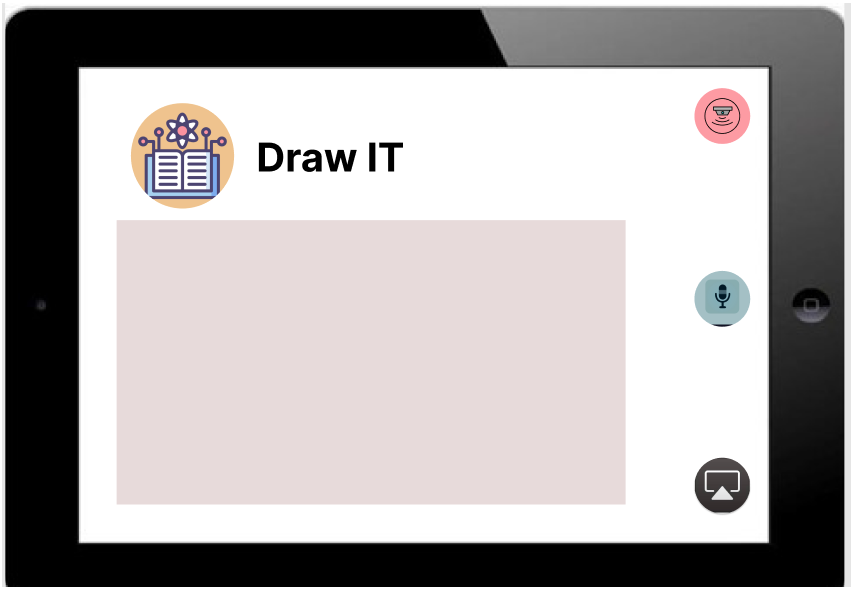


C-Goals: Figma

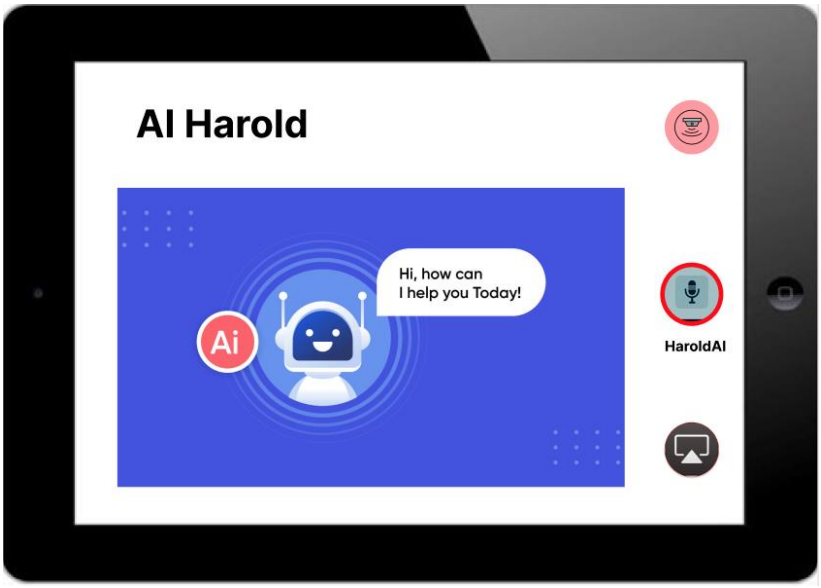
1) Teacher’s content sharing (airplay icon on bottom right)



2) Teachers Content creation



3) Teachers UI for room control (mic icon the top right)



Part 2, B-goals: Flipped classrooms, student interactions

After the teacher shares content, it needs to be presented within a display UI- on the large display, on the touch-tables, on personal devices, in AR. Also, imagine teachers want to do more than lecture- they want to give students opportunities during class to do active work. Sometimes this will involve:

- solving problems independently and sharing answers,
- solving problems in small groups,
- discussing a topic in small groups
- reading an article or watching a video and preparing for a discussion

In these discussions, students may create:

- handwritten solutions to the problem
- sketches or drawings
- typed responses
- other material

Students may also give presentations and share their work- like our class presentations.

How can our classroom make it easier for students to share things?

Well, our interface for the touch tables, personal devices, and AR tech (for A-Goals) can use gestures to detect commands such as Screen Sharing. The sensors detect the user's gestures and respond accordingly. This would mean that the presenter does not need to go through the rather annoying process of setting up the screen share.

For instance, just by a simple swipe motion towards the display, the presenter can display their content onto the large display in the middle of the classroom.

There are 3 interfaces to design:

1. Design the UI where the teacher's content is shared- for large displays, or other in-room devices.

2. Design a UI for students that allows them to create and share content with their class. Sometimes this UI will involve them doing work independently, and other times they will do this work in small groups. Consider that they may want to do this work

using handwriting, sketches, drawings, typing, multiple choice responses, sharing their screen.

3. Add to your teacher UI features that allow them to assign activities to students, view their responses, and select some (or all?) of the responses to show to the class.

Assume that students have a mix of different personal devices (laptops, phones, tablets) and touch-tables.

A. Pre-design work: To design these UIs- sample the real world (as above) and find examples of active work during classes and examples where students share their work. Aim for 10 different examples. If you have difficulty finding real-world examples, you can devise some scenarios of your own based on recalled experiences in your classes.

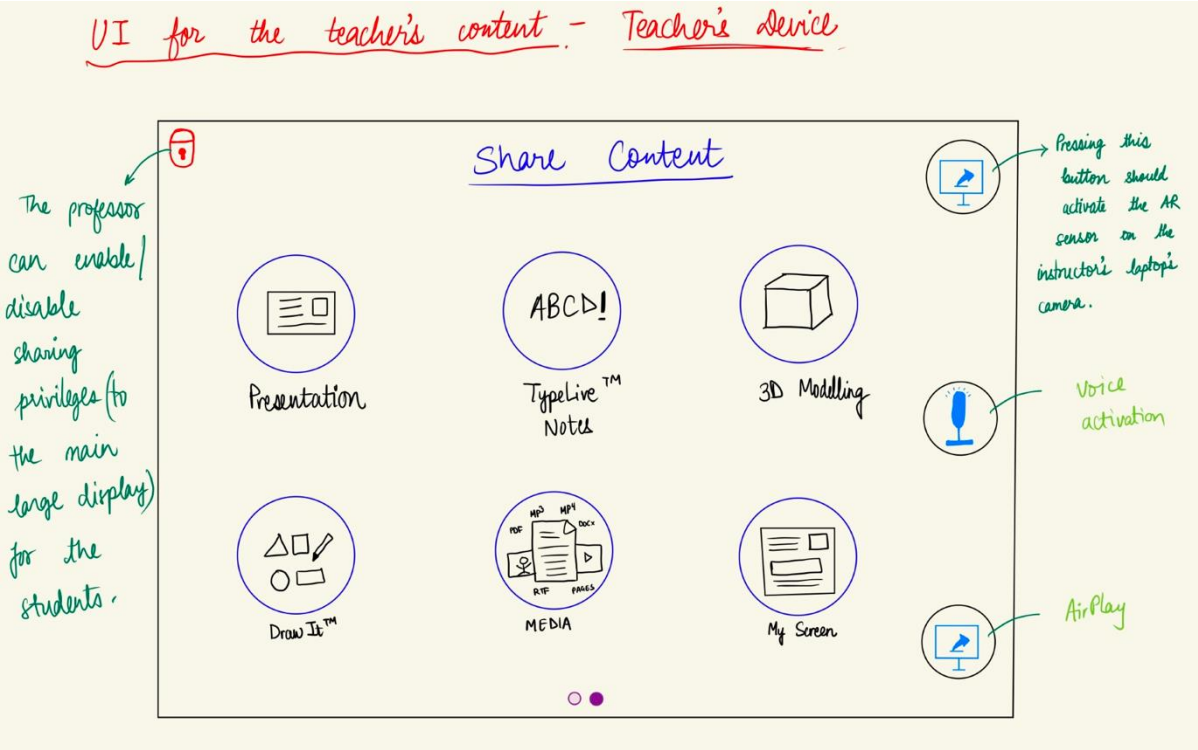
B. Design: Use 1) sketching and 2) vector graphics or wire-framing (in an application like Figma) to design (not implement) the student's interactions user interface. Use your findings from your pre-design work to inform the design.

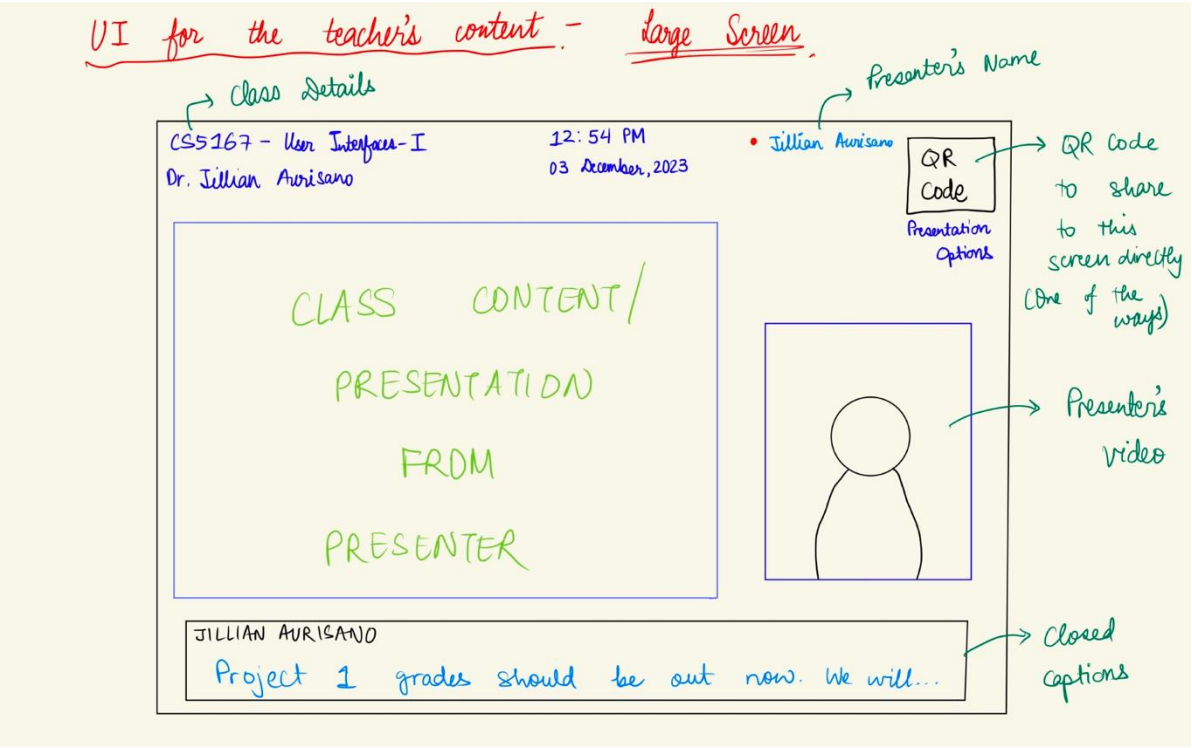
Illustrate how your UI would work through storyboards.

Use hybrid sketches to show how the students and teachers interact with the many devices in the room.

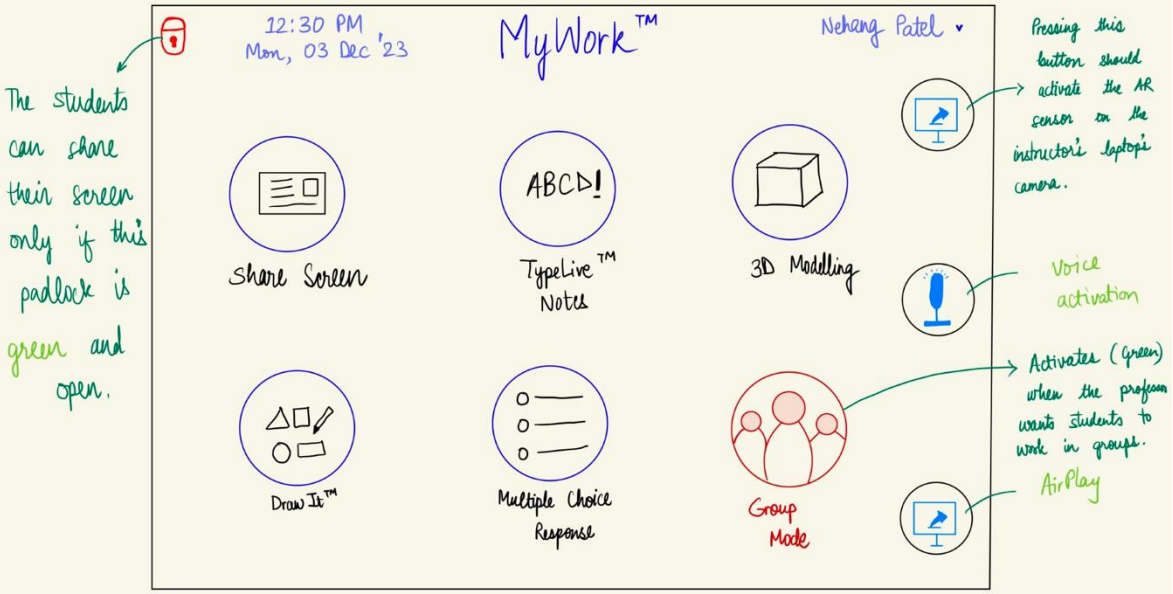
Show your envisioned UI through a set of vector graphics/wireframed illustrations.

B-Goals Sketches

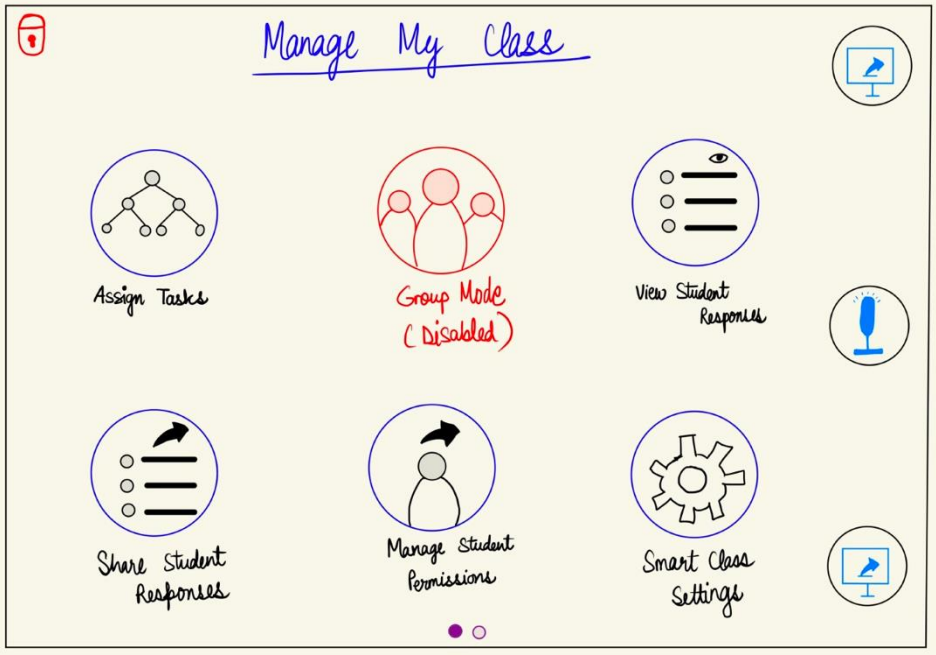




Students' Interface - Touch Table

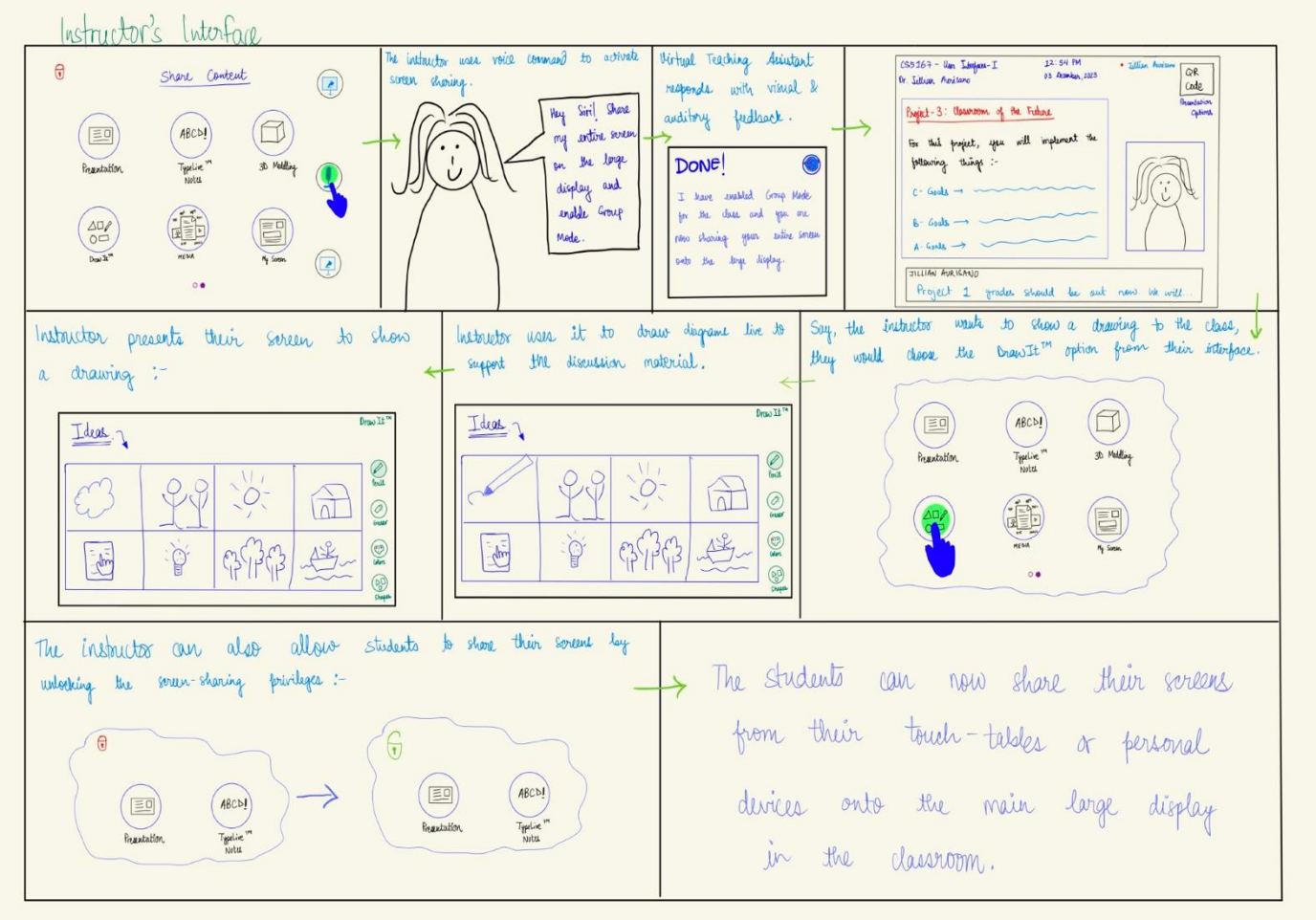


UI for the teacher's content - Teacher's device

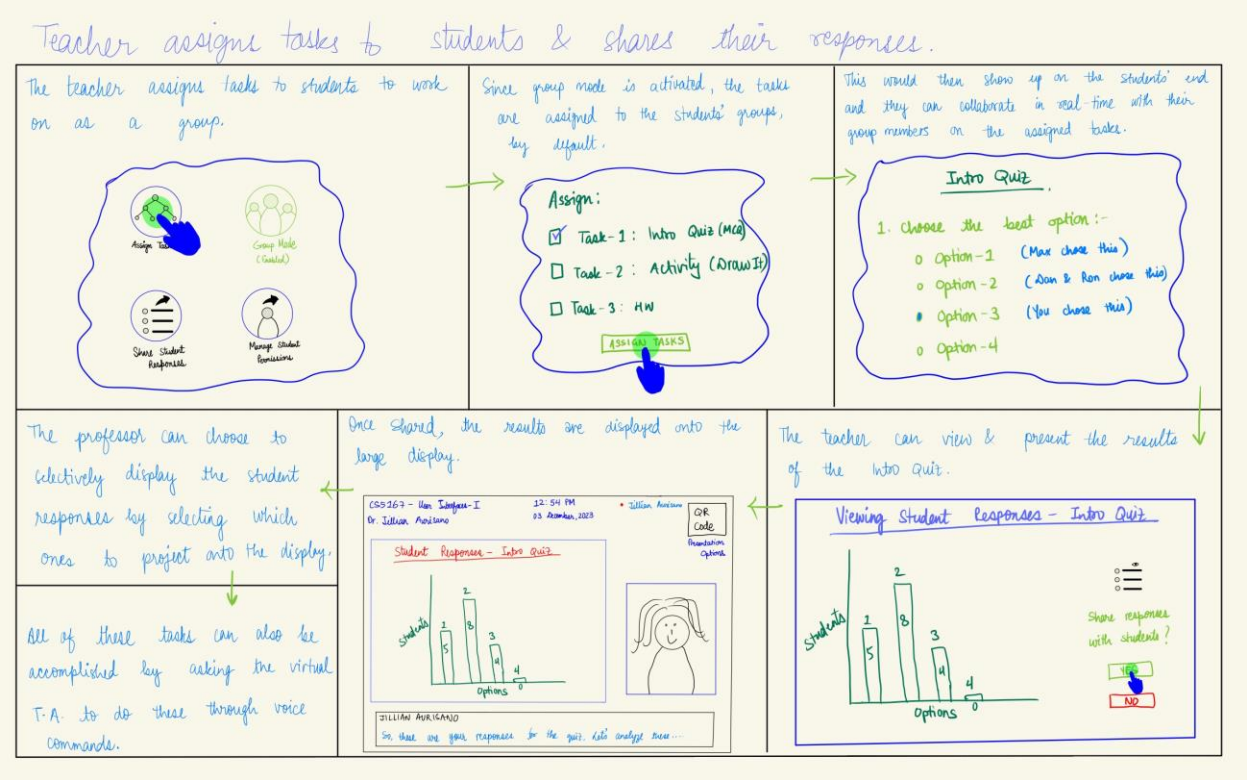


B-Goals Narrative Sketches/Storyboards

1. Illustrating the use of the teacher's interface and the large display

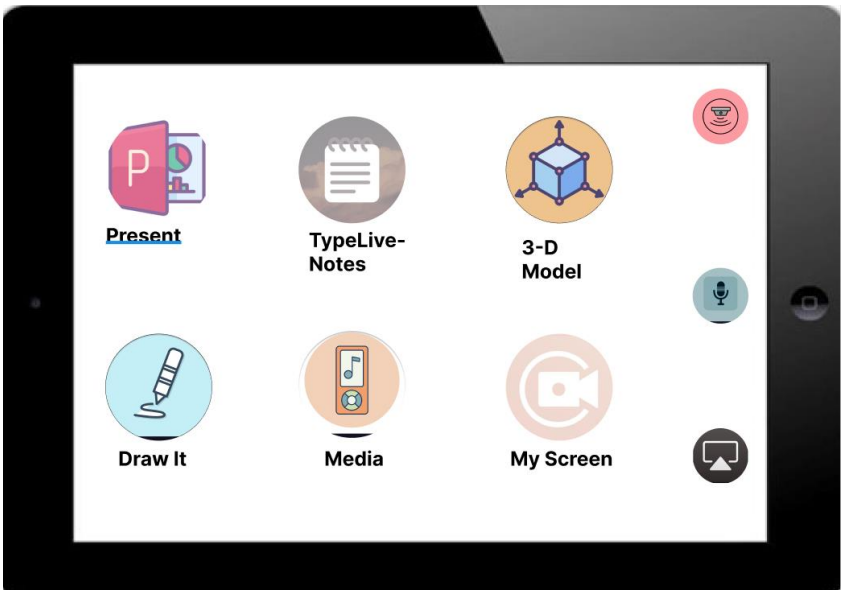


2. Illustrating the use of the teacher's additional interface

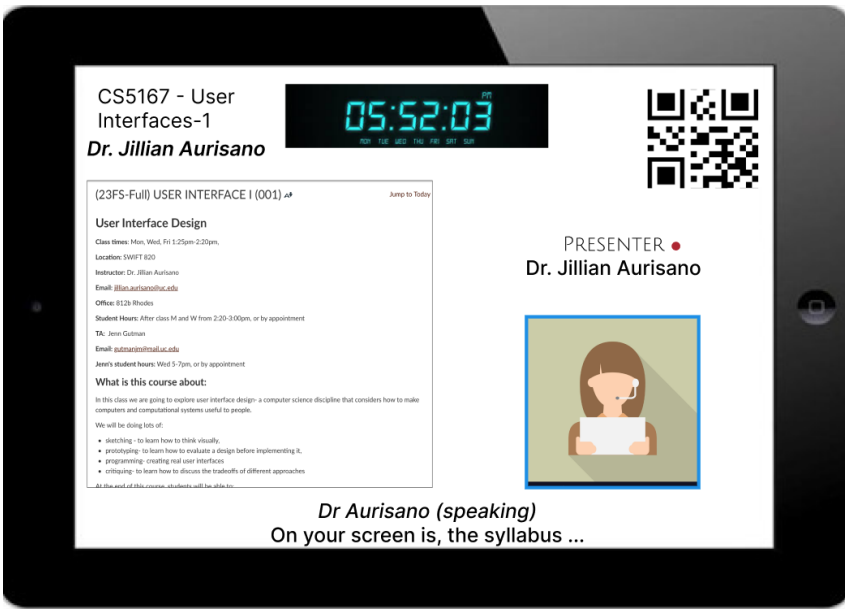


B Goals: Figma

Teacher's UI for sharing content – Teaches UI



Teacher's UI for sharing content – Large Screen



Students Interface – Touch Table

UI for teachers' content

Part 3, A-Goals: Interactions through touch, mid-air gestures, speech, mobile devices, and AR

1. Design a set of **novel interactions** for students and teachers with the displays and interfaces using: A. multi-touch gestures, B. mid-air gestures, and C. speech.

- Discuss within your group when would students or teachers interact with these interfaces using multi-touch gestures, mid-air gestures, or speech?
- For each interaction type, describe a scenario where they might be useful.

For the A-Goals, as mentioned (and implemented) before, we are using Mid-Air Gestures and Speech using AR from the Spatial Vision technology in Apple Vision Pro headset.

(1). Multi touch gestures will be used on the Tablet interface with the Apple Pencil for sketching.

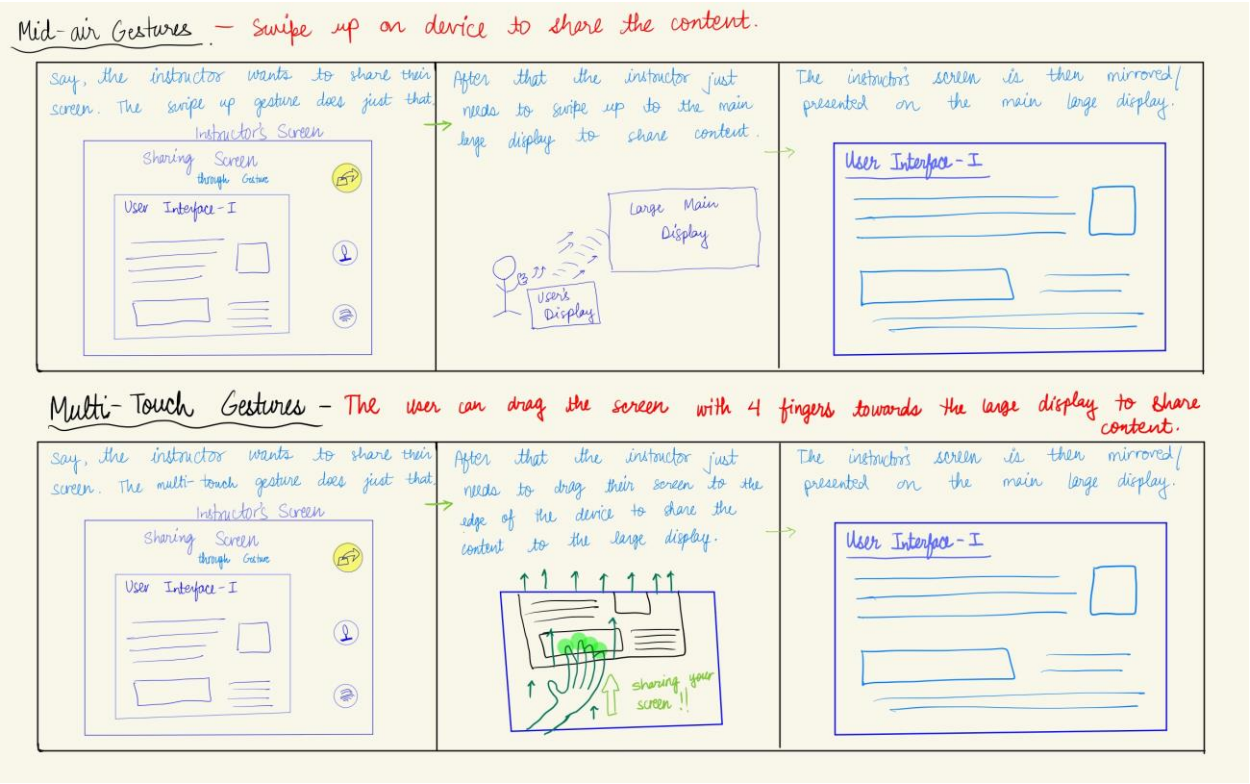
a. Even the Personal devices like iPad and iPhone already implement this technology and we will extend our work to that.
b. It can be used for sketching on the table with the Apple Pencil, resizing images.
c. Students can also use a virtual keyboard on the tablet to type stuff because as mentioned before, professors will give the exams to the students on this tablet.
d. By clicking the airdrop button on this tablet and swiping up, students can display content on the large screen with permission from the professor.

(2). Mid-Air Gestures will be used to AirPlay (Share Play) on different screen interfaces using a Motion detector sensor in the camera. The operations and functionality of the various motions in already sketched and storyboarded above.

e. By clicking the airdrop button on this tablet and moving your hand up, students can display content on the large screen with permission from the professor.
f. Users, after clicking the share content button swipe up in the air to share on large screen or swipe right in the air to share on tablets for all students.
g. Professor can select a particular student and share the content to them individually by selecting the student and then swiping up in the air to share to their tablet.

2) For the speech implementation we have an AI assistant called “Teaching Assistant.” This will be standard in every classroom and will be used for giving voice commands for carrying out basic technical logistics (classroom logistics) and managerial tasks that a real “TA” performs in class. The professor has control over this.
    a. The Teaching Assistant can manage the classroom devices like displays, lights, temperature etc.
    b. It can also help the professor with statistics from the students' performance.
    c. If enabled, it can help students with their questions in class while solving assignments.

For each interaction type, create a narrative sketch (which can include hybrid sketching techniques) to show your chosen scenario. In your sketch, show the user, the device, the UI on the device, the context, and their actions in the world. You should aim to include sufficient visual detail in how the UI behaves and how interactions take place, so that a team could implement your envisioned UI and interaction approach.



2. Consider Augmented Reality in more depth. Suppose every student in the classroom had lightweight AR-glasses. What would this mean for the classroom? Design one scenario for AR in teaching. Create a narrative sketch (which can include hybrid sketching techniques) to show your chosen scenario. In your sketch, show the user, the content they are viewing in AR, the UI in AR, their interactions with this content or other actions in the world. Should have sufficient detail that would allow you to implement this experience.

- Translate these findings into a set of narrative sketches, which step through your envisioned interactions. Hybrid sketches may be helpful, to illustrate how these actions would take place in the real context on campus. You should aim to include sufficient visual detail in how the UI behaves and how interactions take place, so that a team could implement your envisioned UI and interaction approach.

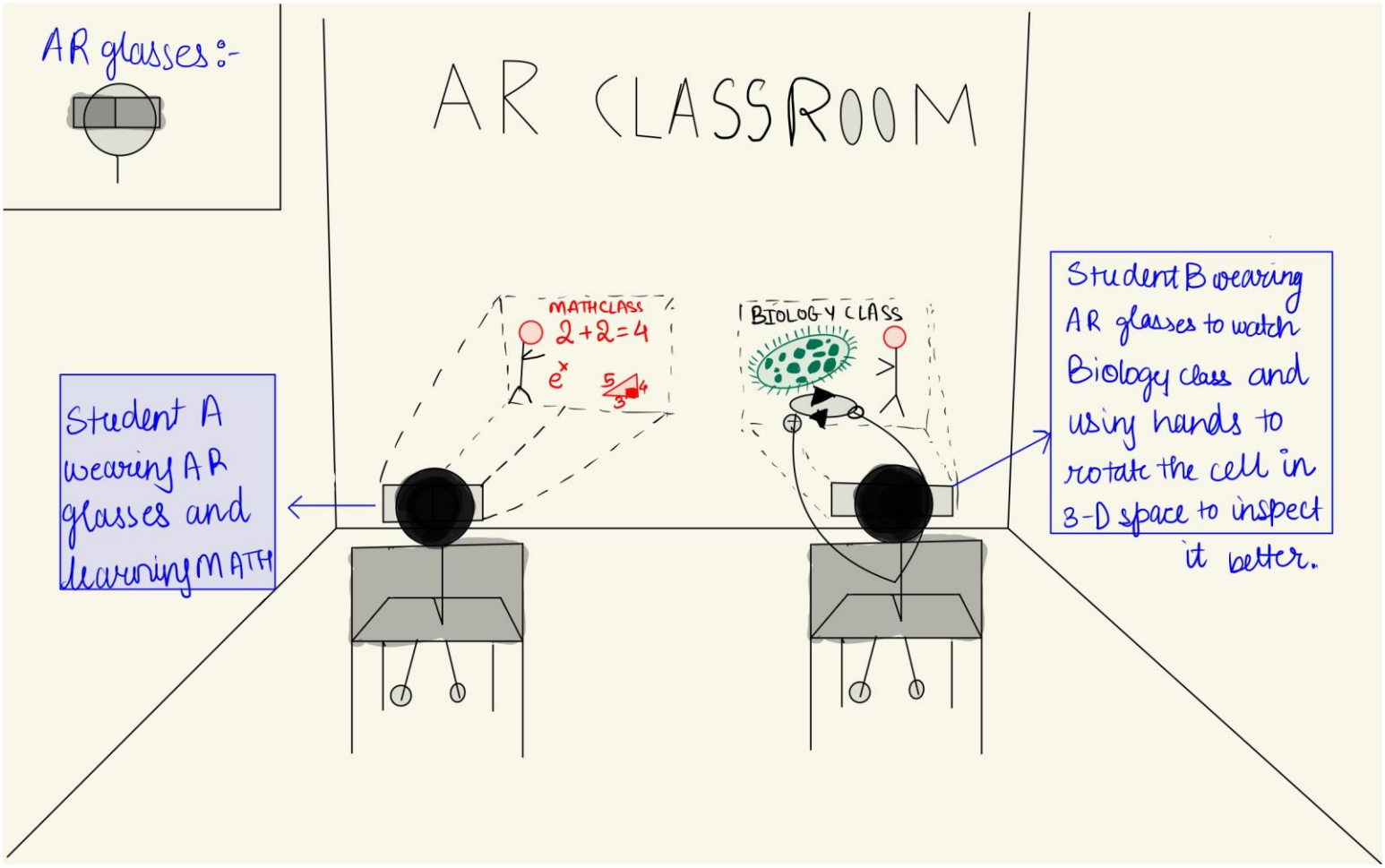
As mentioned earlier, we have an Apple Vison Pro in the classroom for every student and professor. They can use its spatial reality abilities to see models in real life.

For our AR scenario, we are focusing on the same Biology lab example where students are learning Human Anatomy (Heart). Given this AR technology, the class looks like:

- This means that learning is no longer confined to 3 dimensions of the world and the classroom transforms as digital overlays blend seamlessly with the physical environment.
- This also means that students see their own customized learning space. For instance, Amy might have 3D holographic models of plant cells hovering over her desk, while Jake has animal cells.
- Students can individually manipulate and zoom into specific cell structures using hand gestures or voice commands.
- AR makes learning more interactive and engaging, capturing students' attention through immersive experiences.
- AR systems can generate data on student interactions, preferences, and performance. Analyzing this data provides valuable insights into individual and collective learning patterns, allowing for continuous improvement in teaching methodologies and content delivery.

Our Biology Lab scenario:

- The professor is teaching about the Human Heart today
- Students put on their AR headsets, and the system identifies each student, displaying their names and a brief overview of the day's topic.
- Each student's workstation transforms into a virtual dissection station, complete with a 3D holographic model of a human heart and the professor explains the flow of blood and other functions.
- Students use AR tools to virtually dissect the heart. They make incisions, explore chambers, and identify valves.
- Haptic feedback simulates the sensation of touching different heart structures, enhancing the realism of the experience.
- AR allows them to view and manipulate the same 3D model simultaneously, fostering teamwork and shared understanding.
- Professor integrates quizzes into the AR environment to assess understanding and students answer questions by interacting with the virtual heart model, demonstrating practical knowledge.


AR glasses :-
AR CLASSROOM
MATHCLASS
2+2=4
BIOLOGY CLASS
Student A wearing AR glasses and learning MATH
Student B wearing AR glasses to watch Biology class and using hands to rotate the cell in 3-D space to inspect it better.